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THE DISPENSATORY

OF THE

UNITED STATES OF AMERICA.

BY

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FIFTEENTH EDITION.
Rearranged, thoroughly revised, and largely rewritten.
WITH ILLUSTRATIONS.

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PREFACE TO THE FIRST EDITION.

THE objects of a Dispensatory are to present an account of medicinal substances in the state in which they are brought into the shops, and to teach the modes in which they are prepared for use. The importance of these objects, and the general value and even necessity of a work of this nature, will not be disputed. It may, however, be a question, how far the wants of the medical and pharmaceutical community in this country are supplied by the Dispensatories already in circulation; and whether such a deficiency exists as to justify the offer of a new one to the public attention. The great merits of the works severally entitled "The Edinburgh New Dispensatory" and "The London Dispensatory," the former edited by the late Andrew Duncan, M.D., the latter by Anthony Todd Thomson, M.D., are well known wherever the English language is spoken. Founded, as they both are, upon the excellent basis laid by Lewis, they are nevertheless entitled, from the great addition of valuable materials, and the distinctive character exhibited in the arrangement of these materials, to be considered as original works; while the style in which they have been executed speaks strongly in favor of the skill and industry of their authors. But they were calculated especially for the sphere of Great Britain, and are too deficient in all that relates exclusively to this country, to admit of being received as standards here. In the history of our commerce in drugs, and of the nature, growth, and collection of our indigenous medical plants; in the chemical operations of our extensive laboratories; and in the modes of preparing, dispensing, and applying medicines, which have gradually grown into use among us; there is much that is peculiar, a knowledge of which is not to be gained from foreign books, and is yet necessary to the character of an accomplished American pharmaceutist. We have, moreover, a National Pharmacopœia, which requires an explanatory commentary, in order that its precepts may be fully appreciated, and advantageously put into practice. On these accounts, it is desirable that there should be a Dispensatory of the United States, which, while it embraces whatever is useful in European pharmacy, may accurately represent the art as it exists in this country, and give instruction adapted to our peculiar wants. It appears due to our national character that such a work should be in good faith an American work, newly prepared in all its parts, and not a mere edition of one of the European Dispensatories, with here and there additions and alterations, which, though they may be useful in themselves, cannot be made to harmonize with the other materials so as to give to the whole an appearance of unity, and certainly would not justify the assumption of a new national title for the book. Whether, in the Dispensatories which have been published in the United States, these requisites have been satisfactorily fulfilled, it rests with the public to determine. That valuable treatises on Materia Medica and Pharmacy have been issued in this country, no candid person, acquainted with our medical literature, will be disposed to deny. In offering a new work to the medical and pharmaceutical professions, the authors do not wish to be considered as undervaluing the labors of their predecessors. They simply conceive that the field has not been so fully occupied as to exclude all competition. The pharmacy of continental Europe is ground which has been almost untouched; and much information in relation to the natural history, commerce, and management of our own drugs, has lain ungathered in the possession of individuals, or scattered in separate treatises and periodicals not generally known and read. Since the publication of the last edition of our National Pharmacopœia, no general explanation of its processes has appeared, though required in justice both to that work and to the public. The hope of being able to supply these deficiencies may, perhaps, be considered a sufficient justification for the present undertaking.

The Pharmacopœia of the United States has been adopted as the basis of this Dispensatory. It is followed both in its general division of medicines, and in its alphabetical arrangement of them under each division. Precedence is, in every instance, given to the names which it recognizes, while the explanations by which it fixes the significance of these names are inserted in immediate connection with the titles to which they severally belong. Every article which it designates is more or less fully described; and all its processes, after being literally copied, are commented on and explained wherever comment and explanation appeared necessary. Nothing, in fine, has been omitted, which, in the estimation of the authors, could serve to illustrate its meaning, or promote the ends which it was intended to subserve. This course of proceeding appeared to be due to the national character of the Pharmacopœia, and to the important object of establishing, as far as possible, throughout the United States, uniformity, both in the nomenclature and preparation of medicines. In one particular, convenience required that the plan of the Pharmacopœia should be departed from. The medicines belonging to the department of MATERIA MEDICA, instead of being arranged in two divisions corresponding with the *Primary* and *Secondary Catalogues* of that work, have been treated of indiscriminately in alphabetical succession; and the place which they respectively hold in the Pharmacopœia is indicated by the employment of the term *Secondary*, in connection with the name of each of the medicines included in the latter catalogue.

But, though precedence has thus been given to the Pharmacopœia of the United States, those of Great Britain have not been neglected. The nomenclature adopted by the different British Colleges, and their formulas for the preparation of medicines, have been so extensively followed throughout the United States, that a work intended to represent the present state of pharmacy in this country would be imperfect without them; and the fact that the writings of British physicians and surgeons, in which their own officinal terms and preparations are exclusively employed and referred to, have an extensive circulation among us, renders some commentary necessary in order to prevent serious mistakes. The Pharmacopœias of London, Edinburgh, and Dublin have, therefore, been incorporated, in all their essential parts, into the present work. Their officinal titles are uniformly given, always in subordination to those of the United States Pharmacopœia, when they express the same object; but in chief, when, as often happens, no corresponding medicine or preparation is recognized by our national standard. In the latter case, if different names are applied by different British Colleges to the same object, that one is generally preferred which is most in accordance with our own system of nomenclature, and the others are given as synonymes. The medicines directed by the British Colleges are all described, and their processes either copied at length, or so far explained as to be intelligible in all essential particulars.

Besides the medicinal substances recognized as officinal by the Pharmacopœias alluded to, some others have been described, which, either from the lingering remains of former reputation, from recent reports in their favor, or from their important relation to medicines in general use, appear to have claims upon the attention of the physician and apothecary. Opportunity has, moreover, been taken to introduce incidentally brief accounts of substances used in other countries or in former times, and occasionally noticed in medical books; and, that the reader may be able to refer to them when desirous of information, their names have been placed with those of the standard remedies in the Index.

In the description of each medicine, if derived immediately from the animal, vegetable, or mineral kingdom, the attention of the authors has been directed to its natural history, the place of its growth or production, the method of collecting and preparing it for market, its commercial history, the state in which it reaches us, its sensible properties, its chemical composition and relations, the changes which it undergoes by time and exposure, its accidental or fraudulent adulterations, its medical properties and application, its economical uses, and the pharmaceutical treatment to which it is subjected. If a chemical preparation, the mode and principles of its manufacture are indicated in addition to the other particulars. If a poison, and likely to be accidentally taken, or purposely employed as such, its peculiar toxicological effects, together with the mode of counteracting them, are indicated; and the best means of detecting its presence by reagents are explained.

The authors have followed the example of Dr. A. T. Thomson, in giving botanical descriptions of the plants from which the medicines treated of are derived. In relation to all indigenous medicinal plants, and those naturalized or cultivated in this country, the advantages of such descriptions are obvious. The physician may often be placed in situations, in which it may be highly important that he should be able to recognize the vegetable which yields a particular medicine; and the apothecary is constantly liable to imposition from the collectors of herbs, unless possessed of the means of distinguishing, by infallible marks, the various products presented to him. A knowledge of foreign medicinal plants, though of less importance, will be found useful in various ways, independently of the gratification afforded by the indulgence of a liberal curiosity in relation to objects so closely connected with our daily pursuits. The introduction of these botanical notices into a Dispensatory appears to be peculiarly appropriate; as they are to be considered rather as objects for occasional reference than for regular study or continuous perusal, and therefore coincide with the general design of the work, which is to collect into a convenient form for consultation all that is practically important in relation to medicines. The authors have endeavored to preserve a due proportion between the minuteness of the descriptions, and their value as means of information to the student; and, in pursuance of this plan, have generally dwelt more at length upon our native plants than upon those of foreign growth; but, in all instances in which they have deemed a botanical description necessary, they have taken care to include in it the essential scientific character of the genus and species, with a reference to the position of the plant in the artificial and natural systems of classification; so that a person acquainted with the elements of botany may be able to recognize it when it comes under his observation.

In preparing the Dispensatory, the authors have consulted, in addition to many of the older works of authority, the greater number of the treatises and dissertations which have recently appeared upon the various subjects connected with Pharmacy, and especially those of the French writers, who stand at present at the head of this department of medical science. They have also endeavored to collect such detached facts, scattered through the various scientific, medical, and pharmaceutical journals, as they conceive to be important in themselves, and applicable to the subjects under consideration; and have had frequent recourse to the reports of travellers in relation to the natural and commercial history of foreign drugs. The occasional references in the body of the work will indicate the sources from which they have most largely drawn, and the authorities upon which they have most relied. In relation to our own commerce in drugs, and to the operations of our chemical laboratories, they are indebted for information chiefly to the kindness of gentlemen engaged in these branches of business, who have always evinced, in answering their numerous inquiries, a promptitude and politeness which merit their warm thanks, and which they are pleased to have this opportunity of acknowledging.*

It has not been deemed necessary to follow the example of the British Dispensatories, by inserting into the work a treatise upon chemistry, under the name of Elements of Pharmacy. Such a treatise must necessarily be very meagre and imperfect; and, as systems of chemistry are in the hands of every physician and apothecary, would uselessly occupy the place of valuable matter of less easy access.

The authors may, perhaps, be permitted to observe, in relation to themselves, that they have expended much time and labor in the preparation of the work; have sought diligently for facts from every readily accessible source; have endeavored, by a comparison of authorities, and a close scrutiny of evidence, to ascertain the truth whenever practicable; and have exerted themselves to the extent of their abilities to render the Dispensatory worthy of public approbation, both for the quality and quantity of its contents, and the general accuracy of its statements. They are conscious, nevertheless, that, in so great a multiplicity of details, numerous errors and deficiencies may exist, and that the faults of undue brevity in some cases, and prolixity in others, may not have been entirely avoided; but they venture to hope that a candid public will make all due allowances; and they take the liberty to invite, from all those who may feel interested in the diffusion of sound pharmaceutical knowledge, the communication of friendly suggestions or criticisms in relation to the objects and execution of the work.

PHILADELPHIA, *January*, 1833.

*The authors deem it proper to state that they are peculiarly indebted for assistance to Mr. Daniel B. Smith, president of the Philadelphia College of Pharmacy, to whom, besides much important information in relation to the various branches of the apothecary's business, they owe the prefatory remarks on Pharmacy which are placed at the commencement of the second part of the work, and the several articles, in the Materia Medica, upon *Leeches*, *Carbonate of Magnesia*, and *Sulphate of Magnesia*.

PREFACE TO THE FIFTEENTH EDITION.

JUST fifty years have gone by since Dr. Geo. B. Wood penned the preface to the first edition of the United States Dispensatory. Written from a sense of duty, and in the earnest belief that to obtain the acceptance of the newly born United States Pharmacopœia by the American professions of Medicine and Pharmacy a standard commentary was necessary, the book achieved a success which, to its authors, was as unexpected as it was gratifying. During the half-century that has elapsed, the work has passed through fourteen editions; revolutions have swept over science, the fate that awaits all men has come to the authors; and yet, with a steadiness that is unrivalled in medical literature, the United States Dispensatory has maintained its supremacy, until the copies of it which have been sold are to be numbered by the hundreds of thousands, and wherever the English language leads, it follows. Even in the last years, when it was sorely in need of revision, the demand for it has not perceptibly diminished. Such success as this must depend upon extraordinary qualities in the book. Thoroughness, accuracy, and completeness undoubtedly have had much to do with the result, but we conceive that the pre-eminent usefulness of the Dispensatory has rested largely upon the peculiar ability of its authors to perceive what facts are useful and essential to a subject, and upon their judgment and skill in utilizing and setting forth these facts.

In attempting the revision of a book which has become so necessary to the American professions, the editors have fully comprehended the difficulties and the importance of their task. They all have had the experience and the peculiar growth in the power of appreciating the proportionate fitness and importance of facts, which come with successive years of active life as a teacher. One of them has had the good fortune to have worked through the revisions of three editions under the rigid discipline of Dr. Geo. B. Wood, and to have become thoroughly familiar with his methods, not only of work, but also of thought, and with the principles which in his mind were essential to the building up of the Dispensatory. The editors come, therefore to the work not without some especial preparation. Moreover, for the first time in the history of the volume, the original plan of Dr. Geo. B. Wood of having three editors, one for each branch of the subject-matter, has been realized.

It is evident that in the revision of a book with a history like that of the present the changes should be as few as possible. The editors have constantly borne this principle in mind, but circumstances have forced them, whilst strenuously endeavoring to retain the characteristics and essential features of the work, in great part to remodel it. The alteration in the plan of the Pharmacopœia has necessitated a parallel change in the Dispensatory. The first and second parts have therefore been alphabetically collated and formed into Part I. of the present edition. Part III. of former editions has been kept isolated as Part II.; because were it not for the great gain of space achieved by the use of the small type, two volumes would be required to contain the material now compressed between a single pair of covers. The amount of new matter added at this revision may be judged of from the fact that whilst in the index of the fourteenth edition there were about eleven thousand references, in the present index there are more than sixteen thousand titles, including in these, however, German and French synonymes, never before indexed. Part III. of the present volume contains a revision of the Appendix of former editions, with various miscellaneous new matter.

When the fourteenth edition of the Dispensatory was published, Dr. Geo. B. Wood was nearly eighty years of age, and, although he sympathized with the movement which has resulted in putting therapeutics upon the firm foundation of physiological rationalism, he could not fully apprehend the changes which had occurred in therapeutical methods during the previous decade. Consequently, in most of the more important articles the sections treating of Medical Properties and Uses have had to be rewritten. The revision of these sections, as well as of the Botany and Vegetable Materia Medica, has fallen to the senior editor, Prof. H. C. Wood.

The progress of the last decade has necessitated important changes in those sections of the Dispensatory which treat of Pharmaceutical Chemistry, whilst the Pharmacy of the present edition is almost entirely new. This part of the revision has been performed by Prof. Jos. P. Remington, by whose calculations the officinal formulæ have been adapted to the use of those pharmacists who prefer the system of measuring liquids. The alternative formulas *have been carefully tested in practice*, and we believe that they will serve a useful purpose, during the transition stage, caused by the adoption of the principle of *parts by weight.*

Dr. Franklin Bache died in 1864, at the time when the agitation was commencing in chemical science which has ended in the received nomenclature and theory. Since the death of its chemical author the portions of the Dispensatory especially within his province have had no proper revision and adaptation to the needs of the day. All of the Theoretical Chemistry of the volume has, therefore, had to be reproduced. This part of the work, with the Toxicology, has been allotted to Prof. S. P. Sadtler; and we believe that in all points the Dispensatory now represents the latest solid achievements of chemical science.

It seems proper to call attention, as novel features of the fifteenth edition, to the indication of the pronunciation of the officinal titles by diacritical marks; to the complete list of analyses of American Mineral Springs, as far as they have been published, with a number of analyses of European Springs of note; and to the illustrations. The drug illustrations are, with three minor exceptions, original; and the very accurate representations of microscopical sections will, we believe, be of service to students of structural characteristics.

In conclusion, it seems but right to state that the revision has been performed slowly and with great care, occupying most of the spare moments of the editors during the last three years. The present volume may very justly be looked upon as a new book, founded upon the old United States Dispensatory. The editors have no overweening sense of their ability: they recognize profoundly the immense responsibility that has been laid upon them; but they ask a favorable consideration for their work, because with all patience and toil, and with the love of their labor, they have honestly striven, so far as in them lay, to make the new United States Dispensatory worthy of the time when it was universally recognized as the supreme treasure-house of pharmacological lore.

PHILADELPHIA, January, 1883.

ABBREVIATIONS.

At. Wt.—Atomic Weight.
Arab.—Arabic.
B.—Baumé's Hydrometer.
Br.—The British Pharmacopœia, 1867, and Supplement.
B. & T.—Bentley & Trimen's Medicinal Plants.
C.c.—Cubic centimetre.
Codex.—The French Pharmacopœia.
De Cand.—De Candolle.
Fr.—French.
G.—German.
Gen. Ch.—Generic Character.
Gm.—Gramme.
It.—Italian.
Juss.—Jussieu.
Linn.—Linnæus.
m.m.—Millimetre.
Mol.—Molecule.
Mol. Wt.—Molecular Weight.
Nat. Ord.—Natural Order.
Off. Prep.—Officinal Preparations.
Off. Syn.—Official Synonymes.
P. G.—The German Pharmacopœia.
Pharm. Uses.—Pharmaceutical Uses.
Sp. Gr.—Specific Gravity.
Sp.—Spanish.
U. S.—The Pharmacopœia of the United States, 1880.
Willd. Sp. Plant.—Willdenow's edition of the Species Plantarum of Linnæus.
Woodv. Med. Bot.—Woodville's Medical Botany, 2d edition.

JOURNALS FREQUENTLY REFERRED TO IN THE WORK.

A. J. P.—American Journal of Pharmacy.
Am. Journ. Med. Sci.—American Journal of Medical Science.
Amer. Pract.—American Practitioner.
Ann. d. Chem.—Liebig's Annalen der Chemie.
Ann. de Thérap.—Annuaire de Thérapeutique.
Ann. Ch. Phys.—Annales de Chimie et de Physique.
Archiv d. Pharm.—Archiv der Pharmacie.
Archiv für Exp. Path. und Therap.—Archiv für Experimentalische Pathologie und Therap.
Arch. Gén.—Archive Générale.
Ber. d. Chem. Ges.—Berichte der Deutschen Chemischen Gesellschaft.
Ber. Klin. Woch.—Berliner Klinische Wochenschrift.
Bost. Med. and Surg. Journ.—Boston Medical and Surgical Journal.
Buch. Neu. Rep.—Buchner's Neues Repertorium.
Can. Pharm. Journ.—Canadian Pharmaceutical Journal.
Cent. für Chir.—Centralblatt für Chirurgie.
Chem. and Drug.—Chemist and Druggist (London).
Chem. News.—Chemical News (London).
Compt.-Rend.—Comptes-Rendus hebdomadaires des Séances.
Drug. Circ.—Druggist's Circular.
Ed. Med. Journ.—Edinburgh Medical Journal.
Jahresb.—Jahresberichte (Dragendorff's).
Journ. App. Chem.—Journal of Applied Chemistry.
Journ. Chem. Soc.—Journal of Chemical Society (London).
Journ. de Pharm. d'Anvers.—Journal de Pharmacie (Antwerp).
Journ. de Pharm. et de Chim.—Journal de Pharmacie et de Chimie.
Journ. für Prakt. Chem.—Journal für Praktische Chemie.
Med. T. and G.—Medical Times and Gazette.
N. R.—New Remedies.
Neuest. Erfind. und Erf.—Neueste Erfindungen und Erfahrungen.
Pet. Med. Zeit.—Petersburgh Medicinische Zeitschrift.
Pharm. Cent.—Pharmaceutische Centralhalle.
P. J. Tr.—Pharmaceutical Journal and Transactions (London).
Pharm.—Chicago Pharmacist.
Pharm. Zeit.—Pharmaceutische Zeitung.
Proc. A. P. A.—Proceedings American Pharmaceutical Association.
Pogg. Ann.—Poggendorf's Annalen.
Prog. Med.—Progrès Médicale.
Repert. de Pharm.—Répertoire de Pharmacie.
Zeits. für Analyt. Chem.—Zeitschrift für Analytische Chemie.
Zeits. Oest. Apoth. Ver.—Zeitschrift des Oesterreichische Apotheker Verein.

EXPLANATORY KEY TO THE PRONUNCIATION.

THE introduction of diacritical marks to indicate the pronunciation of the officinal titles in this work requires the insertion of a key to make them intelligible. The system in use in Worcester's Dictionary has been adopted.

Ā long, as in fāte.
Ă short, as in făt.
Ạ obscure, as in ạbide.
Á long before *r*, as in fáre.
Ä Italian or grave, as in fär.
Ȧ intermediate, as in fȧst.
Â broad, as in fâll.

Ī long, as in pīne.
Ĭ short, as in pĭn.
Ị obscure, as in perị̣l.
Î like long ē, as in mîen.
Ï obtuse, as in sïr.

Ū long, as in tūbe.
Ŭ short, as in bŭt.
Ụ obscure, as in sụppose.
U̇ as in annu̇al.
Û obtuse, as in bûll.
Ü short and obtuse, as in bür.
Ū̂ long and close, as in rū̂le.

Ē long, as in mēte.
Ĕ short, as in mĕt.
Ẹ obscure, as in othẹr.
Ê like á, as in hêir.
Ë obtuse, as in hër.

Ō long, as in hōpe.
Ŏ short, as in nŏt.
Ọ obscure, as in arbọr.
Ô long, and close as in môve.
Ö broad, as in nör.
Õ like short ŭ, as in sõn.

Ç soft, like s.
Ꞓ hard, like k.
Ģ like j.
Ǥ hard, as in give.
Ş like z.
Ÿ like ī.

THE
DISPENSATORY
OF
THE UNITED STATES.

PART I.

THE United States Dispensatory may very properly be considered as a commentary upon the United States and British Pharmacopœias. Formerly the United States Pharmacopœia was arranged in two distinct divisions, under the respective headings of MATERIA MEDICA and PREPARATIONS. At the late revision, for very sufficient reasons, this arrangement of the Pharmacopœia was abandoned, and crude drugs, with their preparations, were collated in alphabetical order. In its previous editions the Dispensatory has conformed with the United States Pharmacopœia, PART I. and PART II. corresponding respectively to the Materia Medica and the Preparations of the national standard. In order to maintain the principle of conformity it has been necessary to rearrange the Dispensatory, and to combine two parts into one, which should contain all the officinal drugs and preparations in alphabetical sequence. The editors of the book have also allowed to remain in this section or division a few very important substances which are not at present officinal. PART II. of the present volume corresponds to PART III. of previous editions of the Dispensatory. In it are embraced remedies which are not officinal, but which still are worthy of notice in a work of encyclopædic character. PART III. of this edition of the Dispensatory in a measure replaces the Appendix of former editions. In it are considered Tests and Test-Solutions of the two Pharmacopœias, Weights and Measures, the Art of Prescribing Medicines, and other cognate miscellaneous matters.

There can be no question as to the superiority of the alphabetical arrangement of drugs in a book of reference such as the present. Their scientific classification belongs to works which treat of them rather in their relations than their essential properties; and different systems have been adopted, according to the set of relations towards which the mind of the author has been especially directed. Thus, the naturalist classifies them according to the affinities of the several objects in nature from which they are derived; the chemist, according to their composition; the practitioner of medicine, according to their effects upon the system in a state of health and disease. In the present imperfect state of our knowledge, any attempt at a rigidly scientific physiological classification of drugs must prove abortive. A number of such classifications have, however, been made, and may be considered more or less useful aids to memory; and as the terms by which the physiological and therapeutical effects of remedies are expressed are also the titles of classes to which the medicines belong, it will not be amiss to present the reader with the outlines of a system of classification, by consulting which he will be enabled to ascertain the precise meaning attached to the terms employed in this book to designate the peculiar action of different medicinal substances.

Remedies are divided into general and local; the former acting on the whole system, the latter on particular parts or organs.

I. **General Remedies** include 1, ASTRINGENTS, or substances which call in play the vital activities of the tissues in such a way as to cause contraction and condensation of the part; 2, TONICS, or substances which are used to directly or indirectly increase the power of the organism by stimulating or aiding in its nutritive processes. Such are, *Simple Bitters*, which possess no other property than that of stimulating the stomach and increasing digestive activity; *Aromatics*, which are still more stimulant to the gastro-intestinal mucous membrane, but less permanent in their influence, and which all contain a volatile oil; *Mineral Tonics*, which all possess more or less peculiar properties; 3, CARDIAC STIMULANTS; and, 4, CARDIAC SEDATIVES, including drugs which are employed respectively to increase and decrease the force of the circulation by acting upon the heart and vaso-motor system; 5, ANTI-SPASMODICS, or NERVOUS STIMULANTS, which, with a slight general stimulant power, exert a peculiar influence over the nervous system, exhibited in the relaxation of hysterical spasm, the calming of nervous irritation, etc., without any special and decided tendency to the brain; 6, ANALGESICS, remedies which are used to overcome pain, by an action upon the nervous system; 7, MYDRIATICS, or substances which dilate the pupil, and mostly also act as peculiar stimulants to the so-called sympathetic, *i.e.*, vaso-motor, nervous system; 8, ANÆSTHETICS, gaseous bodies or vapors employed to produce surgical anæsthesia; 9, EXCITO-MOTORS, and, 10, DEPRESSO-MOTORS, used respectively for augmenting or diminishing the activity of the spinal or peripheral motor apparatus; 11, ALTERATIVES, medicines employed to modify the nutritive processes of the body when in a diseased condition.

II. **Local Remedies** may be divided into four sections: *a*, *Those affecting the function of a part*, namely, 1, EMETICS, which act on the stomach, producing vomiting; 2, CATHARTICS, which act on the bowels, producing a purgative effect; 3, DIURETICS, which act on the kidneys, producing an increased flow of urine; 4, ANTILITHICS, which act on the same organs, preventing the formation of calculous matter; 5, DIAPHORETICS, which increase the cutaneous discharge; 6, EXPECTORANTS, which augment the secretion from the pulmonary mucous membrane, or promote the discharge of the secreted matter; 7, CHOLAGOGUES, which increase the flow of bile; 8, EMMENAGOGUES, which excite the menstrual secretion; 9, UTERINE MOTOR-STIMULANTS, or OXYTOCICS, which specially promote uterine contraction; 10, SIALAGOGUES, which increase the flow of saliva; and, 11, ERRHINES, which increase the discharge from the mucous membrane of the nostrils: *b*, *Those affecting the organization of a part*, including 1, RUBEFACIENTS, which produce redness and inflammation of the skin; 2, EPISPASTICS or VESICATORIES, which produce a serous discharge beneath the cuticle, forming a blister; and, 3, ESCHAROTICS or CAUSTICS, which destroy the life of the part upon which they act: *c*, *Those operating by a mechanical agency*, consisting of 1, DEMULCENTS, which lubricate the surface to which they are applied, and prevent the contact of irritating substances, or mingle with these and diminish their acrimony; 2, EMOLLIENTS, which serve as vehicles for the application of warmth and moisture; and, 3, PROTECTIVES, which operate by excluding the air: *d*, *Those which act on extraneous matters contained within the organs*, including 1, ANTACIDS, which neutralize acid, whether existing in the alimentary canal, or circulating with the blood; 2, ABSORBENTS, which absorb, and thus in some degree counteract certain irritant or poisonous substances; 3, SOLVENTS, which promote the solution of indigestible matters in the stomach; 4, *Anthelmintics*, which destroy worms, or expel them from the bowels; and, 5, DISINFECTANTS, which destroy or prevent noxious and offensive effluvia, and counteract other injurious influences originating in animal or vegetable decomposition, including *Antizymotics*, which destroy or render inert all microscopic organized beings which are hostile to human health by promoting the fermenting processes.

It is believed that all substances employed as medicines, with the exception of a very few which are so peculiar in their action as scarcely to admit of classification, may be distributed without violence among the above classes. Some substances, however, in addition to the properties of the classes to which they are severally attached, possess others in common, which give them practical value, and authorize their association in distinct groups, not recognized in the system of classification, but constantly referred to in medical language. Thus, we have REFRIGERANTS, which, when internally administered, diminish animal temperature; and CARMINATIVES, which, by promoting contraction in the muscular coat of the stomach and bowels, cause the expulsion of flatus. It is customary, moreover, to attach distinct names to groups of remedies, with reference to certain effects which are incident to the properties that serve to arrange them in some more comprehensive class. Thus, NARCOTICS are remedies which have a sedative influence upon the nervous system. They frequently promote sleep, relieve pain, and produce insensibility, and, in relation to these properties, are called SOPORIFICS, ANODYNES or ANALGESICS, and ANÆSTHETICS; and various medicines, which, by diversified modes of action, serve to remove chronic inflammation and enlargements of the glands or viscera, are called DEOBSTRUENTS. These terms are occasionally employed in the following pages, and are here explained, in order that the sense in which we use them may be accurately understood.

ABSINTHIUM. *U. S.* *Wormwood.*

(A̤B-SĬN'THI̤-ŬM.)

The leaves and tops of Artemisia Absinthium. Linné. (*Nat. Ord.* Compositæ.) *U. S.*

Herba s. Summitates Absinthii; Absinthe commune, Grand Absinthe, Armoise amère, *Fr.;* Gemeiner Wermuth, *G.;* Assenzio, *It.;* Artemisio Axenjo, *Sp.*

Gen. Ch. Receptacle sub-villous, or nearly naked. *Seed-down* none. *Calyx* imbricate, with roundish converging scales. *Corollas of the ray* none. *Willd.*

Several species of Artemisia have enjoyed some reputation as medicines. The leaves of *A. Abrotanum*, or *southernwood*, have a fragrant odor, and a warm, bitter, nauseous taste, and were formerly employed as a tonic, deobstruent, and anthelmintic. Similar virtues have been ascribed to *A. Santonica. A. pontica* has been occasionally substituted for common wormwood, but is weaker. *A. vulgaris*, or *mugwort*, formerly enjoyed considerable reputation as an emmenagogue, and has been used in Germany in epilepsy. Along with assafetida it is also sometimes given in chorea and in amenorrhœa. *A. Ludoviciana*, a native of the southwestern regions of the U. States, is thought, when applied to the head in the state of infusion, to favor the growth of the hair. (Maisch, *A. J. P.*, 1872, p. 106.) In China, *moxa* is said to be prepared from the leaves of *A. Chinensis* and *A. Indica.* The medicine known in Europe by the name of wormseed is the product of different species. The only species which requires particular description here is *A. Absinthium.*

Artemisia Absinthium. Willd. *Sp. Plant.* iii. 1844; Woodv. *Med. Bot.* p. 54, t. 22. Wormwood is a perennial plant, with branching, round, and striated or furrowed stems, which rise two or three feet in height, and are panicled at their summit. The lower portion of the stem lives several years, and annually sends up herbaceous shoots, which perish in the winter. The radical leaves are triply pinnatifid, with lanceolate, obtuse, dentate divisions; those of the stem, doubly or simply pinnatifid, with lanceolate, somewhat acute divisions; the floral leaves are lanceolate; all are hoary. The flowers are of a brownish-yellow color, hemispherical, pedicelled, nodding, and in erect racemes. The florets of the disk are numerous, those of the ray few. The plant is a native of Europe, where it is also cultivated. It is among our garden herbs, and has been naturalized in the mountainous districts of New England. The leaves and flowering summits are employed; the larger parts of the stalk being rejected. They should be gathered in July or August, when the plant is in flower. They preserve their peculiar sensible properties long when dried.

"Leaves about two inches (5 cm.) long, hoary, silky, pubescent, petiolate, roundish, triangular in outline, pinnately two- or three-cleft, with the segments lanceolate, the terminal one spatulate, bracts three-cleft or entire; heads numerous, subglobose, with numerous small, pale-yellow florets, all tubular and without pappus; odor aromatic; taste persistently bitter." *U. S.* Wormwood yields by distillation a volatile oil (*oleum absinthii*), usually dark green, sometimes yellow or brownish, having a strong odor of the plant, an acrid peculiar taste, and the sp. gr. 0·972. It is sometimes adulterated with alcohol, oil of turpentine, etc., which lessen its specific gravity. According to C. R. A. Wright, the oil is chiefly composed of *absinthol*, which has a specific gravity 0·926, composition $C_{10}H_{16}O$, boiling point of 200° C. (392° F.) to 205° C., is isomeric with *myristicol*, and when heated with phosphorus pentasulphide or zinc chloride is split into *cymene* ($C_{10}H_{14}$) and a resinous substance. The portion of absinthol which does not distil over at about 200° C. consists chiefly of the coloring principles *azulene* of Piesse and *cœrulëin* of Gladstone (*Journ. Chem. Soc.*, Jan. 1874). The dried herb yields much more oil than the fresh. The other constituents, according to Braconnot, are a very bitter and an almost insipid azotized matter, an excessively bitter resinous substance, chlorophyll, albumen, starch, saline matters, and lignin; malic and acetic acids are also said to be present. The cold infusion becomes olive-green and turbid on the addition of ferric chloride, indicating the probable existence of a little tannic acid. (*Pereira.*) The *absinthic acid* found by Braconnot is said to be succinic acid. Caventou obtained the bitter principle *absinthin* in an impure condition. (See *U. S. D.*, 14th ed., p. 5.) Dr.

E. Luck prepared pure absinthin in 1851. (*A. J. P.*, xxiii. 358.) A. Kromayer (*Arch. Pharm.* (2), cviii. 129) considers absinthin an aldehyd, and assigns to it the formula $C_{40}H_{56}O_8 + H_2O$. He prepared it by exhausting the dry herb with hot water, evaporating the decoction, absorbing the bitter principle with animal charcoal, extracting with alcohol, partially purifying with lead acetate, precipitating with tannin, dissolving the precipitate in alcohol, mixing with lead oxide, treating the dry residue with alcohol, filtering, and evaporating to dryness. The old *salt of wormwood* (*sal absinthii*) was impure carbonate of potassium, obtained from the ashes of the plant.

Medical Properties and Uses. Wormwood was known to the ancients. It is highly tonic, and formerly enjoyed great reputation in debility of the digestive organs, and of the system generally. Before the introduction of Peruvian bark, it was much used in the treatment of intermittents. It has also been supposed to possess anthelmintic virtues. At present, however, it is little used in regular practice on this side of the Atlantic. It is undoubtedly capable of causing headache and other nervous disorders. The volatile oil in sufficient dose is a violent narcotic poison. In dogs and rabbits from thirty to fifty drops (1·5–3·2 C.c.) of it cause trembling, stupor, hebetude, and it may be insensibility; one to two drachms (3·75–7·5 C.c.) of it, violent epileptiform convulsions, with involuntary evacuations, unconsciousness and stertorous breathing, which may or may not end in death. (Marcé, *Bull. Thérap.*, Mai, 1864; Magnan, *L'Union Méd.*, Août, 1864; Amory, *Bost. Med. and Surg. Journ.*, March, 1868, p. 83.) In man the oil acts similarly; a half-ounce (C.c. 15) of it caused, in a male adult, insensibility, convulsions, foaming at the mouth, and a tendency to vomit; though the patient recovered under the use of emetics, with stimulants and demulcents. (*Lancet*, Dec. 6, 1862.) In large doses, wormwood irritates the stomach, and excites the circulation. The herb is sometimes applied externally, by way of fomentation, as an antiseptic and discutient. The dose in substance is from one to two scruples (1·3–2·6 Gm.); of the infusion, made by macerating an ounce in a pint of boiling water, from one to two fluidounces (30–60 C.c.). The decoction is less actively narcotic than the infusion, owing to the dissipation of the volatile oil during boiling.[*]

Off. Prep. Vinum Aromaticum.

ABSTRACTA. *Abstracts.*

(ẠB-STRĂC'TẠ.)

This new class of preparations is introduced for the first time into the Pharmacopœia. Their introduction grows out of the necessity for convenient and reliable solid preparations which bear a *definite relation to the drug*. Powdered extracts have been found in commerce for many years, but, as usually furnished, are objectionable preparations, owing to the injurious loss of strength resulting from the heating during desiccation, and to their proneness to absorb moisture and become subsequently a hard, solidified mass in the dispensing bottle. Among the advantages possessed by abstracts is that their strength bears a uniform relation with the drug, the fluid extract, and frequently with the tincture. They are in every case twice as strong as the drug or fluid extract, and about ten times the strength of the tincture; the heat employed in evaporating does not exceed 50° C. (122° F.), and the caramel-like odor, produced by excessive heat, is absent in the finished abstract: being in the form of a dry powder, abstracts are conveniently dispensed, and the process for their preparation is simple, requiring no apparatus which is not at the command of every pharmacist. In many cases where the Fluid Extract is alcoholic and free from glycerin, the abstract may be easily made by adding about one-fourth its weight of powdered sugar of milk, drying at a low temperature, as proposed, and making up the quantity to half the weight of the Fluid Extract with more sugar of milk. As the strength of abstracts is uniform, and differs from that of extracts, it was deemed advisable to give them a new title, so that confusion should be avoided. Abstracts were prepared in 1877 by Prof. Jos. P. Remington, and the process offered to the committee of the Philadelphia College of Pharmacy on the revision of the U. S. Pharmacopœia (see *Extracta*). The term "Abstractum" was proposed by Mr. A. B. Taylor as accurately defining the class, and not likely to be mistaken through abbreviation. A valuable paper on "Powdered Extracts," by C. S. Hallberg, may be found in *Proc. Am. Pharm. Assoc.*, 1879–1881. They should be kept in well-stoppered bottles in a cool and dry place.

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[*] *Absinthe.* Under this name, a *liqueur* is much used in France, consisting essentially of an alcoholic solution of oil of wormwood containing some alcoholic extract of angelica, anise, and marjoram. The preparation, if manipulated properly, possesses naturally a bright-green color, but artificial coloring is often resorted to, and indigo, turmeric, cupric acetate, and antimonious chloride have been used to produce the proper shade. According to the French law of 1872, the oil and other concentrated preparations of absinthe can be sold only by pharmacists, and by them only on prescription. It has for some time been noticed that the effects of this liqueur differ essentially from those of pure alcoholic drinks, constituting a series of symptoms which has been designated as *absinthism*. From a case recorded by M. Magnan, in which the patient, having habituated himself to the use of brandy, and afterwards substituted *absinthe*, gave an opportunity of comparing the effects of the two kinds of drink, it appears that the characteristic symptoms of the latter, taken in excess, are restlessness at night, with disturbing dreams, nausea and vomiting in the morning, with great trembling of the hands and tongue, vertigo, and a tendency to epileptiform convulsions, in which the patient loses consciousness, falls, bites his tongue, foams at the mouth, makes facial grimaces, throws about his limbs, etc., but from which he usually recovers.

ABSTRACTUM ACONITI. *U.S. Abstract of Aconite.*

(ẠB-STRĂC′TỤM ĂC-Ọ-NĪ′TĪ.)

"Aconite, in No. 60 powder, *two hundred parts* [or four ounces av.]; Tartaric Acid, *two parts* [or eighteen grains]; Sugar of Milk, recently dried and in fine powder, Alcohol, each, *a sufficient quantity*, To make *one hundred parts* [or two ounces av.]. Moisten the Aconite with *eighty parts* [or one and three-quarter fluidounces] of Alcohol, in which the Tartaric Acid has previously been dissolved, and pack firmly in a cylindrical glass percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Aconite is exhausted. Reserve the first *one hundred and seventy parts* [or three and one-half fluidounces] of the percolate, evaporate the remainder to *thirty parts* [or half a fluidounce] at a temperature not exceeding 50° C. (122° F.) and mix with the reserved portion. Place the mixture in an evaporating dish, and, having added *fifty parts* [or one ounce av.] of Sugar of Milk, cover it with a piece of thin muslin gauze, and set aside in a warm place, where the temperature will not rise above 50° C. (122° F.), until the mixture is dry. Lastly, having added enough Sugar of Milk to make the mixture weigh *one hundred parts* [or two ounces av.], reduce it to a fine, uniform powder. Preserve the powder in a well-stopped bottle." *U. S.*

Duquesnel recommended tartaric acid in alcoholic solution as the best menstruum for aconite root, and his views were confirmed by C. R. Alder Wright (*P. J. T.*, ix., 1878, p. 152) on the ground that alcohol acidulated with tartaric acid extracts a larger percentage of crystallizable aconitine than alcohol containing diluted mineral acid. Whilst the addition of a small quantity of tartaric acid to the menstruum can do no harm, there is still no difficulty in thoroughly exhausting aconite root of its virtues with alcohol alone, and a reliable abstract could be made without the addition of any acid. The root is preferable to the leaves on account of its greater uniformity in quality and its not containing so much soluble inert matter. The dose of the abstract is from one-half to one grain (0·03 to 0·06 Gm.).

ABSTRACTUM BELLADONNÆ. *U.S. Abstract of Belladonna.*

(ẠB-STRĂC′TỤM BĔL-LẠ-DŎN′NÆ.)

"Belladonna Root, in No. 60 powder, *two hundred parts* [or four ounces av.]; Sugar of Milk, recently dried and in fine powder, Alcohol, each, *a sufficient quantity*, To make *one hundred parts* [or two ounces av.]. Moisten the Belladonna Root with *eighty parts* [or one and three-quarter fluidounces] of Alcohol and pack firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Belladonna Root is exhausted. Reserve the first *one hundred and seventy parts* [or three and one-half fluidounces] of the percolate, evaporate the remainder to *thirty parts* [or half a fluidounce], at a temperature not exceeding 50° C. (122° F.), and mix with the reserved portion. Place the mixture in an evaporating dish, and having added *fifty parts* [or one ounce av.] of Sugar of Milk, cover it with a piece of thin muslin gauze, and set aside in a warm place, where the temperature will not rise above 50° C. (122° F.), until the mixture is dry. Lastly, having added enough Sugar of Milk to make the mixture weigh *one hundred parts* [or two ounces av.], reduce it to a fine, uniform powder. Preserve the powder in a well-stopped bottle." *U. S.*

This preparation is of a very light brownish-red color, and may be given in the dose of one-half to one grain (0·03 to 0·06 Gm.).

ABSTRACTUM CONII. *U. S. Abstract of Conium.*

(A̤B-STRĂC′TU̥M CO̤-NĪ′Ī.)

"Conium, in No. 40 powder, *two hundred parts* [or four ounces av.]; Diluted Hydrochloric Acid, *six parts* [or fifty minims]; Sugar of Milk, recently dried and in fine powder, Alcohol, each, *a sufficient quantity*, To make *one hundred parts* [or two ounces av.]. Mix the Hydrochloric Acid with *eighty parts* [or one and three-quarter fluidounces] of Alcohol, and, having moistened the Conium with the mixture, pack firmly in a cylindrical glass percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Conium is exhausted. Reserve the first *one hundred and seventy parts* [or three and one-half fluidounces] of the percolate, evaporate the remainder to *thirty parts* [or half a fluidounce], at a temperature not exceeding 50° C. (122° F.), and mix with the reserved portion. Place the mixture in an evaporating dish, and, having added *fifty parts* [or one ounce av.] of Sugar of Milk, cover it with a piece of thin muslin gauze, and set it aside in a warm place, where the temperature will not rise above 50° C. (122° F.), until the mixture is dry. Lastly, having added enough Sugar of Milk to make the mixture weigh *one hundred parts* [or two ounces av.], reduce it to a fine, uniform powder. Preserve the powder in a well-stopped bottle." *U. S.*

This is the best solid preparation of conium, being superior to the extract on account of the dissipation of the volatile alkaloid during the evaporation of the extract, which to a great extent is avoided in the process for the abstract. The conium seed is preferred to the leaves as more reliable; the hydrochloric acid is used to fix the alkaloid. The commencing dose is from one to two grains (0·06 to 0·12 Gm.).

ABSTRACTUM DIGITALIS. *U. S. Abstract of Digitalis.*

(A̤B-STRĂC′TU̥M DĬǤ-I̤-TĀ′LĬS.)

"Digitalis, recently dried and in No. 60 powder, *two hundred parts* [or four ounces av.]; Sugar of Milk, recently dried and in fine powder, Alcohol, each, *a sufficient quantity*, To make *one hundred parts* [or two ounces av.]. Moisten the Digitalis with *eighty parts* [or one and three-quarter fluidounces] of Alcohol, and pack firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Digitalis is exhausted. Reserve the first *one hundred and seventy parts* [or three and one-half fluidounces] of the percolate, evaporate the remainder to *thirty parts* [or half a fluidounce], at a temperature not exceeding 50° C. (122° F.), and mix with the reserved portion. Place the mixture in an evaporating dish, and, having added *fifty parts* [or one ounce av.] of Sugar of Milk, cover it with a piece of thin muslin gauze, and set aside in a warm place, where the temperature will not rise above 50° C. (122° F.), until the mixture is dry. Lastly, having added enough Sugar of Milk to make the mixture weigh *one hundred parts* [or two ounces av.], reduce it to a fine, uniform powder. Preserve the powder in a well-stopped bottle." *U. S.*

Abstract of Digitalis would well replace the extract, which is very variable in quality and consistence as usually dispensed. Its color is a decided, rather bright green, and it is well adapted for administration either *per se* or in pilular form. The dose is from one-half to one grain (0·03 to 0·06 Gm.), repeated with caution.

ABSTRACTUM HYOSCYAMI. *U.S. Abstract of Hyoscyamus.*

(A̤B-STRĂC′TṲM HȲ-O̤S-CȲ′A̤-MĪ.)

"Hyoscyamus, recently dried and in No. 60 powder, *two hundred parts* [or four ounces av.]; Sugar of Milk, recently dried and in fine powder, Alcohol, each, *a sufficient quantity*, To make *one hundred parts* [or two ounces av.]. Moisten the Hyoscyamus with *eighty parts* [or one and three-quarter fluidounces] of Alcohol, and pack firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Hyoscyamus is exhausted. Reserve the first *one hundred and seventy parts* [three and one-half fluidounces] of the percolate, evaporate the remainder to *thirty parts* [or half a fluidounce], at a temperature not exceeding 50° C. (122° F.), and mix with the reserved portion. Place the mixture in an evaporating dish, and, having added *fifty parts* [or one ounce av.] of Sugar of Milk, cover it with a piece of thin muslin gauze, and set aside in a warm place, where the temperature will not rise above 50° C. (122° F.), until the mixture is dry. Lastly, having added enough Sugar of Milk to make the mixture weigh *one hundred parts* [or two ounces av.], reduce it to a fine, uniform powder. Preserve the powder in a well-stopped bottle." *U. S.*

This abstract is probably more hygroscopic and shows more evidences of coalescing than any of the others, but if it be kept in a cool and dry place and well stoppered, there will be no difficulty; it is of a green color, and when properly made, thoroughly reliable. The dose is from two to three grains (0·12 to 0·18 Gm.).

ABSTRACTUM IGNATIÆ. *U.S. Abstract of Ignatia.*

(A̤B-STRĂC′TṲM ĬG-NĀ′TI̤-Æ (ĭg-nā′shẹ-ē).)

"Ignatia, in No. 60 powder, *two hundred parts* [or four ounces av.]; Sugar of Milk, recently dried and in fine powder, Alcohol, Water, each, *a sufficient quantity*, To make *one hundred parts* [or two ounces av.]. Mix Alcohol and Water in the proportion of *eight parts* [or six fluidounces] of Alcohol to *one part* [or five fluidrachms] of Water, and, having moistened the Ignatia with *one hundred parts* [or two fluidounces] of the menstruum, pack firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, until the Ignatia is exhausted. Reserve the first *one hundred and seventy parts* [three and one-half fluidounces] of the percolate, distil off the alcohol from the remainder, and mix the residue with the reserved portion. Place the mixture in an evaporating dish, and, having added *fifty parts* [or one ounce av.] of Sugar of Milk, cover it with a piece of thin muslin gauze, and set aside in a warm place, where the temperature will not rise above 50° C. (122° F.), until the mixture is dry. Lastly, having added enough Sugar of Milk to make the mixture weigh *one hundred parts* [two ounces av.], reduce it to a fine, uniform powder. Preserve the powder in a well-stopped bottle." *U.S.*

Abstract of Ignatia is intended to replace the extract, which is no longer officinal. Some difficulty is experienced in reducing Ignatia beans to powder, as they consist largely of an exceedingly tough, horny albumen. If they are, however, coarsely ground, and half their weight of water added, and heat applied until they have swollen, they may then be beaten into a paste, and subsequently dried and powdered without much trouble. On account of the fixed oil present in Ignatia, a slight change in the manipulation of this abstract might be advisable: the fluid extract should be evaporated to a soft extract, and allowed to stand a short time, when the fixed oil could be separated by absorbing it from the surface, or, if in sufficient quantity, poured off, and washed with diluted alcohol to separate any alkaloids which might be dissolved in the oil. This alcoholic solution should be mixed with the extract, evaporated, the sugar of milk added, and the preparation finished by the regular process given above. The yield of extract is usually about 10 per cent. The dose of abstract is from one-half to one and a half grains (0·03 to 0·10 Gm.).

ABSTRACTUM JALAPÆ. *U.S. Abstract of Jalap.*

(ẠB-STRĂC'TỤM JẠ-LĀ'PÆ.)

"Jalap, in No. 40 powder, *two hundred parts* [or four ounces av.]; Sugar of Milk, recently dried and in fine powder, Alcohol, each, *a sufficient quantity*, To make *one hundred parts* [or two ounces av.]. Moisten the Jalap with *one hundred parts* [or two fluidounces] of Alcohol, and pack firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Jalap is exhausted. Reserve the first *one hundred and seventy parts* [three and one-half fluidounces] of the percolate, distil off the alcohol from the remainder, and mix the residue with the reserved portion. Place the mixture in an evaporating dish, and, having added *fifty parts* [or one ounce av.] of Sugar of Milk, cover it with a piece of thin muslin gauze, and set aside in a warm place, where the temperature will not rise above 50° C. (122° F.), until the mixture is dry. Lastly, having added enough Sugar of Milk to make the mixture weigh *one hundred parts* [two ounces av.], reduce it to a fine, uniform powder. Preserve the powder in a well-stopped bottle." *U.S.*

There are few extracts which have caused more annoyance to dispensers than Extract of Jalap. It is always preferred in the form of powder, and owing to the hygroscopic character of the aqueous extract, which in the officinal process of 1870 was mixed with the alcoholic extract, the contents of the dispensing bottle in a short time became a hard mass, necessitating repowdering whenever used. As the aqueous extract has been proved to be inert (see *Extractum Jalapæ*), its place is well supplied by sugar of milk, and the abstract is free from the objections urged against the old extract. The dose is from ten to fifteen grains (0·66 to 1 Gm.).

Off. Prep. Pilulæ Catharticæ Compositæ.

ABSTRACTUM NUCIS VOMICÆ. *U.S. Abstract of Nux Vomica.*

(ẠB-STRĂC'TỤM NŪ'CĬS VŎM'Ị-ÇÆ.)

"Nux Vomica, in No. 60 powder, *two hundred parts* [or four ounces av.]; Sugar of Milk, recently dried and in fine powder, Alcohol, Water, each, *a sufficient quantity*, To make *one hundred parts* [or two ounces av.]. Mix Alcohol and Water in the proportion of *eight parts* [or six fluidounces] of Alcohol to *one part* [or five fluidrachms] of Water, and, having moistened the Nux Vomica with *one hundred parts* [or two fluidounces] of the menstruum, pack firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, until the Nux Vomica is exhausted. Reserve the first *one hundred and seventy parts* [three and one-half fluidounces] of the percolate, distil off the alcohol from the remainder, and mix the residue with the reserved portion. Place the mixture in an evaporating dish, and, having added *fifty parts* [or one ounce av.] of Sugar of Milk, cover it with a piece of thin muslin gauze, and set aside in a warm place, where the temperature will not rise above 50° C. (122° F.), until the mixture is dry. Lastly, having added enough Sugar of Milk to make the mixture weigh *one hundred parts* [or two ounces av.], reduce it to a fine, uniform powder. Preserve the powder in a well-stopped bottle." *U. S.*

Abstract of Nux Vomica is well adapted to replace the extract, it having been the custom of late years to use the powdered extract largely in preference to the soft extract. If the fixed oil be not removed by the method noticed under Abstract of Ignatia, the abstract will be in the form of a greasy powder, which is not as sightly as the dry sabulous powder resulting when the fixed oil is removed (see *Extractum Nucis Vomicæ*). The dose is from one to two grains (0·06 to 0·12 Gm.).

ABSTRACTUM PODOPHYLLI. *U.S. Abstract of Podophyllum.*

(ẠB-STRĂC′TỤM PŎD-Ọ-PHY̆L′LĪ.)

" Podophyllum, in No. 60 powder, *two hundred parts* [or four ounces av.]; Sugar of Milk, recently dried and in fine powder, Alcohol, each, *a sufficient quantity*, To make *one hundred parts* [or two ounces av.]. Moisten the Podophyllum with *eighty parts* [or one and three-quarter fluidounces] of Alcohol, and pack firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Podophyllum is exhausted. Reserve the first *one hundred and seventy parts* [or three and one-half fluidounces] of the percolate, distil off the alcohol from the remainder, and mix the residue with the reserved portion. Place the mixture in an evaporating dish, and, having added *fifty parts* [or one ounce av.] of Sugar of Milk, cover it with a piece of thin muslin gauze, and set aside in a warm place, where the temperature will not rise above 50° C. (122° F.), until the mixture is dry. Lastly, having added enough Sugar of Milk to make the mixture weigh *one hundred parts* [or two ounces av.], reduce it to a fine, uniform powder. Preserve the powder in a well-stopped bottle." *U. S.*

This preparation has probably no advantages over the resin of podophyllum. The yield of extract to alcohol is about 10 per cent. The dose of the abstract is from five to ten grains (0·33 to 0·67 Gm.).

ABSTRACTUM SENEGÆ. *U.S. Abstract of Senega.*

(ẠB-STRĂC′TỤM SĔN′Ẹ-ḈÆ.)

"Senega, in No. 60 powder, *two hundred parts* [or four ounces av.]; Sugar of Milk, recently dried and in fine powder, Alcohol, each, *a sufficient quantity*, To make *one hundred parts* [or two ounces av.]. Moisten the Senega with *eighty parts* [or one and three-quarter fluidounces] of Alcohol, and pack firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Senega is exhausted. Reserve the first *one hundred and seventy parts* [or three and one-half fluidounces] of the percolate, evaporate the remainder to *thirty parts* [or half a fluidounce], at a temperature not exceeding 50° C. (122° F.), and mix with the reserved portion. Place the mixture in an evaporating dish, and, having added *fifty parts* [or one ounce av.] of Sugar of Milk, cover it with a piece of thin muslin gauze, and set aside in a warm place, where the temperature will not rise above 50° C. (122° F.), until the mixture is dry. Lastly, having added enough Sugar of Milk to make the mixture weigh *one hundred parts* [or two ounces av.], reduce it to a fine, uniform powder. Preserve the powder in a well-stopped bottle." *U. S.*

This preparation is intended to take the place of the extract formerly officinal. It affords a convenient way of giving senega when a solid preparation is desired. The dose is from one to three grains (0·06 to 0·20 Gm.).

ABSTRACTUM VALERIANÆ. *U.S. Abstract of Valerian.*

(A̤B-STRĂC′TṲM VA̤-LĒ-RI̤-ĂN′Æ.)

"Valerian, in No. 60 powder, *two hundred parts* [or four ounces av.]; Sugar of Milk, recently dried and in fine powder, Alcohol, each, *a sufficient quantity*, To make *one hundred parts* [or two ounces av.]. Moisten the Valerian with *eighty parts* [or one and three-quarter fluidounces] of Alcohol and pack firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Valerian is exhausted. Reserve the first *one hundred and seventy parts* [or three and one-half fluidounces] of the percolate, evaporate the remainder to *thirty parts* [or half a fluidounce], at a temperature not exceeding 50° C. (122° F.), and mix with the reserved portion. Place the mixture in an evaporating dish, and, having added *fifty parts* [or one ounce av.] of Sugar of Milk, cover it with a piece of thin muslin gauze, and set aside in a warm place, where the temperature will not rise above 50° C. (122° F.), until the mixture is dry. Lastly, having added enough Sugar of Milk to make the mixture weigh *one hundred parts* [or two ounces av.], reduce it to a fine, uniform powder. Preserve the powder in a well-stopped bottle." *U.S.*

Abstract of Valerian is a great improvement over the former officinal extract, which was frequently found almost devoid of activity from the evaporation of the active volatile principles. An objection to it, is the large dose necessary, but it may be given enclosed in capsules. The dose is ten to twenty grains (0·67 to 1·34 Gm.).

ACACIA. *U.S. Acacia. [Gum Arabic.]*

(A̤-CĀ′CI̤-A̤.)

A gummy exudation from Acacia verek, Guillemin et Perottet, and from other species of Acacia. (*Nat. Ord.* Leguminosæ, Mimoseæ.) *U.S.*

Off. Syn. ACACIÆ GUMMI. *Gum Acacia.* A gummy exudation from the stems of one or more undetermined species of Acacia. *Br.*

Gummi Arabicum, Gummi Mimosæ; Gomme Arabique, *Fr.;* Arabisches Gummi, *G.;* Gomma Arabica, *It.;* Goma Arabiga, *Sp.;* Samagh Arabee, *Arab.*

This genus is one of those into which the old genus Mimosa of Linnæus was divided by Willdenow. The name *Acacia* was employed by the ancient Greeks to designate the gum-tree of Egypt, and has been appropriately applied to the new genus in which that plant is included.

Gen. Ch. HERMAPHRODITE. *Calyx* five-toothed. *Corolla* five-cleft, or formed of five petals. *Stamens* 4–100. *Pistil* one. *Legume* bivalve. MALE. *Calyx* five-toothed. *Corolla* five-cleft, or formed of five petals. *Stamens* 4–100. *Willd.*

The most important of the gum yielding Acacias are *A. vera* and the officinal *A. verek.* *A. vera* and *A. Arabica* were considered by Willdenow to be distinct species, but are now esteemed as one.

Acacia vera. Willd. *Sp. Plant.* iv. 1805; Hayne, *Darstel. und Beschreib.* x. 34. Syn. *A. Arabica.* Willd. *Sp. Plant.* iv. 1805; Hayne, *Darstel. und Beschreib.* x. 32; Carson, *Illust. of Med. Bot.* i. 31.—*Acacia Nilotica*, Delille, *Illust. Flor. de l'Égypte*, p. 79. This is a tree of middling size, with numerous scattered branches, of which the younger are much bent, and covered with a reddish-brown bark. The leaves are alternate and bipinnate, with two pairs of pinnæ, of which the lower are usually furnished with ten pairs of leaflets, the upper with eight. The leaflets are very small, oblong-linear, smooth, and supported upon very short footstalks. On the common petiole is a gland between each pair of pinnæ. Both the common and partial petiole are smooth in typical specimens of *A. vera*, but downy in the variety *A. Arabica.* Two sharp spines, from a quarter to half an inch long, of the color of the smaller branches, and joined together at their base, are found at the insertion of each leaf. The flowers are yellow, inodorous, small, and collected in globular heads, supported upon slender peduncles which rise from the axils of the leaves, in number from two to five together. The fruit is a smooth, flat, two-valved legume, divided, by contractions occurring at regular intervals, into several roundish portions, each containing one seed. This species flourishes in Southern Nubia, Egypt, and Senegal, and is probably scattered over the whole intervening portions of Africa; it is also abundant in Hindostan.

A. verek, Guillemin and Perottet, *Flore de Sénégambie*, 1830, 246, B. & T., 1877. *A. Senegal*, Willdenow, *Mimosa Senegal*, L.[*] This is a small tree with a grayish bark, the inner layers of which are strongly fibrous, bipinnate leaves, dense spikes of small yellow flowers longer than the leaves, and broad pods 3 or 4 inches long, containing 5 to 6 seeds. It rarely exceeds 20 feet in height, forms large forests in Western Africa, north of the river Senegal, and is abundant in Eastern Africa, Kordofan, and Southern Nubia. It is known by the natives as *Verek* or *Hashab*.

Besides the species above described, the following afford considerable quantities of gum[†]:—*A. Karroo* of the Cape of Good Hope, formerly considered by some as identical with *A. vera; A. gummifera*, seen by Broussonet in Morocco near Mogador; *A. Ehrenbergiana*, a shrub six or eight feet high, named in honor of the German traveller Ehrenberg, who observed it in the deserts of Libya, Nubia, and Dongola; *A. Seyal*, growing in the same region, and also in Upper Egypt and Senegambia; *A. Adansonii*, of the *Flore de Sénégambie*, said to contribute a portion of the Senegal gum; and *A. tortilis*, which sometimes attains the height of sixty feet, and inhabits Arabia Felix, Nubia, Dongola, and the Libyan desert. Brownish or reddish gums are also yielded by *A. stenocarpa*, *A. fistula*, and *A. Nilotica*, and probably by various undescribed species.[‡] *A. decurrens* and *A. floribunda* yield gum in New Holland. Trees, moreover, not belonging to the genus, afford a similar product, especially *Feronia elephantum* of Hindostan, the gum of which, according to Ainslie, is used for medical purposes in Lower India, and *Algarobia glandulosa* of New Mexico, the source of the *mezquite gum*.

The gum-bearing Acacias are all thorny or prickly trees or shrubs, calculated by nature for a dry and sandy soil, and flourishing in deserts where few other trees will grow. We are told that camels, attached to the caravans, derive from them their chief sustenance in many parts of those desolate regions in which Africa abounds. In these situations, they have a stunted growth, and present a bare, withered, and uninviting aspect; but in favorable situations, as on the banks of rivers, they are often luxuriant and beautiful.

Their bark and unripe fruit contain tannic and gallic acids, and are sometimes used in tanning. An extract was formerly obtained from the immature pods of *A. Arabica* and *A. vera*, by expression and inspissation. It was known to the ancients by the name of *acaciæ veræ succus*, and was highly praised by some of the Greek medical writers, but is at present little used. It is a solid, heavy, shining, reddish-brown substance, of a sweetish, acidulous, styptic taste, and soluble in water. Its virtues are probably those of a mild astringent. On the continent of Europe, a preparation is said to be substituted for it called *acacia nostras*, obtained by expression and inspissation from the unripe fruit of *Prunus spinosa*, or the wild plum-tree.

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[*] Why the revisers of the Pharmacopœia selected the name of *A. Verek* for this plant is not clear: according to the received principles of scientific nomenclature it should be known as *A. Senegal*.

[†] *Constitution of Gum.* Much confusion has existed in the use of the word *gum*, which has been employed to express various concrete vegetable juices, and, at the same time, a peculiar proximate principle of plants. It is now proposed to restrict the term to the former of these applications, and to designate the principle alluded to by the name of arabin. The subject of the gums was investigated by M. Guérin, who repeated and corrected the experiments of former chemists, and threw new light upon the nature of these substances. Several of the facts mentioned in the text were derived from his memoir, published in the *Ann. de Chim. et de Phys.* (t. xlix. p. 248). M. Guérin considers as characteristic of gums, the property of affording mucic acid, when acted on by nitric acid. He recognizes in the different gums three distinct proximate principles; namely: 1. *arabin*, or the pure gum of chemical writers, which is the essential constituent of gum arabic; 2, *bassorin*, which enters largely into the composition of Bassora gum and tragacanth; and 3, *cerasin*, which constitutes the portion of cherry gum insoluble in cold water. Of arabin sufficient is said in the text. Bassorin will be treated of under the head of Bassora gum. (See *Part Second.*) The gums which exude from the cherry, apricot, peach, and plum trees, and which the French call *gomme du pays*, appear to be identical in composition, consisting of a portion soluble in cold water, which is arabin, and a portion insoluble, which was formerly thought to be bassorin, but has been proved by M. Guérin to be different, and is appropriately denominated *cerasin*.

[‡] For further information in regard to gum-bearing trees of Northern Africa, see *P. J. Tr.*, Aug. 1873; *Compt.-Rendus*, t. lxxix. p. 1175.

The gum of the Acacias exudes spontaneously from the bark, and hardens on exposure; but incisions are sometimes made in order to facilitate the exudation. The gum is said also to be found immediately under the bark, where it is sometimes collected in regular cavities. (*Journ. de Pharm.*, t. xxiv. p. 321.) It is probably produced by a process of degeneration from the cellulose, and is incapable of serving further in plant-growth.* It is stated by Jackson that, in Morocco, the greatest product is obtained in the driest and hottest weather, and from the most sickly trees. An elevated temperature appears to be essential; for in cooler climates, though the tree may flourish, it yields no gum. According to Ehrenberg, the varieties in the characters of the gum do not depend upon difference in the species of the plant. Thus, from the same tree, it will exude frothy or thick, and clear or dark-colored, and will assume, upon hardening, different shapes and sizes; so that the pieces, when collected, require to be assorted before being delivered into commerce. Schweinfurth and other observers state, however, that the finest gum is obtained only from the *A. vera*, and perhaps one or two other species.

Commercial History and Varieties. The most common varieties of this drug are the *Turkey*, the *Barbary*, the *Senegal*, and the *India gum;* to which may be added the *Cape* and the *Australian gum*.

1. Turkey Gum. Gum arabic was formerly procured chiefly, if not exclusively, from Egypt and the neighboring countries; and much is still obtained from the same sources. It is collected in Upper Egypt, Nubia, Kordofan, and Darfur, whence it is taken down the Nile to Alexandria. We obtain it in this country through Smyrna, Trieste, Marseilles, or some other entrepôt of the Mediterranean commerce. Two varieties have long been noticed, one more or less colored, the other white, which were formerly distinguished by the titles of *gum gedda* and *gum turic*, derived from the ports of the Red Sea, Jidda and Tor, from which the varieties were erroneously supposed to be respectively exported. The gum from Egypt is commonly called *Turkey gum*, and is the kind with which apothecaries are usually supplied. Though interspersed with roundish pieces of various sizes, it consists chiefly of small, irregular fragments, commonly whitish, or slightly tinged with yellow or reddish yellow. It is, on the whole, lighter colored, more brittle, more readily soluble, and freer from impurities than the other commercial varieties, and contains much of that form of gum arabic which is characterized by innumerable minute fissures pervading its substance, and impairing its transparency.

2. Barbary Gum. (*Mogador Gum*, *Morocco Gum.*) Mogador, a port of Morocco, is the chief entrepôt of the trade. The gum is probably derived, in part at least, from *A. Nilotica*. According to Jackson, the natives call the tree which affords it *attaleh*. They gather it in July and August, when the weather is hot and very dry. Two kinds are brought to Mogador, one from the neighboring provinces, the other by caravans from Timbuctoo. This may account for the fact that Barbary gum in part resembles the Turkey, in part the Senegal. When first deposited in the warehouses, it has a faint smell, and makes a crackling noise, occasioned by the rupture of the small masses as they become more dry. Barbary gum is usually in tears, somewhat brownish, roundish or vermiform, wholly soluble in water. It reaches the United States in casks through English commerce.

3. Senegal Gum. This variety was introduced into Europe by the Dutch. The French afterwards planted a colony on the western coast of Africa, and took possession of the trade. St. Louis, at the mouth of the Senegal, and Portendic, considerably farther north, are the ports in which the commerce in gum chiefly centres. Immense forests exist in the interior, containing many species of the genus Acacia,

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* In the lower orders of life the inner cell contents or protoplasm is often set free by the rapid conversion of the cellulose wall into a substance soluble in water, and it is asserted that very frequently in the higher plants cells can be seen with one-half of their walls still cellulose, the other gum. According to Wigand, arabin is a result of a further change in bassorin. For further information see Hofmeister, *Handbuch der physiolog. Botanik*. Bd. iv. p. 368, 1865: also Müller. *Sitzb. Akad. Wiss.*, Wien, ii., Juni, 1875; Mercadante, *Gazz. Chim.; Ber. Chem. Gesell.*, 1876, p. 581; Girand, *A. J. P.*, 1878, p. 127; also, denying explanation, Prillieux, *Compt.-Rend.*, t. lxxviii. p. 135.

all of which are said to yield gum; as is affirmed do also various trees belonging to other genera. (*Journ. de Pharm.*, xxiv. 318.) The juice begins to exude in November. The dry winds, which prevail after the rainy season, cause the bark to crack; the juice flows out and hardens in masses, which are often as large as a pigeon's egg, and sometimes as that of an ostrich. At this period, the Moors and negroes proceed to the forests in caravans, collect the gum in leather sacks, and convey it to the coasts, or frequently it is purchased by barter from the natives. Senegal gum is imported into the United States chiefly from Bordeaux, where it is sorted into twelve or fifteen different grades. (*P. J. Tr.*, ix. 43.) It is usually in roundish or oval unbroken pieces, of various sizes, in the finest grades whitish or colorless, but generally yellowish, reddish, or brownish red. The pieces are larger than those of Turkey gum, less brittle and pulverizable, and breaking with a more conchoidal fracture.[*]

4. INDIA GUM. Most of this gum is taken to Bombay in Arab vessels from Cape Gardafui and Berbera on the northeastern coast of Africa, where it is collected, or from the ports of the Red Sea. It is in pieces of various size, color, and quality, some resembling the broken fragments of Turkey gum, though much less chinky; others large, roundish, and tenacious, like the Senegal. It is often contaminated, containing, besides genuine gum arabic, portions of a different product, having the characteristic properties of Bassora gum. This is distinguished by its insolubility in water, with which, however, it unites, swelling up, and forming a soft viscid mass. It owes its properties to the presence of *bassorin*. Besides this impurity in the India gum, there are often others more readily detected. Among these, we have observed a yellowish-white resinous substance, which has the sensible properties of the turpentines. If care be used in assorting this commercial variety, it may be employed for all the purposes of good gum arabic. India gum is brought to this country partly from Calcutta or Bombay, and partly by way of England. It usually comes in large cases. We have seen a parcel said to have come directly from the Red Sea, enclosed in large sacks made of a kind of matting, and bearing a close resemblance to the gum from Calcutta, except that it was more impure, and contained numerous large, irregular, very brittle masses, not much less than the fist in size.[†]

5. CAPE GUM. During 1872, 101,241 pounds of this gum were imported into Great Britain from the Cape of Good Hope, where it is collected from the *Acacia horrida* of Willdenow. (*Flor. Capens.* 8.) It is of a pale yellow or amber-brown color, in tears or fragments, and is considered an inferior variety. (*A. J. P.*, xxix. 75.)

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[*] Dr. A. Corre divides the gum Senegal into the hard gums, which are of firm consistence, with a large, clear, shining fracture, and the soft or friable gums. For an account of the grades and varieties of these the reader is referred to the *Journ. de Pharm.*, xxiv. 318. *Galam* gum (*Gommes haut-du-fleuve*) is that coming from Galam, Podor, Bakel, and Medina; it is sometimes hard, sometimes soft. For an abstract of Soubeiran's paper on Galam gums, which is scarcely applicable to the present time, see 14th ed. U. S. D. *Gommes bas-du-fleuve* are from the deserts of Bounou and the country of the Braknas.

Brittle gum, *Salabreda*, or *Sadra-beida*, is supposed to be obtained from *A. albida* of the Flora of Senegambia, which is much smaller than *A. verek*, and characterized by its white bark. The gum is usually in small, irregular pieces, like coarse salt, probably the fragments of larger lumps, but sometimes in vermicular pieces about as thick as a goose-quill, and of variable length. It is dull and often wrinkled externally, of a vitreous fracture, and of different tints of color, white, green, yellow, or orange. It is always somewhat bitter. Very easily soluble in its weight of water, it affords a mucilage of little consistence, which has but a slight effect on the tincture of litmus. When the solution is evaporated to the consistence of a paste, it absorbs moisture so as to become viscid; this property detracts much from its value. It is much less esteemed than the Galam gum.

[†] In the *Journ. de Pharm. et de Chim.* (Oct. 1867, p. 270), a variety of India gum, imported into France by way of London. in boxes containing about 400 pounds, is described as follows. It is a mixture of tears of various tints with impurities. In assorting it for use, the lightest-colored tears are selected. These are less perfectly transparent than gum arabic, less fissured on the surface, which is brilliant and often mammillated, and are also much less friable. But the most important distinctive character of this gum consists in its relations to water. If agitated with twice or thrice its weight of cold water, instead of forming, like ordinary gum arabic, a homogeneous, slightly mucilaginous solution, it forms a thick, transparent, very tenacious magma, which cannot be diluted with a larger quantity of water, but may, after a long time, be coarsely divided, still, however, retaining its viscid, ropy aspect, which never entirely disappears, whatever may be the quantity of water added. It imparts to syrup a very thick and very viscid consistence. It is important that the apothecary should be able to distinguish it, as it is unfit for ordinary pharmaceutic use, being employed exclusively by manufacturers in the preparation of cloths. All that is necessary is to add a few pieces to twice their weight of cold water, and allow the mixture to stand. After some hours, the peculiar, viscid mucilage above described betrays the character of the gum.

6. AUSTRALIAN GUM is the product of *A. pycnantha*, Benth.; *A. decurrens*, Willd.; *A. homalophylla* (A. Cunn). It occurs in hard pieces, elongated or globular; rough, varying in color from dark amber to pale yellow; entirely soluble in water, and yielding a very adhesive mucilage, which, when dry, is said not to crack. It sometimes contains tannin.

7. SUAKIN GUM. *Talca* or *Talba Gum*, from *A. stenocarpa* and *A. Seyal*, is exceedingly brittle, and usually semipulverulent. It is a mixture of nearly colorless and brownish gum, and is exported at Alexandria.

General Properties. Gum arabic is in roundish or amorphous pieces, or irregular fragments, of various size, more or less transparent, hard, brittle, pulverizable, and breaking with a shining fracture. It is usually white, or yellowish white, but frequently presents different shades of red, and is sometimes of a deep-orange or brownish color. It is bleached by exposure to the sun. In powder it is always white. It is inodorous, has a feeble, slightly sweetish taste, and when pure dissolves wholly in the mouth. The sp. gr. varies from 1·31 to 1·48 or 1·525 for the dried gum. "The aqueous solution shows an acid reaction with test paper, yields gelatinous precipitates with solution of subacetate of lead, solution of ferric chloride, or concentrated solution of borate of sodium, and is not colored blue by test solution of iodine." *U. S.* Gum arabic consists essentially of an acid (*arabic acid*) combined with lime and potash, and leaves on ignition 2 to 3 per cent. of ash.

The gum dissolves at ordinary temperatures slowly, in an equal weight of water, forming a thick glutinous liquid of distinctly acid reaction. It is insoluble in alcohol, ether, and the oils. 100 parts of diluted alcohol containing 22 per cent. of alcohol by volume, dissolve 57 parts of gum, diluted alcohol containing 40 per cent. alcohol takes up 10 parts, and 50 per cent. alcohol only 4 parts (Flückiger). If the gum be dissolved in cold water, and the solution be slightly acidulated with hydrochloric acid, alcohol produces in it a precipitate of the *arabin* (*arabic acid*), which may also be prepared by placing a solution of gum, acidulated with hydrochloric acid, on a dialyser, when calcium chloride will diffuse out, leaving behind solution of arabin.

Arabic acid dried at 100° C. (212° F.) has the composition $C_{12}H_{22}O_{11}$, and gives up H_2O when it unites with bases. It has a decided tendency to form acid salts. Concentrated nitric acid forms with it nitro-compounds, such as $C_{12}H_{18}(NO_2)_2O_{10}$ and $C_{12}H_{16}(NO_2)_4O_{10}$; dilute nitric acid, on the other hand, gives rise to mucic and saccharic acids, together with oxalic and a little tartaric acid. Dilute sulphuric acid on prolonged boiling gives rise, according to Scheibler, to *arabinose*, or *arabin sugar* (*pectinose*, or *pectin sugar*), $C_6H_{12}O_6$, which reduces alkaline copper solution and turns the plane of polarization 121° to the right.

Neutral acetate of lead does not precipitate its aqueous solution, but the basic acetate forms even in a very dilute solution a precipitate. Soluble silicates, borates, and ferric salts render solution of gum turbid, or thicken it to a jelly. No alteration is produced by silver salts, mercuric chloride, or iodine. Gum dissolves in an ammoniacal solution of cupric oxide.

Prolonged heating of the dry gum causes it to change readily into *metarabic* (*metagummic*) acid, which is identical with the *cerasin* found in the beet and in cherry gum. Sulphuric acid will also change arabic into metarabic acid. 25 Gm. pure gum arabic are covered with 50 C.c. strong alcohol, 10 C.c. water, and 5 C.c. sulphuric acid, and allowed to stand 24 hours. On pouring off the fluid, and washing the residue with alcohol and with water, metarabic acid remains behind as a voluminous mass, which dries to a white, tasteless, and odorless powder of acid reaction. (*Graeger, Jahresbericht der Chem.*, 1872, p. 781.) The *metapectic* acid prepared by Scheibler from the sugar beet is identical with this.

The principle separated by cold water from the soluble arabin proves to be the same as the metarabic (metagummic) acid prepared direct from the pure gum arabic by heating, or by the action of sulphuric acid. It is also identical with gum extracted from the sugar beet by Scheibler. In the normal and sound beet this gum is insoluble in water, and merely swells up like the metarabic acid, while in altered beets there is found a portion (arabin) soluble in water. (Scheibler, *Ber. Chem. Ges.*, 1873, p. 612.)

Kiliani has recently shown (*Ber. Chem. Ges.*, 1880, p. 2304, and 1882, p. 34) that arabinose, the sugar obtained from arabic acid by the prolonged action of dilute sulphuric acid, is identical with *lactose* obtained from milk sugar. Like lactose, it yields mucic acid on oxidation, and reduces Fehling's solution even in the cold. The optical properties of arabinose and lactose are also identical. Kiliani also found that while considerable differences exist in the amount of mucic acid (and correspondingly of lactose) formed, yet all of a number of specimens of the gum yielded the same product, the percentage numbers ranging from fourteen to thirty-eight.

Gum arabic undergoes no change by age, when kept in a dry place. Its concentrated aqueous solution remains for a considerable time unaltered, but ultimately becomes sour, from the production of acetic acid. The disposition to sour is increased by employing hot water in making the solution. The tendency of a weak solution to become mouldy is said to be obviated by adding a few drops of sulphuric acid, and decanting from the sulphate of calcium deposited. (*A. J. P.*, 1872, p. 353.) Solution of gum arabic does not ferment upon the addition of yeast, saliva, or gastric juice; the addition of chalk and cheese, however, starts a fermentation which gives rise to lactic acid and alcohol, but not to mannite or glycerin. The addition of a solution of gum to an acidified albumen solution causes a precipitate, which disappears on further addition of gum, but the solution will then curdle and become flocculent on application of heat. Gum may be distinguished from dextrin by the following tests: 1. Gum contains no dextro-glucose, which, however, is present in dextrin, and may be recognized by the copper test.* 2. Gum contains a lime compound; hence its solution is rendered milky by oxalic acid, while a solution of dextrin remains almost clear. 3. Gum gives a shiny, yellow deposit when its solution is mixed with a neutral ferric salt. (Hager, *Chem. Central.*, 1873, pp. 408 and 584.)

The properties above enumerated belong to gum arabic generally. There are, however, pharmaceutic varieties with differences which deserve notice. 1. *Gum that is transparent and readily soluble.* This constitutes by far the greater portion of the commercial varieties distinguished by the names of Turkey and Senegal gum. It is characterized by its transparency, ready solubility, and the comparatively slight degree of thickness and viscidity of its solution. Under this head may be included the *gomme blanche fendillée* of Guibourt. It is distinguished by the whiteness and deficient transparency of the pieces, attributable to the minute cracks or fissures with which they abound, and which render them very brittle and easily pulverizable. This peculiar structure is generally ascribed to the influence of solar heat and light; but is conjectured by Hayne to arise from the exudation of the juice in the frothy state noticed by Ehrenberg. Though the unbroken pieces are somewhat opaque, each minute fragment is perfectly transparent and homogeneous. This variety, in consequence of its prompt and entire solubility, is usually preferred for medical use, and for most purposes in pharmacy. 2. *Gum less transparent and less soluble.* Guibourt has proposed for portions of this gum the name of *gomme pelliculée*, from the circumstance that the masses are always apparently covered, on some part of their surface, by a yellowish opaque pellicle. Other portions of it have a mammillary appearance on the surface. It is less transparent than the former variety, is less freely and completely dissolved by water, and forms a more viscid solution. It melts with difficulty in the mouth, and adheres tenaciously to the teeth. It is found in all the commercial varieties of gum, but least in that from Egypt. Its peculiarities have been ascribed to variable proportions of *bassorin* or *cerasin* associated with the soluble *arabin.* Between these two varieties of gum there are insensible gradations, so that it is not always easy to classify specimens.†

Impurities and Adulterations. In parcels of gum arabic there are sometimes pieces of a dark color, opaque, and incorporated with ligneous, earthy, or other impurities. The inferior are often mixed with, or substituted for, the better kinds, especially in powder; and portions of insoluble gum, bdellium, and other concrete juices of unknown origin, are found among the genuine. Flour or starch is sometimes fraudulently added to the powder, but is easily detected by the blue color which it produces with tincture of iodine. In consequence of the impurities and difference in quality, gum arabic should generally be assorted for pharmaceutic use. A foreign substance sometimes adheres to its surface, giving it a bitter taste, from which it may be freed by washing in water.* *Dextrin*, broken into small fragments, has been mingled with parcels of gum, and may be recognized by tests already given. The confection sold as *gum-drops*, which should consist of gum and cane sugar, are frequently a mixture of glucose and gelatin. In this state they are not wholly soluble in cold water; but leave, in the bottom of the vessel, a gelatinous hemispherical mass.

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* *Fehling's Solution.* 40 Gm. of crystallized cupric sulphate dissolved in 200 C.c. of water; 160 Gm. of neutral potassium tartrate and 130 Gm. of fused sodium hydrate dissolved in 600 C.c. of water: mix the two solutions, dilute to 1 litre, and boil for some minutes.

† A very handsome white gum was noticed in the market during 1876, which had the property of making a glairy solution with water. On allowing the mixture to stand for some days at a temperature of 95° C. (203° F.) it resumed its ordinary condition.

Medical Properties and Uses. This gum is used in medicine chiefly as a demulcent. By the viscidity of its solution, it serves to cover and sheathe inflamed surfaces; and, by blending with and diluting irritating matters, blunts their acrimony. Hence, it is advantageously employed in catarrhal affections and irritation of the fauces, by being held in the mouth and allowed slowly to dissolve. Internally administered, it has been found useful in inflammations of the gastric and intestinal mucous membrane; and its employment has even been extended to similar affections of the lungs and urinary organs. Whether it is beneficial, in the latter cases, in any other manner than by the dilution resulting from its watery vehicle, is doubtful. It has been used as a food, but has very little if any nutritive value. In pharmacy, gum arabic is extensively used for the suspension of insoluble substances in water, and for the formation of pills and troches. Two kinds of powdered gum arabic are used, one a coarse powder called *granulated*, the other *finely dusted*. The granulated dissolves more readily in water, according to Hager, because it has lost during desiccation only two per cent. of moisture, whilst in preparing the "finely dusted" powder the high heat necessarily used to thoroughly dry it, drives off ten per cent. of water. Its easy solubility and absence of tendency to form "lumps" cause the coarse powder to be preferred for solutions, emulsions, etc.

Off. Prep. Mistura Amygdalæ, *U. S.;* Mistura Glycyrrhizæ Composita, *U. S.;* Mistura Guaiaci, *Br.;* Mucilago Acaciæ; Pulvis Amygdalæ Comp., *Br.;* Pulvis Cretæ Comp., *U. S.;* Pulvis Tragacanthæ Comp., *Br.;* Syrupus Acaciæ, *U. S.*

ACETA. *Vinegars.*

(Ạ-CĒ'TA.)

Medicated Vinegars are solutions of medicinal substances in vinegar or acetic acid. The advantage of vinegar as a menstruum is that, in consequence of the acetic acid which it contains, it will dissolve substances not readily soluble, or altogether insoluble, in water alone. It is an excellent solvent of the alkaloids, which it converts into acetates, thereby modifying in some measure, though not injuriously, the action of the medicines of which they are ingredients. As ordinary vinegar contains principles which promote its decomposition, the Pharmacopœias now direct the substitution for it of diluted acetic acid. Even such preparations are apt to spoil in time; and a portion of alcohol is sometimes added to contribute to their preservation. A small quantity of acetic ether results from this addition; the use of alcohol is unnecessary, and in some cases injurious, as it is liable to induce precipitation. It is better to prepare the vinegars in small quantities and keep them only a short time. The vinegars now are all made of uniform strength to represent 10 per cent. of the crude drug. This change made by the Committee of Revision of Pharm., 1880, is of doubtful utility in our opinion, particularly as in one case—that of vinegar of opium, the most important in the class—the difference amounts to 33 per cent.

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* M. Picciotto has proposed a method of purifying colored gum by dissolving the gum in 6 to 18 parts of water, passing the solution through linen, and then mixing it with gelatinous alumina freshly precipitated. A pap-like substance is formed; and the coloring matter is so fixed by the alumina, that, when the mixture is placed on a linen strainer, the mucilage escapes colorless; or, if not entirely so at first, becomes so on a repetition of the process. The alumina may be used a second time. To recover the alumina, it may be washed with hot water to separate the remaining gum, then treated with chlorine water, or hypochlorite of calcium, and finally washed with boiling water. (*Jour. de Pharm. et de Chim.*, Juillet, 1867, p. 55.)

ACETUM. *Br.* *Vinegar.*

(A-CĒ'TŬM.)

An acid liquid, prepared from malt and unmalted grain by the acetous fermentation. *Br.*

Acetum Crudum, Acetum Vini; Vinaigre, *Fr.*; Essig, *G.*; Aceto, *It.*; Vinagre, *Sp.*

Vinegar is a sour liquid, the product of the acetous fermentation. Viewed chemically, it is a very dilute solution of acetic acid containing certain foreign matters.

The *acetous fermentation* may be induced in all liquors which have undergone or are susceptible of the vinous fermentation. Thus sugar and water, saccharine vegetable juices, infusion of malt, cider, and wine, may be converted into vinegar, if subjected to the action of a ferment, and exposed, with access of air, to a temperature between 24° C. (75° F.) and 32° C. (90° F.). During the acetous fermentation, a microscopic vegetable, *Mycoderma* (*M. Aceti*), develops.* By the presence and influence of this plant, the germs of which exist in the atmosphere, alcohol sufficiently diluted with water is converted into acetic acid, as sugar in solution is, through the agency of an analogous growth, converted into alcohol.

Vinegar is frequently made by the *German process*, by which the time consumed in its formation is greatly abridged. A mixture is prepared of one part of alcohol of 80 per cent., four or six parts of water, and one-thousandth of honey or extract of malt, to act as a ferment. This mixture is allowed to trickle through a mass of beech shavings, previously steeped in vinegar, and contained in a deep oaken tub, called a *vinegar generator*. The tub is furnished near the top with a wooden diaphragm perforated with numerous small holes, which are loosely filled with packthread about six inches long, prevented from slipping through by a knot at one end. The alcoholic mixture, heated to between 24° C. (75° F.) and 28° C. (83° F.), is placed on the diaphragm, and slowly percolates the beech shavings, whereby it becomes minutely divided. It is essential to the success of the process that a current of air should pass through the tub. In order to establish this current, eight equidistant holes are pierced near the bottom of the tub, forming a horizontal row, and four glass tubes are inserted vertically in the diaphragm, of sufficient length to project above and below it. The air enters by the holes below, and passes out by the tubes. The contact of the air with the minutely divided liquid rapidly promotes the acetification, which consists essentially in the oxidation of the alcohol. During the process the temperature rises to 37° C. (100° F.) or 40° C. (104° F.), and remains nearly stationary while the process is going on favorably. The liquid is drawn off by a discharge pipe near the bottom, and must be passed three or four times through the tub, before the acetification is completed, which generally occupies from twenty-four to thirty-six hours. According to Wimmer, pieces of charcoal, about the size of a walnut, may be substituted for the beech shavings in the process, with the effect of expediting the acetification. The charcoal must be deprived of saline matter by diluted hydrochloric acid, and afterwards washed with water. M. Pasteur denies that the more rapid acetification produced by enlarging the surface of contact with the atmosphere by means of packthread, beech shavings, etc., is owing to the direct influence of the air, and ascribes it to the presence of mycoderms upon the surface of these substances.

In his *Etudes sur la Vinaigre*, published in 1862, Pasteur proposed to substitute for the German process the sowing of the mycoderm upon the surface of a mixture of wine and vinegar, or of water, alcohol (2 per cent.) and acetic acid (1 per cent.), adding alcohol daily in small quantities after about half that contained in the original liquid had been converted into acetic acid, until a vinegar of sufficient strength was produced. In 1869, Beton-Laugier announced that he had succeeded in carrying out this process, and in 1870 he received a prize from the Société d'Encouragement de l'Industrie National. Recently Mr. Emanuel Wurm has further elaborated this *French process* with asserted great success (for details, see *P. J. Tr.*, xi. 133).

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* The mycoderm exists in two forms, which may be different plants or different forms of one plant, but all have the power of acetification. In one case the pellicle consists of extremely small globules (micrococci) in contiguous rows, or finally enveloped in a glue-like mass. In other instances rod-like forms (bacilli) make up the mycoderm; these vary much in size. The relations of these organisms to other plants are uncertain. Pasteur considers that they are distinct organisms, but Turpin, Berkeley, and other observers believe that they consist of the mycelium of *Penicillium glaucum*, vegetating actively and increasing also by crops of conidia or gemmæ. The action of the mycoderm seems to be an oxidizing one, so that when the supply of alcohol fails the plant probably grows at the expense of the acetic acid, converting it into carbonic acid and water.

In England, vinegar is made from the infusion of malt by the German process, which is said to have originated with Mr. Ham, of Bristol, England, as early as 1822. The fermented wort is made to fall in a shower upon a mass of fagots of birch twigs, occupying the upper part of a large vat, and, after trickling down to the bottom, is pumped up repeatedly to the top, to be again allowed to fall, until the acetification is completed. This mode of oxidizing the alcohol in the fermented wort has the advantage of rendering insoluble certain glutinous and albuminous principles, which, if not removed, would cause a muddiness in the vinegar, and make it liable to spoil.

In the United States, vinegar is often prepared from cider. When it is made on a large scale, the cider is placed in barrels with their bung-holes open, which are exposed during the summer to the heat of the sun. The acetification is completed in the course of about two years. The progress of the fermentation, however, must be watched; and, as soon as perfect vinegar is formed, it should be racked off into clean barrels. Without this precaution, the acetous fermentation would run into the putrefactive, and the vinegar be spoiled. Cider vinegar contains no aldehyd. It contains malic acid, and therefore yields a precipitate with acetate of lead. The want of such a precipitate indicates that the supposed cider vinegar is a manufactured substitute, although a fictitious article might yield a similar precipitate.

Vinegar may be clarified, without impairing its aroma, by throwing about a tumblerful of boiling milk into from fifty to sixty gallons of the liquid, and stirring the mixture. This operation has the effect at the same time of rendering red vinegar pale.

The series of changes which occur during the *acetous fermentation* is called *acetification*. During its progress, there is a disengagement of heat; the liquor absorbs oxygen and becomes turbid; and filaments form, which are observed to move in various directions, until, finally, upon the completion of the fermentation they are deposited in a mass of a pultaceous consistence. The liquor now becomes transparent, its alcohol has disappeared, and acetic acid has been formed in its place. How is this change of alcohol into acetic acid effected? Liebig supposes that it takes place in consequence of the formation of aldehyd, into which the alcohol is changed by the loss of a part of its hydrogen. The alcohol, consisting of two atoms of carbon, six of hydrogen, and one of oxygen, loses two atoms of hydrogen through the influence of the atmosphere, and becomes aldehyd, composed of two atoms of carbon, four of hydrogen, and one of oxygen. This, by the absorption of one atom of oxygen, becomes two atoms of carbon, four of hydrogen, and two of oxygen; that is, acetic acid (C_2H_3O,OH). Thus the conversion of alcohol into acetic acid consists in, first, the removal of two atoms of hydrogen, and afterwards the addition of one atom of oxygen. The following equation represents this change:

$$C_2H_6O + O = C_2H_4O + H_2O$$
$$C_2H_4O + O = C_2H_4O_2.$$

Aldehyd is a colorless, very inflammable, ethereal liquid, having a pungent taste and smell. Its density is 0·79. It absorbs oxygen gradually, and is thus converted into acetic acid, as just stated. Its property of absorbing oxygen gives it a reducing power like that possessed by glucose. Hence, it responds to Trommer's test for glucose (page 16). A few drops of solution of sulphate of copper are added to the solution suspected to contain aldehyd, and then a solution of potassa in excess. The liquid is next heated nearly to the boiling point, which will cause the precipitation of red suboxide of copper, if aldehyd be present. The name aldehyd alludes to its relation to alcohol, *al*cohol *dehyd*rogenated. Its aqueous solution is decomposed by caustic potassa, with formation of *aldehyd resin*. This is a soft, light-brown mass, which, heated to 100° C. (212° F.), gives off a nauseous soapy smell.

Properties. Vinegar, when good, is of an agreeable penetrating odor, and pleasant acid taste. According to Magnes Lahens, wine vinegar always contains a little aldehyd. The better sorts of vinegar have a grateful aroma, probably due to the presence of an ethereal substance, perhaps acetic ether. The color of vinegar varies from pale yellow to deep red. When long kept, especially if exposed to the air, it becomes ropy, acquires an unpleasant smell, putrefies, and loses its acidity.*

The essential ingredients of vinegar are acetic acid and water; but, besides these, it contains various other substances, derived from the particular vinous liquor from which it may have been prepared. Among these may be mentioned, coloring matter, gum, starch, gluten, sugar, a little alcohol, and frequently malic and tartaric acids, with a minute proportion of alkaline and earthy salts. Vinegar should be devoid of lead and copper and of free sulphuric acid, as shown by its not being discolored by sulphuretted hydrogen, and yielding no precipitate, when boiled with a solution of chloride of calcium; and of such a strength that a fluidounce would require, for saturation, not less than thirty-five grains of bicarbonate of potassium. After saturation it should be free from acrid taste, indicating the absence of acrid substances, the taste of which may have been concealed by that of the acetic acid.

MALT VINEGAR (*Acetum Britannicum*) has a brown color, and a sp. gr. from 1·006 to 1·019. The strongest kind, called *proof vinegar*, contains from 4·6 to 5 per cent. of acetic acid. That of British manufacture usually contains sulphuric acid, which the manufacturer is allowed by law to add in a proportion not exceeding one part in a thousand. This addition was at one time thought necessary to preserve the vinegar; but it is now admitted that, if the vinegar be properly made, it does not require to be thus protected.

As ordered by the British Pharmacopœia, "it has a sp. gr. of 1·017 to 1·019; one fluidounce of it (445·4 grains) requires at least 402 grain-measures of the *volumetric solution of soda* for neutralization, corresponding to 4·6 per cent. of anhydrous acetic acid.† If ten minims of solution of chloride of barium be added to a fluidounce of the vinegar, and the precipitate, if any, be separated by filtration, a further addition of the test will give no precipitate. Sulphuretted hydrogen causes no change of color." *Br.* The chloride of barium test admits the presence of 1 part in 1000 of sulphuric acid. The non-action of sulphuretted hydrogen indicates the absence of metals generally.

WINE VINEGAR (*Acetum Gallicum*) is nearly one-sixth stronger than pure malt vinegar. It is of two sorts, the white and the red, according as it is prepared from white or red wine. *White wine vinegar* is usually preferred, and that made at Orleans is the best. *Red wine vinegar* may be deprived of its color, and rendered limpid, by being passed through animal charcoal.

DISTILLED VINEGAR (*Acetum Destillatum; Vinaigre distillé, Oxéolat simple*, Fr.; *Destillirter Essig*, G.) was officinal in the U. S. Pharmacopœia, 1870, and was prepared by obtaining seven pints of distillate from eight pints of vinegar placed in a glass retort, one pint left in the retort retaining the fixed impurities, salts, etc. One hundred grains should saturate not less than seven and six-tenths grains of potassium bicarbonate. It should be wholly volatilizable by heat, yield no precipitate with acetate of lead or nitrate of silver, nor change color upon the addition of sulphuretted hydrogen or ammonia. If silver be digested with it and hydrochloric acid afterwards added, no precipitate is produced. Although preferred by some pharmacists in making medicated vinegars, it is now usually substituted by diluted acetic acid.

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* It is well known that, in certain kinds of vinegar, little eel-like animals, *Anguillula Aceti*, may be seen in great numbers. Their origin was unknown, until they were shown by M. Davaine to be developed in most fruits, as the apple, plum, peach, cherry, etc., in great numbers, and thus their presence in cider vinegar can easily be explained. These little animals need air for their support; and a curious contest may sometimes be noticed between them and the mycoderms upon the surface, which, as they tend to consume all the oxygen absorbed, the little eels combine their efforts to submerge, so as to expose the liquid freely to the air. They often in the French process interfere with the development of the vinegar, but are readily killed by exposing the liquid to a temperature of 60° C. (128° F.); or sometimes boracic acid is added.

† Dr. Carl Jehn published in *Archiv der Pharmacie*, May, 1877 (*N. R.*, August, 1877), a simple method of determining the percentage of acetic acid in vinegar. A quantity of sodium or potassium bicarbonate is placed in a glass jar, provided with a tightly fitting rubber stopper, carrying a glass tube for conducting off the gas. An open vial containing 10 C.c. of the vinegar to be assayed is placed inside the jar upon the sodium bicarbonate, the stopper is inserted, and by inclining the jar the vinegar flows out, decomposing the bicarbonate. The resulting gas passes through the glass tube into a vessel of water, and by the pressure which the gas exerts upon the surface of the water it displaces a portion of the latter, which flows through an outlet into a graduated cylinder. The divisions of the latter are so arranged as to indicate at once the percentage of anhydrous acetic acid.

Adulterations. The principal foreign substances which vinegar is liable to contain, are sulphuric and sulphurous acids, certain acrid substances, and copper and lead, derived from improper vessels used in its manufacture. Tin has been found in it after standing a short time in tin vessels. Hydrochloric and nitric acids are but rarely present. A test said to have been discovered by Chevallier (*A. J. P.*, April, 1872) is as follows. Put an ounce of the suspected vinegar into a small porcelain capsule, over a water-bath, and evaporate to about half a drachm, or to the consistence of a thin extract. When cool, add half a fluidounce of stronger alcohol, and thoroughly triturate. The free sulphuric acid, if present, will be taken up by the alcohol to the exclusion of any sulphate. Filter the alcoholic solution, add one fluidounce of distilled water, evaporate off the alcohol, and filter. Acidulate the filtrate with hydrochloric acid, add a few drops of a solution of chloride of barium, and a white precipitate of sulphate of barium will result if the sample of vinegar has been adulterated with sulphuric acid. Other methods are described by O. Hehner (*Arch. der Pharmacie*, May, 1877), see *A. J. P.*, May, 1877, Nessler (*Pharm. Cent. Halle*, No. 40, 1877), *Chem. and Drug.*, April 14, 1877, *The Analyist*, 1877, p. 163, *N. R.*, Feb. 1878, F. Masset (*Jour. de Pharm. d'Anvers*, 1879, p. 88), *A. J. P.*, Feb. 1880.

Chloride of barium is not a suitable test for the presence of sulphuric acid; as it will cause a precipitate with sulphates, which are often found in vinegar when no free sulphuric acid is present. The evaporation of a sample of vinegar in contact with a piece of white sugar or on white paper will show the presence of free sulphuric acid by the charring which ensues. Hydrochloric acid may be discovered by adding to a distilled portion of the suspected vinegar a solution of nitrate of silver, which will throw down a curdy white precipitate, insoluble in nitric acid. If nitric acid be present, an improbable impurity, it may be detected by producing a yellow color, when the suspected vinegar is boiled with indigo. The acrid substances usually introduced into vinegar are red pepper, long pepper, pellitory, grains of paradise, and mustard seed. These may be detected by evaporating the vinegar to an extract, which will have an acrid, biting taste, if any one of these substances be present. By far the most dangerous impurities in vinegar are copper and lead. The former may be detected by a brownish precipitate on the addition of ferrocyanide of potassium to the concentrated vinegar; the latter, by a blackish precipitate with sulphuretted hydrogen, and a yellow one with iodide of potassium. Pure vinegar is not discolored by sulphuretted hydrogen. According to Chevallier, wine vinegar, which has been strengthened with acetic acid from wood, sometimes contains a minute proportion of arsenic. This is probably derived from arseniferous sulphuric acid, employed in preparing the acetic acid.

Medical Properties. Vinegar acts as a refrigerant and diuretic. With this view it is added to diluent drinks in inflammatory fevers. It is sometimes used against seat-worms, and for other purposes, as a clyster, diluted with twice or thrice its bulk of water. Externally it is employed as a fomentation in bruises and sprains; it is a very valuable remedy in dermatitis from exposure to the sun. Diluted with water, it forms the best means of clearing the eye from small particles of lime. Its vapor is inhaled in certain states of sore throat, and it is diffused through sick-rooms under the impression that it destroys unwholesome effluvia, though, in fact, it has little other effect than to cover unpleasant smells. The dose is from one to four fluidrachms (3·75–15 C.c.); as a clyster, the quantity used is one or two fluidounces (30–60 C.c.).

Off. Prep. Emplastrum Cerati Saponis, *Br.*

ACETUM CANTHARIDIS. *Br. Vinegar of Cantharides.*

(A̤-CĒ'TŬM CA̤N-THĂR'I̤-DĬS.)

Vinaigre cantharidé, *Fr.;* Canthariden-Essig, *G.*

"Cantharides, in powder, *two ounces* [Avoirdupois]; Glacial Acetic Acid *two fluidounces* [Imperial measure]; Acetic Acid *eighteen fluidounces* [Imp. meas.], or *a sufficiency.* Mix thirteen fluidounces of the Acetic Acid with the Glacial Acetic Acid, and digest the Cantharides in this mixture for two hours at a temperature of 200°; then transfer the ingredients, after they have cooled, to a percolator, and, when the liquid ceases to pass, pour five fluidounces of Acetic Acid over the residuum in the apparatus. As soon as the percolation is complete, subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient acid to make one pint [Imp. meas.]." *Br.*

This preparation was formerly officinal in all the Pharmacopœias of the British Islands; but it was omitted in the first British Pharmacopœia, to be resumed in the present. The mode of preparation differs mainly in the partial substitution of percolation for maceration and expression. The addition of the glacial to the officinal acetic acid is simply to increase the strength of the latter.

This preparation is intended exclusively for external use, as a speedy epispastic. It is said, when lightly applied by a brush, to act as a rubefacient; and, when rubbed freely upon the skin for three minutes, to be followed, in two or three hours, by full vesication. The pain produced by the application, though more severe, is also more transient than that occasioned by the blistering cerate. From experiments made by Mr. Redwood, it may be inferred that the old Acetum Cantharidis of the London Pharmacopœia, which was prepared by maceration without heat, proved epispastic chiefly if not exclusively in consequence of its acetic acid, and that it contained little of the active principle of the flies. (*P. J. Tr.*, Oct. 1841.) Prof. Procter found that, by digestion at a temperature of 100° C. (212° F.), the active principle of the flies is readily taken up by officinal acetic acid, though a portion of the cantharidin is deposited upon cooling. (*A. J. P.*, xxiv. 299.) It would seem, therefore, that the vinegar of Spanish flies would be best prepared with the aid of heat; and, to a certain extent, this advantage is enjoyed in the present process.*

ACETUM LOBELIÆ. *U. S. Vinegar of Lobelia.*

(Ạ-CĒ′TŬM LỌ-BĒ′LỊ-Æ.)

Vinaigre de Lobélie enflée, *Fr.;* Lobelien-Essig, *G.*

"Lobelia, in No. 30 powder, *ten parts* [or one and three-fourths ounces av.]; Diluted Acetic Acid, *a sufficient quantity,* To make *one hundred parts* [or one pint]. Moisten the powder with *five parts* [or one fluidounce] of Diluted Acetic Acid, pack it firmly in a conical glass percolator, and gradually pour Diluted Acetic Acid upon it until *one hundred parts* [or one pint] of filtered liquid are obtained." *U. S.*

Vinegar of Lobelia may also be prepared by macerating the powder in one pint of Diluted Acetic Acid for seven days, expressing the liquid, and filtering through paper.

Vinegar of Lobelia has been reduced about 20 per cent. in strength by the above process in order to make the vinegars conform to the 10 per cent. rule adopted by the Committee of Revision of the last Pharmacopœia.

This is a good preparation of lobelia, and might well be formed into a syrup by the addition of sugar, as in the syrup of squill. It has the advantage that acetic acid gives stability to the alkaloid, which is very liable to decomposition, especially under the influence of heat. It may be used for all the purposes for which lobelia is given, either in substance or tincture, as in asthma, spasmodic catarrh, and catarrhal croup, in which it may often be advantageously conjoined with the syrups of seneka and squill. For these purposes the dose for an adult is from thirty minims to a fluidrachm (2–3·75 C.c.), repeated three or four times a day, or more frequently if required. In the paroxysm of spasmodic asthma one or two fluidrachms (3·75–7·50 C.c.) may be given every two or three hours till relief is obtained. The emetic dose would be half a fluidounce (15 C.c.).

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* The *vinegar of colchicum* (*acetum colchici*) was omitted in the U. S. Pharmacopœia, 1870, although a very active preparation. The following is the article on it in the 14th edition of the U. S. Dispensatory. "Take of Colchicum Root, in fine powder, *two troyounces;* Diluted Acetic Acid *a sufficient quantity.* Moisten the powder with a fluidounce of Diluted Acetic Acid, allow it to stand for half an hour, pack it firmly in a conical glass percolator, and gradually pour upon it Diluted Acetic Acid until the filtered liquid measures two pints. Vinegar of Colchicum may also be prepared by macerating the Colchicum Root, in moderately fine powder, with two pints of Diluted Acetic Acid, in a close glass vessel, for seven days; then expressing the liquid, and filtering through paper."

Vinegar is an excellent solvent of the active principle of colchicum; and the alkaloid of the latter loses none of its efficacy by combination with the acetic acid of the former. Of the two formulas above given, the first, directing percolation, is much preferable to the second, permitting maceration, if performed by competent hands; and the same remark will apply to all the medicated vinegars in which an alternative formula is given.

Medical Uses. This preparation has been extolled as a diuretic in dropsy, and may be given in gout, rheumatism, and neuralgia; but the wines of colchicum are usually preferred. It is recommended by Scudamore to be given in connection with magnesia, so as to neutralize the acetic acid of the menstruum. The dose is from thirty drops to two fluidrachms (1·9–7·5 C.c.).

ACETUM OPII. *U.S. Vinegar of Opium.*

(A̤-CĒ′TŬM O′PĬ-Ī.)

Black Drop; Vinaigre d'Opium, *Fr.;* Opium-Essig, *G.*

"Powdered Opium, *ten parts* [or two ounces av.]; Nutmeg, in No. 30 powder, *three parts* [or two hundred and sixty grains]; Sugar, *twenty parts* [or four ounces av.]; Diluted Acetic Acid, *a sufficient quantity*, To make *one hundred parts* [or eighteen fluidounces.] Macerate the Opium and Nutmeg in *fifty parts* [or in nine fluidounces] of Diluted Acetic Acid for twenty-four hours. Put the mixture into a conical glass percolator, and return the percolate until it passes clear. Then gradually pour on Diluted Acetic Acid until *eighty parts* [or one pint] of liquid are obtained. In this dissolve the Sugar by agitation without heat and strain." *U.S.*

Many will doubtless prefer to make this preparation entirely by maceration. This may be done by placing the powder in a suitable bottle and pouring on the diluted acetic acid, agitating frequently, after allowing the maceration to proceed seven days, expressing and filtering. The vinegar of opium was introduced into the Pharmacopœias as an imitation of or substitute for a preparation which has been long in use under the name of *Lancaster* or *Quaker black drop*, or simply *black drop*. The formula of the first edition of the U.S. Pharmacopœia was so deficient in precision, and so uncertain in its results, that it was abandoned in the second edition; but, as these objections were obviated in a process by Mr. Charles Ellis (*A. J. P.*, vol. ii. p. 202), it was deemed proper to restore it to its officinal rank at the subsequent revision of the Pharmacopœia. The preparation has, we think unfortunately, been omitted in the British Pharmacopœia with most of the other vinegars. The advantages of the black drop over laudanum are, probably, that disturbing principles contained in opium and soluble in alcohol are left behind by the aqueous menstruum employed; while the meconate of morphia is converted by the acetic acid into the acetate. In the original process, published by Dr. Armstrong, who found it among the papers of a relative of the proprietor in England, *verjuice*, or the juice of the wild crab, was employed instead of vinegar. Other vegetable acids also favorably modify the narcotic operation of opium; and lemon-juice has been employed in a similar manner with vinegar or verjuice, and perhaps not less advantageously. For the process officinal in first edition U. S. Pharm., see 14th edition U. S. Dispensatory.

The vinegar of opium may sometimes be advantageously used when opium itself, or the tincture, occasions headache, nausea, or nervous disorder. It exhibits all the anodyne and soporific properties of the narcotic, with less tendency to produce these disagreeable effects. The strength of this preparation has been more *seriously altered* than that of any other of the vinegars; it is now, in opium strength, *one-third weaker* than the black drop formerly officinal. One grain of opium was contained in 6·4 minims or 6·65 grains of the former black drop, whilst now one grain is contained in 9·6 minims or 10 grains of the present preparation. Formerly black drop was double the strength of laudanum; it has now the same strength. This alteration is in our opinion absolutely unjustifiable, and, if the preparation were more frequently used, would very probably lead to loss of life. It would be well for the present to note upon prescriptions after Acetum Opii, [*U. S. P.*, 1880,] as a safeguard, and to revise the dose accordingly. The dose may be stated at from ten to fifteen drops or minims (0·60 to 1 C.c.) of the vinegar of opium (*Pharm.*, 1880).

ACETUM SANGUINARIÆ. *U.S. Vinegar of Sanguinaria.*

(A-CĒ'TŬM SĂN-GUI-NĀ'RI-Æ.)

Vinaigre de Sanguinaire, *Fr.;* Blutwurzel-Essig, *G.*

"Sanguinaria, in No. 30 powder, *ten parts* [or one and three-fourths ounces av.]; Diluted Acetic Acid, *a sufficient quantity*, to make *one hundred parts* [or one pint]. Moisten the powder with *five parts* [or one fluidounce] of Diluted Acetic Acid, pack it firmly in a conical glass percolator, and gradually pour Diluted Acetic Acid upon it until *one hundred parts* [or one pint] of filtered liquid are obtained." *U. S.*

Vinegar of Sanguinaria may also be prepared by macerating the powder in one pint of Diluted Acetic Acid for seven days, expressing the liquid, and filtering through paper.

This preparation is now 20 per cent. weaker than the vinegar of bloodroot of the Pharmacopœia of 1870. It is efficient, and of a deep-red color. On standing, a deposit is always noticed upon the sides of the vessel containing it, and the color pales; the cause of this is unknown, as, according to the late Prof. Procter, the change is independent of the acetate of sanguinarina, which is formed in the process. (*A. J. P.*, May, 1864, p. 210.) A syrup may be formed from this vinegar by the addition of sugar, as in the syrup of squill. The dose of the vinegar of bloodroot as an emetic is three or four fluidrachms (11·25–15 C.c.); as an alterative and expectorant, from fifteen to thirty drops or minims (0·9–1·9 C.c.). It has been used as a local remedy in ringworm and other cutaneous diseases, and has been found by Dr. R. G. Jennings efficient as a gargle in the sore throat of scarlet fever.

ACETUM SCILLÆ. *U.S., Br. Vinegar of Squill.*

(A-CĒ'TŬM SCĬL'LÆ.)

Vinaigre scillitique, *Fr.;* Meerzwiebel-Essig, *G.*

"Squill, in No. 30 powder, *ten parts* [or one and three-fourths ounces av.]; Diluted Acetic Acid, *a sufficient quantity*, To make *one hundred parts* [or one pint]. Moisten the powder with *thirty parts* [or five fluidounces] of Diluted Acetic Acid, and, after the mixture has ceased to swell, transfer it to a conical glass percolator, pack it carefully, and gradually pour Diluted Acetic Acid upon it until *one hundred parts* [or one pint] of filtered liquid are obtained." *U. S.*

Vinegar of Squill may also be prepared by macerating the Squill with one pint of Diluted Acetic Acid for seven days, expressing the liquid, and filtering through paper.

"Take of Squill, bruised, *two ounces and a half* [avoirdupois]; Diluted Acetic Acid, *one pint* [Imperial measure]; Proof Spirit, *one and a half fluidounce* [Imp. meas.]. Macerate the Squill in the Acetic Acid for seven days, then strain with expression, add the Spirit to the strained liquor, and filter." *Br.*

The process now officinal differs from that of the Pharmacopœia of 1860 in allowing the mixture to swell before being transferred. As pointed out by Prof. Procter (*A. J. P.*, 1864, p. 298), the old process was rendered nugatory by the tendency of the squill to swell into an adhesive mass in the percolator.

This was formerly an officinal of the Lond., Ed., and Dub. Colleges, but was omitted as a distinct preparation in the first British Pharmacopœia, being retained simply as the first step in the preparation of the syrup; but it has been introduced into the present edition. As vinegar of squill is apt to be injured by keeping, it should be prepared frequently, and in small quantities, as wanted for use. The British preparation is a trifle stronger than that of the U. S. P. 1880. The spirit added to it in the British formula seems to be of no use as a preservative, for which it was intended.* In the German Pharmacopœia one part of squill is macerated in a mixture of nine parts of pure vinegar and one part of alcohol for three days, shaking frequently, expressing, and filtering. In the Codex twelve parts of white vinegar are used to macerate one part of squill for eight days. The Vinegar is employed chiefly in preparing the syrup. Upon standing, it deposits a precipitate, consisting, according to Vogel, of citrate of calcium and tannic acid.

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* Mr. E. Gregory (*Can. Pharm. Journ.*, Oct. 1875, and *A. J. P.*, Dec. 1875) has experimentally shown that the proof spirit ordered by the British formula is "worse than useless," for the samples prepared by him with this addition did not withstand exposure to heat and light as well as those made without spirit.

Medical Uses. This preparation has all the properties of the squill in substance, and is occasionally prescribed, but the syrup is usually and very properly preferred. The dose is from fifteen minims to a fluidrachm (1–3·75 C.c.); but the latter quantity would be apt to nauseate. It should be given in cinnamon-water, mint-water, or other aromatic liquid calculated to conceal its taste and obviate nausea.

Off. Prep. Oxymel Scillæ, *Br.;* Syrupus Scillæ, *U. S.*

ACIDUM ACETICUM. *U.S., Br. Acetic Acid.*

(ĂÇ'Ị-DŬM Ạ-CĔT'Ị-CŬM.)

Acidum Aceticum Dilutum, *P.G.;* Acetum Concentratum; Acide acétique, *Fr.;* Verdünnte Essigsäure, *G.*

"A liquid, composed of 36 per cent. of absolute acetic acid (**$HC_2H_3O_2$; 60.**—HO, $C_4H_3O_3$; 60), and 64 per cent. of water." *U. S.* An acid liquid prepared from wood by destructive distillation and subsequent purification. 100 parts by weight contain 33 parts of the acetic acid, $HOC_4H_3O_3$, corresponding to 28 parts of anhydrous acetic acid, $C_4H_3O_3$. *Br.*

ACIDUM ACETICUM DILUTUM. *U.S., Br. Diluted Acetic Acid.*

(ĂÇ'Ị-DŬM Ạ-CĔT'Ị-CŬM DỊ-LŪ'TŬM.)

Acetum purum, Acetum destillatum, *P.G.;* Acide acétique dilué, *Fr.;* Reiner Essig., *G.*

Contains 6 per cent. of absolute acetic acid, $HC_2H_3O_2$, sp. gr. 1·0083. *U. S.*

ACIDUM ACETICUM GLACIALE. *U.S., Br. Glacial Acetic Acid.*

$HC_2H_3O_2$; 60. (ĂÇ'Ị-DŬM Ạ-CĔT'Ị-CŬM GLĀ-CĬ-Ā'LĒ.) $HOC_4H_3O_3$; 60.

Acidum Aceticum, *P.G.;* Acidum Aceticum Concentratum; Acetum glacialé, Acide acétique concentré, Esprit de vinaigre, Vinaigre glacial, *Fr.;* Essigsäure, Eisessig, *G.*

Nearly or quite absolute acetic acid, *U. S.;* concentrated acetic acid, corresponding to at least 84 per cent. of anhydrous acid, $C_4H_3O_3$. *Br.*

Three strengths of acetic acid are now officinal in the U.S. and British Pharmacopœias. These are *Acidum Aceticum Glaciale*, of sp. gr. 1·056 to 1·058, *U. S.*, 1·065 to 1·066, *Br.*, *Acidum Aceticum*, of sp. gr. 1·048, *U. S.*, and 1·044, *Br.*, and *Acidum Aceticum Dilutum*, sp. gr. 1·0083, *U. S.*, and 1·006, *Br.*

We shall consider these grades separately, in the order of their strength.

ACIDUM ACETICUM GLACIALE. A process for this preparation was given in the British Pharmacopœia of 1864, which consisted in first heating acetate of sodium so as to drive off all its water of crystallization, then, after cooling, distilling it with concentrated sulphuric acid, and, finally, if the resulting acetic acid, upon being tested with a mixture of solution of iodate of potassium and a little mucilage of starch, was found to contain sulphurous acid, agitating the distilled acid with perfectly dry black oxide of manganese, and again distilling. The object of the process was to furnish an acid of the maximum strength. But, on trial, it was not found to be satisfactory, as the resulting acid was not truly glacial, and always contained sulphurous acid. (C. H. Wood, *P. J. Tr.*, July, 1867, p. 17.) The following modification of the process does, however, yield a pure product. After the crystallized salt has been fused in an iron dish in its own water of crystallization, and has dried out, by increased heat it is again brought to fusion, whereby, if the heat applied be not too strong, no acid is decomposed or vaporized. The anhydrous salt is then treated with half a molecule of sulphuric acid (for 82 parts anhydrous acetate 49 parts of strongest sulphuric acid), which according to Mohr, *N. Rep. Phar.*, 22, p. 28 (1873), and Buchner, *N. Rep. Phar.*, 22, p. 32 (1873), suffices, instead of twice the amount, usually employed. No sulphurous acid is liberated in this case. A process to be followed on a large scale, practically the counterpart of this, is given in a foot-note, page 18, 14th ed. U. S. Dispensatory.

Acetic acid of maximum strength may also be obtained by distilling acid potassium acetate at a heat between 199° C. (390° F.) and 299° C. (570° F.). One molecule of monohydrated acetic acid distils over, and neutral acetate of potassium is left. The acid acetate may be formed by evaporating a mixture of the neutral acetate with an excess of watery acetic acid. In this process, the same acetate of potassium serves repeatedly for conversion into acid acetate, and subsequent decomposition. This process is said to be employed by manufacturers on a large scale in some parts of the continent of Europe. It originated with M. Melsens.

ACIDUM ACETICUM, *U. S.*, *Br.* (Sp. gr. 1·048, *U. S.*, 1·044, *Br.*) *Acetic Acid.* This is the acid resulting from the purification of the crude acetic acid obtained by the destructive distillation of wood. It is the acid most useful to the apothecary. As this grade of acid has its source in the impure acetic acid, obtained by the destructive distillation of wood, it will be proper to premise some account of the crude acid, called *crude pyroligneous acid.*

Wood, when charred, yields many volatile products, among which are an acid liquor, an empyreumatic oil, and tar containing creasote and some other proximate principles. When the carbonization is performed in close vessels, these products, which are lost in the ordinary process of charring, may be collected, and, at the same time, a large amount of charcoal be obtained.

The carbonization of wood in close vessels, with a view to the collection of the condensible products, was first practised by Mollerct in France. The apparatus employed at Choisy, near Paris, is thus described by Thenard. It consists of—1st, a furnace with a movable top; 2d, a strong sheet-iron cylinder, standing upright, sufficiently capacious to contain a cord of wood, and furnished with a sheet-iron cover; 3d, a sheet-iron tube, proceeding horizontally from the upper and lateral part of the cylinder to the distance of about a foot; 4th, a copper tube connected with the last, which is bent in such a manner as to plunge successively to the bottom of two casks filled with water, and, after rising out of the second, is bent back, and made to terminate in the furnace. At the bottom of each cask, the tube dilates into a ball, from the under part of which another tube proceeds, which, passing water-tight through the cask, terminates above a vessel intended to receive the condensible products.

The sheet-iron cylinder, being filled with wood, in the state of billets, or, as some prefer, in that of sawdust, and closed by luting on its cover with fire-clay, is let down into the furnace by the help of a crane. The fire is then applied; and, when the process is completed, the cylinder is removed by the same means, to be replaced by another. During the carbonization, the volatile products are received by the tube; and those which are condensible, being an acid liquor and tar, are condensed by the water in the casks, and collect in the lower bends of the tubes, from which they run into the several recipients; while the incondensible products, being inflammable gases, are discharged into the furnace, where, by their combustion, they assist in maintaining the heat. Eight hundred pounds of wood afford, on an average, thirty-five gallons of acid liquor, weighing about three hundred pounds.

This is the crude pyroligneous acid, sometimes called *pyroligneous vinegar.* It is a dark-brown liquid, having a strong smoky smell, and consists of acetic acid, diluted with more or less water, and holding in solution chiefly tar and empyreumatic oil, with pyroxylic spirit, and probably a small proportion of creasote. It is from this crude acid that the U. S. and British acetic acid, corresponding to the acetic acid of commerce, is obtained. The purification is effected as follows. The acid is saturated with milk of lime, whereby acetate of calcium is formed in solution, and a good deal of the tarry matter precipitated. The solution of acetate of calcium is then mixed with a concentrated solution of sulphate of sodium, and, by double decomposition, acetate of sodium is formed in solution, and sulphate of calcium precipitated. The solution of acetate of sodium is next subjected to evaporation, during which further impurities that separate on the surface are skimmed off. The solution, being duly concentrated, is set aside to crystallize; and the impure salt thus obtained, after having been partially purified by solution and recrystallization, is fused in an iron vessel, stirred until it dries, and, the heat being carefully raised, subjected to incipient carbonization, whereby remaining empyreumatic matters are carbonized, with little damage to the salt. The mass is then dissolved in water, and the solution, being strained and recrystallized, furnishes pure acetate of sodium. (See *Sodii Acetas.*) Finally, this salt, distilled with from 34 to 35 per cent. of its weight of sulphuric acid, yields the acetic acid of commerce, the residue being sulphate of sodium, which is reserved for decomposing fresh portions of acetate of calcium. The acid has still an empyreumatic flavor, which is removed by filtering it through animal charcoal.*

A much finer grade of acetic acid is now made (1882) by Dr. E. R. Squibb by an improvement on the process of Schwartz, the principal feature being the careful regulation of the heat, whereby the excessive charring of the wood is prevented and the formation of the tarry substances so reduced as to leave the acetic acid almost entirely free from empyreuma. The retorts, which are rectangular in shape, are supported by wheels secured to shafts, rotating in bearings connected with the sides, and are run upon car tracks into the ovens, after they have been loaded with small billets of oak wood from the transfer car, in an ingenious and simple manner. In the construction of the ovens, care is taken to economize the fuel and to secure control of the temperature by the use of corrugated bottoms to the retorts and dampers in the flues; when necessary the vapors are condensed in earthenware air condensers. Experience has shown that the production and liberation of acetic acid take place at a considerably lower temperature than that sufficient to convert the wood into charcoal, and, indeed, the wood which is removed from the retorts after the operation is over is sold as kindling wood, and has the color of black walnut. The crude acetic acid does not require the tedious method of purification usually employed, but is treated with soda ash, forming acetate of sodium, which is decomposed by sulphuric acid, and the acetic acid recovered in a purified condition by distillation.

The sp. gr. of the different acetic acids increases with their strength up to the density of 1·0748 (maximum), after which it decreases until it reaches 1·0553, the density of the strongest acid (*glacial acid*).

But it will be noticed by an examination of the following table of Oudemans † that the specific gravity of the glacial (100 per cent.) and the 43 per cent. acid is practically the same, and the 80, 79, 78, 77 per cent. acids have exactly the same density, the variations between 67 and 89 per cent. being very slight. It will thus be seen that specific gravity cannot be relied upon as a criterion for strength. The glacial acid may, however, be distinguished from the 43 per cent. acid by adding 10 per cent. of water, when, if the density increases, the specimen is the stronger acid.

Percentage of Anhydrous Acetic Acid in Acetic Acid of Different Densities.

Per Ct.	Sp. Gr.	Per Ct.	Sp. Gr.	Per Ct.	Sp. Gr.	Per Ct.	Sp. Gr.	Per Ct.	Sp. Gr.
100	1·0553	80	1·0748	60	1·0685	40	1·0523	20	1·0284
99	1·0580	79	1·0748	59	1·0679	39	1·0513	19	1·0270
98	1·0604	78	1·0748	58	1·0673	38	1·0502	18	1·0256
97	1·0625	77	1·0748	57	1·0666	37	1·0492	17	1·0242
96	1·0644	76	1·0747	56	1·0660	36	1·0481	16	1·0228
95	1·0660	75	1·0746	55	1·0653	35	1·0470	15	1·0214
94	1·0674	74	1·0744	54	1·0646	34	1·0459	14	1·0201
93	1·0686	73	1·0742	53	1·0638	33	1·0447	13	1·0185
92	1·0696	72	1·0740	52	1·0631	32	1·0436	12	1·0171
91	1·0705	71	1·0737	51	1·0623	31	1·0424	11	1·0157
90	1·0713	70	1·0733	50	1·0615	30	1·0412	10	1·0142
89	1·0720	69	1·0729	49	1·0607	29	1·0400	9	1·0127
88	1·0726	68	1·0725	48	1·0598	28	1·0388	8	1·0113
87	1·0731	67	1·0721	47	1·0589	27	1·0375	7	1·0098
86	1·0736	66	1·0717	46	1·0580	26	1·0363	6	1·0083
85	1·0739	65	1·0712	45	1·0571	25	1·0350	5	1·0067
84	1·0742	64	1·0707	44	1·0562	24	1·0337	4	1·0052
83	1·0744	63	1·0702	43	1·0552	23	1·0324	3	1·0037
82	1·0746	62	1·0697	42	1·0543	22	1·0311	2	1·0022
81	1·0747	61	1·0691	41	1·0533	21	1·0298	1	1·0007

Temperature 15° C. (59° F.).

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* It has been proposed to remove the empyreumatic odor by distilling with 2 to 3 per cent. of bichromate of potassium.

† Oudemans' more recent researches upon the specific gravities of acetic acid of varying strength are given in preference to Mohr's tables, used in previous editions of the U. S. Dispensatory, as it is believed that Mohr's experiments were conducted with an acid containing 5 per cent. of water. Hoffmann (*Sammlung aller wichtigen Tabellen, Zahlen und Formeln*, p. 114.)

Acidum Aceticum Glaciale. *Br.* *Glacial Acetic Acid.* This acid, sometimes called *radical vinegar*, is a colorless, volatile, inflammable liquid, possessing a corrosive taste, and an acetous, pungent, and refreshing smell. It boils at 118.6° C. (245·5° F.). It crystallizes when cooled to 15·5° C. (60° F.), and remains crystalline until heated above 48° C. (*Br.*). Its sp. gr. is 1·056 to 1·058 at 15° C. (59° F.) *U. S.* (1·065 to 1·066, *Br.*). It possesses the property of dissolving a number of substances, such as volatile and fixed oils (*P. J. Tr.*, Sept. 11, 1875), camphor, resins, and gum resins, fibrin, albumen, etc. As it attracts humidity from the atmosphere, it should be preserved in well-stoppered bottles. Its combinations with salifiable bases are called acetates. To neutralize 3 Gm. should require not less than 49.5 C.c. of the volumetric solution of soda, corresponding to at least 99 per cent. of absolute acetic acid. (*U. S.*) A drachm of it, "mixed with a fluidounce of distilled water, requires for neutralization at least 900 grain-measures of the *volumetric solution of soda.* If a fluidrachm of it, mixed with half a [fluid] ounce of distilled water and half a drachm of pure hydrochloric acid, be put into a small flask with a few pieces of granulated zinc, and, while the effervescence continues, a slip of bibulous paper wetted with solution of subacetate of lead be suspended in the upper part of the flask above the liquid for about five minutes, the paper will not become discolored" (*Br.*); showing the absence of sulphurous acid. (See *Liquor Sodæ.*) One part of a decinormal solution of potassium permanganate in sixteen parts of acid gives a red color, which does not become fully brown in less than two hours (*Squibb*). The anhydride has been isolated by C. Gerhardt, who finds it to be a limpid liquid, heavier than water, and having the constant boiling point of 138° C. (279° F.).

Properties of the Acid of Commerce (*Acidum Aceticum*, U.S., Br.). "A clear, colorless liquid, of a distinctly vinegar-like odor, a purely acid taste, and a strongly acid reaction. It has the specific gravity 1·048 at 15° C. (59° F.). It is miscible in all proportions with water and alcohol, and is wholly volatilized by heat. Acetic acid neutralized with water of ammonia is colored deep red by ferric chloride, and decolorized again by strongly acidulating with sulphuric acid." *U. S.*

Of the British acid (sp. gr. 1·044) the strength in acetic anhydride acid is 28 per cent.; in the pure acid, according to the table, it is 33 per cent. "By weight 182 grains require for neutralization 1000 grain-measures of the *volumetric solution of soda.*" Br. "Acetic acid should not yield a precipitate with hydrosulphuric acid (lead, copper, or tin), or when supersaturated with water of ammonia (iron), or with test solution of oxalate of ammonia (calcium). When slightly supersaturated with water of ammonia, the liquid should not exhibit a blue tint (copper), nor should any residue be left on evaporating this alkaline liquid on the water-bath (other acids and fixed impurities). When supersaturated with solution of potassa, it should not have a smoky odor or taste, and when diluted with 5 volumes of distilled water, the color caused by the addition of a few drops of test solution of permanganate of potassium should not be sensibly changed by standing five minutes at the ordinary temperature (empyreumatic substances). Boiled with an equal volume of sulphuric acid, the liquid should not be darkened (organic impurities). On adding a crystal of ferrous sulphate to a cooled mixture of equal volumes of acetic and sulphuric acids, no brown or reddish-brown zone should make its appearance around the crystal (nitric acid). No precipitate should be formed on the addition of a few drops of test solution of chloride of barium (sulphuric acid), nor by adding to another portion some test solution of nitrate of silver (hydrochloric acid), nor, after the last-named addition, should the mixture turn dark on warming (sulphurous acid). 6·0 Gm. of acetic acid should require for complete neutralization 36 C.c. of the volumetric solution of soda." *U. S.* The U. S. officinal acid is somewhat stronger than the British. Phosphate of calcium has been largely detected in acetic acid sold as pure, and was copiously precipitated by ammonia added in excess. (Bruckner, *A. J. P.*, Sept. 1870, p. 389.) Victor Meyer has met with glacial acetic acid contaminated with 0·108 Gm. furfurol in a litre. (*Ber. Chem. Ges.*, 1878, p. 1870.)

It is difficult to ascertain the strength of acetic acid by saturating it with the carbonated alkalies, when the operator depends upon test-paper for ascertaining the point of neutralization. The difficulty is caused by the fact that the acetates of potassium and sodium, though neutral in composition, are alkaline to test-paper. Hence the liquid begins to be alkaline to test-paper, while some free acid yet remains, but insufficient to overcome the alkaline reaction of the salt formed. It follows, therefore, that by the use of test-paper the strength of the acetic acid will be underrated. The degree of inaccuracy, where test-paper is used, is much diminished by saturating the acid with a solution of saccharate of calcium, of a known strength, as proposed by Mr. C. G. Williams. (*P. J. Tr.*, May, 1854, p. 594.) A still better way is to add to the acid a weighed excess of carbonate of barium, and to calculate its strength by the amount of the carbonate decomposed, ascertained by deducting the undissolved from the total used. (*Redwood.*) Equally accurate results may be obtained by the use of carbonate of calcium in a similar manner. (E. C. Nicholson and D. S. Price, *Chem. Gaz.*, Jan. 15, 1856.)

Uses of Crude Pyroligneous Acid. This acid having been incidentally described as the source of the acetic acid of commerce, it may be proper in this place to notice its uses. It has been employed as an application to gangrene and ill-conditioned ulcers. It acts on the principle of an antiseptic and stimulant; the former property being in part due to the presence of creasote. Several cases in which it was successfully employed are reported in a paper by Dr. T. Y. Simons, of Charleston, S. C. (*Am. Journ. of Med. Sci.*, O. S., v. 310.)

The crude acid is advantageously applied to the preservation of animal food. Mr. William Ramsey made some interesting experiments with it for that purpose. Herrings and other fish, simply dipped in the acid and afterwards dried in the shade, were effectually preserved, and when eaten were found very agreeable to the taste. Herrings, slightly cured with salt by being sprinkled with it for six hours, then drained, next immersed in pyroligneous acid for a few seconds, and afterwards dried in the shade for two months, were found by Mr. Ramsey to be of fine quality and flavor. Fresh beef, dipped in the acid in summer for the space of a minute, was perfectly sweet in the following spring. Professor Silliman states that one quart of the acid, added to the common pickle for a barrel of hams, at the time they are laid down, will impart to them the smoked flavor as perfectly as if they had undergone the ordinary process of smoking.

ACIDUM ACETICUM DILUTUM. *U. S., Br. Diluted Acetic Acid.* "Acetic Acid *seventeen parts* [or one pint]; Distilled Water *eighty-three parts* [or five and one-eighth pints], To make *one hundred parts.* Mix them. Diluted acetic acid contains 6 per cent. of absolute acetic acid, and has the specific gravity 1·0083.* It corresponds in properties to acetic acid, and should respond to the same tests of purity." *U. S.*

"To neutralize 24 Gm. of diluted acetic acid should require 24 C.c. of the volumetric solution of soda," *U. S.;* one-fourth the number of cubic centimetres required being the number per cent. of acid contained.

"Take of Acetic Acid *one pint* [Imperial measure]; Distilled Water *seven pints* [Imp. meas.]. Mix." *Br.* The sp. gr. of this acid is 1·006. 440 grains by weight (one fluidounce [Imp.]) requires for neutralization 313 grain-measures of the *volumetric solution of soda*, corresponding to 3·63 per cent. of anhydrous acetic acid. One fluidounce [Imp.], therefore, corresponds to 16 grains of anhydrous acid. *Br.*

The object of having this preparation is to possess a weak solution of *pure* acetic acid, which may be substituted for distilled vinegar in all formulas in which nicety is required. The strength of this preparation was seriously changed at the recent U.S. revision. For a long period diluted acetic acid has been made by mixing one part of acetic acid with seven of water by measure. The officinal diluted acid is now considerably stronger, as will be seen by consulting the alternative formula. This change is of doubtful utility; in our opinion it would have been better to have made the diluted acid to contain 5 per cent. of absolute acid. This would not have materially altered the strength or specific gravity, would have corresponded with the British Pharm., and would not have done violence to a very well established custom. No advantage is apparent, in the addition of one per cent. of absolute acid. Distilled vinegar contains a little organic matter, which is always darkened or precipitated when its acid is saturated with an alkali, an occurrence which does not take place when the diluted acetic acid is employed.

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* Experiments made by Mr. C. F. Zeller indicate that the specific gravity of diluted acetic acid, by U. S. P. formula, should be 1·013 instead of 1·0083.

Medical Properties of Acetic Acid of Commerce (*Acidum Aceticum*, U. S., Br.). Acetic acid is very rarely used internally, but is refrigerant and astringent when sufficiently diluted. Owing to its volatility and pungency, its vapor is frequently applied to the nostrils as an excitant in syncope, asphyxia, and headache. When employed in this manner, it is generally added to a small portion of sulphate of potassium, so as to moisten the salt, and the mixture is put into small glass bottles with ground stoppers.

It is a mild caustic, and has especially been used in cancer, being injected by means of a syringe into the diseased tissue, but the general result has not been favorable, and the remedy will probably be abandoned ere long. Two or three ounces of it taken internally undiluted very nearly caused death in an adult. (*Lancet*, July, 1867.) The prominent symptoms were at first, slight collapse, and asphyxia from closure of the glottis. Recovery was secured by tracheotomy; after the reaction, great thirst, salivation, pain in the fauces, and inability to swallow, but without any evidence of serious gastric, pulmonary, or cardiac disturbance, were present.

Medical Properties of the Glacial Acid. This acid is used only externally, and acts as a rubefacient, vesicant, or caustic, according to the length of time it is applied. Its application requires caution. It is sometimes employed as a substitute for cantharides, when a speedy blister is desired; as, for example, in croup, sore throat, and other cases of internal inflammation. It may be applied by means of blotting-paper or cambric moistened with the acid. It is a good corrosive for destroying warts and corns, and is also a valuable remedy in scaldhead.

Off. Prep. of Acetic Acid. Acetum Cantharidis, *Br.;* Acidum Aceticum Dilutum; Extractum Colchici Aceticum; Extract. Ergotæ Fluidum, *U.S.;* Liniment. Terebinthinæ Aceticum, *Br.;* Liquor Ammoniæ Acetatis, *Br.;* Liquor Epispasticus, *Br.;* Morphiæ Acetas; Oxymel, *Br.;* Plumbi Acetas, *Br.;* Potassæ Acetas, *Br.;* Zinci Acetas.[*]

Off. Prep. of Glacial Acetic Acid. Acetum Cantharidis, *Br.;* Mistura Creasoti, *Br.*

ACIDUM ARSENIOSUM. *U. S., Br.* *Arsenious Acid.*

As_2O_3; 197·8. (ĂÇ′Ị-DŬM ÄR-SĒ-NỊ-Ō′SŬM.) AsO_3; 98·9.

[Arsenious Oxide; White Arsenic.]

An anhydrous acid, obtained by roasting arsenical ores, and purified by sublimation. AsO_3. *Br.*

Arsenicum Album, *Ed.;* Acidum Arsenicosum (*P. G.*); Arsenious Oxide, Arsenic, Arsenious Anhydrid, White Arsenic; Acide arsénieux, Arsenic blanc, Fleurs d'Arsenic, *Fr.;* Arsenige Säure, Arsenichte Säure, Weisser Arsenik, *G.;* Arsenik, *Dan., Swed., Pol.;* Acido arsenioso, Arsenico, *It.;* Arsenico blanco, *Sp.*

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[*] *Acidum Aceticum Camphoratum* (*Ed., Dub.*). *Camphorated Acetic Acid.* This is an old officinal remedy. It was prepared as follows. "Take of Camphor *one ounce* [av.]; Rectified Spirit *one fluidrachm;* Strong Acetic Acid *ten fluidounces.* Reduce the camphor to powder by means of the Spirit; then add the Acid, and dissolve." *Dub. Pharm.*

The use of the alcohol is simply to facilitate the pulverization of the camphor, and a few drops are sufficient. Acetic acid in its concentrated state readily dissolves camphor. In this preparation, the whole of the camphor is taken up by the acid. In consequence of the powerful chemical agency of the solution, and its extreme volatility, it should be kept in glass bottles accurately fitted with ground stoppers. Camphorated acetic acid is an exceedingly pungent perfume, which, when snuffed up the nostrils, produces a strongly excitant impression, and may be resorted to in fainting or nervous debility. It was an officinal substitute for Henry's *aromatic spirit of vinegar.*

At Apothecaries' Hall, in London, an *aromatic vinegar* is prepared by dissolving the oils of cloves, lavender, rosemary, and calamus, in highly concentrated acetic acid. It is used for the same purpose as the officinal camphorated acetic acid, being dropped on sponge, and kept in smelling-bottles. A similar preparation may be made extemporaneously by adding to a drachm of acetate of potassium, contained in a stoppered bottle, three drops of one or more of the aromatic volatile oils, and twenty drops of sulphuric acid. (*Pereira.*)

A better *aromatic vinegar* is prepared by adding one and a half fluidrachms of best oil of rose geranium, and fifteen minims of oil of cloves, to four fluidounces of glacial acetic acid.

Arsenious acid is prepared in Bohemia and Saxony, where it is procured on a large scale, as a collateral product, during the smelting of cobalt ores, which are almost invariably accompanied by arsenic, and in England from the mineral *arsenopyrite*, also called *mispickel* or *arsenical iron*, which is associated with the ores of tin and copper. The German process is that usually quoted as the older and better known. According to this, the ores are roasted in reverberatory furnaces with long horizontal flues. The arsenic is converted by combustion into arsenious acid, which rises in vapor, and condenses on the sides of the flues. In this state it is impure, and requires a second sublimation, which is performed in cast-iron vessels, fitted with conical heads of the same material, having an opening at the summit. The vessels are placed over a furnace, and brought to a red heat, when a portion of the impure arsenious acid is thrown in through the opening, which is immediately stopped. This portion being sublimed, a second portion is introduced in a similar manner. Finally, the vessels are allowed to cool; and, upon removing the heads, the purified acid is found attached to them in vitreous layers, at first as transparent as glass, but gradually becoming, by contact with the air, opaque at their surface. These are broken into fragments of a convenient size, and thrown into commerce. The arsenious acid so obtained is generally packed in casks, containing from two to five hundred pounds, and is shipped principally from the ports of Hamburg and Bremen. The English process differs somewhat in its details, and essentially in its final product, which is fine and crystalline rather than amorphous. In this process, the crude arsenic of the first sublimation is refined by introducing it into another furnace or series of furnaces, where it is again volatilized by the heat. When it condenses in the long series of chambers through which the vapors are carried, it is, if the process be fully successful, in the form of a perfectly white crystalline solid, which needs only to be ground and packed into kegs to be made ready for the market. The unground arsenic is, as stated, all in the *crystalline* condition, the temperature of the chambers being too low to allow of the formation of the glassy variety.

Properties. Arsenious acid is entirely volatilized by heat. As the German make of arsenic occurs in commerce, it is in masses, with a vitreous fracture, and of a milk-white color externally, but, internally, often perfectly transparent. As first sublimed, the whole mass is transparent; but it gradually becomes white and opaque, the change proceeding progressively from the surface inwards. This change has not been well explained, but probably depends upon the absorption of moisture, causing a gradual passage of the acid from the amorphous to the crystalline state. (*Pereira.*) Hence the masses "usually present a stratified appearance, caused by the existence of layers differing in degrees of opacity." *Br.* According to Guibourt, the sp. gr. of the transparent variety is 3·73, of the opaque 3·69. The experiments, however, of Dr. J. K. Mitchell and Mr. Durand make the density of the former variety from 3·208 to 3·333. The English make of arsenic is always powdered, and, under a lens, is seen to consist of small crystals perfect in form, or of small fragments of larger crystals. In a recent poisoning case (State of Conn. *vs.* Hayden) much was made to hinge upon the differences observed between this crystalline English arsenic and the commoner amorphous or German arsenic. (*Microscop. Exam. of Samples of Commercial Arsenic*, E. S. Dana. F. D. Linn & Co., Publishers, Jersey City, 1880.) As it occurs in the shops for medical use, it is often in the form of a white powder, almost as fine as flour. In this state it is sometimes adulterated with powdered lime or chalk, or sulphate or arsenite of calcium, a fraud which is easily detected by exposing the powder to a heat sufficient to evaporate the arsenious acid, when these impurities will be left behind. In consequence of the liability of the acid to contain impurities when in powder, it was directed in the U. S. Pharmacopœia of 1870 to be kept in masses; so that the apothecary may powder it for himself as it is wanted. It has been erroneously stated to have an acrid taste. Dr. Christison asserts that it possesses hardly any taste; inasmuch as it produces merely a faint sweetish impression on the palate. In strong, hot solution, it has an austere taste, most nearly resembling that of sulphate of zinc. (*Mitchell* and *Durand.*) It has no smell, even in vapor; but, when thrown on ignited charcoal, it emits a garlicky odor, in consequence of its deoxidation, and the volatilization of the reduced metal. Its point of sublimation, according to Berzelius, is at an incipient red heat; but, according to Mitchell and Durand, it is lower than that of metallic arsenic, being only 218° C. (425° F.). In the British Pharmacopœia it is said to be entirely volatilized at a temperature not exceeding 204° C. (400° F.). Dr. Taylor, in his work on Medical Jurisprudence, gives the subliming point at 188° C. (370° F.); and Mr. Wm. A. Guy, who has made careful experiments on the volatility of various substances, states that arsenious acid rises in vapor at about 138° C. (280° F.). (*P. J. Tr.*, Feb. 1868, p. 373.) "On being heated to about 218° C. (424·4° F.) it is completely volatilized, without melting (absence of non-volatile substances), and when thrown on ignited charcoal emits an alliaceous odor." *U. S.* When slowly sublimed, it condenses in regular octohedral crystals of a sparkling lustre. It may also be obtained crystallized in fine octohedrals by the slow cooling of a solution of the acid in boiling diluted hydrochloric acid. (*Journ. de Pharm.*, 1873, p. 246.) "If 0·247 Gm. of Arsenious Acid be dissolved with 0·5 Gm. of bicarbonate of sodium in boiling water, the solution should decolorize not less than 48·5 C.c. of the volumetric solution of iodine (corresponding to at least 97 per cent. of pure Arsenious Acid)." *U. S.* "Four grains dissolved in boiling water with eight grains of bicarbonate of soda, discharge the color of 808 grain-measures of the *volumetric solution of iodine.*" *Br.*

"Arsenious acid is soluble in 30 to 80 parts of water at 15° C. (59° F.), the solubility varying with its physical condition. It is slowly but completely soluble in 15 parts of boiling water. In alcohol it is but sparingly soluble. It is freely dissolved by hydrochloric acid, the alkalies and their carbonates, and is moderately soluble in glycerin." *U. S.* The following is given on the authority of Bussy. The transparent acid dissolves much more rapidly than the opaque. By prolonged ebullition with water, the opaque variety attains the same solubility as the transparent, and may be supposed to be converted into the latter. Thus, at the boiling temperature, a pint of water dissolves 807 grains of both varieties. The transparent variety, in cold saturated solution, gradually lessens in solubility, until it reaches the solubility of the opaque, no doubt in consequence of being changed into the latter. Pulverization lessens the solubility of the transparent variety, without affecting that of the opaque. The mixture of the two varieties of the acid in the same solution serves to explain the anomalies heretofore observed in its solubility. (*Journ. de Pharm.*, Nov. 1847.)* "An aqueous solution of arsenious acid affords a lemon-yellow precipitate with test solution of ammonio-nitrate of silver, and a grass-green one with test solution of ammonio-sulphate of copper; and if the solution is acidulated with hydrochloric acid, a bright-yellow one with hydrosulphuric acid. This latter precipitate is soluble in test solution of carbonate of ammonium and insoluble in diluted hydrochloric acid (distinction from sulphides of antimony and tin)." *U. S.*

Medical Properties. The officinal preparations of arsenic are all of them, when in sufficient concentration, violent irritants, or escharotics. Taken internally in sufficient dose they are exceedingly poisonous to both man and the lower animals. When properly administered they are alteratives, affecting in some unknown way the nutrition, especially of the nervous system. They are often of service in simple nervous debility, but are especially useful in chorea and in chronic malaria. When given for their tonic effect only, they should be used in such small doses as not to cause any general symptoms; but when a specific action, as in chorea, is desired, it is proper to begin with small doses and rapidly increase them until the limit of tolerance is reached. Not rarely, such doses produce gastro-intestinal irritation, especially pain and diarrhœa. To avoid this as much as possible, the remedy should be given after meals. When either gastro-intestinal irritation or the more peculiar effects of arsenic are caused, the dose should at once be lessened. The specific symptoms of *arsenicalism* are a general disposition to œdema, especially of the face and eyelids, a feeling of stiffness in these parts, itching of the skin, tenderness of the mouth, loss of appetite, and uneasiness and sickness of the stomach. The peculiar swelling produced is called *œdema arsenicalis.* In some instances the internal use of arsenic causes a rash not unlike that of measles, and, as in that affection, attended with catarrhal symptoms. (Tilbury Fox, *Med. T. and Gaz.*, March, 1868.) Sometimes salivation is produced, and occasionally the hair and nails fall off. It is stated by M. Charcot that he has seen, in two cases, decided anaphrodisiac effects from the prolonged use of arsenic, which disappeared several months after its discontinuance, and in one instance returned upon its resumption. (*Ann. de Thérap.*, 1865, p. 267.)

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* Experiments of M. L. A. Buchner on the solubility of arsenious acid in its various forms gave the following results. A litre of water saturated at 15° C. with crystallized arsenious acid contains gr. 2·821; with the amorphous and vitreous acid, gr. 9·306; while the same solutions, made by boiling and then allowed to cool for 24 hours, down to 15° C., contain of the crystallized acid gr. 27·839 per litre, and of the amorphous and vitreous, gr. 34·056 per litre. These results serve to confirm those of M. Bussy referred to in the text. (*Journ. de Pharm.*, 1873, p. 247.)

Arsenious acid has been exhibited in a great variety of diseases, the principal of which are scirrhus and cancer, especially cancer of the lip; anomalous ulcers; various cutaneous diseases; intermittent fever; chorea; chronic rheumatism, particularly those forms of it attended with pains in the bones; rheumatic gout; diseases of the bones, especially nodes, and firm swellings with deformity of the small joints of the hands; chronic syphilitic affections; frontal neuralgia; different painful affections of the head, known under the names of hemicrania and periodical headache; and intermittent neuralgic pains of the stomach and bowels. In intermittent fever it is inferior only to Peruvian bark and its alkaloids; and probably no remedy surpasses, or even equals it, in that most obstinate affection of the joints frequently called rheumatic gout. Mr. Henry Hunt, of Dartmouth, England, found it useful in mitigating the pain of ulcerated cancer of the uterus and in menorrhagia; also in irritable uterus, attended with pain and bearing down in the erect posture. He gave it in pill, in the dose of the twentieth of a grain three times a day. In this dose the remedy seldom produces unpleasant feelings, and may be continued for three or four months, for which period it must sometimes be employed in order to produce the desired effect on the uterus. In cutaneous affections, especially those of a scaly character, as lepra and psoriasis, it is an invaluable remedy. There would seem to be no objection against the very protracted use of this remedy in disease. Many years since, Tschudi drew attention to the so-called "*arsenic-eaters*" of Styria and the Tyrol. The habits of these people have been grossly exaggerated by some, whilst by others their existence has been denied, but the truth is that among the lower orders in the countries mentioned, there are many persons who habitually take small amounts of the poison. According to the report of a government commission, the dose of 0·62 grain is rarely exceeded. The "ratsbane eaters" are said not to suffer in their health, and to be unusually strong and vigorous people.

The external application of arsenic has been principally restricted to cancer, and anomalous and malignant ulcers, especially of the kind denominated *noli me tangere.* Dupuytren used with advantage a powder composed of one part of arsenious acid and 24 parts of calomel, as a topical application to herpes exedens, and to the foul ulcers occurring after repeated courses of mercury.

Arsenic is the chief ingredient in nearly all the empirical remedies for the cure of cancer by external application. *Plunket's caustic*, a remedy of this kind, of great celebrity, consisted of the *Ranunculus acris* and *Ranunculus Flammula*, each an ounce, bruised and mixed with a drachm of arsenious acid, and five scruples of sulphur. The whole was beaten into a paste, formed into balls, and dried in the sun. When used, these balls were rubbed up with yolk of egg, and spread on pig's bladder. The use of the vegetable matter is to destroy the cuticle; for, unless this is done, the arsenic will not act. Mr. Samuel Cooper thinks that this caustic was never of any permanent benefit in genuine cancer, but has effected cures in some examples of lupus, and malignant ulcers of the lips and roots of the nails. In onychia maligna, Mr. Luke, of London, regards an ointment composed of two grains of arsenious acid and an ounce of spermaceti ointment as almost a specific. (Pereira, *Mat. Med.*)

At Paris, an *arsenical paste* of the following composition has been used as an application to malignant ulcers:—Red sulphide of mercury 70 parts; dragon's blood

22 parts; arsenious acid 8 parts. It is applied, made up into a paste with saliva. The pain produced by this composition is very severe, and its application dangerous. The *arsenical paste of Frère Côme* has been applied advantageously by M. Biett to the ulcerated surfaces in yaws. The precaution was used of not applying it, at one time, over a surface larger than that of half a dollar. This paste is made by mixing water with a powder consisting of ten grains of arsenious acid, two scruples of red sulphide of mercury, and ten grains of powdered animal charcoal. The practice of sprinkling unmixed arsenious acid on ulcers is fraught with the greatest danger. Mr. S. Cooper characterizes it as a murderous practice.

Febure's remedy for cancer consisted of ten grains of arsenious acid, dissolved in a pint of distilled water, to which were added an ounce of extract of conium, three fluidounces of solution of subacetate of lead, and a fluidrachm of tincture of opium. With this the cancer was washed every morning. Febure's formula for internal exhibition was, arsenious acid two grains, rhubarb half an ounce, syrup of chicory q. s., distilled water a pint. Of this mixture, a tablespoonful, containing about the sixteenth of a grain of the acid, was given every night and morning, with half a fluidrachm of the syrup of poppies. The dose was gradually increased to six tablespoonfuls.

The average dose of arsenious acid is the twentieth of a grain, three times a day, given in the form of pill. It is usually combined with opium, which enables the stomach to bear the medicine better. A convenient formula is to mix one grain of the acid with ten grains of sugar, and to beat the mixture thoroughly with crumb of bread, so as to form a pilular mass, to be divided into ten pills. The *Asiatic pills*, so called, consist of arsenious acid and black pepper, in the proportion of 1 part of the former to 80 of the latter. A preparation much used on the continent of Europe is *Boudin's solution*, which is simply an aqueous solution of arsenious acid with the addition of wine, and is made by boiling one gramme (15·4 grains) of the acid with one litre (2·1 pints) of distilled water till entirely dissolved, then cooling, filtering, adding enough distilled water to supply the loss, and finally mixing with one litre of white wine. Of this solution a fluidounce contains about one-quarter of a grain of arsenious acid.

Properties of Arsenious Acid as a Poison. Arsenious acid, in an overdose, whether internally or externally, acts with very great energy, and generally destroys life in a short time; but, in some rare instances, no well-marked symptoms are developed until eight or nine hours after the ingestion of the poison. Dr. Edward Hartshorne relates a case of recovery, in which at least a drachm of arsenious acid had been swallowed, and where the symptoms of poisoning were delayed for sixteen hours. (*Med. Examiner*, 1855, p. 707.) The symptoms produced by the poison are an austere taste; fetid state of the mouth; frequent ptyalism; continual hawking; constriction of the pharynx and œsophagus; the sensation of the teeth being on edge; hiccough; nausea; anxiety; frequent sinkings; burning pain at the præcordia; inflammation of the lips, tongue, palate, throat, bronchi, and œsophagus; irritable stomach, so as not to be able to support the blandest drinks; vomiting of matters, sometimes brown, at other times bloody; black, horribly fetid stools; small, frequent, concentrated, and irregular pulse, but occasionally slow and unequal; palpitations; syncope; insatiable thirst; burning heat over the whole body, or a sensation of icy coldness; difficult respiration; cold sweats; suppression of urine; scanty, red, bloody, and sometimes albuminous urine; change in the countenance; a livid circle round the eyelids; swelling and itching of the body; livid spots over the surface, and occasionally a miliary eruption; prostration of strength; loss of feeling, especially in the feet and hands; delirium; convulsions, often accompanied with insupportable priapism; falling off of the hair, detachment of the cuticle, etc. In some cases there is inflammation with burning pain in the urino-genital organs. It is very rare to observe all these symptoms in the same individual. Sometimes, indeed, they are nearly all wanting, death taking place without any pain or prominent symptom. Occasionally the symptoms have a perfect resemblance to those of Asiatic cholera, in the stage of collapse. After death, the morbid appearances are various. In some instances no vestige of lesion can be discovered. The appearances, however, in the generality of cases, are the following. The mouth, stomach, and intestines are inflamed; the stomach and duodenum exhibit spots resembling eschars, and perforations of all their coats; and the villous coat of the former is in a manner destroyed, and reduced to the consistence of a reddish-brown pulp. In cases of recovery, it has been a question how long it takes for the poison to be eliminated from the system. In an instance, reported by Dr. D. Maclagan, in which about two drachms of the poison had been swallowed, and in which magnesia was used successfully as an antidote, arsenic was detected in the urine by Marsh's test as late as the twentieth day.

A milder grade of arsenical poisoning, yet sometimes serious in its consequences, has resulted in many instances from the inhalation of the air of apartments lined with green wall-paper, which owes its color to arsenite of copper, and from which a fine poisonous dust sometimes escapes when the paper has not been well prepared. (See *Chem. News*, March 24, 1860.) The burning of green tapers is sometimes attended with an arsenical odor; and chemical examination has shown that, though in relatively rare instances, they do contain arsenious acid in quantities sufficient to prove injurious. (*Lancet*, 1873, p. 715.) Death has also resulted, in more than one instance, from working in the manufacture of green artificial leaves. (*Chem. News*, Nov. 30, 1861.) Ulceration of the anus has resulted from the habitual use of green paper, and has disappeared on the disuse of that material.

In view of the numerous accidents and crimes caused by the use of arsenious acid, its sale should be regulated by law in all the States of the Union. In 1851, an act for this purpose was passed by the British Parliament.

Dr. Christison divides the poisonous effects of arsenious acid into three orders of cases, according to the character and violence of the symptoms. In the first order, the poison produces symptoms of irritation and inflammation along the course of the alimentary canal, and commonly kills in from one to three days. In the second, the signs of inflammation are moderate, or even altogether wanting, and death occurs in five or six hours, at a period too early for inflammation to be always fully developed. In the third order of cases, two stages occur; the first stage being characterized by inflammatory symptoms, as in the first order; the second by symptoms referable to nervous irritation, such as imperfect palsy of the arms or legs, epilepsy, tetanus, hysterical affections, mania, and coma. It is a general character of this poison to induce inflammation of the stomach in almost all instances, provided death does not take place immediately, whatever be the part to which it is applied. Thus the poison, when applied to a fresh wound, will give rise to the same morbid appearances in the stomach and intestines, as when it is swallowed. In some cases, observed by Drs. Mall and Bailie, the rectum was much inflamed, while the colon and small intestines escaped.

There can be no doubt that, when applied to any ulcerated surface, arsenic may be absorbed with fatal result; and Roux has put on record the case of a young woman, whose death was caused, after agonizing sufferings, by the application of an arsenical paste to a cancerous breast. Death has occurred from the application of an arsenical paste to a soft tumor of the temple; the poisonous effects on the system at large being the cause of the fatal result. Sir Astley Cooper bears testimony to the dangerous effects of arsenic, externally applied. On the other hand, some writers assert the safety of the external application of this poison. Mr. Blackadder applied it in large quantities to sores, and never witnessed a single instance in which it acted constitutionally. The late Dr. Randolph, of this city, stated that Dr. Physick frequently and successfully employed arsenic by external application, without the injurious consequences which have been attributed to it. (*North Am. Med. and Surg. Journ.*, v. 257.) As indicated by Mr. Blackadder, absorption is less apt to follow the use of large than of small quantities; the larger amount probably killing the part to which it is applied, and thereby preventing absorption. If this dangerous caustic be used at all, it should be in accordance with these facts. Harles's observations also seem to show that when the surface is that of a chronic ulcer, either simple or malignant, absorption is less prone to occur than from a fresh wound.

Treatment of Poisoning by Arsenious Acid. Before the antidote, to be mentioned presently, can be obtained, the poison should be dislodged as far as possible by free vomiting, induced by the finger, the feather part of a quill, and the administration of an emetic of sulphate of copper or sulphate of zinc. The same object is promoted by the use of the stomach-pump. Demulcent drinks should be freely given, such as milk, white of eggs and water, or flour and water, which serve to encourage the vomiting and envelop the poison.

The antidote above referred to is *ferric hydrate*, in the *moist* or *pulpy* state. As soon as it is ready, it must be given in doses of a tablespoonful to an adult, of a dessertspoonful to a child, every five or ten minutes, until the urgent symptoms are relieved. It is calculated that the quantity taken should be at least twelve times the supposed amount of the poison swallowed; but, as the antidote is perfectly innocent, it is prudent to give it in larger quantities. According to the experiments of E. Riegel, one part of arsenious acid in solution is so fully precipitated by ten of the dry oxide, that, after its action, not a trace of the poison can be detected, even by Marsh's test. Its efficacy is of course greater, the sooner it is administered after the ingestion of the poison; but, even after delay, its use will prove advantageous, so long as any portion of the poison still remains in the stomach. The antidote acts by producing with the poison, by a transfer of oxygen from the oxide to the acid, an insoluble, and therefore inert, ferrous arseniate $2(Fe_2(OH)_6) + As_2O_3 = Fe_3(AsO_4)_2 + 5H_2O + Fe(OH)_2$. The manner of preparing the antidote will be given elsewhere. (See *Ferri Oxidum Hydratum.*) This antidote for arsenious acid was discovered by Drs. Bunsen and Berthold, of Göttingen, in 1834; and its efficacy has been abundantly confirmed by experiments on inferior animals, and by its successful application to numerous cases of poisoning in the human subject. Various observations have been made as to the best forms of the oxide for use, but as long ago as 1842 Prof. William Procter (*A. J. P.*, xiv. 29) proved that the hydrate gradually decreases in its power of neutralizing arsenious acid, the longer it is kept; and that this decrease in power is more rapid when it is mixed with much water than when in the form of a thick magma. The cause of this diminution of neutralizing power, by being kept, is explained by the experiments of G. C. Wittstein. This chemist finds that ferric hydrate, recently precipitated, dissolves readily in acetic and other vegetable acids in the cold, but becomes nearly insoluble when kept for some time under water. This alteration in solubility is attributed by Wittstein to two causes; the gradual change from the amorphous to the crystalline state, and its partial dehydration; for, when kept a long time, it loses half its water. It should be an invariable rule to prepare the antidote at the time it is wanted from materials always kept at hand for an emergency. (*Buchner's Repert.*, xliii. 366)

More recently dialyzed iron has been suggested as an antidote for arsenic (*Phila. Med. Times*, Dec. 8, 1877; *A. J. P.*, Jan. 1878), especially if its administration is followed by a dose of common salt, which precipitates the ferric hydrate in the stomach; but Edward Hirschsohn (Dorpat, Russia) cautions against the use of dialyzed iron, because his experiments show that the resulting combination parts with its arsenic in the presence of acids much more readily than does the *Antidotum Arsenici* of the Russian Pharmacopœia—made by diluting one ounce of solution of ferric sulphate (Monsel's solution) with four fluidounces of water, then adding a mixture of three drachms of calcined magnesia with four fluidounces of water. The presence of sulphate of magnesium, in addition to the ferric hydrate, is considered advantageous by acting as a purgative. (*See Ferri Oxidum Hydratum cum Magnesia.*)

The antidote having been faithfully applied, the subsequent treatment consists in the administration of mucilaginous drinks. Should the patient survive long enough for inflammatory symptoms to arise, these must be combated on general principles. Convalescence is generally long and distressing; and hence it is of the greatest importance to attend to the diet, which should consist exclusively of milk, gruel, cream, rice, and similar bland articles.

Dr. Köhler, of Halle, believes that saccharine oxide of iron in solution, is preferable to all other preparations, in poisoning by arsenious acid. This forms, like the hydrated powder, an insoluble compound with the acid. He bases his opinion upon experiments with the lower animals, and gives the details of a case in which it proved successful in the human subject, after the swallowing of more than half a drachm of the acid in powder. He gave a large teaspoonful of the saccharine oxide with a drachm of water immediately afterwards, which was repeated every 15 minutes for two hours, followed by an emetic dose of ipecacuanha, and then repeated every half-hour. The patient recovered. (*Br. and F. Med.-Chir. Rev.*, 1870, p. 538.)

Bussy has proposed light magnesia, or the kind which has not been too strongly calcined, as well as recently precipitated gelatinous magnesia, as an antidote for arsenious acid; and a case is given by him in which it appeared to prove efficacious. (*Journ. de Pharm.*, x. 81.) The dense kind has very little efficacy. Dr. Christison saw a case in which this antidote seemed very serviceable. A successful case is also reported by Cadet-de-Gassicourt (*Journ. de Pharm.*, Mars, 1848), and another by Dr. E. Bissell, of Norwalk, Conn. (*Am. Journ. of Med. Sci.*, July, 1848). For the full precipitation of arsenious acid, eighteen times its weight of anhydrous magnesia are required. (*E. Riegel.*) Like the ferric hydrate, the magnesian antidote is most conveniently kept, in a pulpy state, under water in stopped bottles. M. Schroff has made some experiments on rabbits, to determine the comparative efficacy, as antidotes, of the ferric hydrate and magnesia, and gives the preference to the latter. The hydrated magnesia is best prepared extemporaneously by quickly forming a solution of sulphate of magnesium, and precipitating by water of ammonia, which is preferable to potassa, as any portion of the latter, remaining in the preparation, might act injuriously by favoring the solubility of the arsenious acid. Notwithstanding these statements, however, it is asserted by T. & H. Smith of Edinburgh, on the basis of experiment, that magnesia is incapable of neutralizing arsenious acid, and is utterly useless as an antidote. (*Pharm. Journ.*, 1865, p. 144.) Under these circumstances, it would be unwarrantable to rely on it when the ferruginous antidote is attainable. Some experiments have been made to show that sugar mixed with magnesia may serve as an antidote to poisoning by arsenious acid. (*Lancet*, 1873, p. 31.)

A mechanical method of counteracting the effects of arsenic is said to have been employed with complete success in several instances. It consists, after thoroughly washing out the stomach, in administering large quantities, a pound or more, of a mixture of chalk and castor oil, of the consistence of thick cream, which so envelops the particles of the poison adhering to the mucous membrane as to render them harmless while carried through the bowels and evacuated. (W. T. Fewtrell, *Chem. News*, 1860, p. 71.)

Reagents for detecting Arsenious Acid. As arsenic is so frequently employed for criminal purposes, it becomes important to detect its presence in medico-legal investigations. The tests for it may be divided into those which indicate indirectly its presence, and those which demonstrate its presence incontestably, by bringing it to the metallic state. The former embrace all the liquid reagents so called; the latter, the processes for metallization. It is necessary, however, to be aware of the fact, that many of the substances employed as tests for arsenic are themselves often contaminated with arsenic, and unless great care be exercised to select reagents perfectly free from this impurity, there will be danger that the results may be fallacious.

The most characteristic reagents are *sulphuretted hydrogen, ammoniacal nitrate of silver, and ammoniacal sulphate of copper.* In the opinion of Dr. Christison, the concurrent indications of these three tests are all-sufficient for detecting arsenious acid; but we think that, in questions involving life, the metallization of the poison should never be omitted.

In using sulphuretted hydrogen, the solution must be neutral or slightly acid. An excess of alkali may be neutralized with acetic acid, and an excess of nitric or sulphuric acid by potassa. A slight excess of acetic acid is not hurtful, but rather favors the subsidence of the precipitate, which is the tersulphide of arsenic, and is soluble in ammonia, ammonium carbonate, and potassium bisulphate, and gives, moreover, a metallic sublimate when heated in a tube with reducing agents, as described on the next page. According to Dr. Christison, this test is so exceedingly delicate that it detects the poison when dissolved in one hundred thousand parts of water. The color it produces is lemon- or sulphur-yellow; but the presence of vegetable or animal matter commonly gives it a whitish or brownish tint. If yellow, it might be mistaken for sulphide of tin or sulphide of cadmium, which are also yellow, but the latter is quite insoluble in ammonia, while the former gives no metallic sublimate when heated with reducing agents. If it be brownish, it may still contain arsenic, but must first be freed from organic matter.

The ammoniacal nitrate of silver gives a yellow precipitate of arsenite of silver, readily soluble to a clear solution in ammonia and in nitric and acetic acids.

The ammoniacal sulphate of copper is a test of very great delicacy. The precipitate occasioned by it is the arsenite of copper, of an apple-green or grass-green color. Its operation is prevented by hydrochloric, nitric, sulphuric, acetic, citric, and tartaric acids in excess; as also by ammonia.

Of the three tests mentioned, perhaps sulphuretted hydrogen is the most delicate; and it has the advantage of yielding a precipitate eligible for subsequent reduction. But they are all liable to the objection of being obscured in their indications, where the amount of poison is small, by the presence of organic matter; a complication constituting the most difficult problem for the medical jurist. As this case includes all others of more easy solution, we shall suppose it to occur, and shall indicate the steps to be pursued.

Having obtained general indications of the presence of arsenic, the first step will be to separate the organic matters; the second, to throw down the arsenic by means of sulphuretted hydrogen; and the third, to reduce the precipitate obtained to the metallic state. It is proper to state here that, in a communication to the Paris Academy, Dr. Blondlot, of Nancy, asserts, as the result of numerous experiments, that the smallest quantity of oily or fatty matter has the effect of diminishing, even to one-twentieth, the solubility of arsenious acid, and consequently of very much increasing the difficulty of detecting it. (See *A. J. P.*, 1860, p. 220.)

The following are the directions given by Prof. Wormley (*Micro-Chemistry of Poisons*, p. 298) for separating the organic principles. After the addition of water, if necessary, the mass is intimately mixed with about one-eighth of its volume of pure hydrochloric acid, and maintained at near the boiling temperature until the organic solids are entirely disintegrated. The mixture is then allowed to cool, transferred to a clean muslin strainer, and the matters retained by the strainer washed with water; the strainer with its contents may be reserved for future examination. The strained liquid is concentrated at a moderate heat if necessary, allowed to cool, and again filtered.

A given portion of the filtrate thus obtained is examined by the method of Reinsch (see page 41), successive slips of the copper being added as long as they receive a deposit. Any pieces of the metal that have thus become coated, after being thoroughly washed and dried, are heated in a suitable reduction tube, and the result examined in the usual manner. Another portion, or the whole of the remaining filtrate, may be exposed for several hours to a slow stream of sulphuretted hydrogen gas, then gently warmed, and allowed to stand until the supernatant liquid has become perfectly clear. The precipitate thus produced is collected upon a small filter, washed, and, while still moist, digested with pure water of ammonia; this liquid will readily dissolve any sulphide of arsenic present, whilst the organic matter may remain undissolved. The ammoniacal solution is filtered, and the filtrate carefully evaporated at a moderate heat to dryness. Should the residue contain organic matter and only a minute quantity of the sulphide, it may require further purification before its arsenical nature can be satisfactorily determined.

If, however, it be moderately pure sulphide of arsenic, it may be at once reduced to the metallic state, which can be accomplished by the method of Fresenius. The sulphide is mixed with carbonate of sodium and cyanide of potassium, and the mixture placed in the wide part of a tube of hard German glass drawn out at one end to capillary fineness. Carbonic anhydride properly dried is then passed through the tube, and the portion containing the mixture heated to redness; in this way the arsenical sulphide is reduced and the metal condensed in the capillary portion, where the smallest quantity can be recognized.

Dr. E. Davy, of Dublin, has recommended (*Chem. News*, vol. iii. p. 288) ferrocyanide of potassium previously dried at 100° C. (212° F.) as a substitute for the cyanide of potassium. It has the advantage over the latter that it does not readily absorb moisture from the atmosphere.

In order to facilitate the detection of arsenic in the solid tissues, as the liver, spleen, stomach, etc., it is necessary first to destroy the animal matter, and then to dissolve out the poison. Various agencies have been resorted to for this purpose, but the method of Fresenius and Babo is generally accepted as the best. According to this, the finely divided fragments of solid matter are heated with pure hydrochloric acid, and chlorate of potassium is added from time to time until the mass becomes homogeneous and of a light yellow color. It is then heated until the odor of chlorine has disappeared. After filtration any arsenic present will exist in the filtrate as arsenic acid. This is reduced by sulphurous acid gas or a solution of bisulphite of sodium, so that the arsenic is brought to the condition of arsenious acid, in which condition it is more readily acted upon by sulphuretted hydrogen gas.

After thorough precipitation of the sulphide and purification of this precipitate by treatment with ammonia as already described, if the residue from the evaporation of the ammonia still contain organic matter mixed with the arsenious sulphide, it is best purified as follows. Treat the residue with a small quantity of concentrated nitric acid, and evaporate the mixture again to dryness, this operation with nitric acid being repeated if necessary until the moist residue has a yellow color. The residue is then moistened with a few drops of a concentrated solution of caustic soda, a small quantity of pure powdered carbonate of soda and nitrate of soda added, and the well-mixed mass cautiously evaporated to dryness; the heat is then very gradually increased until the mass becomes colorless, when the organic matter will be entirely destroyed. The nitric acid and the soda compounds employed should be free from chlorine, or a portion of the arsenic may be volatilized as chloride. (Wormley, *Micro-Chem. of Poisons*, p. 302.)

Another method of separating arsenic in solution from organic matters, now frequently employed by chemists, is by the process of dialysis, invented by Prof. Graham, of London, of which a particular account is given in Part II. (See *Dialysis.*) By means of an instrument called the dialyzer, watery solutions of saline and other crystallizable substances may be separated from those not crystallizable, such as gelatinous, albuminous, mucilaginous, and amylaceous liquids, the latter refusing to pass through a diaphragm of some porous substance, which is readily permeable by the former. Thus, a circular piece of parchment paper, folded in the form of a common filter, is placed in a vessel containing distilled water; the suspected liquid, having been heated so as to effect a more complete solution of the arsenic, is poured into the filter, and the vessel set aside for twenty-four hours. At the end of this time, the crystallizable matter, including the arsenic, will have, to a great extent, passed through into the distilled water, leaving the organic matters behind, and a solution will have been obtained in a condition fit for the application of the different tests.

The passage of the arsenic through the membrane is, however, rarely a complete one, and the test cannot allow us to dispense with more thorough methods of examination.

Following up a suggestion of Dr. Clarke, of Aberdeen, that arsenic might be separated by taking advantage of the volatility of its chloride, Dr. Andrew Fyfe, of the same place, applied the principle to the detection of the metal when mixed with organic matter. For this purpose, he heated the arsenical liquid with sulphuric acid, free from arsenious acid, in a flask to which a bent tube and cooled receiver were adapted. When the mixture was brought to the boiling point, a little dried sea-salt was added, the receiver was connected, and the distillation continued for some time. Hydrochloric acid was evolved, which, by reacting with the arsenious acid, produced terchloride of arsenic, which distilled over free from organic matter. The terchloride of arsenic was then precipitated by a stream of sulphuretted hydrogen to obtain the yellow tersulphide of arsenic, or subjected to the action of Marsh's test. (*Philos. Mag.*, 4th series, ii. 487.) The distillate of terchloride, as thus obtained, is liable to contain sulphurous acid, from the action of organic matter on the sulphuric acid, with the effect of obscuring the indications of Marsh's test when subsequently applied, by giving rise to a yellow ring instead of a black stain. To prevent the formation of sulphurous acid, L. A. Buchner recommends that the chloride of sodium should be added to the arsenical liquid before the sulphuric acid, having been previously mixed with a little chlorate of potassium, the chlorine from which has the effect of promoting the formation of the arsenical terchloride, and of rendering the decomposition of the organic matter more complete. (*P. J. Tr.*, 1855, p. 38.) Much better than this method of prevention is the plan of keeping an amount of salt present larger than can be decomposed by the sulphuric acid, when the formation of sulphurous acid is avoided, and no danger is run of converting arsenious acid into the arsenic compound, as is the case in the presence of the free chlorine. Arsenic acid is not converted into a volatile chloride, and would therefore escape detection in this process. Indeed, it is proposed to distinguish between arsenious and arsenic acids in mixtures by this reaction. After all the arsenious acid has been distilled off as arsenious chloride, the arsenic acid can be reduced by sulphurous acid and then distilled for itself. (*Handwörterbuch der Chem.*, i. 746.) The reduction of arsenic acid to arsenious acid is very conveniently effected, according to E. Fischer, by ferrous chloride used in connection with hydrochloric acid. (*Ber. der Chem. Gesellschaft*, xiii. 1778.) Dr. Penny and Mr. W. Wallace bear testimony to the value of the plan of converting the arsenic into terchloride, as a means of separating the metal from organic matter, but think it will be found in practice more convenient to produce the terchloride by the direct agency of hydrochloric acid, than by sulphuric acid and chloride of sodium, as recommended by Dr. Fyfe.

One formula for reduction, that of Fresenius, has been given. Still another method, and one in which the whole process from beginning to end may take place in a single tube, is the following. The sulphide is mixed with oxalate of sodium (a salt which contains no water of crystallization), and the dry mixture is transferred to a suitable tube sealed at one end. An arsenical mirror is readily obtained, and if the heat is continued long enough no arsenic remains behind—an excellent and easy method, in which the reducing gas is carbonic oxide, in an atmosphere of carbonic anhydride. (Blyth, *Manual of Pract. Chem.*, p. 398.) If any doubt be felt as to the nature of the crust, it may be driven up and down the tube, so as to convert it into sparkling octohedral crystals of arsenious acid, the triangular facets of which may be seen with a magnifying glass. Finally, the crystals may be dissolved in a drop or two of distilled water, and the solution will react characteristically with the liquid tests.

Another method of testing for arsenic was proposed by Mr. Marsh, and is perhaps the best known of the arsenic tests. It consists in taking advantage of the power, which nascent hydrogen possesses, of decomposing the acids of arsenic, with the result of forming water and arseniuretted hydrogen, as illustrated by the subjoined reaction:

$$As_2O_3 + (H_2)_6 = (H_3As)_2 + (H_2O)_3.$$

The liquid from the stomach, or obtained from its contents by boiling water, is added to the materials for generating hydrogen (pure dilute sulphuric acid and zinc), contained in a self-regulating generator of hydrogen. Dr. Canudas y Salva prevents the possible explosion of the apparatus, resulting from the ignition of the hydrogen before all the air has been expelled, by placing in the lateral exit tube two metallic meshes, enclosing between them very loose cotton. (*N. R.*, April, 1878.) Fresenius proposed the same years ago. If the liquid from the stomach contain arsenic, the nascent hydrogen will combine with the metal, and the nature of the compound gas formed may be ascertained by burning a jet of it from a fine jet-pipe connected with the generator. The flame will have a characteristic blue color; and, by holding a porcelain plate against it, a thin film of metallic arsenic, forming a black stain, will be deposited. Liebig and Mohr bear testimony to the delicacy of this test; but, to remove every source of fallacy, it is necessary to be sure of the purity of the materials for generating the hydrogen by a preliminary trial of the gas, before the suspected liquid is added; as zinc and sulphuric acid are both liable to contain arsenic. This trial is made by holding a plate against the burning hydrogen, which, if pure, will produce no stain. The pieces of zinc employed should be changed after every experiment. Magnesium might be advantageously substituted for zinc, as it contains no arsenic, or, still better, sodium amalgam (made by adding about 5 per cent. of metallic sodium to some warmed mercury), as proposed by E. W. Davy. This can be used then in a neutral solution, the evolution of nascent hydrogen being due to the decomposition of the water by the sodium.

Still another modification is Fleitmann's test, in which the use of zinc is retained, but the development of nascent hydrogen is brought about by the addition of caustic potassa or soda. Under these circumstances arseniuretted hydrogen is produced, but antimoniuretted hydrogen cannot be formed. A modification of Marsh's apparatus, which is praised by Berzelius for the certainty and distinctness of its results, consists in having the tube which delivers the hydrogen arsenide narrowed in several places. If, then, while the gas is passing, heat be applied a little this side of the narrowed place, the compound is decomposed and a bright mirror of metallic arsenic is deposited in the contraction. As ever so small a deposit can be changed subsequently into oxide or sulphide, both of which are characteristic, this test is quite delicate.

It has been objected to Marsh's test, that antimony forms a compound with hydrogen, very similar to arseniuretted hydrogen, both in the color of its flame, and in the metallic spot which it deposits during combustion on cold surfaces. Still, the two metals may be distinguished by acting on the metallic spot with a drop or two of fuming nitric acid, with the aid of heat. Arsenic will thus be converted into soluble arsenic acid, precipitable brick-red by nitrate of silver; antimony, on the other hand, into insoluble antimonic acid. Another way of distinguishing them is to apply to the stain a solution of hypochlorite of sodium, which instantly dissolves the arsenical spot, without affecting that of antimony, or solution of protochloride of tin, which has no action on metallic arsenic, while it dissolves slowly but completely the antimony stain. (*Blyth's Manual*, p. 385.) Nitroprusside of sodium also, while it has no effect upon arsenic spots, will dissolve those of antimony completely and easily. (*Handwörterbuch der Chem.*, i. 757.) In case the metallic mirror is obtained in the tube by Berzelius's modification of Marsh's test, a stream of hydrogen sulphide may be passed, whilst immediately behind the stain a gentle heat is applied. Arsenic is changed thereby to yellow sulphide, while antimony produces an orange or black sulphide; if dry hydrochloric acid gas is now transmitted, the arsenical sulphide is unchanged, while antimony sulphide is converted into chloride of antimony, which volatilizes without the application of heat. (*Blyth's Manual of Pract. Chem.*, p. 385.) Sulphide of ammonium dissolves the arsenical spot with difficulty, leaving on evaporation a yellow stain; it readily dissolves the antimonial, and yields an orange-red spot. Marsh's test may be still further modified as proposed by Lassaigne. The current of hydrogen arsenide is conducted into solution of nitrate of silver, when it is decomposed according to the reaction:

$$AsH_3 + (AgNO_3)_6 + (H_2O)_3 = H_3AsO_3 + (HNO_3)_6 + (Ag_2)_3.$$

Here arsenious acid is formed, which goes into solution, and metallic silver separates out. Hydrogen antimonide passed into nitrate of silver solution gives a black precipitate of antimonide of silver, in which all the antimony is contained.

Professor Reinsch has proposed a method for detecting arsenic in organic liquids, which is extremely delicate, and at the same time has the merits of facility and celerity. It consists in acidulating the suspected liquid with hydrochloric acid, which converts the arsenious acid into the terchloride, and boiling in it, for ten minutes, a slip of copper foil, on which the arsenic is deposited as a white alloy of arsenic and copper; and then separating it in the state of arsenious acid, by subjecting the copper, cut into small chips, to a low-red heat in the bottom of a small glass tube. The peculiar crystalline appearance of arsenious acid, mentioned in the preceding page, is conclusive of its presence; and, besides, if collected and dissolved in water, it will answer to the ordinary tests for the poison. The form of copper, preferred by Dr. Maclagan, is that of copper wire, No. 24, made bright by being rubbed with sand-paper, and rolled into a loose spiral, about an inch long, by being twisted round a small pencil. In this form, the copper affords an extensive surface for the deposition of the arsenic. The merit of Reinsch's procedure is not so much that it gives a characteristic deposit on the copper,—for bismuth, tin, zinc, and antimony also give deposits,—as that the copper collects all the arsenic from the organic liquid, and presents it in a convenient form for applying the liquid and subliming tests. Yet the gray metallic appearance of the arsenical deposit can hardly be confounded with that of any other metal, except perhaps of antimony, which can be distinguished by the tests already mentioned. But Reinsch's method is not without its fallacies. Thus, it has been ascertained that the presence of a nitrate or chlorate in the suspected material, prevents the characteristic action of the arsenic on the copper, until the whole of these substances have been consumed by reaction with the metal. Besides, both hydrochloric acid and copper, even such as have been sold in the shops as the purest, are liable to contain arsenic, and therefore to afford fallacious results. This, however, is less true of the hydrochloric acid prepared in this country than the European, as the sulphuric acid employed in its preparation is obtained generally from native sulphur, instead of from pyrites as abroad. Nevertheless, no conclusion from Reinsch's test can be certainly relied on, unless the hydrochloric acid has been ascertained to be free from arsenic. With the copper there is less risk, as the arsenic in it can act only by solution of the copper itself, and this is known by the green color imparted to the liquid; so that, if the arsenical deposit should be produced without discoloration of the liquid, the indication of the presence of the poison may be considered as satisfactory. (*Odling* and *Taylor.*)

If the process of Reinsch is to be applied to the sulphide of arsenic, it will be necessary to bring this into the liquid form. For this purpose Prof. J. C. Draper, of New York, makes use of ammonia, which dissolves the sulphide, and is also capable of attacking copper. The substance supposed to contain the sulphide having been covered, in a suitable vessel, with water of ammonia, is set aside in a warm place, and permitted to stand for a few hours. The solution of the sulphide is then separated by filtration, strips of clean, bright copper are introduced into it, and the whole gently heated. The copper gradually becomes coated with a deposit like that which is formed in Reinsch's process. (*N. Y. Med. Journ.*, 1865, p. 13.)

A modification of the methods of Marsh and Reinsch has been proposed by Dr. Alfred S. Taylor, which he has found effectual in detecting arsenic whether in liquids or solids, and whether associated with organic or inorganic substances, for an account of which, however, we must be content, from want of space, to refer the reader to the paper of that eminent toxicologist in *P. J. Tr.* (1861, p. 411).

Still another method of detecting arsenic is the *electrolytic*, consisting in exposing the suspected liquid, in connection with diluted sulphuric acid, to a voltaic current, through the influence of which, if arsenic be present, even though associated with large quantities of organic matter, arseniuretted hydrogen (*hydrogen arsenide*) is evolved. It is, however, only the arsenious acid that will respond to this test, arsenic acid not being affected; and the presence of mercury interferes materially with the process. For an account of the process, and of the method of rendering arsenic acid sensible to the test, and of counteracting the influence of the mercury, see papers by Mr. C. L. Bloxam in *P. J. Tr.* (1860, p. 376, and 1861, p. 528).

It has been shown by MM. Malaguti and Sarzeau that, for the detection of minute quantities of arsenic in exhumed bodies, the best method of proceeding is to distil the viscera with aqua regia, made by mixing one part of nitric with three of hydrochloric acid. The animal matter (the liver, for example), cut into small pieces, is dried by a gentle heat, and mixed with a quantity of the aqua regia equal to the weight of the matter before it was dried. The mixture is distilled, and the arsenic, if present, comes over in the form of the volatile terchloride, which may be converted into the tersulphide in the usual manner.

Arsenic may be detected in exhumed bodies long after death. M. Blondlot found it in the brain of a body that had been buried twenty years. In this case, it was ascertained that no arsenic existed in the earth of the cemetery. (See *Brit. and For. Med.-Chir. Rev.*, 1855, p. 222.) It is necessary also to be guarded against the possible presence, about the body, of metals which may contain arsenic; as, for example, brass and copper. L. A. Buchner has found, in the intestines of persons who had been poisoned with arsenious acid, examined some months after death, the poison in the state of yellow sulphide of arsenic, into which it had been converted by the sulphuretted hydrogen developed by the putrefactive process that had taken place in the bowels, showing that even in poisonous doses arsenic has not always the property of preserving the body from corruption. (*Neues Repertorium*, xvii. 21.)

Off. Prep. Liquor Arsenicalis, *Br.;* Liquor Arsenici Chloridi, *U. S.;* Liquor Arsenici Hydrochloricus, *Br.;* Liquor Potassii Arsenitis, *U. S.;* Sodæ Arsenias, *Br.;* Sodii Arsenias, *U.S.*

ACIDUM BENZOICUM. *U.S., Br.* *Benzoic Acid.*

$HC_7H_5O_2$; 122. (ĂÇ′Ị-DŬM BĔN-ZŌ′Ị-CŬM.) $HOC_{14}H_5O_3$; 122.

Acidum Benzoicum Sublimatum, Flores Benzoes; Acide benzoïque, Fleurs de Benjoin, *Fr.;* Benzoesäure, Benzoeblumen, *G.*

Both the U. S.* and Br. Pharmacopœias have omitted their process for the preparation of benzoic acid: the British defines it to be "a crystalline acid obtained from benzoin, and prepared by sublimation."

Formerly the benzoin before sublimation was mixed with sand; but this is now usually omitted, as not only useless, but probably injurious by favoring the production of empyreumatic substances. The acid, which exists in the benzoin combined with resin, is volatilized by the heat, and condensed in the upper part of the apparatus. Unless the temperature be very carefully regulated, a portion of the resin is decomposed, and an oily substance generated, which rises with the acid, and gives it a brown color, from which it cannot be entirely freed by bibulous paper; and this result sometimes takes place even with the greatest caution. The process for subliming benzoic acid may be conducted in a glazed earthen vessel, surmounted by a cone of paper, or by another vessel with a small opening at the top, and a band of paper pasted round the place of junction. After the heat has been applied for an hour, the process should be suspended till the condensed acid is removed from the upper vessel or paper cone, when it may be renewed, and the acid again removed; and thus alternately till colored vapors rise. Mohr, after many experiments, recommends the following plan as unobjectionable. In a round cast-iron vessel, eight or nine inches in diameter and two inches deep, a pound or less of coarsely powdered benzoin is placed, and uniformly strewed over the bottom. The top of the vessel is closed by a sheet of bibulous paper, which is secured to the sides by paste. A cylinder of thick paper in the form of a hat, just large enough to fit closely around the sides of the pot, is then placed over it, and in like manner secured by paste. A moderate heat is now applied by means of a sand-bath, and continued for three or four hours. The vapors pass through the bibulous paper, which absorbs the empyreumatic oil, and are condensed within the hat in brilliant white flowers, having an agreeable odor of benzoin. (*Annal. der Pharm.*, xxix. 178.) The process officinal in U. S. P. 1870 was based upon Mohr's, but it frequently happens that the sublimed crystals, after they have formed in the cap, and whilst the sublimation is still going on, fall upon the bibulous paper, and if this paper should happen to be heated to only 120° C. (248° F.) the crystals will melt, and soon stop up the pores of the paper. If coarse muslin be substituted for the bibulous paper, it serves the purpose of retaining any empyreumatic substances, and yet permitting the vapors to pass through without becoming glazed by a deposit of melted acid. Strips of paper passed at irregular intervals across the cap prevent the falling back of crystals. The remaining acid of the benzoin may be extracted, if deemed advisable, by treating the residue of the balsam with lime or carbonate of sodium. From the mode of preparing benzoic acid by sublimation, it was formerly called *flowers of benzoin.*

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* The following is the process officinal in 1870: "Take of Benzoin, in coarse powder, *twelve troyounces.* Spread the Benzoin evenly over the bottom of an iron dish eight inches in diameter, cover the dish with a piece of filtering paper, and, by means of paste, attach it closely to the rim. Then, having prepared a conical receiver or cap of thick, well-sized paper, of rather larger diameter than the dish, invert it over the latter, so as to fit closely around the rim. Next apply heat by means of a sand-bath, or of the iron plate of a stove, until, without much empyreuma, vapors of Benzoic Acid cease to rise. Lastly, separate the receiver from time to time, and remove the Benzoic Acid from it and the paper diaphragm, as long as the Acid continues to be deposited." *U. S.* 1870.

Another mode of separating the acid from benzoin is by combining it with a salifiable base, and precipitating with an acid. Such is the process of Scheele. It consists in boiling the powdered benzoin with hydrate of lime and water, filtering the solution of benzoate of calcium thus obtained, and precipitating the benzoic acid with hydrochloric acid. Carbonate of sodium or of potassium may be substituted for the lime, and sulphuric for the hydrochloric acid; and the precipitated benzoic acid may be purified by dissolving it in boiling water, which will deposit it upon cooling. The acid, however, requires to be still further purified by repeated crystallization from small portions of boiling water. A little animal charcoal may be employed to render the crystals quite colorless. These processes afford a product purer than that obtained by sublimation, but not preferable in a medicinal point of view; as the small quantity of oil present in the sublimed acid adds to its stimulant properties, and at the same time renders it pleasant to the smell. In order to get the benzoic acid in the form to which the eye is accustomed, it has been proposed to sublime the acid after its precipitation.

Several other modes of extracting the acid have been recommended. The following is the process of Stolze. One part of the balsam is dissolved in three parts of alcohol, the solution filtered and introduced into a retort, and the acid saturated by carbonate of sodium dissolved in a mixture of eight parts of water and three of alcohol. The alcohol is distilled off; and the benzoate of sodium contained in the residuary liquid is decomposed by sulphuric acid, which precipitates the benzoic acid. This is purified by solution in boiling water, which lets fall the acid when it cools. By this process Stolze obtained 18 per cent. of acid from benzoin containing 19·425 per cent. By the process of Scheele he obtained 13·5 per cent.; by the agency of carbonate of sodium, 12 per cent.; by sublimation, only 7·6 per cent. Professor Scharling has prepared benzoic acid by means of heated steam, and obtained 8 per cent. (*A. J. P.*, xxiv. 236.)

The acid is manufactured very cheaply from *naphthalene.* According to Wm. A. Tilden (*P. J. Tr.*, July, 1870), the naphthalene is oxidized by nitric acid into oxalic and phthalic acids ($C_{10}H_8 + 4O_2 = H_2C_2O_4 + H_2C_8H_4O_4$), then converted into a phthalate of calcium and strongly heated with hydrate of lime, whereby the phthalate is converted into carbonate and benzoate of calcium; this latter salt is then treated with hydrochloric acid and the benzoic acid thus set free.

A very large quantity of benzoic acid has, within a few years, been imported into the United States from Europe, under the commercial name of *German benzoic acid*, which is prepared from the urine of cattle and horses by boiling the hippurate of calcium with hydrochloric acid. By boiling the hippuric acid thus separated with hydrochloric acid, it is split into benzoic acid and glycocoll,* according to the reaction, $C_9H_9NO_3 + H_2O = C_2H_5NO_2 + C_7H_6O_2$. It is white, has a fine lustre, and is said to be very pure, but sometimes has a slight urinous odor indicative of its origin. (*A. J. P.*, xxvii. 23; *P. J. Tr.*, July, 1875.) Owing to the scarcity of benzoin in the market yielding paying quantities of benzoic acid, it is asserted that the English manufacturers employ certain varieties of Botany Bay gum (*Gum acroides*), and obtain a larger yield of an acid which was formerly regarded as cinnamic, but has recently been shown to be benzoic acid. (*N. R.*, Feb. 1879.) Benzoic acid is also obtained from derivatives of toluol, benzotrichloride and benzaldehyd, and this acid is produced in large quantities, but, although possessing many points of identity, there are still some as yet irreconcilable differences between this acid and those obtained from benzoin and urine. (*N R.*, June, 1880.) Benzoic acid may also be prepared profitably from *suint*, the greasy substance obtained by washing wool. (*Chemist and Druggist*, 1876, p. 358.)

Properties. Sublimed benzoic acid is in white, soft, feathery crystals, of a silky lustre, and not pulverulent. From solution the acid crystallizes in transparent prisms. When quite pure it is inodorous; but prepared by sublimation from the balsam it has a peculiar, agreeable, aromatic odor, dependent on the presence of an oil, which may be separated by dissolving the acid in alcohol and precipitating it with water. Its taste is warm, acrid, and acidulous. It is unalterable in the air, but at 121·5° C. (250° F.) melts, and at a somewhat higher temperature rises in suffocating vapors. Sp. gr. 1·29. The Br. Pharmacopœia gives as its melting point 120° C. (248° F.), and boiling point 239° C. (462° F.). It is inflammable, burning without residue. One hundred parts of 90 per cent. alcohol dissolve about forty parts, whilst the same quantity of pure ether will dissolve about thirty parts. (*Bourgoin.*) The addition of borax or phosphate of sodium increases its solubility. It is readily dissolved by alcohol, and by concentrated sulphuric and nitric acids, from which it is precipitated by water. "Benzoic acid is soluble in 500 parts of water and 3 parts of alcohol at 15° C. (59° F.), in 15 parts of boiling water and in 1 part of boiling alcohol; also soluble in 3 parts of ether, in 7 parts of chloroform, and readily soluble in disulphide of carbon, benzol, benzin, and oils." *U. S.* The fixed oils also dissolve it. It is entirely soluble in solutions of potassa, soda, or ammonia, from which it is precipitated by hydrochloric acid. On carefully neutralizing any of these solutions and adding solution of ferric sulphate previously diluted with water, a flesh-colored precipitate is produced. Its solution reddens litmus paper, and it forms salts with salifiable bases called benzoates. "If gradually heated in a retort with 3 parts of freshly slaked lime, benzol is evolved." *U. S.*

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* Cazeneuve recommends the precipitation of the acid from urine by the use of sulphate of zinc, as hippurate of zinc, decomposing with hydrochloric acid. (*Zeitschr. Oest. Ap. Ver.*, 1879, p. 2.)

"The solution of benzoic acid in pure cold sulphuric acid, when gently warmed, should not turn darker than light-brownish; if now poured into water, the benzoic acid should separate as a white precipitate and the liquid should be colorless. A small quantity of the acid, when taken up by some recently ignited and moistened cupric oxide held in the loop of a platinum wire and introduced into a non-luminous flame, should not impart a green or bluish-green color to the flame (abs. of chlorobenzoic acid). The acid should not have an odor resembling that of bitter almonds or of stale urine. On rubbing together 1 Gm. of benzoic acid and 0·5 Gm. of permanganate of potassium in a mortar with a few drops of water, the odor of oil of bitter almonds should not be evolved (cinnamic acid)." *U. S.* Benzoic acid is a characteristic constituent of the balsams, and has been found in various other vegetable and some animal products. When heated, it should sublime without residue; but the Br. Pharmacopœia allows a slight residue for impurities.

Medical Properties and Uses. Benzoic acid is irritant to the alimentary mucous membrane, and as a stimulant expectorant is of some value in chronic bronchitis and the later stages of the acute disorder. It is, however, chiefly used in connection with genito-urinary diseases. It was proposed by Dr. Alexander Ure as a remedy for uric acid deposits in the urine, and for the chalk-like concretions, consisting of urate of sodium, in the joints of gouty individuals. He supposed it to operate by converting the uric into hippuric acid, and consequently the insoluble urates into soluble hippurates. It appears, however, that such a transformation of uric acid does not take place, but that the benzoic acid is itself converted into hippuric acid, which is always found in the urine, when the former acid is taken freely. Garrod and Kletzinsky affirm that, though the uric acid is unaffected, the urea is decidedly diminished; and Kletzinsky believes that the quantity of nitrogen contained in the urea lost is almost exactly represented by the nitrogen of the hippuric acid formed; so that the benzoic acid is probably converted into the hippuric by combination with a nitrogenous body, either derived from the urea or formed at the expense of it. (*Ann. de Thérap.*, 1860, p. 110.) On the other hand, Ure, Leroy d'Etiolles, and Debouy declare that the uric acid is greatly lessened, and Keller, Meissner, and Shepard have found that the elimination of urea is not affected. In consequence of the acid state of urine produced by benzoic acid, it has been found useful in the phosphatic variety of gravel; though its beneficial influence, being purely chemical, continues only during its use. It is said to have cured nocturnal incontinence of urine. It has been very highly recommended in ammoniacal cystitis by Prof. Gosselin. (*Arch. Gén.*, Nov. 1874.) The urine is rendered neutral or acid, and great relief afforded. In calculous cases a great advantage is the prevention of the formation of the ammoniaco-magnesian phosphate. It is necessary to give very large doses. One gramme a day should be exhibited in the beginning, and increased rapidly to four grammes. Relief is never afforded before the fifth day; sometimes not until the nineteenth. Prof. Gosselin employs an emulsion of one part of benzoic acid, three parts of glycerin, and one hundred and fifty parts of mucilage. Dr. Lemaire (*Phila. Med. Times*, vol. iv. p. 638) commends most highly, in acute gonorrhœa, the use of half a drachm of tincture of cannabis Indica and fifteen grains of benzoic acid in twenty-four hours. As first pointed out by Dougall in 1872, benzoic acid is a powerful antiseptic, being probably fully as poisonous to bacteria as is salicylic or carbolic acid. Bucholtz found that 0·2 per cent. of it has a decided influence upon the development of the organisms of putrefaction; and F. Baden Benger (*P. J. Tr.*, 1875, p. 211) states that one-fourth of a grain of it added to a fluidounce of infusion of orange, buchu, or gentian, will cause it to keep unchanged for at least one month.*

Benzoic acid may be readily dissolved in water by the addition to it of four parts of phosphate of sodium, or one part and a half of biborate of sodium. The dose is from 10 to 30 grains. It may be administered in pill, using soap as an excipient. It is an ingredient in some cosmetic washes, and has been employed by way of fumigation as a remedy in affections of the skin. It has also been employed as a local hæmostatic, in connection with alum, with considerable asserted success; but there can be little doubt that alum is the more efficient ingredient.

Off. Prep. Ammonii Benzoas, *U. S.;* Sodii Benzoas, *U.S.;* Ammoniæ Benzoas, *Br.;* Tinctura Camphoræ Composita, *Br.;* Tinct. Opii Ammoniata, *Br.;* Tinct. Opii Camphorata.

ACIDUM BORICUM. *U.S.* *Boric Acid.* (*Boracic Acid.*)

H_3BO_3; 62. (ĂÇ'Ị-DŬM BŌ'RỊ-CŬM.) $3\,HO\,BO_3$; 62.

Boracic Acid; Acide borique, *Fr.;* Borsäure, *G.*

Boric acid occurs in small amount, most probably in combination as a magnesium salt, in sea-water and in certain mineral waters, as the hot springs of Wiesbaden, Aix-la-Chapelle, and Vichy; in certain minerals, such as the *borocalcite* which occurs in considerable quantities in the nitre-beds of Peru and Chili; and in the natural borax or *tincal*, first found in the basins of dried-up lagoons in Central Asia, but now obtained in large amount from Clear Lake, California. The largest amount is extracted, under the name of *sassolin*, from the lagoons of the volcanic districts of Tuscany, and from the crater of Vulcano, one of the Lipari Islands.

Preparation. In the neighborhood of Monte Rotondo, Lago Zolforeo, Sasso, and Larderello are found numerous hillocks and fissures, the latter of which emit hot aqueous vapor containing boric acid and certain gases. Around one or several of these fissures, called *suffioni*, a circular basin of masonry is built, which is filled with water and called a lagoon. By the jets of vapor constantly breaking through it, the water becomes gradually impregnated with boric acid and heated. A series of such lagoons are made to communicate with each other on the declivity of a hill, and the lowest to discharge itself into a reservoir, where the solution is allowed to rest and deposit mechanical impurities. From this reservoir the solution is made to pass into leaden evaporating pans, heated by the natural vapor, where it receives sufficient concentration to fit it for being conducted into wooden tubs, where it is allowed to cool and crystallize. The crude acid thus obtained contains, on an average, 75 per cent. of boric acid; the impurities consisting chiefly of alum, the double sulphate of ammonium and magnesium, and sulphate of calcium. The seven works belonging to Count Larderel, which are located at Castelnuovo, produce at present (1882) over 3 million kilogrammes of crude acid, and a much larger production would follow increased demand.

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* Henry Trimble (*A. J. P.*, 1876) and B. Archer (*A. J. P.*, 1878) confirm the statement as to its value as an antiseptic in its pharmaceutical applications.

The native borax of California supplies, at present, the entire American demand for boric acid. The free acid is obtained by decomposing the salt in aqueous solution with strong hydrochloric acid.

Properties. Boric acid forms "Transparent, colorless, six-sided plates, slightly unctuous to the touch, permanent in the air, odorless, having a cooling bitterish taste and a feebly acid reaction; in solution turning blue litmus paper red and turmeric paper brown, the tint, in the latter case, remaining unaltered in the presence of free hydrochloric acid." *U. S.* They have a sp. gr. of 1·434, dissolve in 3 parts of boiling water, in 25 parts of cold water, in 6 parts of cold alcohol and 5 of boiling, and in volatile oils, but are insoluble in ether. On evaporation of the alcoholic solution, the boric acid volatilizes even more readily than from the aqueous solution. Glycerin, when heated, dissolves an amount of boric acid so considerable that when cold it thickens to a crystalline mass. Its aqueous solution tastes somewhat acid, colors litmus paper a wine red, and changes turmeric paper to a brown color, analogous to that produced by alkalies, even when hydrochloric acid is present. On moistening the paper so browned and then dried with caustic alkali solution, it turns first blue and then a dirty gray color. "On ignition, Boric Acid loses 43·5 per cent. of its weight, and, on cooling, becomes transparent and brittle." *U. S.*

On heating the alcoholic solution of boric acid, some boric ether (ethyl borate) is produced; to this is ascribed the green color seen when the alcohol is thus ignited. The solution in glycerin, however, yields the same green color when heated on the loop of a platinum wire, the reaction being so delicate as to cause it to be proposed as a test for glycerin. Boric acid, when heated to 100° C. (212° F.), loses a molecule of water and changes into *metaboric* acid; by prolonged heating to 140° C. (284° F.), or in a dry current of air to 160° C. (320° F.), it loses still more water and becomes *pyroboric acid;* finally, by ignition, it swells up and loses all the combined water, leaving *boric oxide*, B_2O_3. Boric acid is a weak acid, or may even act as a base. Thus, with sulphuric and phosphoric acids it forms compounds which may be considered as salts. Its compounds with bases, when in solution, are readily decomposed by other acids, but at a red heat boric oxide will displace many of the stronger but more volatile acids. "An aqueous solution of boric acid should not be precipitated by test solutions of chloride of barium (sulphate), nitrate of silver with nitric acid (chloride), sulphide of ammonium (lead, copper, iron, etc.), or oxalate of ammonium (calcium). A fragment heated on a clean platinum wire in a non-luminous flame should not impart to the latter a persistent yellow color (sodium salt)." *U. S.*

Boric acid is to be tested especially for hydrochloric acid and for common salt. Their presence is shown by acidifying the solution with nitric acid and adding silver nitrate, when a turbidity will appear. Sulphuric acid and sodium sulphate, if present, are indicated by a test with barium chloride solution. Iron is indicated by potassium sulphocyanate, which gives a red color; lead and copper by the test with sulphuretted hydrogen gas. M. Schäuffèle, of Paris, has drawn attention to a commercial boric acid containing lead. (*N. R.*, July, 1877.)

Medical Properties and Uses. The action of boric acid upon the system is not well known, but it probably is identical in its physiological and remedial powers with borax, except that it is more powerful. It has not as yet been much used internally, but is commended by Dr. Wm. Warren Greene (*Bost. Med. and Surg. Jour.*, ciii. 197) in chronic cystitis and prostatitis, in diphtheria, in chronic dyspepsia with fetid eructations, and in septic diseases. He gives it, usually, in doses of thirty grains, in cachet, and has exhibited a drachm every four hours without producing any ill effect. Whether boric acid is a poison, and, if so, in what doses, cannot yet be considered as determined. Cyon found that three-drachm doses of it produce in dogs no pronounced effects (*St. Louis Clin. Record*, Sept. 1881). Mododewkow is stated to have had two fatal cases of poisoning, but as in one case a lumbar abscess, in the other a pleuritic cavity, was freely washed out with a five per cent. solution of the acid, it is possible that the fatal collapse may have been the result of the operation.

When used externally, boric acid acts as a detergent, soothing, and disinfecting substance. It is said to be almost free from irritant properties, and to afford a superior substitute to carbolic acid in antiseptic surgery.* In erysipelatous inflammations, foul ulcers, and similar external disorders, the saturated aqueous solution, or an ointment of the acid, may be continuously applied. Some trouble has been experienced in having this ointment made properly, owing to the tendency of the crystals of boric acid to slip from under the pestle, rendering the process of pulverization very tedious. When triturating, it is very necessary to have the acid in an impalpable powder before incorporating with the fatty body; the gradual addition of ether to the acid has been suggested as a valuable aid to trituration. Boric acid ointment (Lister's) is made from one part each of boric acid and white wax, two parts each of oil of sweet almonds, and paraffin.

ACIDUM CARBOLICUM. *U.S., Br.* *Carbolic Acid.* (*Phenol.*)

C_6H_5HO; 94. (ĂÇ′Ị-DŬM CĂR-BŎL′Ị-CŬM.) $C_{12}H_6O_2$; 94.

A product of the distillation of coal-tar between the temperatures of 180°–190° C. (356°–374° F.). *U. S.*

An acid obtained from coal-tar oil by fractional distillation and subsequent purification. *Br.*

Acidum Phenicum s. Phenylicum Crystallisatum; Phenic Acid; Phenylic Acid; Phenol; Phenylic Alcohol; Acide carbolique, Hydrate de Phényle, Acide phénique, *Fr.;* Carbolsäure, Phenylsäure, Phenylalkohol, *G.*

This important medicine is officinal in the British Pharmacopœia, and was recognized by our own in 1870. It was discovered in 1834, in the tar of coal, by Runge, who gave it the name of carbolic acid. In 1841, it was thoroughly investigated by Laurent, by whom it was considered as the hydrated oxide of a peculiar compound radical called *phenyl* (from φαινω, I show), and therefore described by the name of *hydrated oxide of phenyl.* Its acid properties, however, having been subsequently recognized, it received the name of *phenic acid;* but, out of consideration for the original discoverer, chemical writers generally adhere to the title he gave it of carbolic acid. When on the subject of its composition, we shall have occasion to show that, although more closely related chemically with the alcohols than the acids, it belongs to a peculiar class known in common as *phenols.*

Preparation. For the commercial preparation of carbolic acid that portion of the heavy oil of coal-tar is taken which distils over between 165° C. (329° F.) and 190° C. (374° F.) (*Dead oil*). One or two rectifications of this oil serve to concentrate the carbolic acid greatly. A brown oil obtained in this way is used directly as crude carbolic acid. (See *Acidum Carbolicum Impurum.*) If this be well mixed with strong soda solution, a crystalline mass of sodium phenol separates, from which fluid hydrocarbons and other impurities can be poured off. This sodium phenol can then be heated to about 170° C. (338° F.) without decomposition, whereby many of the adhering compounds distil off or are decomposed. After this roasting, the sodium phenol is dissolved in 10 parts of water, whereby still other foreign substances are separated. An amount of hydrochloric or dilute sulphuric acid calculated from a special test with a small portion, as just sufficient, is then added in order to set the carbolic acid free. It separates as an oily layer upon the surface, and, after being washed with a saturated solution of common salt, is dried over chloride of calcium and again distilled. The product so obtained crystallizes out largely on a cooled surface, and, after removing the crystals from adhering liquid, and drying them by pressure, they are again submitted to the same process of distillation. Only by such a detailed procedure can carbolic acid be separated from its homologues, like cresol (cresylic acid), $C_6H_4(CH_3)OH$, which accompany it, smell exactly like it, and boil between 185° C. (365° F.) and 200° C. (392° F.).

For the preparation of crystallized phenol, Bickerdike (*Chem. News*, xvi. 188) recommends that 1 or 2 per cent. of anhydrous cupric sulphate be added to the commercial acid distillate; this is then distilled, when the dehydrated phenol solidifies at 16° C. (60·8° F). Prof. Church (*Chem. News*, Oct. 13, 1871) proposes to prepare *pure* carbolic acid by agitating the best commercial product with 20 parts of water, siphoning off the clear solution from the undissolved portion which retains the impurities, and adding to the solution pure common salt to saturation, when the purified acid rises to the top, and may afterwards be dehydrated by distillation with lime.

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* *Ointment of Boric Acid.* Dr. Greene especially recommends the following formula: Take of saturated glycerole of boric acid two parts; spermaceti and white wax, each, one part; vaseline six parts. Melt the vaseline, white wax, and spermaceti together, and add the glycerole slowly, with trituration while cooling.

Commercial Forms. In one of his publications in reference to carbolic acid, Dr. F. Crace Calvert, to whom probably, more than any other person, is owing the introduction of this substance into use in Great Britain and the United States, informed us that the carbolic acid obtained by Laurent, melting at 34° C. (93° F.), and boiling at 186° C. (367° F.), was not quite pure. By successive steps of improvement in the process employed by the manufacturing house at Manchester with which he is connected, they had at length succeeded in preparing the pure crystallized acid, without color or sulphurous odor; but, unfortunately, this statement is not accompanied with an account of the means by which the end had been attained. As the products of this factory are those now generally used, a brief notice, derived from the same source, of the forms of the drug prepared by them, and now circulating in the market, is desirable. 1. A pure acid is prepared, crystallizing in white prismatic crystals, but, as usually sold, in a white, hard, fused mass, which differs from Laurent's in being soluble in 20 parts of water instead of 33 parts, fusible at 41° C. (106° F.) instead of 34° C. (93° F.), and boiling at 182° C. (359° F.) instead of 186° C. (367° F.). This should be preferred for internal use. 2. The second form is less pure. Like Laurent's, it is white, solid, and fusible at 34° C. (93° F.), and may be employed for external purposes, whether in medicine or surgery. 3. A third quality is known in commerce as solution No. 4, which is not crystallizable at ordinary temperatures, and contains at least 10 per cent. of water, with varying quantities of homologous acids. 4. The fourth and cheapest form is that of a nearly colorless liquid, which is a mixture of carbolic and cresylic acids. Diluted with 100 parts of water or more, it may be used for the coarser antiseptic and disinfecting purposes out of doors, as in cess-pools and sewers. Besides these forms of carbolic acid, which issue from the manufacturing establishment of the Messrs. Calvert, there are others from different sources, generally in the liquid state, which are usually of a brownish color, and consist of mixtures of carbolic acid with cresylic acid, coloring matter, etc., and of which carbolic acid often constitutes but a small proportion. These are often imported from Germany. They should not be used internally; but, for disinfectant and antiseptic purposes, they are probably equal to solutions of the pure acid, as the cresylic acid is said to be quite as powerfully disinfectant as the carbolic, if not more so.

These impure liquors are sold sometimes under the improper name of *coal-tar creasote.* They are recognized in the U. S. Pharmacopœia under the name of "Acidum Carbolicum Crudum." (See the next article.)

Properties. Carbolic acid, in its pure state, is a solid at ordinary temperatures, crystallizing in minute plates or long rhomboidal needles, white or colorless, of a peculiar odor recalling that of creasote, and an acrid burning taste. Its sp. gr. is 1·065. (*Lemaire.*) It is apt to be colored pinkish or brown, under the influence of light and air, and Dr. Hager thinks that this is due to the presence of ammonia or ammonium nitrite in the atmosphere (*Phar. Centralhalle*, 1880, p. 77); this discoloration, if slight, does not interfere with any of its medical uses. It deliquesces on exposure, and ultimately becomes liquid; and the presence of water in the smallest proportion causes it to liquefy. It is customary to add 10 per cent. of water or glycerin to carbolic acid for dispensing, as it is more convenient to use it in a liquid form. "When diluted it has a sweetish taste with a slightly burning after-taste, and a neutral reaction." *U. S.* When quite pure it melts at 41° C. (106° F.), forming an oily-looking, colorless liquid, and boils at 182° C. (359° F.). (*Calvert.*) But, as often met with, its point of fusion is lower, and that of volatilization higher, than those named. "The crystals melt at 36°–42° C. (96·8°–

107·6° F.), and boil at 181°–186° C. (357·8°–366·8° F.), the higher melting and lower boiling points being those of the pure and anhydrous acid. On continued heating, the acid is completely volatilized." *U. S.* The British gives its melting point at 35° C. (95° F.), and its boiling point at 188° C. (370° F.), both Pharmacopœias, therefore, admitting considerable impurity. Carbolic acid is inflammable, burning with a reddish flame. The plane of polarization of a ray of polarized light is not affected by it. "Carbolic acid is soluble in 20 parts of water at 15° C. (59° F.). 100 parts of the crystals are liquefied by the addition of about 5 parts of water; this liquid is rendered turbid by the further addition of water, until 2000 parts have been added, when a stable and clear solution is formed. It is very soluble in alcohol, ether, chloroform, benzol, disulphide of carbon, commercial and absolute glycerin, and fixed and volatile oils." *U. S.* Its solubility in water increases on heating the water; at 84° C. (183·2° F.), both liquids are miscible in all proportions. Its solution is, if pure, colorless, and remains so; but, if impure, is colored brownish by exposure. It is but slightly soluble in cold petroleum benzin, but dissolves largely on heating.

Though neutral to test-paper, it combines feebly with salifiable bases; its salts being decomposed by carbonic acid, and those with the alkalies having an alkaline reaction. The carbolate of potassium is said to be decomposed even by water. Nitric acid converts it into picric acid, for the manufacture of which it is largely used. It reduces many metallic salts, especially those of silver and copper, and coagulates collodion. Bromine water, added in excess to a weak solution, produces a flocculent white precipitate. This precipitate, which consists of tribromphenol, is so insoluble that it separates even in the most dilute solutions, and affords an extremely delicate test. In 24 hours a solution containing but $\frac{1}{60000}$ of phenol gives the reaction. (Allen, *Com. Org. Analysis*, 1879, p. 307.) If an aqueous solution of phenol be gently warmed with ammonium and solution of sodium hypochlorite (avoiding excess), a deep blue color is obtained, which is lasting, but turns to red on addition of acids. Solutions containing 1 part of phenol in 5000 of water react well when 20 C.c. are employed. Much smaller quantities give the reaction after a time. (*Ibid.*, p. 306.) Ferric chloride (avoiding excess) gives a fine violet color, by which 1 part of phenol in 3000 of water can be detected. The presence even of neutral salts often interferes with this reaction.

All the soluble carbolates communicate to pine wood, impregnated with their solution, the property of assuming a deep blue color half an hour or an hour after having been steeped in hydrochloric acid. (*Lemaire.*) Carbolic acid in solution coagulates albumen and collodion, arrests fermentation, instantly destroys the lower forms of vegetable and animal life, and, in very small proportion, prevents mouldiness in vegetable juices, and protects animal substances against putrefaction.

The substances with which carbolic acid is most likely to be confounded are cresylic acid and creasote, the former, like it, extracted from coal-tar, the latter from wood-tar exclusively. As cresylic acid is incapable of crystallizing at ordinary temperatures, the two cannot be confounded in the solid state, and, as before observed, its presence in the liquid state is of little consequence; as its virtues are of the same kind, and at least equal. Its boiling point, however, is considerably higher than that of carbolic acid, being about 400°; and it may, therefore, be supposed to be present in any suspected liquid which will not crystallize at any common temperature, or boil under 202° C. (395° F.) to 204° C. (400° F.). It is also distinguished by being less soluble in water, ammonia, glycerin, and solution of soda than is the case with carbolic acid, but it is more soluble in petroleum benzin. (Allen.) (*A. J. P.*, Jan. 1879.) Creasote is distinguished by its lower density, its liquid form, and higher boiling point; by its insolubility in strong ammonia, or in 6 per cent. soda solution, as well as its insolubility in pure glycerin (see *Creasotum*); by not coagulating collodion and albumen; and by the different effects on it of strong nitric acid, which with carbolic acid produces pure picric or trinitrophenic acid, and with creasote, oxalic acid, resinous matter, and but a small proportion of picric acid. (Calvert, *Lancet*, 1863, p. 523.) Carbolic acid differs also in having no effect on polarized light. The change of color in pine wood under the successive action of carbolic and hydrochloric acids has been mentioned above. Schaedler estimates the amount of pure carbolic acid in the commercial article by the following process: 2 or 3 grammes of the acid are heated in a water-bath to expel alcohol, if present; an equal quantity of sulphuric acid is added, and the whole digested between 50° and 60° C. (122° and 140° F.); then diluted, and saturated with barium carbonate or litharge; the filtrate precipitated by diluted sulphuric acid, the precipitate washed, dried, and heated, and its weight calculated into that of pure carbolic acid. (*Pharm. Centralhalle*, 1872, p. 25.)

Prof. E. W. Davy proposes as a test for carbolic acid sulpho-molybdic acid, made by dissolving 1 part of molybdic acid in 10 or even 100 parts of pure concentrated sulphuric acid; 3 or 4 drops of this solution are added to the carbolic acid, placed on white porcelain: a beautiful blue coloration will be produced upon standing, particularly if gently heated; if this reagent is applied to wood creasote in aqueous solution, a brownish red color is produced. Carbolic acid in creasote may be detected by distilling an aqueous solution of the mixture: the first portion of the distillate will give the creasote reaction, the last portion that for carbolic acid. (*P. J. Tr.*, June 22, 1878.) Charles Rice (*A. J. P.*, 1873) proposes the use of a test liquid of chlorate of potassium and hydrochloric acid, to which ammonia is added. If a solution containing carbolic acid is added, a brown color will be produced.

"One volume of liquefied carbolic acid containing 5 per cent. of water, forms with one volume of glycerin a clear mixture, which is not rendered turbid by the addition of 3 volumes of water (abs. of creasote and cresylic acid). The amount of water contained in a solution of carbolic acid may be determined by agitating the solution in a graduated cylinder, with an equal volume of chloroform. After standing, the upper layer consists of the water contained in the mixture." *U. S.*

Composition. The view of the composition of carbolic acid, now universally accepted, is, that it is the hydroxyl (OH) derivative of benzol, C_6H_6; and its formula would therefore be C_6H_5,OH. This would ally it to the alcohols, but, as it is not capable of yielding the same products on oxidation, and as a class of true aromatic alcohols are known, it is taken as the type of a class called *phenols*. These are simple OH derivatives of the aromatic hydrocarbons. It is commonly called *carbolic acid*, but its claims to be considered as an acid are very feeble; as, though it combines with salifiable bases, it is incapable of neutralizing the alkalies, does not affect the color of litmus, and may be separated from its combinations with great facility, sometimes, it is asserted, even by water. Shaken in the liquid form with one-fourth of water, and cooled to 40° F., it crystallizes in the form of a hydrate, $C_6H_5,OH + H_2O$, which fuses at 17° C. (62·6° F.).

Medical Properties and Uses. Carbolic acid, in the liquid form, is locally powerfully irritant and anæsthetic, and, applied undiluted to the skin, causes a sharp pain followed by numbness, and accompanied with a whiteness of the surface, due to the coagulation of albumen. In contact with mucous surfaces it acts in the same way, and if continued long enough may produce a superficial caustic effect. Taken internally in large quantities, and in a concentrated state, it operates as an irritant narcotic poison, and has in a large number of cases caused death. Even when it is applied externally its absorption may lead to a fatal result. The symptoms after the ingestion of a lethal dose are usually developed very rapidly; indeed, death has occurred in two or three minutes, the patient dying in immediate collapse. After smaller amounts the symptoms, which may be delayed for several minutes, are nausea, cold sweats, marked pallor of the skin, stupor rapidly deepening into complete insensibility, a feeble pulse, which is usually rapid, but has been in some cases much slower than normal, and great disturbance of the breathing. The respirations are usually hurried and shallow, often very irregular, sometimes paroxysmally arrested. There is usually paralysis both of sensation and motion, but in some cases violent epileptiform convulsions have occurred. An almost diagnostic symptom is a blackish coloration of the urine. In severe poisoning the latter fluid is apt to contain both albumen and tube-casts. Half an ounce of carbolic acid has caused death, and one and a half ounces have been recovered from. When carbolic acid is employed externally the dark discoloration of the urine is especially marked, and its presence should be the signal for disuse of the remedy. When in sufficient concentration, carbolic acid produces a fatal paralysis of all the higher tissues of animal life. In poisoning with it the death seems to be most generally due to paralysis of the respiratory centres; although the heart shares in the deleterious effect of the drug, and in some cases the fatal issue appears to have been produced by syncope. The lesions found after death have been whitish or blackish corrugated spots on the gastric mucous membrane, imperfect coagulability of the blood, and in some instances fatty degeneration of the hepatic cell and of the renal epithelium.

In therapeutic doses carbolic acid has no appreciable effect upon the general system. It is certainly absorbed and probably eliminated by all the emunctories, being especially abundant in the urine, and having been found by Lemaire in the breath of animals which had been poisoned with it. As an internal medicament carbolic acid is, at present, used almost solely for its sedative influence upon the gastro-intestinal mucous membrane and its antifermentative action upon the contents of the primæ viæ. It is especially useful in vomiting or diarrhœa when dependent upon excessive irritability of the gastric or intestinal mucous membrane. In yeasty vomiting, in flatulence, in diarrhœa with offensive passages, in the fermentative diarrhœa connected with intestinal dyspepsia, it is very valuable in doses of from one to three drops, not oftener than once in two hours. Dr. Kempster speaks of it as being successfully used in the State Lunatic Asylum at Utica in sluggishness of the bowels with offensive breath; and in all instances of fetid eructation, or extremely offensive flatulent discharges per anum, it would be very apt to afford relief.

By far the most important property of carbolic acid, both as a therapeutic and sanative agent, is its destructive influence over the lower grades of organic life, whether vegetable or animal. In a solution containing only one part of the acid in 500 of water, it instantly destroys vegetable mould, both plant and spores, and operates with equal destructiveness upon minute or microscopic animalcules. Hoppe-Seyler gives, as the result of his observation, that all inferior organisms perish in a liquid containing 1 per cent. of the acid. (*Arch. Gén.*, 1873, p. 633.) Rosenbach injected dogs and rabbits with unhealthy pus with and without admixture of carbolic acid; and found that death generally followed in the former case, while with the addition of 5 per cent. of carbolic acid no permanent injury resulted. (*Med. Record*, 1873, p. 427.) Through this power, it checks the different proper fermentations, including the putrefactive, and thus acts powerfully as an antiseptic or disinfecting agent. In sufficient concentration it is undoubtedly capable of destroying germs of various diseases. Experiments have determined that, mixed with vaccine matter in the proportion of 2 per cent., it entirely destroys its efficacy; while in a much smaller proportion it has no effect. (*Arch. Gén.*, 1873, p. 632.)

But it is more as a topical than as an internal and systemic remedy that carbolic acid has been used; and its employment in this way has reference in general to its antiseptic and antizymotic property. As regards the mere correction of offensive odor, by decomposition or neutralization of the effluvia on which the odor depends, there are other medicines much more energetic than carbolic acid, as chlorine, bromine, and permanganate of potassium. Indeed, the probability is that it exercises no deodorizing influence beyond that of merely disguising the smell of the offensive exhalations by its own bad odor. Its real action is upon the cause of the exhalations. Most of these offensive odors depend upon a species of fermentation, the putrefactive for example, and carbolic acid, even in very dilute solution, is powerfully destructive of the organisms which cause fermentations, and consequently acts much more by preventing putrefactive exhalations, than by destroying them. A piece of offensive animal matter is less speedily deodorized by carbolic acid than by permanganate of potassium; but the former in a short time entirely suppresses the putrefaction, and the matter consequently ceases to smell because it ceases to putrefy; whereas under the mere chemical agent it is only by its constant presence that the odor is prevented, and the putrefaction goes on unchecked.

Through its parasiticidal influence, carbolic acid is highly useful, as a local application, in all the diseases which are connected with or dependent on the presence of microscopic plants or animals. Hence its use in scabies, in which it destroys the itch insect, in the different forms of porrigo and trichosis, in pityriasis versicolor, in the thrush of infants, and in all cases of minute vermin affecting the human body. In these cases it is applied to the parts affected in weak solution, or in the form of ointment, but care must be taken to avoid poisoning by it. Offensive diphtheritic exudations, putrid ulcers wherever they can be reached, and suppuration with a similar offensive odor, whether on the outer surface, or from the mucous passages, as of the nose, bronchial tubes, external meatus, urinary outlets, the rectum, and the vagina in females, afford similar indications for its use. Its use as a vermicide is too dangerous to be justifiable. It is a very valuable remedy in the treatment of compound fractures, and other surgical or accidental wounds. As success in the so-called *antiseptic* surgery is dependent upon close attention to numerous details, the reader is referred to works upon antiseptic surgery for further information upon the subject. It has been highly recommended as a dentifrice in carious teeth with offensive breath, and to keep the teeth and gums clean from tartar or other morbid deposit, consequent upon, or at least connected with, the presence of minute parasitic organisms in these parts. Introduced on cotton, in a concentrated liquid state, into the cavity of a carious tooth, it quickly relieves pain by its local anæsthetic action; but care must be taken to prevent it from touching the lips or the internal surface of the mouth. In cases, too, of morbidly offensive secretion in the axilla and groin, between the toes, etc., it may be used in the form of solution or ointment with hope of benefit.

Independently of its disinfectant properties, it may be employed locally, in weak solution, as a gentle irritant or alterative, or concentrated, as a mild escharotic,[*] in chronic indolent or flabby ulcers, or in those of a specific character, as the syphilitic, in cutaneous eruptions independent of cryptogamic cause, and in non-suppurative chronic or even acute inflammation of the mucous membranes, as in common angina. In scalds and burns it is said to have proved very useful.

The treatment of carbolic acid poisoning is very important, but hitherto has usually not been satisfactory. When circumstances favor, the stomach pump or the india-rubber tube siphon should be at once employed; the benumbing of the stomach being such that emetics usually will not act. M. Husemann states, as the result of numerous experiments, that the alkaline earths, given in solution, in great excess, are the best antidotes; and the most suitable of these is lime combined with sugar, in the form of *saccharate of lime.* This may be prepared for the purpose, by dissolving 16 parts of sugar in 40 of distilled water, adding 5 parts of caustic lime, digesting it three days with occasional agitation, then filtering and evaporating to dryness. The resulting saccharate should be given in solution. (*Journ. de Pharm.*, 1873, p. 222.) More recently, however, Baumann and Sonnenburg have stated (*Med. T. & G.*, 1877, ii.) that the soluble sulphates, especially the sulphate of sodium, are very certain antidotes, capable of neutralizing the poison even after its absorption into the blood. Dr. David Cernea has confirmed these statements by a series of experiments made in the Pharmacological Laboratory in the University of Pennsylvania, and it would seem as though we had a very sure antidote to the poison.[†] There is probably a union between the two acids, resulting in the formation of an innocuous sulpho-carbolate. As the sulphates used are innocuous, they should be given both promptly and in excess.

The dose of carbolic acid is one to three grains (0·065–0·20 Gm.), or of the acid in its concentrated liquid form one to three drops (0·06–0·18 C.c.), which may be given in half a fluidounce or a fluidounce of sweetened water. An excellent menstruum is glycerin, which dissolves it in all proportions; and a preparation is officinal in both the U. S. and Br. Pharmacopœias, consisting of an ounce of carbolic acid dissolved in four fluidounces of glycerin, of which about four minims represent a grain of the acid. From this solution formulas may be readily prepared, either for internal or external use, by diluting it with water. An emulsion also may be made by mixing one part of the acid with eight parts of water and one or two parts of sugar. (See *Glycerinum Acidi Carbolici.*)

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[*] Dr. Robert Battey, of Rome, Ga., in the *Amer. Pract.*, Feb. 1877, suggests a combination with iodine, as a uterine escharotic and alterative, under the name of *Iodized Phenol*, prepared by "gently warming one ounce of crystallized carbolic acid with half an ounce of iodine." This may be diluted, if necessary, with an equal bulk of glycerin.

[†] Sanftleben strongly recommends a mixture of diluted sulphuric acid 10 Gm.; mucilage of gum arabic 200 Gm.; simple syrup 30 Gm., in tablespoonful doses. (*Ztschr. d. Allg. Oest. Ver.*, 1880, p. 10.)

For external use the strength varies greatly according to the object desired. When applied with a view to its superficial escharotic action, as in gangrenous or specific ulcers, it may be used in the solid state properly comminuted, or in the strongest liquid form. In this condition it may be readily obtained by placing the bottle containing it in hot water. Bufalini recommends its combination with camphor, under the name of *Camphorated Phenol*, asserting that the camphor moderates the caustic and disorganizing character of the phenol without destroying its useful effects; he prepares it by mixing one part of carbolic acid with two parts of camphor, allowing the mixture to stand some hours, and purifying by washing with water; it is a liquid of reddish yellow color, having the smell of camphor, insoluble in water, and soluble in alcohol and ether. For the skin affections one part of the acid may be dissolved in one hundred or two hundred parts of water; or the impure liquid acid may be used, diluted in the same proportion. M. Bazin uses a solution of one part in forty parts of acetic acid of 8° B., and 100 of water, in tetter and psora, and states that a single application will destroy the itch insect. A solution containing a grain to the fluidounce of water may be used for application, in the form of *spray*, to the fauces, larynx, and bronchial tubes, by means of the *atomizer;* and the strength may be increased, if thought desirable, up to four or five grains or more to the fluidounce.

Various fabrics are impregnated with carbolic acid for surgical use. Prof. *Lister's gauze* may be made by soaking a loose cotton cloth with a mixture of 5 parts resin, 7 parts paraffin, and 1 part carbolic acid. Prof. Bruns improves upon this, making a more flexible dressing by dissolving 400 grammes of powdered resin in 2 litres of alcohol, adding 40 grammes castor oil and 100 grammes carbolic acid; this will impregnate 2 pounds of the gauze, which is to be dried by spreading out in the air. (See also Lund's process, *A. J. P.*, Feb. 1874.) *Carbolized jute* may be made by Rosenwasser's process by soaking in a percolator 1 pound of jute with a solution of crystallized carbolic acid 700 grains, paraffin 700 grains, resin 2800 grains, benzin 3 pints. (*Am. Journ. Med. Sci.*, 1879, p. 458. See also *N. R.*, April, 1879, and April, 1880.) For a gargle in diphtheria, the sore throat of scarlatina, etc., 20 minims of the liquid acid may be mixed with half a drachm of acetic acid (*Br.*), 2 fluidrachms of tincture of myrrh, and 6 fluidounces of water. For burns and scalds a liniment may be made by rubbing together 1 part of carbolic acid and 6 parts of olive oil, applied on lint. For the dressing of cancerous and other foul ulcers, a cerate may be used composed of five grains of the acid rubbed with an ounce of simple cerate. There is an officinal ointment. A carbolic acid paper, used in packing fresh meats, in order to preserve them, may be prepared by melting 5 parts of stearin with a gentle heat, stirring in thoroughly 2 parts of carbolic acid, adding 5 parts of melted paraffin, stirring the mixture till it cools, and finally melting, and applying in the usual manner to the paper in quires. (*Chemist and Druggist*, Dec. 1871.)

The impure liquid acid sold in the shops usually contains from 70 to 90 per cent. of carbolic and cresylic acids jointly (*Squibb*), and, as the latter acid is quite equal to the former in disinfecting power, yields, if dissolved in water in the proportion of 1 to 80 parts, a solution equivalent on the average to that produced by dissolving 1 part of the pure acid in 100 parts of water.

Off. Prep. Unguentum Acidi Carbolici, *U. S.;* Glycerinum Acidi Carbolici, *Br.*

ACIDUM CARBOLICUM CRUDUM. *U. S. Crude Carbolic Acid.*

(ĂÇ'Ị-DŬM CÄR-BŎL'Ị-CŬM CRŪ'DŬM.)

" A liquid obtained during the distillation of coal-tar between the temperatures of 170°–190° C. (338°–374° F.), and containing carbolic and cresylic acids in variable proportions together with other substances." *U. S.*

Acide phénique cru, *Fr.;* Rohe Carbosaüre, *G.*

With great propriety, we think, the revisers of the U. S. Pharmacopœia have given a distinct heading to this form of carbolic acid, and directed it to be used only externally; for, while its impurity, and more or less uncertain composition and strength, unfit it for internal employment, it is equally efficacious with the purer acid as a local remedy, and may be very advantageously used for disinfectant purposes. In addition to what has been said of it in the preceding article, the following description of it taken from the Pharmacopœia is all that is required on the subject:

"A nearly colorless or reddish-brown liquid of a strongly empyreumatic and disagreeable odor; having a benumbing, blanching and caustic effect on the skin or mucous membrane, and a neutral reaction. Bromine water produces in an aqueous solution of carbolic or cresylic acid a white flocculent precipitate. Crude carbolic acid should not dissolve in less than 15 parts of water at 15° C. (59° F.), nor should the solution have an alkaline reaction (abs. of alkalies). If 50 volumes of crude carbolic acid be diluted with warm water to measure 1000 volumes, the mixture well shaken, cooled, and allowed to separate, the amount of undissolved impurities should not exceed 5 volumes, or 10 per cent. by volume of the crude acid. The amount of water in a solution of crude carbolic acid may be determined by agitating the solution in a graduated cylinder with an equal volume of chloroform. After standing, the upper layer consists of the water contained in the mixture." *U. S.*

ACIDUM CHROMICUM. *U. S.* *Chromic Acid.*

$Cr\,O_3$; 100·4. (ĂÇ′Ị-DŬM ȻHRŌ′MỊ-CŬM.) $Cr\,O_3$; 50·2.

Chromic acid should be preserved in glass-stoppered vials.

Chromic Anhydride, Chromium Trioxide; Acide chromique, *Fr.;* Chromsäure, *G.*

This is readily obtained by mixing 100 measures of a cold saturated solution of potassium bichromate with 150 measures of sulphuric acid, and allowing the mixture to cool. The sulphuric acid unites with the potassa, and sets free the chromic anhydride, which is deposited in crystals. The mother-liquor having been poured off, these are placed upon a tile to drain, covered with a glass bell-jar. The product so obtained will, however, be contaminated somewhat with potassium sulphate and sulphuric acid.

The best yield of pure crystals is said to be according to the method of Zettnow (*Pogg. Ann.*, cxliii. 471), in which 300 Gm. of potassium bichromate are mixed with 500 C.c. of water, and 420 C.c. of concentrated sulphuric acid added, and the mixture allowed to stand for twelve hours in order that the acid potassium sulphate may crystallize out. The mother-liquor is then heated to from 80° to 90°, and 150 C.c. of sulphuric acid added, together with enough water to dissolve the crystals of trioxide which at first separate out. After standing for twelve hours the liquid is poured off from the crystals which have separated, and a second and a third crop may be obtained by concentration. The crystals having been drained upon a porous plate and washed with pure nitric acid, 1·46 gravity, are dried in a current of warm air. For a method by M. Duviller, in which chromate of barium is treated by nitric acid, and chromic acid crystallized out of the mother-liquor, see *A. J. P.*, 1873, p. 23.

Properties. Chromic acid is in the form of anhydrous, acicular crystals, of a brilliant crimson red color and an acid metallic taste, deliquescent, and very soluble in water, forming an orange red solution. "On being heated to about 190° C. (374° F.) chromic acid melts, and at 250 C. (482° F.) it is mostly decomposed with the formation of dark green chromic oxide and the evolution of oxygen. On contact, trituration, or warming with strong alcohol, glycerin, spirit of nitrous ether, and other easily oxidizable substances, it is liable to cause sudden combustion or explosion." *U.S.*

Chromic acid is a teroxide of the metal chromium, having the formula CrO_3. At a heat above the melting point, it gives off half its oxygen, and is converted into the green sesquioxide, Cr_2O_3. It is a powerful oxidizing and bleaching material, and gives up its oxygen with great facility to organic matter. The oxidation of weaker alcohol is attended with the production of aldehyd recognized by the odor, of stronger alcohol by inflaming. "If 1 Gm. of chromic acid be dissolved in 100 C.c. of cold water and mixed with 10 C.c. of hydrochloric acid, the further addition of 1 C.c. of test solution of chloride of barium should cause not more than a white turbidity (limit of sulphuric acid)." *U.S.*

Medical Properties and Uses. As an antiseptic and disinfectant, chromic acid is asserted by Dr. John Dougal (*Lancet*, Dec. 16, 1871), who founds his conclusions on experiment, to be second to none, and in some respects to surpass even carbolic acid. A piece of fresh beef immersed in a solution of chromic acid, containing only 1 part in 2000 of water, became in two days quite black, in six as hard as wood, and at the end of three months remained perfectly free from mould or taint. It is a powerful coagulant of albumen, being, according to Dougal, 10 times stronger than carbolic acid, 15 times stronger than nitric acid, and 20 times stronger than bichloride of mercury. It is, therefore, one of the best tests of the presence of albumen in a fluid; two grains dissolved in an ounce of water readily detecting albumen in a solution containing one part of a saturated solution of beef-juice in 20 of water. Besides coagulating albuminous substances, it oxidizes decaying organic matter, combines with and neutralizes the escaping ammonia, and decomposes sulphuretted hydrogen, reducing it to water and free sulphur. It is also one of the most powerfully destructive agents to inferior organic life, greatly exceeding carbolic acid in this respect. Chromic acid has been used medically only as an escharotic, in which capacity it acts by rapidly oxidizing and thus decomposing the tissues, while by the loss of one-half its oxygen it is itself converted into the inert sesquioxide. It was first employed as a caustic by Prof. Sigmund, of Vienna, on the recommendation of Dr. Heller. Used in substance, made into a paste with water, its action is exceedingly slow and gradual, but deeply penetrating. In saturated solution its action is less penetrating and less gradual. By using a solution more or less dilute, the effect may be graduated according to the degree desired. Prof. Sigmund tried the concentrated solution, with advantage, for the destruction of condylomata, occurring in his syphilitic wards. But caution is necessary in its use; as it may give rise to a deep slough if too largely applied; and, according to M. Gubler, patients have been poisoned, through absorption, by a too extensive application of the acid to the surface. (*Ed. Med. Journ.*, Sept. 1871, p. 281.) Besides these applications, it has been recommended to destroy growths in the mouth and larynx, from its combined escharotic and disinfecting properties, in hospital gangrene, scorbutic or gangrenous ulcers of the mouth, phagedænic ulcers, bites of rabid animals, poisoned wounds, etc.; as a wash to arrest fetid discharges; as an injection in ozæna, leucorrhœa, and gonorrhœa; to prevent suppuration and putrefaction in wounds, etc.; and for the disinfection of cholera and fever stools, as well as for correcting fetid odors from all sources. Care should be taken not to prescribe it in combination with glycerin, or any substance which will cause it to rapidly part with its oxygen: a compounded prescription containing 8 grains of chromic acid and 1 drachm of glycerin exploded violently. (*Zeitschr. Oester. Apoth. Verein*, June 1, 1875.) It is best to use a simple aqueous solution. The solution, or even the pure acid, is used by gynæcologists to destroy intra-uterine growths, but great care is requisite.

Chromic acid is very rarely, if ever, used internally; if employed, the dose should not exceed one-quarter of a grain (0·016 Gm.).

ACIDUM CITRICUM. *U.S., Br.* *Citric Acid.*

$H_3C_6H_5O_7, H_2O$; 210. (ĂÇ′Ị-DŬM CĬ′TRỊ-CŬM.) $3\,HOC_{12}H_5O_{11}\,2HO$; 210.

Acidum Citri, s. Limonis, s. Limonum, s. Limonorum; Acide citrique, Acide du Citron, *Fr.;* Citronensäure, Citronsäure, *G.;* Acido citrico, *It., Sp.*

Citric acid is the peculiar acid to which limes and lemons owe their sourness. It is present also in the juice of other fruits; such as the cranberry, the red whortleberry, the berry of the bittersweet, the red gooseberry, the currant, the strawberry, the raspberry, the tamarind, and the red elderberry (fruit of *Sambucus racemosa rubra*). The latter berry contains citric acid so abundantly that it has been proposed as a source of the acid by M. Thibierge, of Versailles. It is contained also largely in the fruit of *Cyphomandra botacea*, a solanaceous plant, indigenous in Mexico, Peru, and other parts of South America, where it is called *tomato de la paz.* (*Journ. de Pharm.*, Oct. 1869, p. 305.) The commercial source of citric acid is lime, lemon, and bergamot juice; large quantities of *lime-juice* are made in Sicily, concentrated, and exported to England and the United States. It varies considerably in quality, containing usually some alcohol to preserve it, and occasionally nitric, sulphuric, and hydrochloric acids as adulterants. (Allen, *Organic Analysis*, 1879, p. 271.)

The acid is extracted from lemon or lime juice by a very simple process, but one requiring some careful manipulation, for which we are indebted to Scheele. The boiling juice is first completely saturated with carbonate of calcium (chalk or whiting) in fine powder, and the citrate of calcium formed is allowed to subside. This is then washed repeatedly with water, and decomposed by dilute sulphuric acid. An insoluble sulphate of calcium is precipitated, and the disengaged citric acid remains in solution. This is carefully concentrated in leaden boilers until a pellicle begins to form, when it is transferred to other vessels to cool and crystallize.

In the U.S. Pharmacopœia, very properly, no process is given for making citric acid, as it is always purchased from the manufacturing chemist. The British Pharmacopœia gives the following process for preparing it:

"Take of Lemon Juice *four pints* [Imperial measure]; Prepared Chalk *four ounces and a half* [avoirdupois]; Sulphuric Acid *two fluidounces and a half;* Distilled Water *a sufficiency.* Heat the Lemon Juice to its boiling point, and add the Chalk by degrees till there is no more effervescence. Collect the deposit on a calico filter, and wash it with hot water till the filtered liquor passes from it colorless. Mix the deposit with a pint [Imp. meas.] of Distilled Water, and gradually add the Sulphuric Acid previously diluted with a pint and a half [Imp. meas.] of Distilled Water. Boil gently for half an hour, keeping the mixture constantly stirred. Separate the acid solution by filtration, wash the insoluble matter with a little Distilled Water, and add the washings to the solution. Concentrate the solution to the density of 1·21, then allow it to cool, and after twenty-four hours decant the liquor from the crystals of sulphate of lime which have formed; further concentrate the liquor until a film forms on its surface, and set it aside to cool and crystallize. Purify the crystals if necessary by a recrystallization." *Br.*

A preliminary fermentation, which was directed in the former British Pharmacopœia, has been abandoned in the present; and properly, as the viscidity which it was intended to remove is sufficiently got rid of by heating the juice to the boiling point. The Br. Pharmacopœia states, as an evidence of the purity of the crystals, that "70 grains dissolved in distilled water are neutralized by 1000 grain-measures of the *volumetric solution of soda.*"

Preparation on the Large Scale. The juice is placed in a large vat, closed at top, and is saturated with whiting (carbonate of calcium). Carbonic acid gas is evolved, which passes out by an exit-pipe, and may be used in the manufacture of bicarbonate of sodium; and citrate of calcium precipitates. The supernatant liquor, containing much extractive matter, is drawn off; and the citrate of calcium is decomposed by dilute sulphuric acid, liberating the citric acid, and precipitating the lime as a sulphate. The mixture of citric acid and sulphate of calcium is run off into a wooden filter back, lined with lead, furnished with a perforated false bottom, and lined throughout with stout twilled flannel. The solution of citric acid passes off through a pipe, leading from the bottom of the back to suitable reservoirs. The sulphate is washed until it becomes tasteless, and the washings are run off into the same reservoirs. The filtered acid solution is then concentrated by evaporation in wooden vessels lined with lead, through which steam is made to pass by means of coiled lead pipes. As citric acid is liable to decomposition, if subjected to too high a temperature, the use of the vacuum pan is highly advantageous in concentrating the solution. When the liquor is sufficiently concentrated, it is transferred to cylindrical sheet-lead vessels, placed in a warm situation, to crystallize. The crystals, at first obtained, are colored. In order to purify them, they are redissolved in a small quantity of water, with the assistance of heat, and the solution is digested with purified animal charcoal, filtered, and recrystallized. The crystals, after having been washed and drained, are dried on wooden trays lined with sheet-lead, in a room heated by steam. More recently, Dr. Price, Mr. Pontifex, and J. Carter Bell have made improvements in the manufacture of citric acid, for the details of which the reader is referred to *P. J. Tr.* (xiii. 313, and xvi. 430); *N. R.*, 1880, p. 274.*

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* In the *Chemical News* (1866, p. 40) is a short paper by Mr. Frederick Row, in which it is stated that the lemon or lime juice imported, from which most of the acid is prepared, contains so much coloring matter, mucilage, and other impurities, as very much to impede the process, and

The citrate of calcium of the above process should be decomposed without delay; for, if kept, it will undergo fermentation, with the effect of destroying the citric acid. According to Personne, the products of this fermentation are acetic and butyric acids; carbonic acid and hydrogen being evolved. It is desirable to have a slight excess of sulphuric acid, as this rather favors than otherwise the crystallization of the citric acid. It is found necessary, also, to add occasionally a small proportion of sulphuric acid to the citric acid liquor, during the progress of its concentration. According to J. Carter Bell (*N. R.*, 1880, p. 274), the concentrated juice contains from sixty-four to ninety-six ounces of citric acid to the imperial gallon. The more recent the juice the better the quality. That which is stale will sometimes be quite sour, without containing any citric acid, in consequence of having undergone the acetous fermentation.

Properties. "Colorless, right rhombic prisms, not deliquescent except in moist air, efflorescent in warm air, odorless, having an agreeable purely acid taste and an acid reaction." *U. S.* Its sp. gr. is 1·6. When heated, it dissolves in its water of crystallization, and, at a higher temperature, undergoes decomposition, becoming yellow or brown, and forming a very sour syrupy liquid, which is uncrystallizable. By destructive distillation it gives rise to water, empyreumatic oil, acetic and carbonic acids, carburetted hydrogen, and a number of pyrogenous acids, among which is *aconitic*, $C_{66}HO_6$. A voluminous coal is left, which is readily combustible.

Citric acid dissolves in three-fourths of its weight of cold, and half its weight of boiling water. It is soluble also in an equal weight of alcohol and half its weight of boiling alcohol, but is nearly insoluble in pure ether, chloroform, benzol, and benzin, requiring 48 parts for its solution in common ether. A weak solution of it has an agreeable taste, but cannot be kept, as it undergoes spontaneous decomposition. It is incompatible with alkaline solutions, whether pure or carbonated, converting them into citrates; also with the earthy and metallic carbonates, most acetates, the alkaline sulphides, and soaps. It is characterized by its taste, by the shape of its crystals, and by forming an insoluble salt with lime-water when heated, and a deliquescent one with potassa. If sulphuric acid be present the acid will be hygroscopic, and the precipitate by acetate of lead will not be entirely soluble in nitric acid; the insoluble portion being sulphate of lead. Sometimes crystals of tartaric acid are substituted for or mixed with the citric, or the two acids may be mixed in powder, a fraud which is readily detected by adding a solution of potash to that of the suspected acids, when, if tartaric acid be present, a crystalline precipitate of bitartrate of potassium (cream of tartar) will be formed: "If 1 part of the acid be dissolved in 2 parts of water and treated with a solution of 1 part of acetate of potassium in 2 parts of water, the mixture should remain clear after the addition of an equal volume of alcohol (tartaric and oxalic acids)." *U. S.* See Spiller, *Journal Chemical Society*, x. 110. A still more delicate method of

to make repeated crystallization and saturation necessary, to render the crystals fit for the market. It seems that the acid imported has undergone concentration, for the obvious purposes of enabling it to keep better, and to lessen the cost of carriage. Mr. Row states that he has found that much of the difficulty may be obviated by diluting the concentrated liquor, so that it shall have the strength of the fresh juice, by which operation much of the mucilage and other impurities will be made to separate in a flocculent form, and the citrate of calcium, and consequently the citric acid, will be obtained in a state of comparative purity. Another important point is that the sulphuric acid, in slight excess at first, accumulates largely in proportion with the repeated evaporation and crystallization of the citric acid out of the solutions, and thus exercises a most destructive action on that remaining in the mother-liquors. The most effectual way of removing this difficulty is to pass the mother-liquors, as soon as the sulphuric acid becomes in injurious excess, through a fresh portion of citrate of calcium, which not only removes the sulphuric acid, but causes also at the same time the deposition of flocculent matters before held in solution by means of the acid, consisting mainly of sulphate of calcium.

Preparation of citric acid with the aid of magnesia. M. Perret proposes to manufacture citric acid by preparing from the juice, in the situations where lemons and limes are produced, first an insoluble tribasic citrate of magnesium, and then from this a soluble bibasic citrate of magnesium, which may be delivered to the manufacturing chemist for the extraction of the citric acid. The advantage of this method is that a material is brought to the manufacturer not liable to the injurious changes to which lemon-juice and mere citrate of calcium are liable on exposure. The tribasic citrate is made from the defecated juice by adding an excess of magnesia; and the bibasic from it, by treating it with an additional quantity of juice equal to that first employed. (*Journ. de Pharm. et de Chim.*, 4e sér., iv. 48; also *Chem. News*, March 2, 1866, p. 100.)

detecting tartaric acid is to digest the suspected acid with ferric hydrate in a test tube, afterwards to raise the heat slowly to the boiling point, and, having allowed the excess of hydrate to subside, to decant the clear liquid, and evaporate it to a syrupy consistence. If the acid be pure, the liquid remains limpid, and of a fine red color; if contaminated with the tartaric acid, even to the extent of only one per cent., it becomes cloudy, and deposits tartrate of the sesquioxide. (*Journ. de Pharm.*, 1862, p. 169.) Another test is permanganate of potassium, of which an alkaline solution is without action on citric acid; while, under the influence of tartaric acid, the peroxide of manganese is deposited. (*Ibid.*, 1867, p. 239.) "If 1 Gm. of citric acid be dissolved, without heat, in 10 C.c. of a cold, saturated solution of bichromate of potassium, no darkening of the liquid should be observed within five minutes (abs. of 1 per cent. or more of tartaric acid)." *U. S.* "When heated to 100° C. (212° F.) the acid melts and gradually loses 8·6 per cent. of its weight. At a higher temperature it emits inflammable vapors, chars, and is finally dissipated without leaving more than 0·05 per cent. of ash. On adding an aqueous solution of the acid to an excess of lime-water, the mixture remains clear until boiled, when a white precipitate separates, which is nearly all redissolved on cooling. An aqueous solution of the acid should not be darkened nor be precipitated by hydrosulphuric acid (lead and copper). If the crystals have left, on ignition, some ash (see above), this ash should not turn blue by treatment with a few drops of water of ammonia (copper); nor should the further addition of one drop of test solution of sulphide of ammonium cause any black coloration (lead, copper, and iron). 10 C.c. of a concentrated solution should show no precipitate within five minutes after the addition of 1 C.c. of test solution of chloride of barium with excess of hydrochloric acid (sulphuric acid). To neutralize 3·5 Gm. of citric acid should require 50 C.c. of the volumetric solution of soda." *U. S.* Lead is frequently found in the metallic state in citric acid in small quantity, and this arises from small portions being rubbed off in breaking off the crystals from the crystallizing vats. The presence of lead or copper may be detected as above, or by igniting in a porcelain crucible a small quantity of the acid, dissolving the ash in a few drops of nitric acid, diluting largely, and passing sulphuretted hydrogen through it; a black precipitate indicating the impurity.

Composition. The formula of the anhydrous acid is $C_6H_5O_7H_3$. It is a tribasic acid, and may therefore yield three classes of citrates according as one, two, or three atoms of hydrogen are replaced by metal, the first two classes being acid citrates, and the third class neutral citrates. When crystallized from its solution by cooling, it contains one molecule of water. Crystals of the formula $(C_6H_8O_7)_2 + H_2O$ have also been formed. (Flückiger, *Pharm. Chem.*, 1879, p. 157.)

Medical Properties, etc. Citric acid acts as a poison chiefly if not solely by irritating the gastro-intestinal mucous membrane. It is, however, much less irritant than is tartaric acid, and, so far as we know, no death has been caused by it. The action of therapeutic doses upon the system is not decided. In scurvy, citric acid is probably of some value, but is very inferior to lemon-juice. It is eliminated by the kidneys, and, as first stated by Bence Jones, when given in sufficient quantities renders the urine acid. In a free state it is very rarely, if ever, used internally, except as an imperfect substitute for lemon-juice. When added in the quantity of nine drachms and a half to a pint of distilled water, it forms a solution of the average strength of lemon-juice. Of this solution, or of lemon-juice, a scruple of bicarbonate of potassium saturates three fluidrachms and a half; a scruple of carbonate of potassium, four fluidrachms; and a scruple of carbonate of ammonium, six fluidrachms. Half a fluidounce of lemon-juice, or of an equivalent solution of citric acid, when saturated, is considered a dose. An agreeable substitute for lemonade may be made by dissolving from two to four parts of the acid, mixed with sugar and a little oil of lemons, in nine hundred parts of water; or a scruple of the acid may be dissolved in a pint of water, and sweetened with sugar which has been rubbed on fresh lemon-peel. The dose of the acid may be stated at from five to thirty grains (0·33–1·95 Gm.).

Pharm. Uses. In preparing Ferri Pyrophosphas, *U. S.*

Off. Prep. Ferri et Ammoniæ Citras, *Br.;* Ferri et Quiniæ Citras, *Br.;* Liquor

Ammoniæ Citratis, *Br.;* Liquor Bismuthi et Ammoniæ Citratis, *Br.;* Liquor Ferri Citratis, *U. S.;* Liquor Magnesii Citratis, *U. S.;* Liquor Potassii Citratis, *U. S.;* Lithiæ Citras, *Br.;* Potassæ Citras, *Br.;* Potassii Citras, *U.S.;* Sodæ Citro-tartras Effervescens, *Br.;* Syrupus Acidi Citrici, *U. S.*

ACIDUM GALLICUM. *U. S., Br.* *Gallic Acid.*

$HC_7 H_5 O_5, H_2 O$; 188. (ĂÇ′Ị-DŬM GĂL′LỊ-CŬM.) $HO\ C_{14} H_5 O_9, 2\ HO$; 188.

Acide gallique, *Fr.;* Gallussäure, *G.*

In the last revision of the U. S. Pharmacopœia the process for the preparation of gallic acid was omitted.*

The British Pharmacopœia process is essentially the same as that of the U. S. 1870; differing in requiring an exposure of six weeks instead of a month, in not expressing the paste before boiling in water, in expressing the impure acid deposited from the filtered decoction before redissolving it in boiling water, and in omitting the use of animal charcoal. The process based on the influence of sulphuric acid in favoring the change of tannic into gallic acid, has the merit of requiring less time for completion. See former editions of U. S. Dispensatory.

The U. S. 1870 process is founded upon the fact that when galls in infusion, or in the state of moistened powder, are exposed to the air, their tannic acid is gradually converted into gallic acid. The gallic acid, being freely soluble in boiling but very sparingly in cold water, is extracted from the altered galls by decoction, and is deposited as the water cools. A repetition of the solution and deposition renders the acid more pure; but it cannot be obtained wholly colorless unless by the aid of animal charcoal. There are few processes in which it is more necessary that the animal charcoal should be purified. The presence of the slightest quantity of ferric salt interferes with the bleaching of the acid; and it is even advisable to examine the filtering paper, lest it may contain sufficient of this substance to vitiate the results of the process. The first crop of crystals in the process retains a very large proportion of water; and it will be found convenient to subject them to strong expression between folds of bibulous paper.

Dr. C. Wetherill, believing that gallic acid differs from tannic simply in containing water, conceived the idea of preparing the former from the latter by the fixation of water. This he effected through the agency of sulphuric acid. Having mixed 13 drachms of tannic acid with 22 fluidounces of sulphuric acid and four times that bulk of water, he heated the mixture to the boiling point, and then allowed it to stand. In a few days an abundant precipitate of white gallic acid took place, amounting to 87·4 per cent. of the tannic acid. (*A. J. P.*, xx. 112.) Dr. Christison states that the process was originally proposed by Liebig.

The elder Robiquet first suggested that galls contained a principle capable of converting tannic into gallic acid, with the presence of water, and in the absence of atmospheric air. M. Laroque proved that this principle acts as a ferment, and that the change referred to is the result of a *gallic acid fermentation* in the galls. M. Edmond Robiquet showed that galls contain *pectose* and *pectase*, the former of which, according to the experiments of M. Frémy, is the principle out of which pectin is formed in plants, and the latter a peculiar ferment which effects the transformation. He believed that in galls the pectase, aided by a proper temperature and the presence of water, changed not only pectose into pectin, but also tannic into gallic acid. Strecker previously advanced the opinion that tannic acid was a combination of gallic acid and sugar, the latter of which is destroyed in the process for procuring gallic acid, which is thus simply set free from the combination. It would seem, if this view were correct, that the pectase acted upon the saccharine matter of the tannic acid, causing its conversion into carbonic acid and alcohol, and liberating the gallic acid, and that the process was in fact an example of the vinous fermentation. M. E. Robiquet admitted the occasional transformation of tannic acid into gallic acid and sugar, but did not believe that the sugar pre-existed as such in the tannin. (*Journ. de Pharm.*, 3e sér., xxiii. 241.) Wittstein, in endeavoring to obtain gallic acid from *Chinese galls* by forming them into a paste with water, found that but a very small proportion of the acid was generated at the end of six weeks. Thinking that this might have resulted from the want of the ferment in the Chinese galls, he added to these one-eighth of their weight of common galls, and, at the end of three weeks, obtained an amount of gallic acid nearly equal to one-half the weight of the galls employed. The same result, though more slowly, followed the addition of yeast to the Chinese galls. Wittstein obtained both carbonic acid and alcohol as products of this operation, thus favoring the views of Strecker as to the constitution of tannic acid. And the idea that tannin was a glucoside convertible through exposure of galls to the air, or more rapidly by sulphuric acid, into glucose and gallic acid, was accepted without qualification, until Schiff (*Deut. Chem. Ges. Ber.*, iv. 231, 967, and *Bull. Soc. Chem.* [2], xviii. 23) proved that although crude tannic acid contains glucose, it is possible to separate a large quantity of the glucose without destroying the tannic acid. He proposes that *pure tannic acid* be called *digallic acid*, and that the term *tannin* be applied to natural tannin, *i.e.*, the *glucoside* of digallic or pure tannic acid, for when natural tannin is boiled with dilute mineral acids, or subjected to the influence of a nitrogenous ferment, it splits into digallic acid and glucose, $C_{34}H_{28}O_{22} + 4H_2O = 4C_7H_6O_5 + C_6H_{12}O_6$. Digallic acid is the first anhydride of gallic acid—$C_{14}H_{10}O_9 + H_2O = 2C_7H_6O_5$.

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* The U. S. Pharmacopœia of 1870 gives the following. "Take of Nutgall, in fine powder, *thirty-six troyounces;* Purified Animal Charcoal, Distilled Water, each, *a sufficient quantity*. Mix the Nutgall with sufficient Distilled Water to form a thin paste, and expose the mixture to the air, in a shallow glass or porcelain vessel, in a warm place, for a month, occasionally stirring it with a glass rod, and adding from time to time sufficient Distilled Water to preserve the semi-fluid consistence. Then submit the paste to expression, and, rejecting the expressed liquor, boil the residue in eight pints of Distilled Water for a few minutes, and filter while hot through Purified Animal Charcoal. Set the liquid aside that crystals may form, and dry them on bibulous paper. If the crystals be not sufficiently free from color, they may be purified by dissolving them in boiling Distilled Water, filtering through a fresh portion of Purified Animal Charcoal, and crystallizing." *U. S.*

Properties. Gallic acid is in delicate, silky, acicular crystals, which, as ordinarily found in the shops, are slightly brownish, but when quite pure are colorless. It is inodorous, and of a sourish, astringent taste and an acid reaction. It is soluble, according to Braconnot, in 100 parts of cold and 3 of boiling water, in 4·5 parts of alcohol, 1 part of boiling alcohol, 3 parts of absolute alcohol, and 39 parts of absolute ether. It is even less soluble in chloroform, benzol, and benzin. Mr. Thomas Weaver, of Philadelphia, has found that it is soluble in glycerin in the proportion of 40 grains to the ounce, and that the solution may be diluted to any extent with water without affecting its transparency. (*A. J. P.*, xxix. 82.) It produces a deep bluish-black color with solutions of ferric salts, which disappears when the solution is heated; a result which Dr. Mahla has shown to depend on the conversion of the gallic into *gallhumic* or *metagallic acid*, by the loss of the constituents of carbonic acid and water. (*Am. Journ. of Sci. and Arts*, Nov. 1859.) It does not precipitate gelatin, or a solution of ferrous sulphate. "When dried at 100° C. (212° F.) the crystals lose 9·5 to 10 per cent. of combined water." *U. S.* It should leave no residue when burned, and be entirely dissipated when thrown on red-hot iron. On exposure to the air, its solution undergoes spontaneous decomposition; but it is said that by the addition of a drop of oil of cloves it may be kept for a long time without change. (*P. J. Tr.*, xvi. 223.) T. Löwe has found that gallic acid, dissolved in water, is converted into tannic acid by nitrate of silver through its oxidizing influence; and that the change is more complete when a salt of gallic acid is used. (*Chem. News*, 1868, p. 59; from *Journ. für prakt. Chem.*, cii. 111.) "An aqueous solution of gallic acid should not precipitate alkaloids, gelatin, albumen, gelatinized starch, or solution of tartrate of antimony and potassium with chloride of ammonium (distinction from tannic acid)." By the action of arsenic it is converted almost entirely into tannic acid without the production of arsenious acid. (Schiff, *Chem. News*, xxix. 73.) A very delicate test for gallic acid has been proposed by Henry R. Procter (*A. J. P.*, Aug. 1874.) It consists in adding the suspected solution to a faintly alkaline solution of arseniate of sodium or potassium. If gallic acid be present, an intense green color is soon developed, appearing, if the liquid be quiet, first upon the surface. Prof. Flückiger has pointed out (*P. J. Tr.*, Aug. 1, 1874) that the arseniate plays no part in this test. The change is produced by an alkali, whether caustic or not, provided it is present in very small quantity. The reaction does not occur with gallo-tannic or pyrogallic acid. A test proposed by Flückiger consists in adding to the solution of gallic acid a dilute (1 to 100) solution of pure ferrous sulphate. To the colorless solution a little acetate of sodium is to be added, when a deep violet color will appear, due to the formation of ferrous gallate. The Pharmacopœia test is as follows. "If 5 C.c. of a cold saturated solution of gallic acid be treated in a watch glass with not more than two drops of solution of potassa, a deep green color will gradually be developed. This color is changed to purple red by acids, and is prevented by an excess of alkaline hydrate or carbonate." Heated to 216° C. (420° F.), gallic acid gives out carbonic acid, and is changed into *pyrogallic acid.* (See Part II.)

Medical Properties. Gallic acid is astringent, but less powerfully so than tannic acid. As it does not coagulate albumen, it is readily absorbed when ingested, and is rapidly eliminated by the kidneys. Its presence in the urine is under these circumstances readily demonstrated by the addition of a soluble ferric salt of iron. Owing to its being more readily transported by the blood, it is more effective than tannic acid in all cases of hemorrhage (hæmoptysis, hæmaturia, etc.), in which the bleeding vessels must be reached through the route of the circulation. But in hemorrhage from the alimentary mucous membrane, or from any other part with which tannic acid can be brought into direct contact, the latter astringent is by far the more effectual. Tannic acid is also much more efficient in anginose or other relaxations in which a decided astringent action is desired, and in which a direct application can be made. Gallic acid has been employed with advantage in pyrosis, and in the night-sweats of phthisis, or exhaustion. In albuminuria, when there is a very large amount of albumen excreted, gallic acid may be employed with service to diminish the flow, and the drug has even been used in acute Bright's disease, following scarlatina, with asserted great advantage. (*N. R.*, Oct. 1875.) It is said not to constipate the bowels. The dose is from five to fifteen grains (0·33–1·0 Gm.) three or four times a day, and may be given in the form of pill or powder.

Off. Prep. Unguentum Acidi Gallici.

ACIDUM HYDROBROMICUM DILUTUM. *U.S. Diluted Hydrobromic Acid.*

(ĂÇ′Ị-DŬM HȲ-DRỌ-BRŌ′MỊ-CŬM DỊ-LŪ′TŬM.)

Acidum Bromhydricum Dilutum, Acidum Bromohydricum; Acide hydrobromique, *Fr.;* Hydrobromsäure, Bromwasserstoffsäure, *G.*

"A liquid composed of 10 per cent. of absolute Hydrobromic Acid [**H Br; 80·8**—H Br; 80·8] and 90 per cent. of water." *U. S.*

The following process is based upon that of Dr. E. R. Squibb, and although not finally adopted by the Committee of Revision of the last Pharmacopœia, on the ground of inexpediency, it merits a place in this commentary.

Take of Bromide of Potassium and Sulphuric Acid, each, one hundred and fifty parts, Distilled Water, a sufficient quantity. Add the Sulphuric Acid to twenty-five parts of Distilled Water, and cool the mixture. Then dissolve the Potassium Bromide in one hundred and fifty parts of water by the aid of heat, supplying the loss of water by evaporation during the heating. Carefully pour the diluted Sulphuric Acid into the hot solution with constant stirring, and set the mixture aside for twenty-four hours, in order that the Potassium Sulphate may crystallize. Pour off the liquid into a retort, break up the crystalline mass, transfer it to a funnel, and, having drained the crystals, drop slowly upon them fifty parts of cold Distilled Water so as to wash out the acid liquid. Add this liquid to that in the retort, and distil nearly to dryness at a moderate heat. If red fumes of bromine are given off during any stage of the distillation, change the receiver as soon as such fumes cease to appear. Finally determine in the distillate the amount of actual Hydrobromic Acid (16·2 Gms. should require 20 C.c. of the volumetric solution of soda), and add to the remaining weighed distillate such an amount of cold Distilled Water as shall cause the finished acid to contain 10 per cent. of actual hydrobromic acid.

This process for making solution of hydrobromic acid does not differ essentially from that of Dr. E. R. Squibb (*A. J. P.*, 1878, p. 116), except in the improvement of the rather smaller proportion of sulphuric acid used, and in the fact of the difference in strength of the two hydrobromic acids, Dr. Squibb's being 34 per cent., the above 10 per cent. The advantages possessed by both methods over those frequently used are greater purity, and that of more definite strength secured by the volumetric assay. The most convenient process is undoubtedly that of Dr. Dewitt C. Wade (*Peninsular Medical Journal*, Feb. 1875), modelled after Buchanan's method of making hydriodic acid, which directs that 120 grains of bromide of potassium be dissolved in one fluidounce of water, and 153 grains of tartaric acid be added to the solution; acid tartrate of potassium is produced, the greater part of which crystallizes out on standing 12 hours at a low temperature, and a solution of hydrobromic acid is formed, sp. gr. 1·228, containing about 80 grains real hydrobromic acid to the fluidounce, equivalent to nearly 15 per cent. Fothergill's acid, although based upon Wade's formula, is weaker, the quantity of bromide of potassium being 81¼ grains and that of tartaric acid 99 grains to the fluidounce, the manipulation being the same; each fluidounce of Fothergill's acid contains about 55 grains real hydrobromic acid, or about 10 per cent. Diluted hydrobromic acid made in this way is open to the objection of containing cream of tartar, and probably some undecomposed bromide of potassium in solution, and thus is not strictly pure. To lessen this, Charles Rice proposes the addition of a double quantity of alcohol to facilitate the precipitation, recovering the alcohol by distillation subsequently. (*N. R.*, 1877, p. 107.) Other processes have been suggested for preparing hydrobromic acid. Edward Goebel (*N. R.*, Sept. 1880) proposes a method based on Glover's process, which is to decompose 148 grains barium bromide, dissolved in half an ounce of water, with 50·6 grains sulphuric acid, diluted with two drachms of distilled water; the precipitated barium sulphate is washed with distilled water until the filtrate weighs 810 grains to make the 10 per cent. acid solution. He makes bromide of barium by triturating 100 parts pure carbonate of barium with 95 parts bromide of ammonium with a little water, so as to make a damp powder, and heating in an evaporating dish until vapors of carbonate of ammonium cease to be evolved; the residue is dissolved in distilled water, filtered, evaporated, and dried. Winckler proposes a plan for making hydriodic acid, which has been adapted by Charles Rice to making hydrobromic acid. (See *N. R.*, Jan. 1880.) Bromine is dissolved in bisulphide of carbon, and hydrogen sulphide passed through the solution. The processes of Balard, Millon, and Loewig are commented upon by John M. Maisch (*Proc. A. P. A.*, 1860), who proposes some useful modifications. Prof. Markoe (*Ibid.*, 1875, p. 686) recommends an economical process, which, however, must be followed with care, and is better adapted for making the acid on a large scale. He pours a pint of water in a gallon stoneware jar, and then adds one pound or more of phosphorus, distributing it over the bottom; ice is now added until the jar is half full, a gallon glass funnel is inserted in the throat of the jar, and a funnel tube adjusted, so that the end will be a short distance above the surface of the phosphorus; the funnel is about one-third filled with broken ice, and the jar placed in a larger vessel, and broken ice packed between. Three or four pounds of bromine after being chilled are *slowly* added, in order that the fumes of hydrobromic acid and bromine that may arise will be fully condensed by the ice in the funnel, and an accumulation of bromine avoided, which might produce an explosion from too sudden reaction. The excess of phosphorus is removed after all the bromine has been added, the liquid distilled, hydrobromic acid condensed, and the strength adjusted, whilst to the residue in the retort water may be added to make diluted phosphoric acid. For other processes see Wène (*Comptes-Rend.*, 1849), Bruylants (*Journ. de Pharm. d'Anvers*, 1879, p. 343, and *A. J. P.*, Jan. 1880), Hager (*Handbuch d. Pharm. Praxis*, i. 628).

Properties. Diluted hydrobromic acid is a colorless, transparent liquid, entirely vaporized by heat, inodorous, strongly acid to the taste, sp. gr. 1·077 at 15° C. (59° F.), containing 10 per cent. absolute hydrobromic acid. Although of a pungent and irritating odor, and fuming when in contact with the atmosphere when concentrated, in its diluted state it is odorless. On adding chlorine or nitric acid to diluted hydrobromic acid, bromine is liberated, which is soluble in chloroform or disulphide of carbon, imparting to these liquids a yellow color.

Tests. "Test solution of nitrate of silver causes a white precipitate insoluble in nitric acid, and in water of ammonia, and sparingly soluble in stronger water of ammonia. On being kept for some time, the acid should not become colored; test solution of chloride of barium should not produce a turbidity or precipitate (sulphuric acid)." *U. S.* 20 C.c. of the volumetric solution of soda should neutralize 16·2 Gm. of the diluted acid. It should be preserved in glass-stoppered bottles.

The following table by Biel will be found useful in showing from the specific gravities of solutions the percentage of absolute hydrobromic acid.

Biel's table of Percentage and Specific Gravity of Hydrobromic Acid.

Per Ct. HBr.	Specific Gravity at 15° C. (59° F.)	Per Ct. HBr.	Specific Gravity at 15° C. (59° F.)	Per Ct. HBr.	Specific Gravity at 15° C. (59° F.)	Per Ct. HBr.	Specific Gravity at 15° C. (59° F.)
1	1·0082	14	1·110	27	1·229	40	1·375
2	1·0155	15	1·119	28	1·239	41	1·388
3	1·0230	16	1·127	29	1·249	42	1·401
4	1·0305	17	1·136	30	1·260	43	1·415
5	1·038	18	1·145	31	1·270	44	1·429
6	1·046	19	1·154	32	1·281	45	1·444
7	1·053	20	1·163	33	1·292	46	1·459
8	1·061	21	1·172	34	1·303	47	1·474
9	1·069	22	1·181	35	1·314	48	1·490
10	1·077	23	1·190	36	1·326	49	1·496
11	1·085	24	1·200	37	1·338	50	1·513
12	1·093	25	1·209	38	1·350		
13	1·102	26	1·219	39	1·362		

Medical Properties and Uses. Dilute hydrobromic acid is very nearly identical with bromide of potassium in its action, but clinical experience has not yet fully tested its use as a substitute in *epilepsy* and other serious affections. In an experimental study made by Dr. Reichert, of the University of Pennsylvania, it was found to act upon animals precisely as does the bromide, and if it should be found equally serviceable in human disease it will have the advantage of the absence of the depressing effects of the potash. It has been especially commended in tinnitus aurium. Two fluidrachms contain 12 grains of bromine, equivalent in this to 18 grains of the bromide of potassium, and may be given at once well diluted with syrup.

ACIDUM HYDROCHLORICUM. *U.S., Br.* *Hydrochloric Acid.*

[*Acidum Muriaticum*, Pharm. 1870.]

(ĂÇ′Ị-DŬM HȲ-DRỌ-ȻHLŌ′RỊ-CŬM.)

A liquid composed of 31·9 per cent. of absolute Hydrochloric Acid [**HCl; 36·4**—HCl; 36·4] and 68·1 per cent. of water. *U. S.* Hydrochloric acid gas, HCl, dissolved in water, and forming 31·8 per cent. by weight of the solution. *Br.*

Acidum Hydrochloratum, s. Chlorhydricum; Spirit of Sea-Salt, Marine Acid, Muriatic Acid. Chlorhydric Acid; Acide hydrochlorique, Acide chlorhydrique, ou muriatique, *Fr.;* Salzsäure, Chlorwasserstoffsäure, *G.;* Acido muriatico, *It.*, *Sp.*

The hydrochloric acid of pharmacy and the arts is a solution of hydrochloric acid *gas* in water. The *British* Pharmacopœia gives the following process for preparing it.

"Take of Chloride of Sodium, dried, *forty-eight ounces* [avoirdupois]; Sulphuric Acid *forty-four fluidounces;* Water *thirty-six fluidounces;* Distilled Water *fifty fluidounces.* Pour the Sulphuric Acid slowly into thirty-two [fluid]ounces of the Water, and when the mixture has cooled, add it to the Chloride of Sodium previously introduced into a flask having the capacity of at least one gallon [Imp. meas.]. Connect the flask by corks and a bent glass tube with a three-necked wash-bottle, furnished with a safety tube, and containing the remaining four [fluid]ounces of the Water; then, applying heat to the flask, conduct the disengaged gas through the wash-bottle, into a second bottle containing the Distilled Water, by means of a bent tube dipping about half an inch below the surface; and let the process be continued until the product measures sixty-six [fluid]ounces, or the liquid has acquired a sp. gr. of 1·16. The bottle containing the distilled water must be kept cool during the whole operation." *Br.*

Preparation. Hydrochloric acid is obtained by the action of sulphuric acid on chloride of sodium or common salt. The commercial acid is procured, on a large scale, by distilling the salt with an equal weight of sulphuric acid, somewhat diluted with water, from iron stills, furnished with earthen heads, into earthenware receivers containing water. When thus obtained, it is contaminated with iron and other impurities, and is not fit for medicinal purposes.

Commercial hydrochloric acid is now produced in large quantities in England, during the decomposition of common salt for the purpose of making sulphate of sodium, from which soda-ash and carbonate of sodium are afterwards manufactured in immense quantities. The decomposition of the sea-salt is performed in semi-cylindrical vessels, the curved part, next the fire, being made of iron, and the upper or flat surface, of stone. The acid gas is conveyed by a pipe to a double-necked stoneware receiver, half filled with water, and connected with a row of similar receivers, likewise containing water. As carried out on a larger scale, the decomposition of the salt takes place in hemispherical iron pans, 9 feet in diameter, covered by a brick-work dome; upon the mass of salt the requisite quantity of sulphuric acid is allowed to run from a leaden cistern placed above the decomposing pan. Torrents of hydrochloric acid gas are evolved, which collect in the space between the pan and the brick-work dome, whence they pass by a brick-work or earthenware flue into upright towers or condensers. These towers are filled with bricks or coke, down which a small stream of water is allowed to trickle. The gas, passing upwards, meets the water, and is dissolved by it; and as the acid liquor approaches the bottom of the tower, it becomes more and more nearly saturated with the gas.

The acid, when required to be pure, is generally prepared by saturating distilled water with the gas in a Woulfe's apparatus. A quantity of pure fused common salt is introduced into a retort or matrass, placed on a sand-bath. The vessel is then furnished with an S tube, and connected with a series of bottles, each two-thirds full of water. A quantity of sulphuric acid is then gradually added, equal in weight to the common salt employed, and diluted with one-third of its weight of water. The materials ought not to occupy more than half the body of the retort. When the extrication of the gas slackens, heat is applied, and gradually increased until the water in the bottles refuses to absorb any more, or until no more gas is found to come over. As soon as the process is completed, boiling water should be added to the contents of the retort or matrass, in order to facilitate the removal of the residue. During the progress of the saturation, the water in the several bottles increases in temperature, which lessens its power of absorption. It is, therefore, expedient, in order to obtain a strong acid, to keep the bottles cool by means of water or ice. The connecting tubes need not plunge deeply into the acid.

The process of the British Pharmacopœia is substantially the same as the one here described, with the exception of the proportion of the acid and salt employed. In the process for hydrochloric acid, theory calls for a little less than 82 parts of liquid sulphuric acid to 100 of common salt. A moderate excess of the former may be useful to insure the complete decomposition of the salt; but the quantity of acid directed in the British process is sufficient to decompose twice the quantity of common salt taken. The intention obviously is to use enough of the acid to form the acid sulphate instead of the neutral sulphate of sodium; the former being more soluble and readily removed from the retort, and the reaction requiring less heat for its completion than when one mol. of sulphuric acid is taken to two of salt. The reaction for its formation is $NaCl + H_2SO_4 = HCl + HNaSO_4$. If only half the amount of sulphuric acid be used, the reaction is $(NaCl)_2 + H_2SO_4 = (HCl)_2 + Na_2SO_4$. In the first of these reactions (that of the British Pharmacopœia process), as only one mol. of salt is taken, it is obvious that there is not enough sodium furnished to neutralize the sulphuric acid completely and make the normal sulphate Na_2SO_4, so the result is the acid sulphate (bisulphate) $HNaSO_4$. On the other hand, in the second reaction, the two mols. of salt furnish just the sodium necessary to neutralize the one molecule of sulphuric acid and make the neutral sulphate Na_2SO_4.

As hydrochloric acid, prepared in the ordinary mode, often contains arsenic, so as to obscure its indications when employed in testing for that poison, it is of interest to the practical toxicologist to know that it may be obtained free from that impurity by distilling chloride of sodium or potassium with oxalic acid in equivalent proportions. (*Chem. News*, 1862, p. 41.)

The following method of freeing hydrochloric acid from arsenious acid is recommended by M. Engel as easy and entirely efficacious. It is founded on the fact that arsenious acid is held in solution by hypophosphorous acid. Into a litre (about 2 pints) of arsenical hydrochloric acid introduce 4 to 5 grammes (about 60 or 70 grains) of hypophosphite of potassium, dissolved in a little water. At the end of an hour or two, the liquid becomes yellow and then brown; and a precipitate soon forms, more or less copious according to the amount of impurity. After the liquid becomes clear, which usually happens in 45 minutes, decant the hydrochloric acid and distil it. The acid thus obtained is entirely free from arsenic. This process should be conducted in a place where the direct rays of the sun may fall on the vessels; or, where this is impossible, the vessels should be subjected, by means of a water-bath, from 4 to 6 hours, to a heat little short of the boiling point of the acid. (*Journ. de Pharm.*, 1873, p. 10.) Traces of arsenic may also be removed by adding solution of stannous chloride, and after the precipitate of impure arsenic has settled, the clear liquid is re-distilled. (Bettendorff, *Zeit. für Chem.* [2], 5, p. 492.)

Properties of the Pure Acid. Hydrochloric acid, when pure, is a transparent colorless liquid, of a suffocating odor and corrosive taste. Exposed to the air it emits white fumes, owing to the escape of the acid gas, and its union with the moisture of the atmosphere. When concentrated, it blackens organic substances like sulphuric acid. Its sp. gr. varies with its strength. When as highly concentrated as possible, its density is 1·21. The *U. S. acid*, as well as that of the present *British* Pharmacopœia, has the sp. gr. 1·16. "3·64 Gm. should require for complete neutralization 31·9 C.c. of the volumetric solution of soda," *U. S.*, or "114·8 grains by weight, mixed with half a [fluid]ounce of distilled water, require for neutralization 1000 grain-measures of *the volumetric solution of soda*." *Br.* When exposed to heat, it continues to give off hydrochloric acid gas, with the appearance of ebullition, until its sp. gr. falls to 1·094, when it properly boils, and may be distilled unchanged, or entirely volatilized.

Hydrochloric acid is characterized by forming, on the addition of nitrate of silver, a white precipitate (chloride of silver), insoluble in nitric acid, but readily soluble in ammonia. It is incompatible with alkalies and most earths, with oxides and their carbonates, and with sulphide of potassium, tartrate of potassium, tartar emetic, tartrate of iron and potassium, nitrate of silver, and solution of subacetate of lead.

As it is desirable to know, on many occasions, in chemical and pharmaceutical operations, the quantity of absolute acid contained in samples of acid of different densities, we subjoin the table of Kolb.

Kolb's table of Percentage and Specific Gravity of Hydrochloric Acid.

Specific Gravity.	100 Parts contain at 15° C. (59° F.) HCl.	Specific Gravity.	100 Parts contain at 15° C. (59° F.) HCl.	Specific Gravity.	100 Parts contain at 15° C. (59° F.) HCl.
1 000	0·1	1·083	16·5	1·166	33·0
1·007	1·5	1·091	18·1	1·171	33·9
1·014	2·9	1·100	19·9	1·175	34·7
1·022	4·5	1·108	21·5	1·180	35·7
1·029	5·8	1·116	23·1	1·185	36·8
1·036	7·3	1·125	24·8	1·190	37·9
1·044	8·9	1·134	26·6	1·195	39·0
1·052	10·4	1·143	28·4	1·199	39·8
1·060	12·0	1·152	30·2	1·205	41·2
1·067	13·4	1·157	31·2	1·210	42·4
1 075	15·0	1·161	32·0	1·212	42·9

Impurities. This acid, when pure, will evaporate without residue in a platinum spoon. On heating it with black oxide of manganese an abundance of chlorine gas is given off. If sulphuric acid be present, a solution of chloride of barium will cause a precipitate of sulphate of barium in the acid, previously diluted with distilled water. Iron may be detected by saturating the diluted acid with carbonate of sodium, and then adding ferrocyanide of potassium, which will strike a blue color if that metal be present, or by the simple addition of potassium sulphocyanate, when a blood-red coloration is produced. The absence of arsenic may be inferred if it does not tarnish bright copper foil when boiled with it. "If 1 C.c. of hydrochloric acid be diluted with water to make 10 C.c. and slightly supersaturated with water of ammonia, no precipitate should be formed upon gently warming, showing absence of iron or much lead; the liquid should not have a blue tint (copper). The further addition of two drops of test-solution of sulphide of ammonium should not cause a black coloration (lead, iron); the remaining liquid should leave no fixed residue on evaporation and gentle ignition (non-volatile metals). When diluted with five volumes of water it should not liberate iodine from test-solution of iodide of potassium (absence of chlorine), nor should 10 C.c. of the diluted acid be precipitated within five minutes, after the addition of 20 drops of test-solution of chloride of barium (sulphuric acid)." *U. S.* Ammonia in excess shows the absence of iron, if it produces no precipitate.

If another portion of the diluted acid be treated with test zinc, the evolved gas should not blacken paper wet with test-solution of nitrate of silver (arsenious or sulphurous acid). Free chlorine or nitric acid may be discovered by its having the power to dissolve gold-leaf. Any minute portion of the leaf which may be dissolved is detected by adding a solution of stannous chloride, which will give rise to a purplish tint. The free chlorine is derived from the reaction of nitric or nitrous acid on a small portion of the hydrochloric acid, which is thus deprived of its hydrogen. Hence it is that, when free chlorine is present, nitrous acid or some other oxide of nitrogen is also present as an impurity. The nitric and nitrous acids are derived from nitrates in the common salt, and from nitrous acid in the commercial sulphuric acid employed in the preparation of the hydrochloric acid.

Hydrochloric Acid of Commerce. This acid has the general properties of the pure aqueous acid. It has a yellowish color, owing to the presence of sesquichloride of iron, or of a minute proportion of organic matter, such as cork, wood, etc. It usually contains sulphuric acid, and sometimes free chlorine and nitrous acid. But the most injurious impurity, to those who consume it in the arts, is sulphurous acid. T. H. Savory analyzed three samples of commercial hydrochloric acid, each having a sp. gr. of between 1·16 and 1·17, and found them to contain from 7 to nearly 11 per cent. of sulphurous acid. To detect this acid, M. Girardin has proposed a very delicate test, namely, stannous chloride. The mode of using the test is to take about half an ounce of the acid to be tested, and to add to it two or three drachms of the stannous chloride. The mixture having been stirred two or three times, as much of distilled water as of the stannous salt is to be added. If sulphurous acid be present, the hydrochloric acid becomes turbid and yellow immediately upon the addition of the stannous chloride; and, upon the subsequent addition of the water, a slight evolution of sulphuretted hydrogen takes place, perceptible to the smell, and the liquid assumes a brown hue, depositing a powder of the same color. The manner in which the test acts is as follows. By a transfer of chlorine, the test is converted into stannic chloride and metallic tin, the latter of which, by reacting with the sulphurous acid, gives rise to a precipitate of stannic and stannous sulphides. In case the sulphurous acid forms but one-half of one per cent. of the commercial acid, the precipitate may not be perceptible. Under these circumstances, a solution of sulphate of copper must be added to the liquid previously warmed, when a brown precipitate of sulphide of copper will be immediately formed. (*Heintz.*) Or, if weak solution of iodine is decolorized by the hydrochloric acid, sulphurous or arsenious acid may be suspected. M. Lembert has proposed the following, which he considers as a more delicate test of sulphurous acid. Saturate the suspected hydrochloric acid with carbonate of potassium, and add successively a little weak solution of starch, one or two drops of solution of iodate of potassium, and sulphuric acid, drop by drop. Sulphurous acid, if present, will be set free with iodic acid, and these, by reacting on each other, will develop iodine, which will cause a blue color with the starch. Or the addition of pure zinc will liberate nascent hydrogen, which will cause the evolution of hydrogen sulphide gas detected with acetate of lead paper.

Another impurity occasionally present in the commercial acid, as shown by Dupasquier, is arsenic. The immediate source of this impurity is the sulphuric acid used to prepare the hydrochloric acid. The sulphuric acid derives the arsenic from the sulphur used in its manufacture, and this last from pyrites containing a little of the poisonous metal. The arsenic, when present, is in the form of a terchloride, and, from its volatility in this state of combination, is transferred to the hydrochloric acid, distilled from the commercial acid. This impurity is separated by diluting the acid with an equal volume of water, and passing through it sulphuretted hydrogen, which throws down the arsenic as a tersulphide. According to Wittstein, hydrochloric acid is freed from arsenic by mercury, according to Reinsch, by copper, and in either case it may be deprived of metallic impregnation by careful distillation. (*A. J. P.*, 1851, p. 408.) M. Auguste Houzeau asserts that to deprive commercial arseniferous hydrochloric acid of arsenic it is sufficient simply to boil it, in a flat-bottomed vessel, to two-thirds of its original volume; all the arsenic escaping in the form of the terchloride. (*Journ. de Pharm. et de Chim.*, 4e sér., i. 97.) Bettendorff separates arsenious and arsenic acids from hydrochloric acid, sufficiently concentrated, by precipitating with stannous chloride, and then distilling the acid: when it is so treated, it is perfectly free from arsenic. (*A. J. P.*, 1870, p. 219.) When leaden vessels are used in preparing hydrochloric acid, it is apt to contain chloride of lead, which falls as a white precipitate on neutralizing the acid. The nature of the precipitate is verified by dissolving it in nitric acid and adding iodide of potassium, when the yellow iodide of lead will fall. (*Hainault.*) Prof. E. Scheffer proved the presence of lead in a sample used for making solution of perchloride of iron. (*A. J. P.*, Nov. 1875.) Another instance was noted by F. Reppert. (*A. J. P.*, Dec. 1875.) This impurity, being fixed, may be separated by distilling the acid. A small proportion of thallium has been detected in commercial hydrochloric acid by Mr. Wm. Crookes, being derived from sulphuric acid, in the manufacture of which pyrites were employed. (*Chem. News*, 1863, p. 194.) Selenium has been found in French hydrochloric acid, causing it to have a characteristic bad odor.

Properties of Hydrochloric Acid Gas. Hydrochloric acid gas is a colorless elastic fluid, possessing a pungent odor, and the property of irritating the organs of respiration. It destroys life and extinguishes flame. It reddens litmus powerfully, and has the other properties of a strong acid. Its sp. gr. is 1·278 (Gay-Lussac and Biot). Subjected to a pressure of 40 atmospheres, at the temperature of 10° C. (50° F.), it is condensed into a transparent liquid, to which alone the name of *liquid hydrochloric acid* properly belongs. It is absorbed by water with the greatest avidity, and, according to the temperature and pressure, unites with a greater or less quantity of that liquid. Water, at the temperature of 20·5° C. (69° F.), takes up 464 times its volume of the gas, increasing one-third in bulk, and about three-fourths in weight. Water thus saturated constitutes the strong aqueous acid already described. A crystallized hydrate of hydrochloric acid having the composition $HCl,2H_2O$ has been produced by J. Pierre and E. Puchot. (*Journ. Chem. Soc.*)

Composition. Hydrochloric acid gas consists of one atom of chlorine 35·5, and one of hydrogen 1 = 36·5; or of one volume of chlorine and one of hydrogen, united without condensation.

Medical Properties. Hydrochloric acid is tonic, refrigerant, and antiseptic. It is exhibited, largely diluted with water, in low fevers, phthisis, some forms of syphilis, and to counteract phosphatic deposits in the urine. Dr. Paris has given it with success in malignant cases of typhus and scarlatina, administered in a strong infusion of quassia. It is especially valuable in gastro-intestinal indigestion when there is no tendency to diarrhœa, and may often be added with advantage to liquid preparations of columbo, gentian, and cinchona. It is also frequently given in dyspepsia, along with pepsin, to aid its solvent powers. The dose for internal exhibition is from five to ten minims (0·3–0·6 C.c.) in a sufficient quantity of some bland fluid, as barley-water or gruel. (See *Acidum Hydrochloricum Dilutum.*) It is a decided caustic when applied in concentrated form, although less powerful than nitric acid, and is frequently used to destroy small dermal growths.

Toxicological Properties. Hydrochloric acid, when swallowed, is highly irritating and corrosive, but less so than sulphuric or nitric acid. It produces blackness of the lips, fiery redness of the tongue, hiccough, violent efforts to vomit, and agonizing pain in the stomach. There is much thirst, with great restlessness, a dry and burning skin, and a small, concentrated pulse. If the acid has been recently swallowed, white vapors of a pungent smell are emitted from the mouth. The best antidote is magnesia, but soap or sufficiently dilute alkaline solutions are almost equally efficient. In the course of the treatment, bland and mucilaginous drinks must be freely given. When inflammation supervenes, it must be treated on general principles.

Pharm. Uses. In the preparation of Acidum Hydrocyanicum Dilutum, *U. S.;* Calcis Phosphas, *Br.;* Carbo Animalis Purificatus; Liquor Sodæ Chloratæ, *Br.;* Potassæ Bicarbonas, *Br.;* Quiniæ Sulphas; Sodæ Bicarbonas, *Br.;* Veratria, *Br.*

Off. Prep. of Hydrochloric Acid. Acidum Hydrochloricum Dilutum, *Br.;* Acidum Hydrochloricum Dilutum, *U. S.;* Acidum Nitrohydrochloricum Dilutum. *Br.;* Acidum Nitrohydrochloricum, *U. S.;* Acidum Nitrohydrochloricum Dilutum, *U. S.;* Aqua Chlori, *U. S.;* Calcii Chloridum, *Br.;* Liquor Antimonii Chloridi, *Br.;* Liquor Arsenici Chloridi, *U. S.;* Liquor Arsenici Hydrochloricus. *Br.;* Liquor Chlori. *Br.;* Liquor Ferri Chloridi, *U. S.;* Liquor Ferri Perchloridi Fortior, *Br.;* Liquor Zinci Chloridi, *U. S.;* Podophylli Resina, *Br.;* Zinci Chloridum, *Br.*

ACIDUM HYDROCHLORICUM DILUTUM. *U. S., Br.* *Diluted Hydrochloric Acid.*

(ĂÇ'Ị-DŬM HȲ-DRO-ȻHLŌ'RỊ-ÇŬM DỊ-LŪ'TŬM.)

Acidum Muriaticum Dilutum, *Pharm.* 1870; Acide chlorhydrique dilué, *Fr.;* Verdünnte Salzsäure, *G.*

"Hydrochloric Acid, *six parts* [or five and one-half fluidounces]; Distilled Water, *thirteen parts* [or fourteen fluidounces]. Mix the acid with the water, and preserve the product in glass-stoppered bottles." *U. S.*

"Take of Hydrochloric Acid *eight fluidounces* [Imp. measure]; Distilled Water *a sufficiency.* Dilute the Acid with 16 fluidounces [Imp. meas.] of the water; then add more water, so that, at a temperature of 60°, it shall measure 26½ fluidounces [Imp. meas.]. Or, as follows: Take of Hydrochloric Acid 3060 grains; Distilled Water *a sufficiency.* Weigh the Acid in a glass flask, the capacity of which, to a mark on the neck, is one pint [Imp. meas.]; then add Distilled Water until the mixture, at 60° temperature, after it has been shaken, measures a pint [Imp. meas.]." *Br.*

The existing U. S. formula differs from that of 1870 in yielding a diluted hydrochloric acid, which contains about twelve per cent. more officinal acid than the older preparation did. The change was made in order that the diluted mineral acids might have a uniform strength (ten per cent. of absolute acid). It is important to bear this fact in mind in prescribing, although the difference is not sufficient to render the present strength dangerous. "Diluted Hydrochloric Acid contains ten per cent. of absolute hydrochloric acid. It has the sp. gr. 1·049, and should respond to the same reactions and tests as Hydrochloric Acid. To neutralize, 7·28 Gm. should require 20 C.c. of the volumetric solution of soda." *U. S.*

The British preparation has the sp. gr. 1·052. "345 grains by weight (6 fluidrachms) require for neutralization 1000 grain-measures of the *volumetric solution of soda,* corresponding to 10·58 per cent. of real acid. Six fluidrachms [Imp. meas.] contain one eq. or 36·5 grains of hydrochloric acid, HCl." *Br.* The extreme precision of the British formula, though no doubt useful when the diluted acid is used as a test, is quite unnecessary in a therapeutical point of view.

For medical properties and uses, see *Acidum Hydrochloricum.* The dose of the diluted acid is from fifteen to thirty minims (0·95–1·9 C.c.), to be taken in water or other convenient vehicle.

Pharm. Uses. In preparing Ferri et Quiniæ Citras. *Br.*

Off. Prep. Liquor Morphiæ Hydrochloratis, *Br.;* Liquor Strychniæ, *Br.;* Morphiæ Hydrochloras, *Br.*

ACIDUM HYDROCYANICUM DILUTUM. *U.S., Br.* *Diluted Hydrocyanic Acid. Prussic Acid. Cyanhydric Acid.*

(ĂÇ′Ị-DŬM HȲ-DRỌ-CȲ-ĂN′Ị-CŬM DỊ-LŪ′TŬM.)

"A liquid composed of 2 per cent. of Absolute Hydrocyanic Acid [**HCN**; 27 —HC_2N; 27] and 98 per cent. of Alcohol and Water." *U.S.*

Acidum Hydrocyanatum s. Borussicum; Acide cyanhydrique, ou hydrocyanique, *Fr.;* Cyanwasserstoff–Säure; Blausäure, *G.*

"Ferrocyanide of Potassium, in coarse powder, *twenty parts* [or four ounces av.]; Sulphuric Acid, *fifteen parts* [or one and a half fluidounces]; Diluted Alcohol, *sixty parts* [or twelve and a half fluidounces]; Water, Distilled Water, each, a *sufficient quantity* [q. s.]. Place the Ferrocyanide of Potassium in a tubulated retort, and add to it *forty parts* [or eight fluidounces] of water. Connect the neck of the retort (which is to be directed upward), by means of a bent tube, with a well-cooled condenser, the delivery tube of which terminates in a receiver surrounded with ice-cold water, and containing *sixty parts* [or twelve and a half fluidounces] of Diluted Alcohol. All the joints of the apparatus, except the neck of the receiver, having been made air-tight, pour into the retort, through the tubulure, the Sulphuric Acid previously diluted with an equal weight [or three fluidounces] of Water. Agitate the retort gently and then heat it, in a sand-bath, until the contents are in brisk ebullition, and continue the heat regularly until there is but little liquid mixed with the saline mass remaining in the retort. Detach the receiver, and add to its contents so much distilled water as may be required to bring the product to the strength of two per cent. of absolute hydrocyanic acid if tested by the method of assay given in the note." (See page 73.)

"*Diluted Hydrocyanic Acid* may be prepared, extemporaneously, in the following manner: Take of Cyanide of Silver *six parts* [or fifty and a half grains]; Hydrochloric Acid *five parts* [or thirty-seven minims]; Distilled Water *fifty-five parts* [or one fluidounce]. Mix the Hydrochloric Acid with the Distilled Water, add the Cyanide of Silver, and shake the whole together in a glass-stoppered bottle. When the precipitate has subsided, pour off the clear liquid." *U. S.*

"Take of yellow Prussiate of Potash *two ounces and a quarter* [avoirdupois]; Sulphuric Acid *one fluidounce* [Imperial measure]; Distilled Water *thirty fluidounces* [Imp. meas.], or *a sufficiency.* Dissolve the Prussiate of Potash in ten [fluid]ounces of the Water, then add the Sulphuric Acid previously diluted with four [fluid]ounces of the Water and cooled. Put the solution into a flask or other suitable apparatus of glass or earthenware, to which are adapted a condenser and a receiver arranged for distillation, and having put eight [fluid]ounces of Distilled Water into the receiver, and provided efficient means for keeping the condenser and receiver cold, apply heat to the flask until by slow distillation the liquid in the receiver is increased to seventeen [fluid]ounces. Add to this three [fluid]ounces of the Distilled Water, or as much as may be sufficient to bring the acid to the required strength, so that one hundred grains (or 110 minims) of it, precipitated with a solution of nitrate of silver, shall yield ten grains of dry cyanide of silver." *Br.*

The British preparation has the sp. gr. 0·997. If 270 grains of it be made alkaline by solution of soda, they will require 1000 grain-measures of the volumetric solution of nitrate of silver to be added before a permanent precipitate begins to form, corresponding to 2 per cent. of the real acid.

When ferrocyanide of potassium is decomposed by sulphuric acid, the residue in the retort is sulphate of potassium, mixed with an insoluble compound of cyanide of iron and cyanide of potassium (*Everitt's Salt*). The reaction is expressed by the following equation:

$$2(K_4FeC_6N_6) + 3H_2SO_4 = 3K_2SO_4 + 2(KFeC_3N_3) + 6HCN.$$

Half of the cyanogen present in the ferrocyanide of potassium goes to form the hydrocyanic acid, while the other half remains in the white residue. Everitt's salt, so named from its discoverer, is a yellowish white powder. Like ferrocyanide of potassium, it is a double cyanide of iron and potassium, but of different molecular ratio. As it appears in practice, it is apt to be greenish, owing probably to the presence of a little Prussian blue.

An excess of sulphuric acid, or the use of concentrated acid, would endanger the production of hydrocyanic acid, as this is decomposed by strong sulphuric acid, with the formation of carbon monoxide (CO) and ammonium sulphate. The proportion of the acid should not exceed three-fourths of the weight of the ferrocyanide. In relation to the most convenient method of bringing the hydrocyanic acid to the standard strength, and to some other points in its preparation by the officinal formula, see Prof. Procter's paper, *A. J. P.*, xix. 259.

In the U.S. process for obtaining hydrocyanic acid extemporaneously, the reacting materials are single molecules respectively of cyanide of silver and hydrochloric acid. These, by double decomposition, generate hydrocyanic acid, which dissolves in the water, and chloride of silver, which subsides, and from which the acid is poured off when clear. (See *Argenti Cyanidum.*) The extemporaneous process is useful to country practitioners, because the acid will not generally keep. A portion of hydrocyanic acid, if purchased by a practitioner, may spoil on his hands before he has occasion to use it; but if he supply himself with cyanide of silver, he may readily at any moment prepare a small portion of the acid, by following the directions of the formula.

It will be observed that a change has been made in the process of the Pharmacopœia of 1880, in the substitution of diluted alcohol for the distilled water formerly used as the solvent for the hydrocyanic acid. This is in accordance with the views of Gault and others, who assert that greater stability is thus secured.

Another process for obtaining medicinal hydrocyanic acid, proposed by Dr. Clark, and adopted by Mr. Laming, is by the reaction of tartaric acid on cyanide of potassium in solution. Laming's formula is as follows. Dissolve twenty-two grains of the cyanide in six fluidrachms of distilled water, and add fifty grains of crystallized tartaric acid, dissolved in three fluidrachms of rectified spirit. Crystallized bitartrate of potassium precipitates, and each fluidrachm of the clear decanted liquor contains one grain of pure hydrocyanic acid. Dr. Pereira considered this process to have several advantages, but very properly objected to it on account of the trouble and expense of obtaining the cyanide of potassium pure, and its liability to undergo spontaneous decomposition. (See *Potassii Cyanidum.*) This difficulty may, according to Mr. B. S. Proctor, be remedied by substituting the double cyanide of zinc and potassium, a cheap and stable salt, which even in solution may be kept without change almost indefinitely. He proposes the following formula as yielding an acid of officinal strength. Water 1 ounce; cyanide of zinc and potassium 22 grains; tartaric acid 40 grains. Dissolve the cyanide in water, add the acid, and allow the precipitate to subside; decant the clear liquid. (*P. J. Tr.*, Sept. 1874.)

The processes, thus far given, are intended to furnish a *dilute* hydrocyanic acid for medicinal purposes. The methods of obtaining the *anhydrous* acid are different. Vauquelin's process for the anhydrous acid is to pass a current of hydrosulphuric acid gas over cyanide of mercury contained in a glass tube, connected with a receiver kept cold by a freezing mixture of ice and salt. The first third only of the tube is filled with cyanide; the remaining two-thirds being occupied, half with carbonate of lead, and half with chloride of calcium; the carbonate being intended to detain the hydrosulphuric acid gas, the chloride to separate water.

The process of Wöhler for the anhydrous acid is the following. The cyanide of potassium selected is a black cyanide, formed by fusing together, in a covered crucible, 8 parts of dry ferrocyanide, 3 of ignited cream of tartar, and 1 of charcoal in fine powder. The cyanide, while still warm, is exhausted by 6 parts of water; and the clear solution, placed in a retort, is decomposed by cold diluted sulphuric acid, gradually added. The hydrocyanic acid is condensed first in a U-tube, containing chloride of calcium and surrounded with ice-cold water, and afterwards in a small bottle, connected with the U-tube by a narrow tube, and immersed up to the neck in a mixture of ice and salt. After the acid has been condensed and dehydrated in the U-tube, the cold water surrounding it is withdrawn by a siphon, and replaced by water at a temperature between 29·4°–32·2° C. (85°–90° F.), whereby the anhydrous acid is made to distil over into the small bottle.

M. Berthelot has made hydrocyanic acid synthetically. He first prepares, by a direct synthesis of its elements, *acetylene* (C_2H_2), a hydrocarbon remarkable for its chemical activity. He then mixes vapors of acetylene with pure nitrogen, passes a series of electric discharges from a Ruhmkorff coil through the mixture, and, when the odor of prussic acid is perceptible, agitates with a solution of potassa to get the fixed cyanide. (*Journ. de Pharm.*, April, 1869.)

Properties of the Medicinal Acid. Diluted hydrocyanic acid, of the proper medicinal strength, is a transparent, colorless, volatile liquid, possessing a smell resembling that of peach kernels, and a taste at first cooling and afterwards somewhat irritating. It imparts a slight and evanescent red color to litmus. If it reddens litmus strongly and permanently, some acid impurity is present. It loses strength rapidly in open vessels. It is not reddened by the iodo-cyanide of potassium and mercury. The non-action of this test shows the absence of contaminating acids, which, if present, would decompose the test, and give rise to the red iodide of mercury. The red color produced when picrate of ammonia is added to a solution of an alkaline cyanide and heated has been proposed as a test for prussic acid. (P. Guyot, *N. R.*, May, 1877.) It is liable to undergo decomposition if exposed to the light, but is easily kept in a bottle covered with black paint or black paper. "On being heated it is completely volatilized. If to the acid, rendered alkaline by potassa, a little ferrous sulphate and ferric chloride be added, and the mixture be acidulated with hydrochloric acid, a blue precipitate will make its appearance." *U. S.* From experiments carefully conducted by MM. Bussy and Buignet, it appears that, when the alteration in the acid under the influence of light has begun, it will afterward go on very rapidly in the dark; and that, after exposure for a certain time to the light, though no alteration may be apparent, an influence has nevertheless been exerted which disposes to change, and promotes decomposition even in the absence of light. Hence the necessity of immediately enclosing the acid in bottles from which the light is excluded. (*Journ. de Pharm.*, 1863, p. 475.)* Experience has shown that it is best preserved in cork-stopped bottles of amber glass; when glass and rubber stoppers were used, decomposition frequently took place rapidly. Its most usual impurities are sulphuric and hydrochloric acids; the former of which may be detected by chloride of barium, which will produce a precipitate of sulphate of barium; and the latter by precipitating with nitrate of silver, when so much of the precipitate as may be chloride of silver will be insoluble in boiling nitric acid, while the cyanide of silver is readily soluble. The presence of these acids, in slight amount, is injurious only by rendering uncertain the strength of the medicinal acid, as ascertained by its saturating power. It is now generally acknowledged that mineral acids prevent the deterioration of the dilute prussic acid. But the presence of a mineral acid is not necessary for its preservation; for Dr. Christison has known the medicinal acid from ferrocyanide of potassium to keep perfectly well, although nitrate of barium did not produce the slightest muddiness. Nevertheless it has been recently shown that much of the acid as kept in the drug-stores is often below the officinal strength. Various remedies have been proposed. (*P. J. Tr.*, July, 1871; Feb. 1, 1874; Sept. 1874.) One of these is to reduce the strength to one-tenth per cent., this weak solution being said not to undergo change. In our experience a one per cent. acid retained its properties through very severe tests of exposure. Mr. John Williams has found in a series of experiments that the addition of 20 per cent. of glycerin has a very pronounced influence in preventing deterioration. (*P. J. Tr.*, Sept. 1874; Sept. 1875.) If lead be present in prussic acid, it may be detected by hydrosulphuric acid gas, which will cause a blackish precipitate. Hydrocyanic acid is incompatible with nitrate of silver, the salts of iron and copper, and most of the salts of mercury. According to the experiments of Prof. Flückiger (*A. J. P.*, Dec. 1872), it does not form salts with the alkaloids.

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* Anhydrous hydrocyanic acid sometimes undergoes an apparently spontaneous molecular change by which it is converted into a black solid body, which was supposed to be *paracyanogen* (C_3N_3), or its compounds. This change takes place more slowly in watery solutions of the acid, which are converted into a black liquid; and it is only in a state of extreme dilution, when, for example, water contains not more than one per cent. of the acid, that it is altogether prevented. It sometimes takes place in the officinal diluted acid; and Prof. Procter exhibited a bottle, which had been most carefully closed, and kept excluded from the light, and in which, nevertheless, the acid had become as black as ink. The cause of this phenomenon remained long unknown: some years ago M. E. Millon satisfied himself, by experiment, that the real agency was the presence of ammonia, which may sometimes operate even through the air. It has also been asserted that the cause of the decomposition is the presence of a microscopic plant. (*Journ. de Pharm.*, 1862, p. 48.) The preservative influence of a little sulphuric acid in the diluted hydrocyanic acid would be thus explained; and it is not impossible that the greater resistance offered to the change by the preparation made by the officinal process, in which sulphuric acid is used, than by the others, may be owing to the influence of this acid, either passing over with its vapor, or acting on the acid vapor before it leaves the retort. An important practical inference from all this is the necessity of providing, as far as possible, that ammonia should in no manner have access to the acid, during or after its preparation. The effect of ammonia in inducing changes in dilute hydrocyanic acid is denied by Pettit (*A. J. P.*, 1873.) Mr. Rimmington asserts that hydrocyanic acid acts upon the alkali of some varieties of glass. Mr. Siebold, who has confirmed this, declares that the addition of hydrochloric acid is perfectly useless as a preservative, except when the prussic acid is kept in bottles which yield the alkali. (*Pharm. Journ.*, Sept. 1874.) MM. Lescolm and Rigaut (*Comptes-Rendus*, Aug. 4, 1879) state that pure hydrocyanic acid can be preserved for a long time; that the presence of ammonium cyanide and water induces the formation of the solid black substance *azulmin*, or a trace of potassium cyanide brings about this decomposition even in the absence of water.

Formerly the medicinal acid was of different strengths, as ordered by the different pharmaceutical authorities; but happily the U. S. and Br. Pharmacopœias conform in this important point. At one time its strength was indicated by its specific gravity, which is lower in proportion as it is stronger; but this unprecise mode of estimate is not now relied on; and, though the British Pharmacopœia gives the sp. gr. of its dilute acid at 0·997, both Pharmacopœias give quantitative tests as indices of the strength. "13·5 Gm., diluted with 30 C.c. of water, and mixed with enough of an aqueous suspension of magnesia to make the mixture quite opaque, and afterward with a few drops of solution of chromate of potassium, should require 50 C.c. of the volumetric solution of nitrate of silver, before the red color caused by the latter ceases to disappear on stirring" (corresponding to the presence of two per cent. of absolute hydrocyanic acid). *U. S.* This method of assay is based upon Pappenheim's process for the determination of hydrocyanic acid in bitter almond water, as described by Vielhaber in *Archiv d. Pharm.*, 1878, p. 408; the addition of an alkali to a solution of hydrocyanic acid, previous to titration, not only prevents the volatilization of the acid, but, as has been shown by Siebold, the double cyanides of silver with the alkali metals are very permanent; the use of chromate of potassium as an indicator, whereby a red color, due to a combination of the chromic acid with the silver, is produced, is highly recommended. The Br. Pharmacopœia directs that 270 grains of it, when treated with solution of soda in excess, shall require the addition of 1000 grain-measures of the volumetric solution of nitrate of silver, before a permanent precipitate begins to form. To explain this test it is necessary to notice that cyanide of silver, though itself insoluble, is rendered soluble by combining with cyanide of sodium, in the proportion of one molecule of each. When, therefore, the diluted hydrocyanic acid is converted, by the addition of soda, into cyanide of sodium, no permanent precipitate will begin to appear, upon the addition of nitrate of silver, until more than sufficient cyanide of silver is produced to form the soluble compound referred to, which happens when one-half of the cyanide of sodium has been converted into cyanide of silver. An acid of the strength indicated by either of these methods contains two per cent. of anhydrous acid. The test of entire solubility in boiling nitric acid, applied to the precipitate obtained by nitrate of silver, is intended to verify its nature; for, if the hydrocyanic acid contain hydrochloric acid, part of this precipitate would be chloride of silver, not soluble in the boiling acid. Scheele's medicinal hydrocyanic acid contains about 5 per cent. of anhydrous acid; and, therefore, two minims of it are equal to five of the U. S. acid. The use of Scheele's acid should be discouraged as unnecessary and very dangerous.

MM. Fordos and Gélis have proposed, as a test of the strength of the compounds containing cyanogen, an alcoholic solution of iodine of known strength; as, for example, three grains to the fluidounce. The test-solution is added, drop by drop, to the cyanogen compound, until a permanent yellowish tinge is produced. The iodine unites with the cyanogen, and with the substance in combination with the cyanogen, in the ratio of their several equivalents; and hence the cyanogen present is easily calculated from the proportion of iodine expended in uniting with it. This test is commended for its accuracy by Mr. James Roberton, of Manchester, Eng. (See *A. J. P.*, 1853, p. 551.) A. Link and R. Moeckel (*Zeitsch. f. Analyt. Chem.*, 1878, p. 455) made a series of experiments, and showed that the most delicate test for hydrocyanic acid was that of sulphocyanate of iron. (*A. J. P.*, 1879, p. 86.)

Properties of the Anhydrous Acid. Hydrocyanic acid, perfectly free from water, is a colorless, transparent, inflammable liquid, of extreme volatility, boiling at 27° C. (80° F.), and congealing at —15° C. (5° F.). Its sp. gr. as a liquid is 0·6969, at the temperature of 18° C. (64° F.); and as a vapor 0·9423. Its taste is at first cooling, then burning, with an after-taste in the throat like that of bitter almonds; but, from its extremely poisonous nature, it must be tasted with the utmost caution. Its odor is so strong as to produce immediate headache and giddiness; and its vapor so deleterious that the smallest portion of it cannot be inhaled without the greatest danger. Both water and alcohol dissolve it readily. It is much more prone to undergo decomposition than the dilute acid. In the course of a few hours it sometimes begins to assume a reddish brown color, which becomes gradually deeper, till at length the acid is converted into a black liquid, which exhales a strong smell of ammonia. It is a very weak acid in its chemical relations, and reddens litmus but slightly. It does not form solid compounds with metallic oxides, but a cyanide of the metal, the elements of water being exhaled. According to Sobero, hydrocyanic acid is generated, in sensible quantities, by the action of weak nitric acid on the volatile oils and resins. Wöhler affirmed in 1828 that picric acid when treated with baryta-water yields it; and Julius Post and H. Hübner have found that nitrobenzol and dinitrobenzol also do so when treated, the former with fusing potassa, the latter with boiling dilute solution of potassa. It has also been formed by the slow action of carbonate of potassium on tincture of hyoscyamus, given together as a medicine. (Dr. J. T. Plummer, of Indiana, *A. J. P.*, xxv. 513.) Though a product of art, it exists in some plants, and is generated by reaction between the constituents of many vegetable products upon contact with water. These principles are usually amygdalin and emulsin, but according to Peckholt the root of *Manihot utilissima* copiously generates hydrocyanic acid with water, although he was unable in 15 analyses to find amygdalin in it. (*A. J. P.*, Oct. 1872.) (See *Amygdala Amara.*)*

Composition. Hydrocyanic acid consists of the atomic group cyanogen 26, and one atom of hydrogen $1 = 27$; or, in volumes, of one volume of cyanogen and one of hydrogen without condensation, its formula being HCN or HCy. *Cyanogen* (Cy) is a colorless gas, of a strong and penetrating smell, inflammable, and burning with a beautiful bluish purple flame. Its sp. gr. is 1·8157. It was discovered in 1815 by Gay-Lussac, who viewed it as a compound radical, which, when combined with hydrogen, becomes hydrocyanic acid. Hydrocyanic acid, in a dilute state, was discovered in 1780 by Scheele, who correctly stated its elements to be carbon, nitrogen, and hydrogen; but the peculiar way in which they are combined was first pointed out by Gay-Lussac, by whom also the anhydrous acid was first obtained.

Medical and Toxical Properties. Hydrocyanic acid is one of the most deadly poisons known, and frequently exceedingly rapid in its action. According to Dr. Christison, a grain and a half of the anhydrous acid is capable of producing death in the human subject. One or two drops of the pure acid are sufficient to kill a vigorous dog in a few seconds. Sometimes death occurs almost instantaneously. Usually, however, three stages of the poisoning are manifest: a first very brief one of difficult respiration, slow cardiac action, and disturbed nervous action; a second violent convulsive stage, with dilated pupils, vomiting, often loud cries, unconsciousness, etc.; and a third closing period of asphyxia, collapse, and paralysis, sometimes interrupted by convulsions. When smaller doses are ingested, the symptoms come on more slowly, but are similar to those just described, and when paralysis is developed it affects both motility and sensation. A peculiar bloated look of the deeply suffused face and neck, with frothing at the mouth, occurring along with the symptoms previously described, is almost pathognomonic of the poisoning. The odor of hydrocyanic acid is sometimes very strong, and should always be searched for about the mouth. It is very important as an aid in the diagnosis, but is certainly not always present. Death is usually the result of asphyxia, produced by a direct paralyzant action of the poison upon the respiratory centres. The poison appears also to have a direct paralyzing action upon the heart, and sometimes to produce fatal syncope. The post-mortem appearances are glistening and staring expression of the eyes; gorged state of the venous system with fluid, dark, or bluish-black blood, especially of the veins of the brain and spinal marrow; and sometimes redness of the internal coat of the stomach. The lungs are sometimes natural, at other times turgid with blood. When the death has been very rapid, all of the blood may be found of a bright arterial hue. After a slow death the blood is cyanotic. It is rarely true that all of the muscles are insensible to the galvanic current. If the autopsy be not too long deferred, the odor of the acid is generally perceptible when the cadaver is opened. The odor after nitrobenzol poisoning resembles very closely that of the acid, but it is affirmed that the diagnosis can be made by leaving the opened body exposed, when the smell of the acid will disappear, and that of the nitrobenzol remain. Notwithstanding the tremendous energy of this acid as a poison, it has been ventured upon in a dilute state as a sedative, anodyne, and antispasmodic. Though occasionally employed as a remedy prior to 1817, it did not attract very much attention until that year, when Magendie published his observations on its use in diseases of the chest, and recommended it to the profession. When given in medicinal doses gradually increased, it produces the following symptoms in different cases: peculiar bitter taste; increased secretion of saliva; irritation of the throat; nausea; disordered respiration; pain in the head; giddiness; faintness; obscure vision; and tendency to sleep. It appears to have a special action on the larynx and trachea. (*Dr. Cogswell.*) The pulse is sometimes quickened, at other times reduced in frequency. It has been extensively used in complaints of the respiratory organs, but later experience has shown that it has but little virtue, except in the quieting of cough. Its influence upon the circulation is not sufficiently pronounced to render the drug of any value as an arterial sedative in acute pulmonary or other inflammations. In phthisis it may be resorted to with advantage as a palliative for the cough. In various other affections of the chest, attended with dyspnœa or cough, such as asthma, hooping-cough, and chronic catarrh, it has often been decidedly beneficial, by allaying irritation or relaxing spasm. In certain affections of the stomach, characterized by pain and spasm, and sometimes attended with vomiting, but unconnected with inflammation, and in similar painful affections of the bowels, it has proved beneficial in the hands of several practitioners. In these cases it probably acts locally upon the nerve-endings in the stomach and intestines. It has been used with asserted good results in the paroxysmal excitement of mania. (*Ann. de Thérap.*, 1865, p. 111.) Sometimes it is used externally, diluted with water, as a wash in cutaneous diseases. The late Dr. A. T. Thomson insisted particularly on its efficacy in allaying the itching of impetiginous affections.

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* It has been proposed to employ solutions of these vegetable products for the extemporaneous preparation of hydrocyanic acid, and in the Swedish Pharmacopœia the *Emulsio Hydrocyanata* has replaced entirely the dilute prussic acid. An emulsion is first made of 3 parts of sweet almonds, 2 of sugar, and 24 of water. To 80 parts of this emulsion is added one part of amygdalin. In an hour the mixture is ready for use; one ounce of it contains one-third of a grain of anhydrous acid. Dose, one to two teaspoonfuls. (*Nat. Med. Journ.*, July, 1871.)

The dose of the diluted hydrocyanic acid is from two to four drops (0·12–0·24 C.c.), dissolved in distilled water, or mixed with gum-water or syrup. It should be administered with the greatest caution, on account of its minute dose, and its variable strength as usually found. The proper plan, therefore, is to begin with a small dose, two drops for example, and gradually to increase the quantity until some obvious impression is produced. On account of the rapidity and fugaciousness of its action, it should be given at intervals of not more than two hours; indeed, it is very improbable that the largest therapeutic dose of the substance exerts any influence whatever upon the system one hour after its ingestion. If giddiness, weight at the top of the head, sense of tightness at the stomach, or faintness come on, its use should be discontinued. In all cases in which a fresh portion of medicine is used, the dose should be lowered to the minimum quantity, lest the new sample should prove stronger than that previously employed. When resorted to as a lotion, from thirty minims to a fluidrachm may be dissolved in a fluidounce of distilled water.

Toxicology. Hydrocyanic acid is so rapidly fatal as a poison that physicians have seldom an opportunity to treat its effects. Death, if it occur at all, usually takes place in from one to forty minutes. One case has, however, been reported in which it was delayed one hour and a quarter. When recovery is brought about, the symptoms in most cases abate very rapidly. The antidotes and remedies most to be relied on are chlorine, ammonia, cold affusion, and artificial respiration. Chlorine in the form of chlorine-water, or weak solutions of chlorinated lime or soda, may be exhibited internally, or applied externally. When chlorine is not at hand, water of ammonia, largely diluted, may be given, and the vapor arising from it cautiously inhaled. A case is related, in the *Dublin Med. Journal* for Nov. 1835, of poisoning by this acid, in which the diluted aromatic spirit of ammonia applied to the mouth, and the solid carbonate assiduously held to the nostrils, produced speedy and beneficial effects. Cold affusion was first proposed in 1828, by Herbst, of Göttingen, and its utility was subsequently confirmed by Orfila. Its efficacy is strongly supported by experiments performed in 1839 by Dr. Robinson and M. Lonyet, who quickly resuscitated rabbits, apparently dead from hydrocyanic acid, by pouring on their heads and spines a stream of water artificially refrigerated. In a case of poisoning, reported by Dr. Christison in 1850, the patient recovered under a stream of cold water poured upon the head from a moderate height. In another case, reported in the *Lancet* in 1854, in which the largest reported quantity was taken to be followed by recovery (2·4 grains of anhydrous acid), the cold water douche was the principal remedy. (See *Am. Journ. Med. Sci.*, July, 1854, p. 276.) Messrs. T. & H. Smith, of Edinburgh, have recommended especially as an antidote for the medicinal acid a mixture of the ferric salts, swallowed after a solution of carbonate of potassium. So soon as the antidote comes in contact with hydrocyanic acid, sulphate of potassium is formed, and the poison is converted into Prussian blue. It may be prepared extemporaneously, by adding ten grains of sulphate of iron, and a drachm of the tincture of chloride of iron, to a fluidounce of water contained in one vial, and twenty grains of carbonate of potassium to a fluidounce of water in another vial. The patient is made to swallow the solution of carbonate of potassium, and immediately afterwards the mixed ferruginous solution. This quantity is estimated to be sufficient to render insoluble nearly two grains of the anhydrous acid.[*] In one instance this antidote is said to have proved very effectual. (*P. J. Tr.*, 1865, p. 139.) Atropine has been proposed as a counter-poison, on the grounds of its physiological action, and of experiments made with it on the lower animals. (See *Am. Journ. Med. Sci.*, 1868, p. 577.) It has, however, been shown by the elaborate experiments of Keen (*Proc. Phil. Acad. Nat. Sci.*, 1869), of Reese (*Am. Journ. Med. Sci.*, Jan. 1871), and of Boehm and Knie (*Archiv für Exper. Path. und Therap.*, Bd. ii.), to be of little or no antidotal value even in the case of the lower animals. Morphine has also been supposed to be antagonistic to hydrocyanic acid.

Tests. After suspected death from poison, it is sometimes necessary to ascertain whether the event was caused by this acid. At a period long after death, it would be needless to search for so volatile a poison ; but it has been recognized three weeks after death, in a case reported by M. Brame, in which about six drachms of acid, containing between 8 and 9 per cent. of anhydrous acid, had been swallowed. The best test is that proposed by Liebig in 1847, consisting in the change of the hydrocyanic acid into sulphocyanate of ammonium, which salt is then tested with a ferric salt. Two drops of the acid, so dilute as not to afford the least blue tint with the salts of iron, upon being mixed with a drop of ammonium sulphydrate (yellow from dissolved sulphur), and heated upon a watch-glass until the mixture is colorless, yield a solution of sulphocyanate of ammonium, which becomes of a deep blood-red color upon the addition of ferric sulphate, in consequence of the formation of the sulphocyanate of iron. (*Chem. Gaz.*, April 1, 1847; from Liebig's *Annalen.*) This test is praised by Mr. A. S. Taylor, who found it to act characteristically on two grains of dilute hydrocyanic acid, containing only 1-3930th of a grain of anhydrous acid. To render the test thus delicate, Mr. Taylor deems it necessary to evaporate the liquid gently to dryness, after the addition of the ammonium sulphydrate, in order to bring the sulphocyanate to the solid state before adding the iron test, a fractional part of a drop of which will commonly suffice to produce the characteristic color. The red color is instantly discharged by solution of corrosive sublimate or mercuric nitrate, and is thus distinguished from that which might possibly be produced under similar circumstances by acetic acid. Should the acid be mixed with organic matters, Mr. Taylor proposes a modification of Liebig's test as follows. Place it in a watch-glass, and invert over it another, holding in the centre a drop of ammonium sulphydrate. In from half a minute to ten minutes, without heat, the sulphydrate will be converted into the sulphocyanate of ammonium; and upon removing the upper glass, and evaporating its contents to dryness, the iron test will produce the blood-red color. MM. O. Henry and E. Humbert have proposed, as a test of hydrocyanic acid, first to convert it into cyanide of silver by distilling the suspected matters into a dilute solution of nitrate of silver, and then to decompose the cyanide by iodine, so as to form iodide of cyanogen. The dried cyanide is added to half its estimated weight of *pure* iodine, contained in a test tube. Upon the application of a gentle heat, iodide of cyanogen is formed, and characteristic crystals of it are deposited on the cool surface of the tube. (*Journ. de Pharm.*, 1857, p. 173.) Prof. Wormley (*Micro-Chemistry of Poisons*, p. 186) considers the nitrate of silver test as the most delicate of all when the hydrocyanic acid vapor is distilled from a mixture and received in a drop of nitrate of silver placed in a watch-glass above it.

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[*] In a subsequent communication the Messrs. Smith recommend the following proportions. Mix of solution of perchloride of iron (*Br.*) 37 minims, sulphate of iron, as pure as possible and in fine crystals, 25 grains, and about half a fluidounce of water. Dissolve 77 grains of crystallized carbonate of sodium in the same measure of water. These quantities will neutralize between 150 and 200 minims of the medicinal hydrocyanic acid. (*P. J. Tr.*, 1865, p. 147.) Still more recently the authors propose to substitute magnesia for carbonate of sodium, as better fitted to neutralize any considerable quantity of gastric acid that might be present. The following is the formula now recommended. From one to two drachms of magnesia, made into a smooth cream with water, are to be first administered, and then 16 minims of solution of perchloride of iron (*Br.*) and 12½ grains of ferrous sulphate are dissolved in water. These quantities are calculated for 100 minims of medicinal hydrocyanic acid. Should more than this be supposed to have been taken, the ferruginous ingredients must be increased in proportion, but not the magnesia. (*Ibid.*, 1865, p. 276.)

An extremely sensitive test of hydrocyanic acid, in the state of vapor, has recently been offered by Schönbein. It consists of white filtering paper imbued with the resin of guaiacum, by dipping it in a solution of 3 parts of the resin in 150 of alcohol, and then drying. At the moment of use it is to be moistened with a solution of sulphate of copper containing 1 part in 500 of water. If now brought into contact with hydrocyanic acid, whether dissolved in water or diffused in the air in the form of vapor, it instantly becomes blue. According to Schönbein, it will change color in air containing only a forty-millionth part of hydrocyanic acid. (See *A. J. P.*, 1869, p. 174.) The test cannot, however, be relied on, since a similar reaction is yielded by numerous other substances, such as nitrous, nitric, and hydrochloric acids, chlorine, bromine, iodine, ammonia, dilute sulphuric acid, chromic acid, bichromate of potassium, etc. The paper should be exposed to a current of air, drawn through the suspected liquid, and, if indications be yielded, distillation practised to get the volatile acid in a state of sufficient purity to be submitted to the sulphur-iron test. This, as performed by Almén and Strieve, consists in adding ammonium sulphide, to form the sulphocyanate; converting this into the non-volatile sulphocyanate of potassium by the addition of a few drops of liquor potassæ; then evaporating nearly or quite to dryness; adding a few drops of water, acidulated with hydrochloric acid, and finally adding a drop or two of sesquichloride of iron, when the blood red of the sulphocyanate will be developed. (*Boston Med. and Surg. Journ.*, July, 1873.) Another test, which was proposed by Schönbein, and which was found to be exceedingly delicate by M. Büchner, is dependent upon the power prussic acid has of preventing the catalytic action of the red blood corpuscles. Normally, when these are brought into contact with oxygenated water, the latter is decomposed and oxygen liberated; if prussic acid be present, no oxygen is set free, but the mixture becomes of a deep brown color. In this way Büchner recognized 5 milligrammes of the anhydrous acid in 600 grammes of blood and water. This test is not applicable to old blood. (*A. J. P.*, Sept. 1869.)

A very delicate test recently proposed for prussic acid is as follows. About one-half centigramme (2 grains) of ammonio-ferrous sulphate (or other pure ferrous salt), and the same quantity of uranic nitrate are dissolved in 50 C.c. of water, and 1 C.c. of this test liquid is placed in a porcelain dish. On now adding a drop of a liquid containing the smallest quantity of prussic acid, a gray purple color or a distinct purple precipitate is produced. (M. Carey Lea, *Amer. Journ. of Sci.* [3], ix. 121–123.)

Off. Prep. Vapor Acidi Hydrocyanici, *Br.*

ACIDUM LACTICUM. *U. S.* *Lactic Acid.*

(ĂÇ′Ị-DŬM LĂC′TỊ-CŬM.)

Acide lactique, *Fr.;* Milchsäure, *G.*

"A liquid composed of 75 per cent. of absolute Lactic Acid [**$HC_3H_5O_3$; 90**—$HOC_6H_5O_5$; 90] and 25 per cent. of water." *U. S.*

Lactic acid was discovered by Scheele. It exists in sour milk, and has been found in a number of the secretions, including the healthy gastric juice, in which its presence has been incontestably proved by Bernard and Barreswil. Liebig has shown that a variety of lactic (sarcolactic) acid exists in the juice of flesh. It has been detected by Prof. Wittstein in the vegetable kingdom, especially in the peduncles of *Solanum Dulcamara*, and the liquid which oozes from freshly-cut vine branches. It is a product of the viscous or lactic fermentation of rice-water, or of the juices of the beet, turnip, and carrot. Indeed, it is formed whenever sugar in solution, of whatever kind, is placed in contact with an alkaline or earthy carbonate, in presence of a special ferment, as, for example, the casein of milk, or cheese which contains it. Pasteur has demonstrated that the lactic acid fermentation, like the vinous, is accompanied with the growth of a peculiar microscopic plant or mycoderm, which he is disposed to consider as the real agent of the changes produced. This fermentation is attended with the production not only of lactic acid, but of other substances also, and among them, a peculiar *gum-like substance* in abundance, which, first noticed by Kirchof, has been isolated in a pure state by Brüning. Though similar to arabin and dextrin, with the formula $C_6H_{10}O_5$, it is not exactly identical with either. (See *Chem. Gaz.*, 1858, p. 197.) The lactic acid of fermentation is one of three isomeric acids known by the common name of lactic acid. As all three have been obtained synthetically, their structural formulas are known. Their oxidation products are also different. They are: 1. The ordinary officinal acid, known chemically as *ethylidene-lactic acid;* 2. *Ethylene-lactic acid*, which with a right-rotating modification of the ordinary lactic acid makes up what is called sarcolactic acid extracted from muscular juice; 3. *Hydracrylic acid*, as yet only obtained synthetically.

Preparation. Lactic acid may be obtained by the following process, which was recommended by M. Louradour as the first step in preparing lactate of iron. Ferment whey by keeping it at a temperature between 21·1° C. (70° F.) and 26·6° C. (80° F.), whereby it becomes charged with a considerable quantity of lactic acid. Evaporate the liquor to one-third of its bulk, decant and filter, and then saturate with milk of lime. This converts the lactic acid into lactate of calcium, which remains in solution, and throws down a precipitate, consisting principally of phosphate of calcium. The liquor is filtered again, and precipitated by oxalic acid, which throws down the lime as oxalate of calcium, and sets free the lactic acid. By a new filtration a solution of lactic acid is obtained, containing lactose (sugar of milk) and certain salts. From these it may be purified by concentrating it to a syrupy consistence, and treating it with alcohol, which dissolves the acid, and precipitates the lactose and foreign salts. The solution is filtered, and the lactic acid is obtained pure by distilling off the alcohol. Wackenroder's method is to mix 10 parts of skimmed milk, 2·5 of milk sugar, 2 of chalk, and 20 of water, to digest at about 23·8° C. (75° F.) for a month, or till the chalk is dissolved, then to express, clarify, and evaporate so as to crystallize the lactate of calcium, and, having recrystallized this salt, to decompose it with sulphuric or oxalic acid in exact saturating proportions.

Lautemann proposes a modification of this plan, consisting in substituting oxide of zinc for chalk. The fermentation is completed in eight or ten days. After boiling, the mixture is filtered, and the liquor, having been evaporated and again filtered, is allowed to stand. Lactate of zinc now separates, from which the acid may be obtained by dissolving the salt in boiling water, throwing down the zinc by sulphuretted hydrogen, filtering, and concentrating. The solution now contains mannite and lactic acid, both the result of the fermentation. By agitating with ether the acid is dissolved, and the mannite left; and by evaporating the ethereal solution the lactic acid is obtained. (See *Philos. Mag.*, 1860, p. 385.)

Another process for making lactic acid is to evaporate the water, obtained from wheat starch factories, from which starch has been deposited. The extract so obtained amounts to about 1 per cent., but is rich in lactic acid (containing 87 per cent., Thenius). (*Neueste Erfind. und Erfahr.*, 1879, p. 180.) The supply of lactic acid comes almost entirely from Germany. For a report by Chas. Rice on the quality of the commercial article see *A. J. P.*, 1873, p. 388. Kiliani (*Ber. der Chem. Ges.*, xv. 136 and 699) has quite recently found that lactic acid may be readily prepared by the action of potassium or sodium hydrate upon both grape sugar and invert sugar (or cane sugar after treatment with dilute acids). He considers invert sugar to be the best material for the preparation of the acid, as it gives a better yield than ordinary glucose, and recommends caustic soda in preference to caustic potash. His procedure is the following: 500 grammes of cane sugar are placed with 150 grammes of water and 10 C.c. of the sulphuric acid, to be used later, in a stoppered flask of 2 litres' capacity and heated for 3 hours to about 50° C. (122° F.). The solution of invert sugar so obtained is colorless, or at most faintly yellow. After cooling there is to be added to it in portions of 50 C.c. at a time 400 C.c. of a caustic soda solution made by dissolving 1 part of caustic soda in 1 part of water. The strong alkali settles at first as a slimy mass on the bottom, and a new portion is only to be added when the mixture has become perfectly homogeneous by shaking. The flask should also be cooled with water while the alkali is being added. The mixture nevertheless becomes colored and greatly heated. Finally the mixture is heated to 60° or 70° C. (140° F.–158° F.) until a test heated over a boiling water-bath does not separate cuprous oxide from Fehling's solution, but gives it only a slight greenish tinge. Into the cooled mixture the calculated amount of sulphuric acid (made by mixing 3 parts of sulphuric acid with 4 of water) is then run. As soon as the acid liquid has cooled to the temperature of the room, a crystal of Glauber's salt is dropped in and the flask dipped in cold water until a thin crystalline crust forms on the sides, which is removed by a rapid shaking of the flask. Cooling and shaking are continued until a crust no longer forms, when the mixture is allowed to stand quiet for 12 to 24 hours. At the end of this time the contents of the flask appear to consist of a crystalline cake soaked with a reddish liquid. There is then added 93 per cent. of alcohol, and the whole is shaken up until on further addition no precipitate separates out. The separated Glauber's salt is freed from the alcoholic solution by a vacuum filter, and can be washed with relatively very little alcohol. The half of the alcoholic solution is neutralized over the water-bath with carbonate of zinc, filtered boiling hot and united with the other half. The crystallization begins immediately upon cooling, and is complete after standing 36 hours. The lactate of zinc so obtained can be pressed free from mother-liquor and crystallized once, when it is perfectly pure. The weight of this first crystallization amounts to from 30 to 40 per cent. of the sugar used. The concentrated mother-liquor yields yet another portion of crystals, which are nearly pure, although slightly yellowish in color.

Properties. Lactic acid is a limpid, syrupy liquid, nearly colorless, of a slight not unpleasant odor, and a very sour taste. Its sp. gr. is 1·212, but acid of this strength is considered as containing only 75 per cent. of absolute lactic acid, the specific gravity of which is 1·248. (Allen, *Commerc. Org. Anal.*, 1879, p. 228.) It is not solidified by evaporation, and not vaporized by a heat not exceeding 160° C.

(260° F.). "At a higher temperature it emits inflammable vapors, then chars, and is finally entirely volatilized, or leaves but a trace of residue." *U. S.* It unites in all proportions with water, alcohol, and ether, but is nearly insoluble in chloroform. Exposed to a heat of 150° C. (302° F.), it is for the most part converted into a new body called concrete lactic acid or *lactide*, an anhydride of the formula $C_3H_4O_2$. It coagulates albumen, and dissolves a large quantity of freshly precipitated phosphate of calcium; a property which, doubtless, renders it important in the animal economy.

"When diluted with water, Lactic Acid should afford no precipitate with test-solutions of nitrate of silver (hydrochloric acid), chloride of barium (sulphuric acid), sulphate of copper (sarcolactic acid), nor with sulphide of ammonium after addition of excess of water of ammonia (lead, iron). It should not reduce warm test-solution of potassio-cupric tartrate (sugars). When mixed and heated with excess of hydrated zinc oxide, and extracted with absolute alcohol, the latter should not leave a sweet residue on evaporation (glycerin). Cold concentrated sulphuric acid, shaken with an equal volume of Lactic Acid, should assume at most only a pale-yellow color (organic impurities). To neutralize 4·5 Gm. of Lactic Acid should require 37·5 C.c. of the volumetric solution of soda." *U. S.*

Medical Properties and Uses. Lactic acid was proposed by Magendie, on account of its being a normal constituent of gastric juice, as well of the sweat, urine, etc., as a remedy in certain forms of dyspepsia, and for the removal of phosphatic deposits in the urine. It has subsequently been employed with good effects in dyspepsia by Dr. Handfield Jones and Dr. O'Connor, both of London. The remedy should be taken at the time of meals. It is most conveniently given in solution sweetened with sugar, prepared like lemonade. From one to three drachms (3·75–11·25 C.c.) may be taken in the course of the day. Professor Cantani, of Naples, was induced by theoretical considerations to employ lactic acid in diabetes, in connection with an exclusively meat diet, and reported very remarkable success. (*Ed. Med. Journ.*, 1871, p. 533.) Certain other practitioners have achieved similar results, but the remedy has not answered the expectations formed of it, and is at present not very frequently employed. If used, half a fluidounce in a pint of water should be administered daily. Hypnotic properties have also been ascribed to lactic acid, but the claim has not been verified. In solution the acid has been found very efficacious, locally applied, in dissolving false membrane, and it has consequently been employed, with much apparent advantage, in diphtheritic affections and croup; the solution employed containing one part of the acid to five parts of the menstruum. (*Ann. de Thérap.*, 1869, p. 220.)

Lactic acid is a useful addition to medicinal pepsin, increasing the solvent power of that agent upon the food, when taken into the stomach. Some importance has also been attached to it from the supposition that it might be the materies morbi in rheumatism, as uric acid has been supposed to be in gout; but in either case the acid is probably rather the effect than the cause of the disease.

Off. Prep. Ferri Lactas, *U. S.;* Syrupus Calcii Lactophosphatis.

ACIDUM NITRICUM. *U. S., Br.* *Nitric Acid.*

(ĂÇ'Ị-DŬM NĪ'TRỊ-CŬM.)

"A liquid composed of 69·4 per cent. of absolute Nitric Acid [**HNO_3; 63**—$HONO_5$; 63] and 30·6 per cent. of Water." *U. S.* An acid containing 70 per cent. by weight of the nitric acid HO,NO_5, corresponding to 60 per cent. of anhydrous nitric acid NO_5. *Br.*

Acidum Nitri s. Azoticum, Spiritus Nitri Acidus; Spirit of Nitre; Aqua Fortis; Acide nitrique, Acide azotique, *Fr.;* Salpetersäure, *G.;* Zaltpeterzuur, Sterkwater, *Dutch;* Shedwater, *Sw.;* Acido nitrico, *It.*, *Sp.*

Nitric oxide is one of the five compounds formed by the combination of nitrogen and oxygen. These are nitrogen protoxide or hyponitrous oxide (laughing gas), N_2O; nitrogen dioxide, N_2O_2 or $(NO)_2$; nitrous oxide, N_2O_3; nitrogen tetroxide or peroxide, N_2O_4; and nitric oxide, N_2O_5. From this latter by the addition of water is formed nitric acid: $N_2O_5 + H_2O = (HNO_3)_2$.

Nitric acid is now officinal in two forms; the pure acid of the sp. gr. 1·42, and the diluted. The strong acid, of the sp. gr. 1·5, which was recognized in the former Br. Pharmacopœia, has been abandoned in the present.

Preparation. The usual practice adopted in the laboratory for obtaining nitric acid is to add to nitrate of potassium in coarse powder, contained in a retort, an equal weight of strong sulphuric acid, poured in by means of a tube or funnel, so as not to soil the neck. The materials should not occupy more than two-thirds of the capacity of the retort. A receiver being adapted, heat is applied by means of a spirit or gas-lamp, the naked fire, or a sand-bath, moderately at first, but afterwards more strongly when the materials begin to thicken, in order to bring the whole into a state of perfect fusion. Red vapors will at first arise, and afterwards disappear in the course of the distillation. Towards its close they will be reproduced, and their reappearance will indicate that the process is completed.

The proportion of equal weights, as above given, corresponding nearly to one mol. of nitrate of potassium and one of sulphuric acid, is the best for operations on a small scale in the laboratory. This proportion is preferred by Thenard. In operations on a large scale, where an iron vessel is used, a strong heat applied, and water placed in the receivers to condense the acid, less sulphuric acid is preferable.

MONOHYDRATED NITRIC ACID. *Hydrogen Nitrate.* This is the strongest liquid nitric acid that can be procured, and may be supposed to be obtained by distilling one molecule of pure and dry nitre with one molecule of monohydrated sulphuric acid. One molecule of monohydrated nitric acid distils over, and one molecule of bisulphate of potassium remains behind: $KNO_3 + H_2SO_4 = HNO_3 + HKSO_4$. Acid of this strength is very difficult to get, and requires for its preparation the most elaborate attention to separate the superabundant water. According to Mr. Arthur Smith, of London, acid dehydrated as far as possible is perfectly colorless, boils at 84° C. (184° F.), has the sp. gr. 1·517 at 15·4° C. (60° F.), and nearly approaches, in composition, to a monohydrate. Acid of this strength, even at the boiling temperature, has not the slightest action on tin or iron. (*Phil. Mag.*, Dec. 1847.) According to Kolb (*Ann. Chem. Phys.* [4], x. 140), the true HNO_3 has a sp. gr. at 15° C. (59° F.) as high as 1·530.

The acid of the former Br. Pharmacopœia, having the sp. gr. 1·5, is of a yellowish color, and strongly corrosive. Strictly speaking, it is hydrogen nitrate diluted with half a molecule of water ($HNO_3 + \frac{1}{2}H_2O$). An acid of this strength is inconveniently strong, is constantly undergoing decomposition under the influence of light, and has consequently been replaced by a pure acid of the density 1·42. This substitution was made in the U. S. Pharmacopœia of 1850, and in the British of 1867.

NITRIC ACID (sp. gr. 1·42). This is the acid now officinal in both the U. S. and Br. Pharmacopœias. Acid of the density 1·5 was not found in any of the shops, and much pains was required to get it of that strength. Besides, acid of this density was not necessary for any process of the Pharmacopœia. Considerations of this kind induced the revisers of our national standard of 1850 to lower the strength of officinal nitric acid to 1·42, its purity in other respects remaining the same. "If 1 C.c. of Nitric Acid be treated with a slight excess of water of ammonia, no precipitate should be formed (absence of iron or much lead), the liquid should not have a blue tint (copper), and the further addition of 2 drops of test-solution of sulphide of ammonium should not cause a black precipitate (lead and iron). The remaining liquid should leave no fixed residue on evaporation and gentle ignition (non-volatile metals). If one part of Nitric Acid be neutralized with solution of potassa, two parts of potassa then added, and the mixture boiled with test zinc, a gas is evolved which should not blacken paper wet with test-solution of nitrate of silver (arsenic acid). A portion diluted with five volumes of water should afford no precipitate with test-solution of chloride of barium (sulphuric acid), or with test-solution of nitrate of silver (hydrochloric acid). If 5 C.c. of Nitric Acid are diluted with an equal volume of water, no blue color should be produced by the addition of a few drops of gelatinized starch (absence of free iodine), nor should the further addition, without agitation, of a layer of solution of hydrosulphuric acid cause a blue zone at the line of contact of the two liquids (abs. of iodic acid). To neutralize 3·15 Gm. of Nitric Acid should require 34·7

C.c. of the volumetric solution of soda." *U. S.* To satisfy the tests given in the U. S. Pharmacopœia, it must be colorless, and entirely volatilizable by heat; must dissolve copper with the disengagement of red vapors, and stain woollen fabrics and animal tissues a bright yellow. Acid of the density 1·42 is the most stable of the hydrated compounds of nitric acid, and boils at 121° C. (250° F.). When either stronger or weaker than this, it distils over at a lower temperature; and, by losing more acid than water in the first case, and more water than acid in the second, constantly approaches to the sp. gr. 1·42, when its boiling point becomes stationary. These facts in relation to nitric acid of this strength were first observed by Dalton, and have since been confirmed by Mr. Arthur Smith, of London. This acid may be assumed to have the composition $HNO_3 + 1\frac{1}{2}H_2O$. "Ninety grains by weight of it, mixed with half an ounce of distilled water, require, for neutralization, 1000 grain-measures of the *volumetric solution of soda.*" *Br.*

NITRIC ACID OF THE ARTS. Two strengths of this acid occur in the arts; *double aqua fortis* (sp. gr. 1·36), which is of half the strength of concentrated nitric acid, and *single aqua fortis* (sp. gr. 1·22), which is half as strong as the double. Aqua fortis is sometimes obtained by distilling a mixture of nitre and calcined sulphate of iron. By an interchange of ingredients, sulphate of potassium and nitrate of iron are formed, the latter of which, at the distilling heat, readily abandons its nitric acid. The sulphate of potassium is washed out of the residue, and the sesquioxide of iron which is left is sold, under the name of *colcothar*, to the polishers of metals. The distillation is performed in large cast-iron retorts, lined on the inside with a thick layer of red oxide of iron, to protect them from the action of the acid. The acid is received in large glass vessels containing water. A considerable portion of the acid is decomposed by the heat into reddish vapors, which subsequently dissolve in the water, and absorb the oxygen which had been disengaged. The acid thus obtained is red and tolerably strong, but is diluted with water before being sold.

The reddish acid, called *nitrous acid*, is nitric acid containing more or less nitrogen tetroxide (N_2O_4). The same acid may be formed by impregnating, to a limited extent, nitric acid with nitrogen dioxide (N_2O_2). If the saturation be complete, every two molecules of nitric oxide become three molecules of nitrogen tetroxide by the aid of one molecule of nitrogen dioxide ($2N_2O_5 + N_2O_2 = 3N_2O_4$). The commercial nitrous acid may be converted into nitric acid by exposing it to a gentle heat. As nitrogen tetroxide (N_2O_4) forms, in contact with bases, a nitrate and nitrite, there being no hyponitrates, some chemists consider it as a compound of nitric and nitrous oxides ($2N_2O_4 = N_2O_5 + N_2O_3$).

In making nitric acid on the commercial scale, sodium nitrate is substituted for nitre, as it is much cheaper, and the salt is decomposed with sulphuric acid as before. The proportions of these two substances employed are not the same in all works. If one molecule of sulphuric acid and two of sodium nitrate be taken, the following are the reactions: $H_2SO_4 + NaNO_3 = NaHSO_4 + HNO_3$. When the heat is raised, the acid sodium sulphate acts upon a second molecule of sodium nitrate; thus: $NaHSO_4 + NaNO_3 = Na_2SO_4 + HNO_3$.

In this case, however, a part of the acid is decomposed, owing to the high temperature, and nitrogen peroxide is evolved in the form of red fumes, which dissolve in the concentrated acid, giving it the red appearance usually noted in the strong commercial product. When a large excess of sulphuric acid is employed, a certain quantity of acid sodium sulphate is formed, which lowers the melting point of the residual mass so that it can be withdrawn from the retorts in a fused state, whereas in the other case the residue can only be removed in the solid state after the cylinder has cooled.

The ordinary commercial acid has a specific gravity of from 1·30 to 1·41, and is usually prepared by means of chamber (sulphuric) acid; but if a more concentrated acid is required, a stronger sulphuric acid must be employed. The strongest nitric acid occurring in commerce has a sp. gr. of 1·43, and this is obtained by distilling well-dried Chili saltpetre with sulphuric acid having a sp. gr. of 1·85.

The retorts in which nitric acid is usually prepared in England consist of cast-iron cylinders, built in a furnace in such a way that they may be heated as uniformly as possible. Some manufacturers cover the upper half of the cylinder with fire-bricks, in order to protect the iron from the action of the nitric acid vapors. This is unnecessary, however, if the retorts are so thoroughly heated that no nitric acid condenses on the surface of the iron.

M. Mallet, of Paris, has proposed to obtain nitric acid from nitrate of sodium, by distilling it with well-dried boric acid. In this case, biborate of sodium or borax is the residue. Another method, employed by Kuhlmann, is to expose a mixture of nitrate of sodium and chloride of manganese to a heat of about 232° C. (450° F.), and to pass the mixed gases which escape through water. Hyponitric acid and oxygen are disengaged, which become nitric acid when they enter the water. (See *P. J. Tr.*, 1862, p. 155.)

General Properties of Nitric Acid. Nitric acid, so called from nitre, is an extremely sour and corrosive liquid. It was discovered by Raymond Lully, in the thirteenth century, and its constituents by Cavendish, in 1784. When perfectly pure it is colorless; but, as usually obtained, it has a straw color, owing to the presence of hyponitric acid. The concentrated acid, when exposed to the air, emits white fumes, possessing a disagreeable odor. By the action of light it undergoes a slight decomposition, and becomes yellow. It acts powerfully on animal matter, causing its decomposition. On the living fibre it operates as a strong caustic. It stains the skin and most animal substances of an indelible yellow color. On vegetable fibre it acts peculiarly, abstracting hydrogen or water, and combining with its remaining elements. When diluted, nitric acid converts most animal and vegetable substances into oxalic, malic, and carbonic acids. The general character of its action is to impart oxygen to other bodies, which it is enabled to do, as oxygen in the nascent state is liberated in its decomposition. If this liberation take place while in contact with bodies capable of oxidation, the oxygen goes to effect this oxidation. Free nitric acid, however, will evolve oxygen at a red heat, according to the following reaction:

$$4HNO_3 = (N_2O_4)_2 + O_2 + (H_2O)_2.$$

It oxidizes sulphur and phosphorus, giving rise to sulphuric and phosphoric acids, and all the metals, except chromium, tungsten, columbium, cerium, titanium, osmium, rhodium, gold, platinum, and iridium. It combines with salifiable bases and forms nitrates. When mixed with hydrochloric acid, mutual decomposition takes place, according to the reaction: $HNO_3 + 3HCl = NOCl + Cl_2 + 2H_2O$, and a liquid is formed, capable of dissolving gold, called nitro-hydrochloric acid.

A trace of nitric acid has been detected in the atmosphere. It is said to be always present in the air in summer. (*Kletsinsky.*)

Tests. Nitric acid, when uncombined, is recognized by its dissolving copper with the production of red vapors, and by its forming nitre when saturated with potassa. When in the form of a nitrate, it is known by its action on gold-leaf, after the addition of hydrochloric acid, in consequence of the evolution of chlorine, or it may be discovered, according to Dr. O'Shaughnessy, by heating the supposed nitrate in a test tube with a drop of sulphuric acid, and then adding a crystal of morphine. If nitric acid be present, it will be set free by the sulphuric acid, and reddened by the morphine. The same effect is produced by brucine, by commercial strychnine, on account of its containing brucine, and still more strongly, according to M. Braun, by sulphate of anilin, which affords an exceedingly delicate test. (*Journ. de Pharm.*, 1867, p. 157.) To prevent all ambiguity arising from the accidental presence of nitric acid in the sulphuric acid employed, the operator should satisfy himself, by a separate experiment, that the latter acid has no power to produce the characteristic color with morphine. Another test for nitric acid is to add *pure* sulphuric acid to the concentrated liquid, suspected to contain it, together with a little concentrated solution of ferrous sulphate. The smallest trace of nitric acid affords, when the mixture is warmed, a pink red color; and if it be present in considerable amount, the liquid becomes almost black.*

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* *A quantitative test for nitric acid* in water, first proposed by M. Boussingault, in 1857, was simplified by M. Marx, and finally perfected by M. Fischer, who substituted indigotin for indigo, on account of its solution being permanent. His method is first to prepare a test-solution by mix-

A method, particularly useful in the determination of the nitrates contained in drinking-water, depends upon the fact that a thin zinc plate, which has been covered with a deposit of spongy metallic copper by dipping it in a solution of copper sulphate, on being heated with water containing nitrates, reduces them to ammonia, zinc hydroxide and free hydrogen being at the same time formed (*Gladstone* and *Tribe*); thus: $KNO_3 + 4H_2 = NH_3 + KOH + 2H_2O$.

The nitric acid of commerce sometimes contains iodine, probably derived from the native nitrate of sodium, in which iodate frequently occurs. This may be reduced by passing sulphuretted hydrogen into the diluted acid, taking care not to use an excess. A few drops of chloroform or bisulphide of carbon shaken up with the liquid will then show the iodine color. Still better is the test proposed by Mr. Stein, which is to introduce a stick of tin into the suspected acid, and, after red vapors have begun to escape, to withdraw the metal, add a few drops of bisulphide of carbon, and agitate. If iodine be present, the drops of the sulphide which soon separate will be colored more or less deeply red according to the amount of impurity. These impurities, however, do not affect the medical properties of the acid.

The following table, drawn up by B. J. Kolb (*Ann. Ch. Phys.*, 4, 10, 136), is the recognized standard at present:

Table showing percentage of absolute Nitric Acid in Nitric Acid of different densities, at 0° C. (32° F.) and 15° C. (59° F.).

Per Cent. HNO_3.	Specific Gravity.		Per Cent. HNO_3.	Specific Gravity.		Per Cent. HNO_3.	Specific Gravity.		Per Cent. HNO_3.	Specific Gravity.	
	At 0° C.	At 15° C.		At 0° C.	At 15° C.		At 0° C.	At 15° C.		At 0° C.	At 15° C.
0·00	1·000	0·999	40·00	1·267	1·251	61·21	1·400	1·381	83·00	1·495	1·470
2·00	1·013	1·010	41·00	1·274	1·257	62·00	1·404	1·386	84·00	1·499	1·474
4·00	1·026	1·022	42 00	1·280	1·264	63·59	1·413	1·393	85·00	1·503	1·478
7·22	1·050	1·045	43·53	1·291	1·274	64·00	1·415	1·395	86·17	1·507	1·482
11·41	1·075	1·067	45·00	1·300	1·284	65·07	1·420	1·400	87·45	1·513	1·486
13·00	1·085	1·077	46·64	1·312	1·295	66·00	1·425	1·405	88·00	1·514	1·488
15·00	1·099	1·089	47·18	1·315	1·298	67·00	1·430	1·410	89·56	1·521	1·494
17·47	1·115	1·105	48·00	1·321	1·304	68·00	1·435	1·414	90·00	1·522	1·495
20·00	1·132	1·120	49·00	1·328	1·312	69·20	1·441	1·419	91·00	1·526	1·499
23·00	1·153	1·138	49·97	1·334	1·317	69·4	....	1·420	92·00	1·529	1·503
25·71	1·171	1·157	50·99	1·341	1·323	69·96	1·444	1·423	93·01	1·533	1·506
27·00	1·180	1·166	52·33	1·319	1·331	71·24	1·450	1·429	94·00	1·537	1·509
28·00	1·187	1·172	53·00	1·353	1·335	72·39	1·455	1·432	95·27	1·542	1·514
29·00	1·194	1·179	53·81	1·358	1·339	73·00	1·457	1·435	96·00	1·544	1·516
30·00	1·200	1·185	54·00	1·359	1·341	74·01	1·462	1·438	97·00	1·548	1·520
31·00	1·207	1·192	55·00	1·365	1·346	75·00	1·465	1·442	97·89	1·551	1·523
32·00	1·214	1·198	56·10	1·371	1·353	76·00	1·469	1·445	99·52	1·557	1·529
33·86	1·226	1·211	57·00	1·376	1·358	77·66	1·476	1·451	99·72	1·558	1·530
35·00	1·234	1·218	58·00	1·382	1·363	79 00	1·481	1·456	99·84	1·559	1·530
36·00	1·240	1·225	58·88	1·387	1·368	80·00	1·484	1·460	100·00	1·559	1·530
37·95	1·253	1·237	59·59	1·391	1·372	80·96	1·488	1·463			
39·00	1·260	1·244	60·00	1·393	1·374	82·00	1·492	1·467			

Composition. The composition of the officinal acid of the density 1·42 has already been given. It contains about 75 per cent. of nitric acid, of the sp. gr. 1·5. Nitric oxide or anhydride consists of two atoms of nitrogen 28, and five atoms of oxygen 80 = 108; or, in volumes, of two volumes of nitrogen and five volumes of oxygen, supposed to be condensed to form nitric oxide vapor, into two volumes. In 1849, the interesting discovery was made by M. Deville, of Besançon, of the means of isolating nitric oxide or anhydride. The method pursued was to pass perfectly dry chlorine over nitrate of silver. The oxide is in the form of colorless, brilliant, limpid crystals, which melt at 29·5° C. (85° F.) and boil at 45° C. (113° F.). In con-

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ing 5 cubic centimetres of solution of indigotin with 30 cubic centimetres of pure sulphuric acid, and then adding a titrated solution of nitrate of potassium (5 decigrammes to the litre) until the blue color is changed to a faint green. Then the solution of indigotin is diluted until one cubic centimetre is decolorized by 0·2525 milligrammes of nitrate of potassium. In using this test-solution the temperature should always be at least 110° C. (230° F.), and the amount of sulphuric acid should always be at least double the joint volume of the indigotin solution and the water. (*Journ. de Pharm.*, Nov. 1874.)

tact with water, they form a colorless solution with evolution of heat, without the disengagement of gas. (*Journ. de Pharm.*, 1849, p. 207.)

Medical Properties. Nitric acid is tonic, antiseptic, astringent, and appears to act upon the intestinal glands in some way so as to modify their function. It is a very useful remedy in cases of intestinal indigestion: in this it resembles hydrochloric acid; the choice between the two acids in any individual case should be guided by the existence or non-existence of diarrhœa, the nitric acid being given when there is looseness of the bowels. In syphilis, and in the chronic hepatitis of India, this acid was highly extolled by Dr. Scott, formerly of Bombay. It has occasionally excited ptyalism. It cannot be depended upon as a remedy in syphilis, but, in worn-out constitutions, is often an excellent adjuvant, either to prepare the system for the use of mercury, or to lessen the effects of that metal on the economy: in hepatic troubles it is inferior to the nitro-hydrochloric acid, unless, it may be, when there is much diarrhœa. As nitric acid dissolves both uric acid and the phosphates, it was supposed to be applicable to cases of gravel in which the uric acid and the phosphates are mixed; but experience has not confirmed the opinion. Nevertheless, when the sabulous deposit depends upon disordered digestion, this acid may prove serviceable by restoring the tone of the stomach. The dose is from five to fifteen minims (0·3–0·9 C.c.) in three fluidounces or more of water, given in divided doses three or four times a day.

Externally, nitric acid has been used with advantage as a lotion to ulcers, in the strength of about twelve minims to the pint of water. This practice originated with Sir Everard Home, and is particularly applicable to those ulcers which are superficial and not disposed to cicatrize. In sloughing phagedæna, *strong* nitric acid is one of the best remedies, applied by means of a piece of lint tied round a small stick, or by the use of a glass brush. Sometimes a piece of lint is soaked with the strong acid, and pressed into the sore, being allowed to remain for several hours. In cancrum oris, concentrated nitric acid, freely applied, is one of the best local remedies that can be employed for arresting the phagedænic ulceration and disposing the sore to heal, but great care must be exercised to protect the teeth. The *strong* acid has also been found very useful as an escharotic in venereal sores and other affections.

Nitric acid vapors were formerly used as a disinfectant. Half an ounce of powdered nitre was put into a saucer, placed in an earthen dish containing heated sand, and two drachms of sulphuric acid were then poured over it. The quantities just indicated were considered sufficient for disinfecting a cubic space of ten feet. Dr. Carmichael Smyth received from the British Parliament, for the discovery of this use, a reward of five thousand pounds, but the plan is at present rarely practised.

Properties as a Poison. The swallowing of concentrated nitric acid is at once followed by burning heat in the mouth, œsophagus, and stomach, acute pain, disengagement of gas, abundant eructations, nausea, and hiccough. These effects are soon followed by repeated and excessive vomiting of matter having a peculiar odor and taste, tumefaction of the abdomen with exquisite tenderness, a feeling of coldness on the surface, horripilation, icy coldness of the extremities, small depressed pulse, horrible anxieties, continual tossings and contortions, and extreme thirst. The breath becomes extremely fetid, and the countenance exhibits a complete picture of suffering. The cases are almost always fatal. Sometimes the collapse has been immediate and has masked all the other symptoms. The best remedies are repeated large doses of alkaline solutions, soap, magnesia, chalk, as antidotes, mucilaginous drinks in large quantities, olive or almond oil in very large doses, emollient fomentations, etc.

Pharm. Uses. In the preparation of Acidum Phosphoricum Dilutum; Ferri Chloridum, *U. S.;* Hydrargyri Oxidum Rubrum; Liquor Ferri Chloridi, *U. S.;* Liquor Ferri Perchloridi Fortior, *Br.;* Liquor Ferri Subsulphatis, *U. S.;* Liquor Ferri Persulphatis, *Br.;* Liquor Ferri Tersulphatis, *U. S.;* Liquor Zinci Chloridi, *U. S.;* Pyroxylon, *U. S.*

Off. Prep. Acidum Nitricum Dilutum; Acidum Nitro-hydrochloricum Dilutum, *Br.;* Acidum Nitro-hydrochloricum, *U.S.;* Acidum Nitro-hydrochloricum Dilutum, *U. S.;* Liquor Ferri Nitratis, *U. S.;* Liquor Ferri Pernitratis, *Br.;* Liquor Hydrargyri Nitratis, *U. S.;* Liquor Hydrargyri Nitratis Acidus, *Br.;* Spiritus Ætheris Nitrosi; Unguentum Hydrargyri Nitratis, *U. S.*

ACIDUM NITRICUM DILUTUM. *U. S., Br.* *Diluted Nitric Acid.*

(ĂÇ′Ị-DŬM NĪ′TRỊ-CŬM DỊ-LŪ′TŬM.)

Acide azotique dilué, *Fr.;* Verdünnte Salpetersäure, *G.*

"Nitric Acid, *one part* [or one and a half fluidounces]; Distilled Water, *six parts* [or twelve and a half fluidounces]. Mix the Acid with the Water, and preserve the product in glass-stoppered bottles." *U. S.*

"Take of Nitric Acid *six fluidounces* [Imperial measure], Distilled Water *a sufficiency.* Dilute the Acid with 24 fluidounces [Imp. meas.] of the Water; then add more water, so that at a temperature of 60° it shall measure 31 fluidounces [Imp. meas.]. Or, as follows:

"Take of Nitric Acid 2400 grains, Distilled Water *a sufficiency.* Weigh the Acid in a glass flask, the capacity of which, to a mark on the neck, is one pint [Imp. meas.]; then add Distilled Water until the mixture, at 60° temperature, after it has been shaken, measures a pint." *Br.*

The U. S. acid, as now directed, varies considerably from that formerly officinal. The U. S. P. 1870 diluted acid contained 18·5 per cent. of officinal nitric acid, whilst that of the present Pharmacopœia contains but 14·3 per cent., and is therefore correspondingly weaker. "Diluted Nitric Acid contains 10 per cent. of absolute Nitric Acid. It has the sp. gr. 1·059, and should respond to the same reactions and tests as Nitric Acid. To neutralize 12·6 Gm. should require 20 C.c. of the *volumetric solution of soda.*" *U. S.*

The British diluted acid is considerably stronger than our own in the same measure. It has the sp. gr. 1·101; and "361 grains by weight (six fluidrachms) require for neutralization 1000 grain-measures of the *volumetric solution of soda*, corresponding to 14·95 per cent. of anhydrous nitric acid. Six fluidrachms [Imp. meas.], therefore, correspond to 54 grains of the anhydrous acid (one eq. of NO_5)." *Br.*

In making the U. S. diluted acid, pharmacists should be careful to use acid of the sp. gr. 1·42; or, if the acid used be weaker than this, to add proportionally less water; otherwise the diluted acid would be weaker than it is directed to be in the Pharmacopœia.

The medicinal properties of the diluted acid are the same as those of the strong acid. (See *Acidum Nitricum.*) The dose of the U. S. diluted acid is from twenty to forty drops or minims (1·25–2·5 C.c.), that of the British, from fifteen to thirty (0·9–1·9 C.c.), three times a day, properly diluted.

ACIDUM NITRO-HYDROCHLORICUM. *U. S.* *Nitro-hydrochloric Acid.*

(ĂÇ′Ị-DŬM NĪ-TRỌ-HȲ-DRỌ-ÇHLŌ′RỊ-CŬM.)

Acidum Chloro-nitrosum, *P. G.* Acidum Nitromuriaticum, Pharm. 1870; Aqua Regia; Acide chloro-azotique ou chloro-nitreux, Eau régale, *Fr.;* Salpeter Salzsäure, Königswasser, *G.*

"Nitric Acid, *four parts* [or three fluidounces]; Hydrochloric Acid, *fifteen parts* [or thirteen fluidounces, five fluidrachms]. Mix the Acids in a capacious open glass vessel, and, when effervescence has ceased, pour the product into glass-stoppered bottles," which should not be more than half filled, and keep them in a cool place.* *U. S.*

Nitro-hydrochloric acid is the *aqua regia* of the earlier chemists, so called from its property of dissolving gold. Nitric and hydrochloric acids, when mixed together, are mutually decomposed. According to the researches of Gay-Lussac (June, 1848), the reaction gives rise to two compounds, NO_2Cl (nitroxyl chloride) and NOCl (nitrosyl chloride), mixed with free chlorine. Later researches seem, however, to show that the latter of the two chlorides exclusively is produced, the reaction for the decomposition of aqua regia being: $HNO_3 + 3HCl = 2H_2O + NOCl + Cl_2$.

The power of nitro-hydrochloric acid to dissolve gold, and similar metals having a weak affinity for oxygen, is owing exclusively to the free chlorine present, and is in no wise dependent on the compound above referred to, which remains entirely passive during the solution of the metal. According to the reaction just given, the proportion of acids needed would be 1 part of nitric for every 3 of hydrochloric acid; and this agrees very closely with the proportions in the officinal formula. It should be borne in mind, however, that the U. S. P. 1870 formula contained a large excess of nitric acid, the proportions being 3 parts of nitric to 5 parts of hydrochloric acid; it is now 1·3 parts of nitric to 5 parts of hydrochloric acid. When nitro-hydrochloric acid is made from strong acids, there is always a loss of the nitrosyl chloride and of free chlorine by effervescence, in consequence of the acids not containing sufficient water to hold the gaseous products in solution. Hence the substitution, in the U. S. Pharmacopœia of 1850, of nitric acid of 1·42 for the acid of 1·5 was an improvement.

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* For an apparatus for making nitro-hydrochloric acid upon a large scale, see *P. J. Tr.*, xi. 422.

Properties. "A golden-yellow, fuming and very corrosive liquid, having a strong odor of chlorine and a strongly acid reaction. By heat it is wholly volatilized. It readily dissolves gold-leaf, and a drop added to test-solution of iodide of potassium liberates iodine abundantly." *U. S.* Nitro-hydrochloric acid has an orange color, soon changing to a golden yellow, and the odor of chlorine. It possesses the power of dissolving gold and platinum. It should be kept in a cool dark place, on account of its liability to lose chlorine by heat, and to have its chlorine converted into hydrochloric acid by the action of light and the decomposition of water. On account of its tendency to decomposition, it should not be made in large quantities, nor be kept very long by the apothecary; and care should be taken not to transfer it to the bottle in which it is to be dispensed, until effervescence has ceased, lest the pressure within should drive out the stopper. Nitric and hydrochloric acids, as found in commerce, are sometimes so weak that when mixed they will not readily act on gold-leaf. In this case, their solvent power may be rendered effective by the addition of a little sulphuric acid, which, by its superior affinity for water, concentrates the other acids, and causes immediate action.

Medical Properties and Uses. Nitro-hydrochloric acid was brought to the notice of the profession in consequence of the favorable report of its efficacy as an external remedy in hepatitis, made by Dr. Scott, formerly of Bombay. When thus employed, it produces a tingling sensation of the skin, thirst, a peculiar taste in the mouth, and occasional soreness of the gums and plentiful ptyalism; and at the same time stimulates the liver, as is evinced by an increased flow of bile. It is used either by sponging, or in the form of a local or general bath. When applied by sponging, the acid is first diluted so as to have the sourness of strong vinegar. When used as a foot-bath, three gallons of water, contained in a deep narrow wooden tub, may be acidulated with six fluidounces of the acid. In this the feet and legs are to be immersed for twenty minutes or half an hour. The bath may be employed at first daily, and afterwards twice or thrice a week; and the sponging may be used at the same time. The bath is said to be effective in promoting the passage of biliary calculi. The solution, prepared for a bath as above mentioned, may be used for a week, adding to it daily a pint of water acidulated with two fluidrachms of the acid, to make up for the waste by evaporation. The bath should have a temperature of about 97° F., which may be attained by heating part of the acid solution and throwing it back into the remainder.

Nitro-hydrochloric acid is much used internally, and it is an excellent remedy in chronic hepatic affections, in oxaluria, and in dyspepsia with a tendency to constipation. It is sometimes given also in syphilitic diseases. The strong fresh acid is preferable to the dilute, and may be given in doses of 3 to 6 drops (0·18–0·36 C.c.), well diluted, after meals, care being exercised to prevent its injuring the teeth.

ACIDUM NITRO-HYDROCHLORICUM DILUTUM. *U. S., Br.*

Diluted Nitro-hydrochloric Acid.

(ĂÇ'Ị-DŬM NĪ-TRỌ-HȲ-DRỌ-ÇHLŌ'RỊ-CŬM DỊ-LŪ'TŬM.)

Acidum Nitromuriaticum Dilutum, Pharm. 1870; Diluted Nitromuriatic Acid; Acide chlorazotique dilué, *Fr.;* Verdünnte Salpetersalzsäure, *G.*

"Nitric Acid, *four parts* [or three fluidrachms]; Hydrochloric Acid, *fifteen parts* [or thirteen and a half fluidrachms]; Distilled Water, *seventy-six parts* [or ten fluidounces]. Mix the Acids in a capacious, open glass vessel, and, when effervescence has ceased, add the Distilled Water. Keep the product in glass-stoppered bottles, in a cool place." *U. S.*

"Take of Nitric Acid *three fluidounces;* Hydrochloric Acid *four fluidounces* [Imperial measure]; Distilled Water *twenty-five fluidounces* [Imp. meas.]. Mix the Acids, and allow them to remain for twenty-four hours in a bottle, the mouth of which is partially closed, then add the Water in successive portions, shaking the bottle after each addition, and preserve the mixture in a stoppered bottle. Sp. gr. 1·074. Six fluidrachms [Imp. meas.] (352·4 grains by weight) require for neutralization 920 grain-measures of the *volumetric solution of soda.*" *Br.*

"A colorless, or faintly yellow liquid, odorless or having a faint odor of chlorine, a very acid taste and reaction. By heat it is wholly volatilized. On adding a few drops to test-solution of iodide of potassium, iodine is liberated." *U. S.*

Between diluted nitric and hydrochloric acids no reaction occurs; and therefore both Pharmacopœias direct that the acids shall be mixed before dilution. But according to the researches of Mr. Tilden, confirmed by Mr. Redwood (*P. J. Tr.*, x. 508), water determines a decomposition of the products resulting from the reaction between nitric and hydrochloric acids, and the reformation of hydrochloric and nitric acids, with a little nitrous acid. It would seem, therefore, that diluted nitro-hydrochloric acid is not an eligible preparation, a conclusion confirmed by clinical experience. The dose is from ten to twenty drops or minims (0·6–1·25 C.c.), properly diluted.

ACIDUM OLEICUM. *U. S.* *Oleic Acid.*

$HC_{18}H_{33}O_2$; 282. (ĂÇ′Ị-DŬM Ọ-LĒ′Ị-CŬM.) $HO, C_{36}H_{33}O_3$; 282.

Acide oléique, *Fr.;* Oleinsäure, *G.*

This acid is a new officinal, and, although known for many years, was not used medicinally until 1872 (*London Lancet*, 1872, p. 709), when Prof. John Marshall introduced the oleates to the profession as substitutes for some of the older ointments, stating that they are not only cleaner and more elegant, but are also much more efficacious. (See *Oleata.*)

Preparation. The difficulty in preparing oleates of good quality arises usually from the use of the commercial oleic acid, which, being obtained as a by-product in the manufacture of glycerin and candles, has a reddish brown color and a disagreeable fatty odor. It is almost always contaminated with oxyoleic and stearic or palmitic acids. Various processes have been suggested for the purification of oleic acid. Charles Rice (*A. J. P.*, xlv. 2) exposes the commercial acid to a temperature of 4° C. (39° F.), and expresses the liquid portion, which is oleic acid deprived of the greater part of the contaminating substances. The odorous and coloring principles are not removed by this process. A writer in *A. J. P.* (xlv. 97) prepares *oleic acid* for making oleates by saponifying almond oil with potassa; decomposing by tartaric acid, separating the precipitated bitartrate; heating for several hours on a water-bath with half its weight of finely powdered oxide of lead; after cooling, mixing with three times its volume of ether, settling, decanting, and treating the residue with ether as before; agitating the mixed ethereal solutions with dilute hydrochloric acid; skimming off the ethereal solution of oleic acid, washing it with water, skimming again, and finally recovering the ether by distillation. The impure oleic acid thus obtained is freed from *oxyoleic acid* by saturation with ammonia, precipitating with chloride of barium, drying the precipitate, treating it with boiling alcohol, which deposits on cooling crystals of pure oleate of barium; and finally decomposing these by a solution of tartaric acid in *boiled* water. In this process care must be exercised not to expose the oleic acid to the air, and the acid obtained readily dissolves as much as 20 per cent. of the red oxide of mercury.

L. Wolff (*A. J. P.*, 1879, p. 8) saponifies oil of sweet almond with lead oxide, agitates the plaster or lead soap in benzin, which retains lead oleate in solution, the lead palmitate being deposited. The benzin solution of lead oleate is shaken repeatedly with diluted hydrochloric acid (1 to 7), when lead chloride separates, and a benzin solution of purified oleic acid is left; finally the benzin is driven off by evaporation. The objection to this process is the difficulty of freeing the oleic acid from traces of a disagreeable benzin odor. Ernest C. Saunders (*N. R.*, June, 1880) makes a solution of 5 pounds of white castile soap in 20 pounds of boiling water, adds 10 ounces of sulphuric acid, and boils with stirring, until two clear layers are formed. The upper layer is decanted, shaken with 5 pounds of hot water, and the oily layer again decanted; 4 ounces of lead oxide are dissolved in it with a gentle heat, and while hot 5 pounds of alcohol, previously heated to 65·5° C. (150° F.), are added. It is filtered after standing 24 hours, and 1 ounce of hydrochloric acid shaken with the filtrate; 10 pounds of water are added, the acid decanted, again washed with 10 pounds of water, and finally recovered; the yield is about 2½ pounds.

Properties. "A yellowish, oily liquid, gradually becoming brown, rancid and acid, when exposed to the air; odorless or nearly so, tasteless, and, when pure, of a neutral reaction. Sp. gr. 0·800 to 0·810. Oleic Acid is insoluble in water, but completely soluble in alcohol, chloroform, benzol, benzin, oil of turpentine, and the fixed oils. At 14° C. (57° F.), it becomes semi-solid, and remains so until cooled to 4° C. (39·4° F.), at which temperature it becomes a whitish mass of crystals. At a gentle heat, the Acid is completely saponified by carbonate of potassium. If the resulting soap be dissolved in water and exactly neutralized with acetic acid, the liquid will form a white precipitate with test-solution of acetate of lead. This precipitate, after being twice washed with boiling water, should be almost entirely soluble in ether (abs. of more than traces of palmitic and stearic acids). Equal volumes of the Acid and of alcohol, heated to 25° C. (77° F.), should give a clear solution, without separating oily drops upon the surface (fixed oils)." *U. S.*

Chemical Constitution. Oleic acid, $C_{18}H_{34}O_2$, does not belong to the "fatty acid" series, but differs from the corresponding acid of that series, stearic acid, $C_{18}H_{36}O_2$, by having two atoms of hydrogen less. It belongs to a series derived by oxidation from alcohols, which, like allyl alcohol, C_3H_5OH, have two atoms of hydrogen less than the normal monatomic alcohols, like propyl alcohol, C_3H_7OH. The alcohol from which oleic acid is in theory derivable is not, however, known. Oleic acid is monobasic, as shown in the formula $HC_{18}H_{33}O_2$.

Medical Properties. Oleic acid is not itself used in medicine, but is officinal for the preparation of oleates, which act as corresponding ointments, but are more elegant and efficient.

ACIDUM OXALICUM. *Oxalic Acid.*

$H_2C_2O_4, 2H_2O$; 126. (ĂÇ'Ị-DŬM ỌX-ĂL'Ị-CŬM.) $2HO\,C_4O_6, 4HO$; 126.

Acide oxalique ou carboneux, *Fr.;* Oxalsäure, Kleesäure, *G.*

"In small, colorless, prismatic crystals, odorless and of a very sour taste, slightly efflorescent in dry air, fusible at 98° C. (208° F.), and entirely volatile at a red heat."*

This acid is found both in animals and vegetables. It is generated occasionally in consequence of a diseased action in the kidneys, and deposited in the bladder as oxalate of calcium, forming a peculiar concretion, called the *mulberry calculus.* In vegetables, it occurs in a free state in the bristles of the chick-pea (*Cicer arietinum*), combined with potassa as acid potassium oxalate in *Rumex acetosa* or common sorrel, and *Oxalis Acetosella* or wood-sorrel, and united with lime in several species of lichen, and in rhubarb, valerian, and many other plants, where it forms the so-called raphides.

Preparation. The usual process for obtaining oxalic acid consists in decomposing sugar by nitric acid. Four parts of sugar are acted upon by 24 of nitric acid of the sp. gr. 1·24, and the mixture is heated so long as any nitrogen tetroxide is disengaged. A part of the carbon of the sugar is converted into carbonic acid by oxygen derived from the nitric acid, which thereby is reduced to nitrogen tetroxide. The undecomposed nitric acid, reacting with the remaining elements of the sugar, generates oxalic and saccharic acids, the former of which crystallizes as the materials cool, while the latter remains in solution. The crystals being removed, a fresh crop may be obtained by further evaporation. The thick mother-water which now remains is a mixture of saccharic, nitric, and oxalic acids; and, by treating it with six times its weight of nitric acid, the greater part of the saccharic will be converted into oxalic acid. The new crop of crystals, however, will have a yellow color, and contain a portion of nitric acid, the greater part of which may be driven off by allowing them to effloresce in a warm place. It is probable that, in the reaction occurring between nitric acid and sugar, half the carbon of the latter is converted into carbonic acid, and the other half into oxalic acid.

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* See test-solution of oxalic acid at the end of the volume.

The manufacturing chemists are said to obtain oxalic acid on a large scale by heating a mixture of 112 lbs. of sugar, 560 lbs. of nitrate of potassium, and 280 lbs. of sulphuric acid. The products are 135 lbs. of oxalic acid, and 490 lbs. of acid sulphate of potassium, or *sal enixum.* (*L. Thompson.*)

Many substances, besides sugar, yield oxalic acid by the action of nitric acid; as molasses, rice, potato starch, gum, wool, hair, silk, and many vegetable acids. In every case in which it is thus generated, the proportional excess of oxygen which it contains, compared with every other organic compound, is furnished by the nitric acid. When the acid is obtained from potato starch, this is first converted into starch sugar by the action of sulphuric acid. The following is an outline of the process, as conducted on a large scale. The pulp of potatoes, obtained by rasping or other suitable means, is washed two or three times by stirring it well with water, allowing it to subside, and running off the water. It is then boiled for some hours with water in wooden boilers, lined with lead and heated by steam; a quantity of sulphuric acid being stirred in the mixture, equal to 2 per cent. of the weight of the potatoes employed. By this treatment the starch of the potatoes is converted into starch sugar; and the change is known to be completed when a drop of tincture of iodine, added to a little of the boiling liquor, placed on a piece of glass, ceases to produce a purple color. The product is then filtered through a horse-hair cloth, and the liquid which passes is carefully evaporated until a gallon of it weighs about fourteen pounds. This liquid consists of a concentrated solution of starch sugar, and is now ready for conversion into oxalic acid. For this purpose it is placed in wooden boilers, lined with lead, eight feet square and three deep, and, having been mixed with the requisite proportion of nitric acid, is heated to a temperature of about 52° C. (125° F.) by means of steam, passed through a coil of lead pipe, until the decomposition is effected. The liquor is then drawn off by a siphon or cock into shallow lead-lined wooden coolers to crystallize. The crystals having formed, the mother-waters are drawn off for use in a subsequent operation. When the manufacture of the acid is conducted in vessels of the size just indicated, the density of the nitric acid should not be less than 1·20 nor higher than 1·27. If the nitric acid is used of undue strength, a part of the oxalic acid first formed is converted into carbonic acid, to the no small diminution of the desired product. (*Chem. Gaz.*, 1852, p. 112.) The yield of oxalic acid from a given quantity of material has been much understated. If properly treated with nitric acid, 100 lbs. of good sugar will yield from 125 to 130 lbs. of oxalic acid, and the same weight of molasses, from 105 to 110 lbs.

Certain organic substances yield oxalic acid when heated with potassa. Wood-shavings, if mixed with a solution of caustic potassa, and exposed to a heat considerably higher than 100° C. (212° F.), will be decomposed, and partly converted into oxalic acid, which then combines with the alkali. At present most of the oxalic acid of commerce is obtained by heating saw-dust with a mixture of caustic soda and potassa. Soda alone will not generate the acid, and potassa is too costly to be used by itself for the purpose; but Mr. Dale ascertained that, by mixing the two in the proportion of two molecules of soda to one of potassa, the same or an even better result was obtained than from the latter alone. The mixture of caustic alkalies and saw-dust is made in a thick paste and then heated for several hours to a temperature of 200° C. (392° F.) to 220° C. (428° F.). The gray mass is then washed with carbonate of sodium, whereby the potash is removed as carbonate, the less soluble sodium oxalate remaining. This is converted into calcium oxalate, by milk of lime, and the calcium salt then decomposed with sulphuric acid. The impure oxalic acid is then purified by recrystallization. Bohlig has suggested an improvement by precipitating the solution of potassium oxalate with magnesium chloride or sulphate. (Bayer, *N. R.*, Aug. 1877.)

As the oxalic acid of commerce often contains more or less of foreign matter, it requires for certain purposes to be purified. It has sometimes been fraudulently mixed with 25 per cent. of Epsom salt. M. E. J. Maumené gives the following process for purification, which he says answers better than the method generally recommended. Sufficient hot water is added to the crystals to leave, on the cooling of the solution, 10 to 20 per cent. undissolved, according to the degree of impurity. The first crystals are put aside. The mother-water is then concentrated; and, if the resulting crystals be submitted to two or three successive crystallizations, the acid will be obtained finally free from alkaline oxalate. (*Journ. de Pharm.*, 1864, p. 154.) Stolba prefers the method of purification by crystallization from hydrochloric acid (boiling hot). (*Journ. App. Chem.*, Aug. 1874.) Villiers (*Journ. Chem. Soc.*, 1880, p. 544) prepares anhydrous oxalic acid by dissolving 1 part of ordinary acid in about 12 parts of warm concentrated sulphuric acid, allowing the oxalic acid to crystallize out.

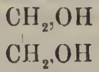
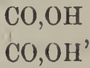
Properties. Oxalic acid is a colorless crystallized solid, possessing considerable volatility, and a strong, sour taste. Its crystals have the shape of slender, flattened four- or six-sided prisms, with two-sided summits; and, when exposed to a very dry atmosphere, undergo a slight efflorescence. "Soluble in 4·5 parts of absolute alcohol, in 7 parts of alcohol, and almost insoluble in ether, chloroform, benzol, and benzin. The crystals should dissolve in not less than 8 to 10 parts of distilled water at 15° C. (59° F.) (greater solubility indicating contamination with adherent nitric acid.)" *U. S.*

It fuses in its water of hydration at 98° C. (208·4° F.), although continued exposure to a heat of 60° C. (140° F.) to 70° C. (158° F.) will render it perfectly anhydrous. Solutions of oxalic acid at 100° C. (212° F.) lose acid by sublimation, and at 157° C. (314·6° F.) it sublimes rapidly. If the heat rise to 160° C. (320° F.), much loss of acid occurs. (Allen, *Commer. Org. Anal.*, 1879, p. 233.)

It combines with salifiable bases, and forms salts called oxalates. The most interesting of these are the three *oxalates of potassium*, severally called *oxalate*, *binoxalate*, and *quadroxalate* (acid potassium oxalate plus free oxalic acid), and the *oxalate of calcium*. The binoxalate and quadroxalate, both popularly called *salt of sorrel* or *essential salt of lemons*, are employed for removing iron moulds from linen, and act by their excess of acid, which forms a soluble salt with the sesquioxide of iron constituting the stain. These oxalates are sometimes met with in the market contaminated with free sulphuric acid. Oxalic acid is used for removing ink stains and iron moulds, for cleaning the leather of boot-tops, and for discharging colors in calico-printing. Prussian blue dissolves in aqueous oxalic acid to a clear blue liquid which is often employed as a *blue ink*.

This acid has a very strong affinity for lime, and makes with it an insoluble precipitate consisting of oxalate of calcium, whenever the acid and earth are brought into contact in solution. An aqueous solution forms with solution of lime a white precipitate, insoluble in an excess of oxalic or acetic acid, but dissolved by dilute hydrochloric acid. It is even capable of decomposing fluoride of calcium, evolving hydrofluoric acid. (*J. W. Slater.*) Oxalic acid and its soluble combinations are the best tests for lime; and, conversely, a soluble salt of lime for oxalic acid. In weak solution the acid is said to absorb oxygen and to be converted into carbonic acid; but a strong solution is quite permanent. (*A. J. P.*, 1870, p. 317.) When lime is searched for, oxalate of ammonium is the most convenient test. So strong is the mutual attraction between this acid and lime, that the former takes the latter even from sulphuric acid. Hence the addition of a soluble oxalate disturbs the transparency of a solution of sulphate of calcium.

Oxalic acid is distinguished from all other acids by the form of its crystals, and by its solution yielding a precipitate with lime-water, insoluble in an excess of the acid or of acetic acid.

Composition. Anhydrous oxalic acid consists of two atoms of carbon 24, two of hydrogen 2, and four of oxygen 64 = 90. It is a bibasic acid. When crystallized, two molecules of water must be added, making the molecular weight of the crystals 126. These two molecules of water may be driven off by a regulated heat, by which the acid is made to effloresce. As oxalic acid is the final oxidation product of the diatomic alcohol *glycol*, to which the formula  $\begin{matrix}CH_2,OH\\ |\\ CH_2,OH\end{matrix}$ is given, we may conclude that its structural formula is  $\begin{matrix}CO,OH\\ |\\ CO,OH\end{matrix}$, which explains the readiness with which sulphuric acid splits it up into carbon dioxide, CO_2, and carbon monoxide, CO, by withdrawing H_2O from its formula, and with which oxidizing agents like manganese and lead dioxides change it into carbonic acid.

Medical and Toxical Properties. Oxalic acid has been employed as a substitute for citric acid, but at present is never used as a medicine. Attention was first called to it as a poison by Mr. Royston in 1814, and the certainty and rapidity of its action have caused it to be largely used for suicidal purposes. Death has been produced by it in ten minutes. (Case, *Chem. News*, April 24, 1868.) The minimum fatal dose recorded is one drachm (*Taylor*).

From the general resemblance which the crystallized oxalic acid bears to Epsom salt, many fatal mistakes have occurred in consequence of its being sold for that saline purgative. It is, however, at once distinguished by its sour taste.

Oxalic acid acts on the economy in two principal ways, according as its solution is concentrated or dilute. When concentrated it causes exquisite pain, followed by violent efforts to vomit, then sudden dulness, languor, and great debility, and finally death without a struggle. When dissolved in twenty times its weight of water, it possesses no corrosive and hardly any irritating power, but causes death by acting on the brain, spinal marrow, and heart. It should be noted, however, that the acid, in weak solution, always exercises a corroding or softening power on the animal tissues.

The morbid appearances caused by oxalic acid are various. In a dissection reported by Dr. Christison, the mucous coat of the throat and gullet had an appearance as if scalded, and that of the gullet could be easily scraped off. The inner coat of the stomach was pultaceous, in many points black, in others red, and that of the intestines, similarly but less violently affected. In another case, the whole villous coat of the stomach was either softened or removed, as well as the inner membrane of the œsophagus; so that the muscular coat was exposed, and this coat exhibited a dark, gangrenous appearance, being much thickened and highly injected. The stomach usually contains a dark fluid, resembling coffee-grounds, consisting chiefly of altered blood. The tongue and mouth are sometimes white or spotted with white. In a few cases no morbid appearances have been discovered.

In the treatment of poisoning by oxalic acid, the remedial measures must be employed with great promptitude. Vomiting may be encouraged and the stomach-pump used, but unless the antidote is at hand death will rarely be averted. The proper antidote is chalk or magnesia, mixed with water; and as soon as either can be procured, it must be administered in large and repeated doses. In many cases whitewash or some other preparation of lime can be obtained sooner than chalk, and should be at once administered. These substances act by forming with the poison an insoluble, inert oxalate of calcium or of magnesium. The soluble salts of oxalic acid, as oxalate of ammonium, and oxalate of potassium, are equally poisonous, and the antidotes for them are the same as for the acid.

The best tests for the detection of oxalic acid in the contents of the stomach, or in the vomited matter, in cases of suspected poisoning, are chloride of calcium, sulphate of copper, and nitrate of silver. The first causes a white precipitate of oxalate of calcium, known by its being soluble in nitric acid; the second, a bluish-white precipitate of oxalate of copper; and the third, a dense white precipitate of oxalate of silver, which, when dried and heated, becomes brown and detonates faintly. When the antidotes have been freely used during life, the poison will be in the state of oxalate either of calcium or magnesium. In this case, the oxalate found is to be boiled with a solution of carbonate of potassium, whereby an oxalate of potassium will be generated; and this must then be examined with the reagents above indicated.

ACIDUM PHOSPHORICUM. *U. S.* *Phosphoric Acid.*

(ĂÇ′Ị-DŬM PHỌS-PHŎR′Ị-CŬM.)

"A liquid composed of 50 per cent. of Orthophosphoric Acid [$\mathbf{H_3PO_4}$; **98**—3HO, PO_5; 98] and 50 per cent. of water." *U. S.*

"Phosphorus, *sixteen parts;* Nitric Acid, Distilled Water, each, *a sufficient quantity*, To make *one hundred parts.* Mix *one hundred parts* of Nitric Acid with *one hundred parts* of Distilled Water, in a glass retort having the capacity of *four hundred parts.* Having placed the retort upon a sand-bath or wire-gauze support, connect it loosely with a well-cooled receiver and add to the acid in the retort the Phosphorus previously cut into fine pieces. Insert a funnel through the tubulure of the retort, and then gradually apply heat until the reaction is seen to commence. Regulate the heat carefully so as to prevent the reaction from becoming too violent, or, if necessary, check it by the addition of a little Distilled Water through the funnel. From time to time return the acid liquid, which collects in the receiver into the retort, until all the Phosphorus is dissolved. Then transfer the liquid to a weighed porcelain capsule, and continue the heat, at a temperature not exceeding 190° C. (374° F.), until the excess of Nitric Acid is driven off, and an odorless syrupy liquid remains. Cool the dish and contents, and add enough Distilled Water to make the liquid weigh *one hundred parts.* Test small portions for Nitric, Phosphorous, and Arsenic Acids by the following methods. If Nitric Acid should be present, evaporate the liquid until no reaction for Nitric Acid can be obtained. Then cool the Acid and add enough Distilled Water to make the product weigh *one hundred parts.* If Phosphorous Acid be present, add to the liquid a mixture of *six parts* of Nitric Acid and *six parts* of Distilled Water, and again evaporate until no reaction for Phosphorous or Nitric Acid can be obtained. Then, having cooled the Acid, add sufficient Distilled Water to make the product weigh *one hundred parts.* If Arsenic Acid be present, dilute the Acid with *one hundred and fifty parts* of Distilled Water, heat to about 70° C. (158° F.), and pass through the liquid a stream of Hydrosulphuric Acid Gas for half an hour, then remove the heat and continue passing the gas until the liquid is cold. Close the vessel tightly, set it aside for 24 hours, filter the liquid, heat it until all the odor of the gas has been driven off, again filter, and evaporate until the residue weighs *one hundred parts.* Preserve the product in glass-stoppered bottles." *U. S.*

This preparation, although in common use for the last few years, is for the first time officinal in the present Pharmacopœia. It is recommended on account of its small bulk and its great convenience to the apothecary for preparing the diluted acid. The glacial phosphoric acid is no longer officinal, it having been shown that it is practically impossible to obtain it of sufficient purity to be reliable. (See *Proc. A. P. A.*, 1875, pp. 666, 672.) The present syrupy acid is a great improvement in every way, as it can be obtained of undoubted purity and strength, and by simple dilution with water diluted phosphoric acid of any desired strength can easily be produced from it.* The process for its preparation is the old and well-known one of oxidizing phosphorus by the use of nitric acid, and it does not differ very greatly from the British method of making the diluted acid or the first process in the U. S. Pharmacopœia of 1870. (See *Acidum Phosphoricum Dilutum*, p. 95, and *Acidum Phosphoricum Glaciale*, p. 94.)

Properties. "A colorless liquid, without odor, of a strongly acid taste and reaction. Its specific gravity is 1·347. When heated the liquid loses water, and when a temperature of about 200° C. (392° F.) has been reached, the acid is gradually converted into pyrophosphoric and metaphosphoric acids, which may be volatilized at a red heat. If the diluted acid be supersaturated with ammonia, addition of test mixture of magnesium produces a white crystalline precipitate. If this precipitate be dissolved in diluted acetic acid, the solution yields a yellow precipitate with test-solution of nitrate of silver. Phosphoric Acid, diluted with 5 volumes of water, and gently warmed, should not be blackened by test-solution of nitrate of silver, nor be turned white or whitish by test-solution of mercuric chloride (absence of phosphorous acid); when heated to about 70° C. (158° F.), thoroughly saturated during half an hour, and afterward until it is cold, with hydrosulphuric acid gas, then set aside for twenty-four hours, it should not deposit a lemon-yellow sediment (absence of arsenic acid). If a crystal of ferrous sulphate be dropped into a cooled mixture of Phosphoric and Sulphuric Acids, no brown or reddish zone should make its appearance around the crystal (absence of nitric acid). After diluting the Acid with 5 volumes of distilled water, no precipitate should be produced on the addition of small portions of test-solutions of chloride of barium (sulphuric acid), or of nitrate of silver (hydrochloric acid); nor should any precipitate be formed after several hours, by the addition of an equal volume of tincture of chloride of iron (pyrophosphoric and metaphosphoric acids).

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* James T. Shinn (*A. J. P.*, Oct. 1880) proposes a formula for *Liquor Acidi Phosphorici* and *Liq. Acidi Phosph. Comp.* A similar preparation under the name of Horsford's Acid Phosphates has a large use in this country. The formula is as follows. *Liquor Acidi Phosphorici* (without Iron): Calcii Phosphat. 384 gr.; Magnesii Phosphat. 256 gr.; Potassii Phosphat. 192 gr.; Acidi Phosphorici (60 per cent.) 640 minims; Aquæ, q. s. ft. 1 pint. *Liq. Acidi Phosph. Comp.* (with Iron): Calc. Phosphat. 384 gr.; Magnes. Phosphat. 64 gr.; Potassii Phosphat. 32 gr.; Ferri Phosphat. 64 gr.; Acid Phosph. (60 per cent.) 816 minims; Aquæ q. s. ft. 1 pint.

"On pouring 5 Gm. of Phosphoric Acid upon 10 Gm. of oxide of lead free from carbonate of lead and from moisture, evaporating, and igniting, a residue will be obtained which should weigh 11·81 Gm." *U. S.*

Medical Properties. This acid is rarely used medicinally. It has the same properties and uses as the diluted Phosphoric Acid (see p. 95). The dose is 5 to 10 minims (·3–·6 C.c.), one-fifth that of the diluted acid.

Off. Prep. Acidum Phosphoricum Dilutum.

ACIDUM PHOSPHORICUM GLACIALE. (*Glacial Phosphoric Acid; Metaphosphoric Acid, Monobasic Phosphoric Acid; Monohydrated Phosphoric Acid; Acide phosphorique glacial*, Fr.; *Glasige Phosphorsäure*, G.) Formula HPO_3; mol. wt., 80. Phosphoric oxide consists of two atoms of phosphorus and five atoms of oxygen, P_2O_5, and can be obtained only by the direct union of its constituents, which takes place when phosphorus is burned in perfectly dry oxygen gas. Thus procured, it is in the form of a white amorphous powder, extremely deliquescent, volatilizable at a red heat, and assuming, when it cools after fusion, a vitreous appearance. The classic researches of Prof. Graham first established clearly the character of the several varieties of phosphoric acid, which may be considered as derived from this oxide. When amorphous phosphorus is boiled with nitric acid, or when phosphoric oxide is boiled with water, the oxide takes up three molecules of water, and yields tribasic or *ordinary phosphoric* acid, according to the reaction: $P_2O_5 + 3H_2O = H_6P_2O_8$ or $(H_3PO_4)_2$. If this acid be heated for a considerable time to 215° C. (419 F.), the two molecules lose one molecule of water and yield *pyrophosphoric* acid, a tetrabasic variety, according to the reaction: $H_6P_2O_8 - H_2O = H_4P_2O_7$. Lastly, at a red heat the ordinary phosphoric acid is converted into *metaphosphoric* acid, a monobasic variety, according to the reaction: $H_3PO_4 - H_2O = HPO_3$. This last variety may also be obtained direct from the oxide by dissolving it in cold water, when it takes up one molecule of water: $P_2O_5 + H_2O = H_2P_2O_6$ or $(HPO_3)_2$. (See *Chem. News*, Jan. 7, 1876; or *A. J. P.*, 1876, p. 109.) An aqueous solution of either of the three acids, heated so long as water escapes, yields the monobasic or metaphosphoric acid; and as, upon cooling, it becomes a transparent ice-like solid, it has received in this state the name of glacial phosphoric acid. Conversely, this monobasic acid is slowly transformed, in aqueous solution, and more rapidly if the solution is heated, into the tribasic form. Prof. Maisch has ascertained that nitric acid, added to the solution of the monobasic acid, with the aid of heat, causes the change from the monobasic to the tribasic form, viz., to the common phosphoric acid, without the intermediate production of the tetrabasic variety.

Tests. The three acids are distinguishable by peculiar reactions. Thus, the *monobasic* is characterized by coagulating albumen, and giving white gelatinous uncrystallizable precipitates with the soluble salts of baryta, lime, and silver; the *tetrabasic* does not coagulate albumen, and, though it causes a *white* precipitate with nitrate of silver, must first be neutralized; the tribasic does not coagulate albumen, and until neutralized does not precipitate nitrate of silver, but after neutralization throws down a *yellow* precipitate of phosphate of silver.

Glacial phosphoric acid is most advantageously obtained from calcined bones, by first treating them with sulphuric acid, which produces an insoluble sulphate and soluble acid phosphate of calcium; then dissolving out the latter salt, and saturating it with carbonate of ammonium, which generates phosphate of ammonium in solution; and, finally, obtaining the phosphate of ammonium by evaporation to dryness, and then igniting it in a platinum crucible. The ammonia and all the water except the one molecule needed for the formation of metaphosphoric acid are driven off, and the glacial acid remains. In France, a fossil phosphate of calcium found in the Département du Lot is sometimes substituted for bones, in the manufacture of phosphoric acid. (*Journ. de Pharm.*, 1872, p. 188.)

Properties. Thus procured, glacial phosphoric acid is in the form of a white, uncrystallizable, fusible solid, inodorous, very sour to the taste, slowly deliquescent, slowly soluble in water, and soluble also in alcohol. Its formula is HPO_3, and it is made up of 11·2 per cent. of water in combination with 88·8 per cent. of phosphoric oxide. As already stated, it is characterized by producing white gelatinous precipitates with albumen, and with the soluble salts of lime, baryta, and silver; and the precipitate produced with the chloride of barium is readily redissolved by an excess of the acid. This is the form of the acid which results when the oxide, produced by burning phosphorus in dry oxygen gas, is introduced into cold water.

Impurities. Glacial phosphoric acid is seldom prepared in this country. That found in commerce is almost all imported, and chiefly from Germany. It is often more or less impure, containing, as shown by the experiments of Prof. Maisch, silica, and the phosphates of calcium and magnesium, which are precipitated from a neutralized solution of the acid by ammonia. In one instance 8 per cent. of these impurities was found; but in some others little or none. Prof. Maisch never found nitric or hydrochloric acid, and sulphuric acid rarely; and, though the presence of ammonia might be suspected from the source whence the acid is obtained, he did not detect it. (*A. J. P.*, 1860, p. 194.) The chief impurity, however, is soda, as has been pointed out by Brescius, Remington, Dohme, Prescott, and others (see *Proc. A. P. A.*, 1875, 666, 672); of late years the acid has been found to contain occasionally as much as 60 per cent. of sodium metaphosphate, and rarely less than 55 per cent. (*N. R.*, Feb. 1879.) In consequence of its deliquescence upon exposure to the air, a portion of the monobasic acid passes into the tribasic state. This is detected, if in considerable quantity, by its giving a yellowish color to the precipitate with nitrate of silver. The U. S. Pharm. 1870 directed that the acid, in aqueous solution, should yield no precipitate with sulphuretted hydrogen, showing the absence of metals; should cause a white precipitate with chloride of barium soluble in an excess of acid; with an excess of ammonia, should cause only a slight turbidity, proving the almost total absence of earthy salts; and should yield no ammonia when treated with potassa in excess. Should the presence of arsenic be ascertained by the tests for that metal, it may be separated by boiling with hydrochloric acid, so as to convert the arsenic into its very volatile chloride, which would escape with the vapors of the hydrochloric acid.

Glacial phosphoric acid was introduced into the Materia Medica of the Pharmacopœia of 1860 as affording a convenient method of preparing the medicinal acid, but, owing to its unreliability, was very properly dismissed from the present Pharmacopœia. Thirty-eight and a half grains, dissolved in a fluidounce of water, form a solution about equal in strength to the U. S. diluted acid of Pharm. 1860.

ACIDUM PHOSPHORICUM DILUTUM. *U.S. Diluted Phosphoric Acid.*

(ĂÇ′Ị-DŬM PHỌS-PHŎR′Ị-CŬM DỊ-LŪ′TŬM.)

Acide phosphorique médicinal, *F.;* Verdünnte Phosphorsäure, *G.*

" Phosphoric Acid, *twenty parts* [or two and a half fluidounces]; Distilled Water, *eighty parts* [or thirteen and a half fluidounces]. To make *one hundred parts* [or one pint]. Mix the Phosphoric Acid with the Distilled Water. Diluted Phosphoric Acid has a specific gravity of 1·057, and contains 10 per cent. of orthophosphoric acid. It should respond to the tests of purity required for Phosphoric

Acid. On pouring 5 Gm. of Diluted Phosphoric Acid upon 5 Gm. of oxide of lead free from carbonate and from moisture, evaporating and igniting, a residue will be obtained which should weigh 5·36 Gm." *U. S.*

"Take of Phosphorus *four hundred and thirteen grains;* Nitric Acid *six fluidounces* [Imperial measure]; Distilled Water a *sufficiency*. Put the Nitric Acid, diluted with eight [fluid]ounces [Imp. meas.] of Distilled Water, into a tubulated retort connected with a Liebig's condenser, and, having added the Phosphorus, apply a gentle heat, so as slowly to distil five fluidounces [Imp. meas.] of liquid. Return this to the retort, and continue the distillation, occasionally returning the distillate, until the phosphorus has entirely disappeared. Transfer the contents of the retort to a porcelain dish of hard well-enamelled ware, and evaporate the liquid until it is reduced to four fluidounces [Imp. meas]; then transferring it to a platinum vessel, continue the evaporation until it is reduced to about two fluidounces [Imp. meas.], and orange-colored vapors are no longer formed. Mix it now with Distilled Water until, when cold, it measures one pint [Imp. meas]." *Br.*

It will be observed that in the U. S. Pharmacopœia of 1880, diluted phosphoric acid is made by simple dilution of the stronger acid, and that the older method of dissolving the glacial acid has been very properly abandoned. (See *Acidum Phosphoricum Glaciale.*) The officinal diluted acid is weaker than the British, the U. S. P. acid containing ten per cent. of orthophosphoric acid, whilst the British contains nearly fourteen; with this exception they are identical. The process for making the stronger phosphoric acid does not differ in principle from that of the British; in both, phosphorus is oxidized at the expense of the nitric acid, any excess of nitric acid, and all the lower oxides of nitrogen being driven off by heat. Strong nitric acid acts too energetically on phosphorus, producing explosion and rapid combustion; but when diluted, as in the processes above given, it parts with its oxygen slowly, and it is even desirable to aid the operation with a gentle heat. Along with the nitrous fumes, a portion of the undecomposed nitric acid also rises in vapor, which, in the British process, to prevent loss, is collected by means of a distillatory apparatus, and returned into the retort. In the U. S. process of 1870, the same end was effected by placing over the liquid in the capsule a glass funnel, upon the inner surface of which the acid was condensed, and returned of itself into the capsule so as to considerably simplify the operation. This modification was originally suggested by Mr. Geo. W. Andrews, of Baltimore, who, however, inverted a dish over the materials; the suggestion of the funnel being due to Prof. Procter. The operation was continued till the whole of the phosphorus was converted into phosphoric acid and dissolved, and the liquid having been deprived of any remaining acid, and reduced to a certain weight by concentration, the process was completed by adding a certain measure of water; so that an acid of definite strength was obtained. Prof. Diehl found, in carrying this process into effect, that the glass funnel covering the capsule almost always breaks through the violence of the reaction, thus causing loss of phosphorus, besides annoyance to the operator. He, therefore, prefers using a French tubulated glass retort, and this suggestion is adopted in the present process for Phosphoric Acid (see p. 93). (*A. J. P.*, 1867, p. 138.) Prof. G. F. H. Markoe (*Proc. A. P. A.*, 1875, p. 677) proposed a method for making phosphoric acid which is particularly adapted for making large quantities, yet works well in a smaller way. Into a flask (or stone jar) having double the capacity of the materials used, 12 troyounces of water, 2 troyounces of phosphorus, and 10 grains of iodine are placed, then 40 grains of bromine are cautiously dropped in;* when the reaction has ceased, the nitric acid is added; a glass funnel is adjusted in the neck of the flask, and a smaller inverted funnel set inside of it; the apparatus is placed in a stoneware dish, and surrounded with cold water or ice; the reaction takes place slowly and regularly. In about 24 hours, if all the phosphorus be not acted upon, heat may be applied until it disappears, and the excess of bromine, iodine, and nitric acid is driven off. The acid may then be diluted to the desired specific gravity. Prof. J. U. Lloyd (*N. R.*, July, 1880) suggests the use of alcohol, to

* Dr. W. H. Pile, of Philadelphia, met with a serious accident in preparing diluted phosphoric acid by this process, by adding the bromine too rapidly. (*A. J. P.*, 1875, p. 525.)

unite with the nitric acid to form nitrous ether, which is more volatile and thus easier to drive off.

Much dissatisfaction has been caused among pharmacists by the fact that diluted phosphoric acid frequently produces a white precipitate in solutions of ferric salts. An examination proved that this occurred only in the product of the second process in which the glacial acid is used. Experiments conducted by Louis Dohme and Prof. Remington seemed to indicate that the precipitation resulted from the presence of pyrophosphoric acid. (*Proc. A. P. A.*, 1874, pp. 431, 511; 1875, pp. 663, 670, 677.) Considerable difficulty was experienced in driving off all the nitric acid, and in the attempt to do so, the temperature became so elevated as to reconvert some of the tribasic acid to the bibasic form. This occurred slightly at 148·8° C. (300° F.), but to a much greater extent between 176·6° C. (350° F.) and 204·4° C. (400° F.). The diluted acid, made from phosphorus, can be brought to the boiling point of 232·2° C. (450° F.), and will then only produce a slight cloud with tincture of chloride of iron, but if diluted, when cool, with about half its bulk of cold water, which causes considerable elevation of temperature, it forms a clear solution. The same acid evaporated, heated to redness, allowed to congeal, and then dissolved in water, precipitated the iron solution. The addition of twenty per cent. of pyrophosphate of sodium to the same dilute acid made a preparation which in all respects resembled that made from the glacial acid; thus giving evidence that the presence of this contamination was the cause of the difference in the two preparations.

It has been suggested that red phosphorus might be substituted for common phosphorus, as producing the same results, with less danger of explosion; but when the officinal process is carefully followed in reference to the due dilution and to the use of a moderate heat, there is no danger to be apprehended.

The following is Schiff's table exhibiting the quantity of orthophosphoric acid and phosphoric anhydride contained in solutions of different densities at 15·5° C. (60° F.), from Bayley's *Chemist's Pocket Book*.

Specific Gravity.	Per Ct. H_3PO_4.	Per Ct. of P_2O_5.	Specific Gravity.	Per Ct. H_3PO_4.	Per Ct. of P_2O_5.	Specific Gravity.	Per Ct. H_3PO_4.	Per Ct. of P_2O_5.
1·0054	1	·726	1·1262	21	15·246	1·2731	41	29·766
1·0109	2	1·452	1·1329	22	15·972	1·2812	42	30·492
1·0164	3	2·178	1·1397	23	16·698	1·2894	43	31·218
1·0220	4	2·904	1·1465	24	17·424	1·2976	44	31·944
1·0276	5	3·630	1·1534	25	18·150	1·3059	45	32·670
1·0333	6	4·356	1·1604	26	18·876	1·3143	46	33·496
1·0390	7	5·082	1·1674	27	19·602	1·3227	47	34·222
1·0449	8	5·808	1·1745	28	20·328	1·3313	48	34·948
1·0508	9	6·534	1·1817	29	21·054	1·3399	49	35·674
1·0567	10	7·260	1·1889	30	21·780	1·3486	50	36·400
1·0627	11	7·986	1·1962	31	22·506	1·3573	51	37·126
1·0688	12	8·712	1·2036	32	23·232	1·3661	52	37·852
1·0749	13	9·438	1·2111	33	23·958	1·3750	53	38·578
1·0811	14	10·164	1·2186	34	24·684	1·3840	54	39·304
1·0874	15	10·890	1·2262	35	25·410	1·3931	55	40·030
1·0937	16	11·616	1·2338	36	26·136	1·4022	56	40·756
1·1001	17	12·342	1·2415	37	26·862	1·4144	57	41·482
1·1065	18	13·068	1·2493	38	27·588	1·4207	58	42·208
1·1130	19	13.794	1·2572	39	28·314	1·4301	59	42·934
1·1196	20	14.520	1·2651	40	29·040	1·4395	60	43·660

Properties. Diluted phosphoric acid is a colorless, inodorous, sour liquid, acting strongly on litmus, and possessing powerful acid properties. Although evaporated so as to become dense, it is not corrosive like the other mineral acids. Dr. Neubauer found that the strong acid, when pure and warm, was capable of dissolving oxalate of calcium. The officinal acid is not precipitated by chloride of barium or nitrate of silver. If precipitates are produced, chloride of barium indicates sulphuric acid or a sulphate; nitrate of silver, hydrochloric acid or a chloride. Strips of copper or silver are not affected by the acid, showing the absence of nitric acid; it is not colored by sulphuretted hydrogen, proving the general absence of metals; and albumen produces no precipitate with it, indicating the non-existence of metaphosphoric acid. If carbonate of sodium causes a precipitate, phosphate of calcium, or some other phosphate insoluble in water, is probably held in solution. It has been supposed that one-tenth of phosphorous acid would render the diluted acid dangerous to life; but experiments go far to show that this was an erroneous opinion, as half a drachm of that acid given to a dog produced no obvious poisonous effect. (See *A. J. P.*, 1858, p. 359.) Phosphorous acid may be detected by testing the medicinal acid with a solution of corrosive sublimate, which will be converted into calomel if this impurity be present. (Pagels, *Chem. Gaz.*, Jan. 15, 1857.)

Medical Properties and Uses. Diluted phosphoric acid is deemed tonic and refrigerant. It is free from astringency, and is certainly a valuable remedy in many cases of dyspepsia. Various properties have been ascribed to it; such as allaying pain and spasm, strengthening the sexual organs, preventing the morbid secretion of bony matter, and correcting phosphatic deposits in the urine. The last two properties are supposed to depend upon its power of dissolving phosphate of calcium. It has been recommended in hysteria, in diabetes, and in leucorrhœa when the secreted fluid is thin and acrid; it has also been used with asserted good results in low fevers, but probably has no action upon the system other than that upon the digestive organs, although Dr. A. Judson (*Ann. de Thérap.*, 1871 and 1872, p. 152) asserts that in doses of from one to three drachms it acts as a stimulant, increasing the force and frequency of the pulse, and causing headache and cerebral confusion,—effects which may be the result of gastric irritation. The dose is from twenty drops to a teaspoonful (1·25–3·75 C.c.), largely diluted with water.

Off. Prep. Ammoniæ Phosphas, *Br.;* Syrupus Ferri Phosphatis, *Br.*

ACIDUM SALICYLICUM. *U. S.* *Salicylic Acid.*

$HC_7H_5O_3$; 138. (ĂÇ'Ị-DŬM SĂL-Ị-ÇY̆L'Ị-CŬM.) $HO, C_{14}H_5O_5$; 138.

Ortho-Oxybenzoic Acid, *E.;* Acide salicylique, *Fr.;* Salicylsäure, *G.*

In 1834 salicyl aldehyd (*salicylous acid*) was discovered by Pagenstecher in the flowers of *Spiræa Ulmaria.* In 1837, Piria and Ettling found that by oxidizing agents salicyl aldehyd was converted into a new body, salicylic acid, and in 1839, Löwig and Weidmann derived the latter principle directly from the flowers of the *Spiræa Ulmaria.* Shortly afterwards Prof. Procter (*A. J. P.*, 1843; Aug. 1875) discovered that the acid could be procured from the oil of wintergreen (*Gaultheria procumbens*). Modern research has shown that many essential oils contain methyl salicylate, of which ether, oil of wintergreen contains 90 per cent. When potassa is added, a new salt is formed, from which the acid is readily obtained by means of hydrochloric acid. Notwithstanding the discovery of this fact, and also the invention of still another process of manufacture by Ettling in 1845, salicylic acid remained so expensive as to be of no value in the arts until Kolbe and Lautemann discovered that it could be prepared by uniting phenol with carbonic acid through the instrumentality of sodium. The article now began to attract some attention, but remained beyond the reach of general use until Prof. Kolbe, continuing his researches, succeeded, in 1874 (*Journ. für Prakt. Chemie*, July, 1874), in producing it at a moderate cost.

Preparation. While salicylic acid may be prepared from salicin by fusion with potassium hydrate, or from oil of wintergreen by saponification with potassium hydrate solution, practically it is now obtained, according to Kolbe's patent, by treating sodium phenol (or carbolate) with carbon dioxide gas. For this purpose, the most concentrated caustic soda solution is evaporated with the corresponding amount of phenol to a dry powder, which is then heated to 100° C. (212° F.), while a stream of dry carbon dioxide gas is passed over it. The temperature is gradually raised to 180° C. (356° F.), increased to 220° C. (428° F.) as soon as phenol distils over, and finally raised to 250° C. (482° F.), until no more phenol distils. In t retort, the half of the phenol used remains as sodium salicylate, while the ot half has distilled over unchanged. The reaction is as follows: $2C_6H_5ONa + CO$ $C_6H_5OH + C_6H_4(ONa),COO,Na$.

The sodium salt thus obtained is dissolved in water, decomposed by hydroc acid, the salicylic acid filtered off, washed, and crystallized out of hot water, or purified by sublimation in a current of superheated steam. Salicylic acid has been also obtained synthetically from copper benzoate and water, which, when heated together in sealed tubes, yield cuprous oxide, free benzoic acid, and salicylic acid. (E. F. Smith, *Am. Chem. Jour.*, 2, p. 338.) Dr. A. Rautert has found that the acid volatilizes with steam of 170° C. (338° F.), and has devised a process of purification based upon this, which yields at very little cost a beautiful product. Biel (*Pharm. Zeitsch. f. Russl.*, 1876) reports that the sublimed acid is liable to decompose spontaneously. For details the reader is referred to *A. J. P.*, 1875, p. 303, and 1876, p. 409. Dialyzed salicylic acid of beautiful appearance has been in the market since 1876. All traces of tarry matter can be removed by dialysis, and this acid is unexceptionable. Kolbe also obtained salicylic acid from the carbolates of barium and calcium, but the yield was less than when the soda salt was employed. The potassium phenol yielded only a trace of the salicylic acid, but an abundance of *paraoxybenzoic acid.* Salicylic acid may also be prepared as mentioned above by heating salicin with an excess of potash, but the plan of Kolbe has completely superseded all others.

Properties. Salicylic acid, when pure, occurs as a snow-white crystalline powder, free from odor, and also from taste, but leaving a sense of astringency on the tongue and of irritation in the fauces, with an increased flow of saliva. "Fine, white, light, prismatic, needle-shaped crystals, permanent in the air, free from odor of carbolic acid, but sometimes of a slight aromatic odor, of a sweetish and slightly acrid taste and an acid reaction." *U. S.* To the mucous membrane of the nose it is irritating, and will sometimes produce sneezing. It crystallizes out of its hot watery solution on cooling in slender, often very long needles, and on the spontaneous evaporation of its alcoholic solution in large four-sided prisms. It is strongly acid, acting decisively on blue litmus, and forming salts not only with alkalies, but also with metallic oxides. Salicylic acid is "soluble in 450 parts of water and in 2·5 parts of alcohol at 15° C. (59° F.); in 14 parts of boiling water; very soluble in boiling alcohol; also soluble in 2 parts of ether, in 2 parts of absolute alcohol, in 3·5 parts of amylic alcohol, and 80 parts of chloroform.* When heated to about 175° C. (347° F.) the crystals melt, and at about 200° C. (392° F.) they begin to sublime; at a higher temperature they are volatilized and decomposed, with odor of carbolic acid. The aqueous solution is colored intensely violet-red by test-solution of ferric chloride." *U. S.* When heated rapidly it is converted into carbolic and carbonic acids. According to Dr. Charles B. Goldsborough (*Inaugural Thesis*), its exact solubilities are as follows: In cold spring water, 1 in 600; in boiling water, 1 in 100, only 1 in 300 remaining on cooling, unless the boiling has been continued for fifteen or twenty minutes, when the acid will be retained in the proportion of 1 in 150 or 200; in alcohol, 1 in 2; ether, 1 in 5; hot oil of turpentine, 1 in 5, solidifying on cooling. It is stated that, by careful heating, glycerin can be made to dissolve 1 part in 50, and that the solution not only remains clear on cooling, but also may be diluted with water without separating. (*A. J. P.*, 1875, p. 212.) Dr. Goldsborough also affirms that a mixture of the acid with alcohol, 1 to 10, may be diluted with 150 parts of water without crystallizing. By the presence of various neutral salts, its solubility is increased without its antiseptic value being interfered with. Thus:

Mixed	with	1	part	potassium nitrate,	it dissolves in	50	parts	cold water.
"	"	1½	"	ammonium citrate,	"	60	"	" "
"	"	2	parts	sodium sulphite,	"	50	"	" "
"	"	2	"	sodium phosphate,	"	50	"	" "
"	"	2½	"	sodium phosphate,	"	12½	"	" "

(Allen, *Commerc. Org. Analysis*, 1879, p. 344.)

On distilling salicylic acid or one of its salts with wood-spirit and sulphuric acid,

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* Prof. Emlen Painter proposes a strong solution whereby two grains of salicylic acid can be given in a teaspoonful of solution by simply dissolving 32 grains of the acid in 2 fluidounces of solution of acetate of ammonia. (See also *N. R.*, 1876, pp. 9, 204, and *P. J. Tr.*, Nov. 25, 1876.) *Elixir of salicylic acid* may be prepared by adding the desired quantity of this solution to simple elixir.

acid methyl salicylate is formed, having an agreeable aromatic odor. The reaction with ferric salts is much more delicate (1 in 100,000) than that of phenol with the same reagent (1 in 3000). Commercial salicylic acid is often very impure. Chloride of sodium, carbolic acid, cresotic acid, and oxybenzoic and para-oxybenzoic acids are the usual impurities. The first of these substances remains on igniting the acid. · Carbolic acid may be detected by nearly neutralizing the sample with soda and agitating the liquid with ether. On evaporating, the ethereal liquid leaves the carbolic acid recognizable by its smell and taste. (Allen, *Commerc. Org. Anal.*, p. 347.)

The most sensitive test for it is a ferric salt, with which it develops a beautiful violet color. Goldsborough states that to insure the delicacy of this reaction it is necessary that the iron salt be perfectly neutral; also that with this precaution he has clearly detected 1 part of the acid in 400,000 parts of water. On the addition of ammonia the violet color is changed to a reddish brown, then to an orange, then to a permanent greenish yellow. Sulphuric and nitric acids change the violet to a light brown (*Goldsborough*). It must be remembered that salicylous acid reacts similarly with ferric salts. Salicylous acid, however, precipitates the potassic or ammonio-nitrate of silver white, the salicylic acid yellow. Kolbe recommends a simple test to detect impurities. A little of the acid is dissolved in 10 times its weight of strong alcohol, and the solution allowed to evaporate spontaneously from a watch crystal. If the salicylic acid which remains in the dish be perfectly colorless, the acid is strictly pure; it should not be of a brown color, although a slight yellowish color would not indicate sufficient impurity to affect its medicinal value. Hager states that pure salicylic acid equal in volume to the size of a bean will yield, after agitation with about 5 C.c. of pure sulphuric acid, a colorless solution, while others which yielded a white residue from the alcoholic solution, rendered yellowish to brown-yellow solutions. (*Pharm. Centralbl.*, 1876, No. 51; *A. J. P.*, June, 1877.)

By distilling with alcohol and strong sulphuric acid, salicylic acid forms methyl- and ethyl-salicylic acids.

Tests. "A solution of 1 part of Salicylic Acid in 10 parts of alcohol, mixed with a few drops of nitric acid, should not become turbid upon the addition of a few drops of test-solution of nitrate of silver (absence of hydrochloric acid). A saturated solution in absolute alcohol, when allowed to evaporate spontaneously in an atmosphere free from dust, should leave a perfectly white crystalline residue, without a trace of color at the points of the crystals (absence of organic impurities; also of iron). On agitating a portion of Salicylic Acid with 15 parts of concentrated sulphuric acid, no color should be imparted to the latter within 15 minutes (foreign organic matter). If 5 C.c. of a saturated aqueous solution of Salicylic Acid be poured into a test tube, into which had been introduced, shortly before, a crystal of chlorate of potassium and 2 C.c. of hydrochloric acid, and some water of ammonia be now carefully poured on top, the latter should not assume a reddish or brownish tint (absence of carbolic acid)." *U. S.*

Medical Properties and Uses. Salicylic acid was originally brought to the notice of the profession on account of its inhibitory influence on putrefaction. Kolbe found that 0·04 per cent. had great influence in preventing souring of milk. Bucholz found that 0·15 per cent. of the acid is sufficient to prevent the development of bacteria in ordinary organic mixtures, and that the influence of 0·005 per cent. is plainly visible; 0·3 to 0·4 per cent. of the acid killed bacteria in vigorous growth. (*Arch. Exper. Path. u. Pharm.*, Bd. iv.) The salicylate of sodium was about equal to the pure acid, 0·4 per cent. destroying the bacteria. In the preservation of urine, Meyer and Kolbe found that one part of salicylic acid to two thousand of urine was sufficient to prevent putrefaction. (*Journ. für Prakt. Chem.*, Bd. xii.) According to Kolbe and others, salicylic acid arrests or prevents the action of the non-organized organic ferments. Thus, it will prevent the development of the hydrocyanic acid by the action of emulsin upon amygdalin in the presence of water, and will also inhibit the formation of the volatile oil of mustard. Dr. Miller found that one per cent. of salicylic acid was sufficient to check the action of ptyaline upon starch, thus equalizing in power ten per cent. of carbolic acid. He also found that 0·2 per cent. of salicylic acid affected outside of the body the digestive action of pepsin; but it must be remembered that large doses of it taken internally have no perceptible influence on gastric digestion, although in certain diseases they do seem to control fermentation of the gastro-intestinal contents. The experience of surgeons is in accord with these facts, and there can be no doubt that salicylic acid is capable of accomplishing much in antiseptic surgery, but it does not seem to be replacing carbolic acid, as it at one time bade fair to do. Its freedom from odor and comparative freedom from poisonous and irritant properties are certainly strong recommendations; nevertheless, carbolic acid is more generally employed, and Mr. Callender, after twelve months' trial in the wards of St. Bartholomew's Hospital, has formally condemned salicylic acid as much inferior to carbolic acid. (*Trans. London Clin. Soc.*, ix.) Thiersch's *salicylic acid wadding* for hermetically sealing wounds is made by dissolving two ounces of the acid in two pints of alcohol (sp. gr. 0·83), diluting with twenty pints of water at 158° to 178° F., saturating with this six pounds and eight ounces of cotton batting deprived of oily matter, and afterwards drying. This wadding contains 3 per cent. of the acid; for some purposes a stronger batting, containing 10 per cent., is prepared. When the wound or abscess is discharging profusely, jute is substituted for the cotton batting, because it is much more permeable to pus. An efficient ointment may be prepared by dissolving one and a half parts of the acid in two parts of alcohol and adding lard, or the solubility of the drug in glycerin may be taken advantage of. The following solutions are used in St. Bartholomew's Hospital. Phosphate of sodium three parts; salicylic acid one part; water fifty parts.—Salicylic acid one part; olive oil forty-nine parts.—Salicylic acid one part; bicarbonate of sodium half part; water one hundred parts.—Salicylic acid ten parts; borax eighteen parts; water one hundred parts. A 25 per cent. solution, which will bear dilution with water or alcohol, may be prepared according to the following formula. ℞ Acid. salicyl. ʒii; Sodii biborat. ʒi; Glycerinæ q. s. Mix the acid and borax with four fluidounces of glycerin; heat gently until dissolved; then add enough glycerin to make one fluidounce. Prof. Thiersch has found that the drug cannot be employed for cleaning surgical instruments, because it corrodes the steel.

When salicylic acid is given to man in doses just sufficient to manifest its presence, symptoms closely resembling those of cinchonism result. These are fulness of the head, with roaring and buzzing in the ears. After larger doses, to these symptoms are added distress in the head, or positive headache, disturbances of hearing and vision (deafness, amblyopia, partial blindness), and excessive sweating. According to Reiss (*Berliner Klin. Wochenschrift*, 1875, p. 674), decided fall of temperature without alteration of the pulse also occurs; but this is denied by other observers. The actions upon the system of the acid and of its sodium salts (also ammonium salt, Martenson, *Petersb. Med. Zeitschrift*, 1875, p. 343) appear to be identical, and, as several cases of poisoning with one or other of these agents have occurred, we are able to trace the toxic manifestations. Along with an intensification of the symptoms already mentioned, there are ptosis, deafness, strabismus, mydriasis, disturbance of respiration, excessive restlessness passing into delirium, slow laboring pulse, olive-green urine, and involuntary evacuations. In some cases the temperature has remained about normal, but in others has approached that of collapse. The respiration seems to be characteristic, it being both quickened and deepened, often sighing. Sweating usually is very free, and the urine early becomes albuminous. Various local evidences of vaso-motor weakness may supervene, such as rapidly appearing bed-sores at points subjected to pressure, and transitory dark colored maculæ on various parts of the body. In several cases death was probably produced by the acid, although there is scarcely one instance which is beyond doubt. In certain cases the mental disturbance has been strangely prolonged, lasting for eight days. In some instances it is cheerful, in others melancholic in type. It is stated that upon drunkards the acid acts very unfavorably, violent delirium being an early symptom of its influence.

Upon the lower mammals the drug acts very much as it does upon man, but we have not sufficient knowledge to enable us to frame a complete theory of its action. It undoubtedly affects very markedly the nerve centres, and, in sufficient dose, seems to be a paralyzant to all the higher nerve tissue. The earlier cerebral symptoms and the quickening of the respiration indicate that it stimulates the centres at the base of the brain before overwhelming them. Small doses seem to have very little influence upon the arterial pressure, although Danewsky affirms that moderate doses produce vaso-motor spasm of centric origin, with consequent rise of pressure. After toxic doses the force of the circulation is decreased chiefly, according to the researches of Köhler and of Danewsky, by a direct depression of the heart itself.

Salicylic acid is undoubtedly absorbed; probably in the form of a salicylate. It is eliminated chiefly by the kidneys, appearing in the urine soon after its administration, but escaping only slowly from the system. According to Byanon, it is excreted partly as salicyluric acid, partly as a form of salicin, and he believes to some extent as oxalic acid. Urine which had been passed some hours after the ingestion of a dose polarized to the left. Dr. A. E. Stuart (*Lond. Practitioner*, vol. xviii. p. 425), after so small a dose as nine grains of the acid, saw free, distinct crystals of salicyluric acid in the urine. It is possible that such of the salicylic acid as escapes unchanged from the kidney may, as first excreted, be in the form of a salicylate, but be set free by the acid of the urine. The green coloration of the urine characteristic of poisoning by this substance is stated not to be due to the presence of a derivative of the acid, but to the excessive formation of indican or allied coloring principle.

In health therapeutic doses of salicylic acid have no constant influence upon the bodily temperature, but in febrile disorders its powers are beyond question. The first effect of a single antipyretic dose in fever is usually a profuse sweat, which may appear fifteen minutes after the ingestion of the remedy. (Ewald, *London Practitioner*, vol. xvi. p. 200.) Very shortly after this the temperature begins to fall, and, according to Justi (*Centralblatt für Chirurgie*, 1876, p. 629), the depression reaches its maximum in about six hours. The sweating is profuse and exhausting, amounting, according to Ewald, not rarely to seven hundred and fifty grammes. The perspiration can scarcely be the only factor in the reduction of temperature, as there appears to be no relation between its amount and the degree of the fall, and it usually ceases before the latter reaches its maximum. The antipyretic dose employed varies somewhat. Ewald gives as a minimum to the adult seventy-five grains, repeated in five hours if necessary; Justi, from ninety to one hundred and twenty-five grains. The question as to whether good is achieved in fevers by its administration is, of course, entirely separate from that as to its power of reducing temperature. It is certainly possible for a drug to lower the fever-heat, and yet to do far more harm than good, and the evidence at hand does not yet seem sufficient to decide as to the value of the drug in typhoid and other allied febrile affections. This use of the remedy has not, however, gained ground, in this country at least, and must be considered doubtful. The possession of very marked antiperiodic powers has been claimed for salicylic acid, but experience has not substantiated this claim. In rheumatism the remedy is the most valuable one known. Although some cases do not seem to yield to the drug, in the great majority of instances improvement sets in within twenty-four hours, and is rapidly followed by disappearance of the pain aud fever. The dangers of cardiac and cerebral complications are certainly lessened, but not altogether done away with. In excessive *rheumatic hyperpyrexia* it cannot be depended upon to the exclusion of the cold bath. Jaccoud states (*Progrès Méd.*, 1877, pp. 528, 745) that he has found it of great service in *chronic rheumatism;* but the general testimony appears to show that it is much less certain in the chronic than in the acute disorder. In accord, however, with the French professor, we have found it efficient in chronic cases. Jaccoud also states that in acute *gout* it acts with extraordinary effect. As in cases of habitual gout the kidneys are often seriously affected, the urine should always be examined, and if it be found albuminous the remedy should be withheld. The dose of salicylic acid in acute rheumatism may be set down as a drachm in the twenty-four hours, although it is employed by some practitioners in much larger doses. It may be given in powder, but is best administered in the form of the salicylate of sodium (fifteen grains five times in twenty-four hours), which is equally efficacious and much less irritant to the stomach than is the acid. If ringing of the ears or other evidences of intoxication appear, the remedy should at once be partially or entirely withdrawn.

ACIDUM SULPHURICUM. *U.S., Br.* *Sulphuric Acid.*

H_2SO_4; 98. (ĂÇ′Ị-DŬM SŬL-PHŪ′RỊ-CŬM.) HO,SO_3; 49.

"A liquid, composed of not less than 96 per cent. of absolute Sulphuric Acid [**H_2SO_4; 98**—HO,SO_3; 49], and not more than 4 per cent. of Water." *U. S.* "It contains 96·8 per cent. by weight of the Sulphuric Acid, HO,SO_3, and corresponds to 79 per cent. of anhydrous sulphuric acid, SO_3." *Br.*

Acidum Sulfuricum, *P.G.;* Oil of Vitriol, Vitriolic Acid; Acide sulfurique, Huile de Vitriol, *Fr.;* Vitriolöl, Schwefelsäure, *G.;* Acido solforico, *It.;* Acido sulfurico, *Sp.*

Preparation. Sulphuric acid is obtained by burning sulphur or iron pyrites, FeS_2, and allowing the product of combustion, SO_2, to mix with nitrous fumes obtained from the decomposition of nitre, which change SO_2 into SO_3, and this uniting with steam yields H_2SO_4. If the sulphur were burned by itself, the product would be sulphurous oxide, which contains only two-thirds as much oxygen as sulphuric oxide. The object of the nitre is to furnish, by its decomposition, the requisite additional quantity of oxygen. To understand the process, it is necessary to remember that several of the oxides of nitrogen have oxidizing power. Thus, the main reactions of the sulphuric acid process are universally conceded to be: $2SO_2 + N_2O_4 = 2SO_3 + N_2O_2$. $SO_3 + H_2O = H_2SO_4$. $N_2O_2 + O_2 = N_2O_4$; in which the sulphurous oxide, from the burning pyrites or sulphur, is oxidized to sulphuric oxide by the nitrogen tetroxide, which readily parts with two atoms of oxygen to such bodies as sulphurous oxide, and then takes two atoms of oxygen again from the atmosphere, regenerating the original tetroxide. The nitrogen tetroxide thus acts simply as a carrier of atmospheric oxygen, whereby the SO_2 is changed into SO_3. This latter compound then unites with steam to form H_2SO_4, the final product.

If the supply of steam be insufficient, at the same time white crystals (*lead chamber crystals*) are observed to form, which have the composition $HSO_3(NO_2)$, and whose formation is explained by the following reactions: $2SO_2 + H_2O + N_2O_3 + O_2 = 2HSO_3(NO_2)$; when steam enters in larger amount they disappear with formation of sulphuric acid, while red fumes are given off, thus: $2HSO_3(NO_2) + H_2O = 2H_2SO_4 + N_2O_3$. In this case, therefore, nitrous oxide, N_2O_3, assists in the oxidation.

Preparation on the Large Scale. The manufacture of this most important chemical has grown to enormous proportions. In England, where it is manufactured in largest amount, the present annual production is over 850,000 tons, nearly all of which is made from pyrites. In this country Sicilian sulphur is used, thereby giving a product practically free from arsenic, which is not the case with the acid made from pyrites. As carried out in England, the process is as follows. Beginning with the pyrites-kilns, or burners, the broken mineral is placed in moderate-sized lumps on the bars of the burners, which have previously been heated to redness, and when the burning is once started, the fire is kept up by placing a new charge on the top of that nearly burned out. The ordinary charge for each burner of pyrites, containing about 48 per cent. of sulphur, is 5 to 6 cwt., which is burnt out in twenty-four hours. The hot sulphur dioxide and air are drawn from the pyrites-burners through the whole system of tubes, towers, and chambers by help of the powerful draught from a large chimney, which is placed in connection with the apparatus. These gases then pass either into a tall tower (called the Glover or denitrating tower), where they meet a descending stream of strong sulphuric acid charged with nitrous fumes, which at this moment of descent is mixed with a weaker sulphuric acid, thereby liberating the nitrous fumes, and these then mix with the sulphur dioxide and air, or they are charged with nitrous fumes direct from the nitre pots, where a mixture of Chili saltpetre and sulphuric acid liberates them. The mixed gases are then delivered at a temperature of about 75° C. (167° F.) into the first of the leaden chambers. These chambers, of which there are three, are now made of much larger size than was formerly the case, having often a capacity of 38,000 cubic feet.

Here the gases meet jets of steam and deposit liquid sulphuric acid, as also in the second chamber. In the third or exhaust chamber all the sulphur dioxide should have been converted into sulphuric acid, and red nitrous fumes must always be visible. These must not be lost, but are drawn into a so-called Gay-Lussac tower filled with coke, over which a finely-divided shower of strong acid is allowed to fall. The nitrous fumes are absorbed by this, and give the so-called nitrated acid used as before mentioned in the Glover tower. The acid obtained in the lead chamber has a sp. gr. of 1·55, or contains 64 per cent. of H_2SO_4. The acid which comes from the Glover tower (or, in case this is not used, is obtained by further concentration of chamber acid in leaden pans) has a sp. gr. of 1·71, and contains 78 per cent. H_2SO_4. The strongest acid must be procured by still further concentration in glass or platinum vessels, and will contain 98 per cent. H_2SO_4. (Roscoe and Schorlemmer, *Chem.*, vol. i. pp. 321–338.)

According to theory, 100 parts of sulphur burnt should yield 305·9 parts of pure sulphuric acid. In practice the yield is 290–294. The amount of nitrate of sodium used varies very much. Manufacturers who employ Glover and Gay-Lussac towers require from 3·5 to 6·5 parts of nitrate for every 100 of sulphur burnt, while works unprovided with these appliances may take from 12 to 13 parts. (*Roscoe and Schorlemmer*, vol. i. p. 337.)

The process for making sulphuric acid by the combustion of sulphur with nitre was first mentioned by Lemery, and afterwards put in practice by an English physician, of the name of Ward. As practised by him, the combustion was conducted in very large glass vessels. About the year 1746, the great improvement of leaden chambers was introduced by Dr. Roebuck, of Birmingham, where the first apparatus of this kind was erected. In consequence of this improvement, the acid immediately fell to one-fourth of its former price.

The only way to obtain pure sulphuric acid is by distillation. Owing to the high boiling point of this acid, the operation is rather precarious, in consequence of the danger of the fracture of the retort from the sudden concussions to which the boiling acid gives rise. Dr. Ure recommends that a retort of the capacity of from two to four quarts be used in distilling a pint of acid. This is connected, by means of a wide glass tube three or four feet long, with a receiver surrounded with cold water. All the vessels must be perfectly clean, and no luting employed. The retort is then gradually heated by a small furnace of charcoal, or, what is better, by means of a sand-bath, the retort being buried in the sand up to the neck. It is useful to put into the retort a few sharp-pointed pieces of glass, slips of platinum foil, or clay tobacco-pipe tubes, with the view of diminishing the shocks produced by the acid vapor. The distilled product ought not to be collected until a dense grayish white vapor is generated, the appearance of which is a sign that the pure concentrated acid is coming over. If this vapor should not immediately appear, it shows that the acid subjected to distillation is not of full strength; and the distilled product, until this point is attained, will be an acid water. In the distillation of sulphuric acid, M. Lembert uses fragments of the mineral called quartzite, instead of pieces of glass or platinum foil. After a time the fragments get worn, and must be changed.

What is said above relates to the mode of preparing common sulphuric acid; but there is another kind, known on the continent of Europe by the name of the *fuming sulphuric acid of Nordhausen*, so called from its properties, and a place in Saxony where it is largely manufactured. This acid is obtained by distilling dried sulphate of iron in large stoneware retorts, heated to redness, and connected with receivers of glass or stoneware. The fuming acid distils over, and ferric oxide is left in the form of *colcothar* or *polishing rouge*, a material used for polishing metals, particularly gold and silver. The formula usually given to this product is $H_2S_2O_7$ or $H_2SO_4 + SO_3$. This would demand about 45 per cent. of sulphuric oxide or SO_3. In fact, the so-called Nordhausen acid seldom contains more than 10 per cent. of SO_3, and to obtain that demanded by the formula a re-distillation is necessary. This product is semi-solid, and is now obtainable in commerce put up in sealed glass flasks. Its sale has been largely curtailed lately owing to the introduction into commerce of the *anhydride* under the name of *Solid Sulphuric Acid.* When moisture is rigidly excluded, the acid has little action on metals, and it is put up in soldered boxes of tinned sheet-iron; it is used largely in the arts in the manufacture of artificial alizarin. *Persulphuric Oxide*, S_2O_7, may be obtained in solution by carefully mixing chlorine water with strong sulphuric acid. (*Journ. de Pharm et Chim.*, 1878, p. 168.)

Properties. Sulphuric acid (*hydrogen sulphate*), commonly called *oil of vitriol*, is a dense, colorless, inodorous liquid, of an oily appearance, and strongly corrosive. On living tissues it acts as a powerful caustic. It unites with water in all proportions, and much heat is evolved on the mixture of the two fluids. When pure, and as highly concentrated as possible, as manufactured in leaden chambers, its sp. gr. is 1·840 (1·8485, Ure), a fluidounce weighing a small fraction over 14 drachms. If its density exceed this, the presence of sulphate of lead or other impurity may be inferred. Kohlrausch (*Pogg. Ann. Erganzungs*, Bd. viii. p. 675, Lunge) found the sp. gr. of *pure sulphuric acid*, *real hydrate*, to be 1·8342, and believes that a higher sp. gr. than this is due to impurities (probably lead sulphate). The commercial acid is seldom of this strength. According to Mr. Phillips, it has generally the sp. gr. 1·8433, and this is about the strength of the Br. acid, of which the sp. gr. is stated to be 1·843. The sp. gr. of the officinal acid is permitted to be 1·840, slightly less than that of U. S. P. 1870, which was 1·843. There is no doubt that a thorough investigation should be made to reconcile the discordant views of investigators on this question of specific gravity, and to ascertain the truth. The strong acid boils at 327° C. (620° F.), and freezes at —26° C. (—15° F.). When diluted, its boiling point is lowered. When of the sp. gr. 1·78, it deposits crystals of the formula $H_2SO_4 + H_2O$ at about 0° C. (32° F.), and hence it is hazardous for manufacturers to keep an acid of that strength in glass vessels in cold weather, as they are liable to burst. With salifiable bases it forms a numerous class of salts, called sulphates. It acts powerfully on organic bodies, whether vegetable or animal, depriving them of the elements of water, developing charcoal, and turning them black. A small piece of cork or wood, dropped into the acid, will on this principle render it of a dark color. It absorbs water with avidity, and is used as a desiccating agent. It has been ascertained by Professors W. B. and R. E. Rogers to be capable of absorbing 94 per cent. of carbonic acid gas, a fact having an important bearing on analytical operations. When diluted with distilled water, it ought to remain limpid; and, when heated sufficiently in a platinum spoon, the fixed residue should not exceed one part in 400 of the acid employed. When present in small quantity in solution, it is detected unerringly by chloride of barium, which causes a precipitate of sulphate of barium. The most usual impurities in it are arsenious acid and sulphate of lead; the former derived from the presence of arsenides in the pyrites, where that has been used in the production of the sulphurous oxide; the latter from the leaden boilers in which the acid is concentrated. Sulphate of sodium or of magnesium is said to have been added to increase its specific gravity. "When heated on platinum foil, it is vaporized without leaving a residue. If the Acid be warmed with sugar, it blackens the latter; if diluted with 5 volumes of water, the liquid yields, with test-solution of chloride of barium, a white precipitate insoluble in hydrochloric acid." *U. S.* Occasionally nitre is added to render dark samples of acid colorless. This addition gives rise to the impurity of sulphate of potassium. These impurities often amount to 3 or 4 per cent. The commercial acid cannot be expected to be absolutely pure; but, when properly manufactured, it should not contain more than one-fourth of 1 per cent. of impurity. The fixed impurities are discoverable by evaporating a portion of the acid, when they will remain. If sulphate of lead be present, the acid will become turbid on dilution with an equal bulk of water. This impurity is not detected by sulphuretted hydrogen, unless the sulphuric acid be saturated with an alkali. If only a scanty muddiness arise, the acid is of good commercial quality.

Other impurities occur in the commercial sulphuric acid. The several oxides of nitrogen are always present in greater or less amount. They may be detected by gently pouring a solution of ferrous sulphate over the commercial acid in a tube, when the solution, at the line of contact, will acquire a deep red color, due to the liberation of nitrogen tetroxide. Another method is to pass into tincture of guaiac the gases proceeding from the suspected acid heated with iron filings. If nitrogen tetroxide be present, the tincture becomes blue. The commercial acid, however, is not to be rejected unless the test shows the presence of nitrogen tetroxide in unusual quantity. Nitrogen tetroxide is an injurious impurity when the sulphuric acid is employed in the manufacture of hydrochloric acid, which is decomposed by the nitrogen tetroxide with evolution of chlorine. To remove this impurity it was recommended by Wackenroder, before distilling it, to heat the acid with a little sugar. This and the N_2O_4 mutually decompose each other, and the products are dissipated by heat. For the removal of the nitrogen acids generally, Dr. J. Löwe recommends the addition, to the heated sulphuric acid, of small portions of dry oxalic acid, so long as it exhibits a yellow tinge. The oxalic acid is decomposed into carbonic acid and oxide, the latter of which, in becoming carbonic acid, deoxidizes and destroys the nitrogen acids. A slight excess of oxalic acid produces no harm, as it is immediately decomposed. Perhaps a better method of getting rid of these acids is to distil with a little sulphate of ammonium. When sulphate of potassium is fraudulently introduced into the acid to increase its density, it may be detected by saturating the acid with ammonia, and heating to redness in a crucible; when sulphate of ammonium will be expelled, and the sulphate of potassium left.

Arsenic is sometimes present in sulphuric acid. In consequence of the high price of Sicilian sulphur, most English manufacturers have employed iron pyrites for the purpose of furnishing the necessary sulphurous acid in the manufacture of oil of vitriol. As the pyrites usually contains arsenic, it happens that the sulphurous acid fumes are accompanied by arsenious oxide, and thus the sulphuric acid becomes contaminated. From 22 to 35 grains of arsenious acid have been found in 20 fluidounces of oil of vitriol, of English manufacture, by Dr. G. O. Rees and Mr. Watson, and a still larger proportion by Mr. J. Cameron, of South Wales. To detect this impurity, the acid, previously diluted with five or six measures of distilled water, must be examined by Marsh's test. (See *Acidum Arseniosum.*) But a more easy method, said to be nearly as delicate, is that of Bettendorff. A little stannous chloride is treated, in a shallow dish, with pure hydrochloric acid (sp. gr. 1·12) until dissolved. The suspected sulphuric acid is then added, drop by drop, to the solution, the vessel being shaken on each addition. Considerable heat will be produced, and the liquid, if no arsenic be present, will remain clear; but, if the acid be in the slightest degree contaminated with the poison, first a yellow, then a brown, and finally a dark grayish brown color will appear, and the liquid become turbid. (*N. R.*, April, 1873, p. 367.) To separate the arsenious acid, Dr. J. Löwe recommends that the concentrated sulphuric acid should be gently heated in a flat dish, in a place where the fumes may be carried off, and then treated with small quantities of finely powdered chloride of sodium, constantly stirred in with a glass rod. By the reaction between the arsenious acid and disengaged hydrochloric acid, ter-chloride of arsenic is formed, which, being volatile, is separated by the heat. The heat is afterwards continued, to expel the excess of hydrochloric acid. This mode of purification introduces into the oil of vitriol a little sulphate of sodium. Buchner proposes a similar process; instead of chloride of sodium, employing hydrochloric acid, or a stream of the acid gas. This plan does not introduce sulphate of sodium into the acid; but is less convenient than that of Löwe, and, when the aqueous hydrochloric acid is used, tends to weaken the oil of vitriol by introducing water. Experience, however, has shown that neither plan can be entirely relied on. An excess of sulphuric acid is said to prevent the formation of the chloride of arsenic. (See *A. J. P.*, 1860, p. 88.) For other methods of detecting arsenic in sulphuric acid, see *N. R.*, 1876, p. 297; 1880, p. 101. The sulphuric acid manufactured in the United States, being usually made from Sicilian sulphur, seldom contains arsenic. Dupasquier states that tin is sometimes present in commercial sulphuric acid, derived from the solderings of the leaden chambers; but this could scarcely happen now, as care is taken to avoid soldering, and to effect the union of the metal by fusion by means of the blow-pipe. It may be discovered by sulphuretted hydrogen, which precipitates sulphide of tin, convertible by nitric acid into the white insoluble stannic oxide. Should the precipitate be the mixed sulphides of arsenic and tin, the former would be converted by nitric acid into arsenic acid, and dissolved, and the latter into insoluble stannic oxide and left. Another impurity occasionally existing in French sulphuric acid is selenium, supposed to be derived from copper pyrites sometimes substituted for sulphur in the manufacture of the acid. For the mode of detecting and separating this impurity, see the *Journal de Pharmacie* (1872, p. 42). "To neutralize 2·45 Gm. diluted with about 10 volumes of water, should require not less than 48 C.c. of the volumetric solution of soda." *U. S.* As ordered by the Br. Pharmacopœia, "50·6 grains by weight, mixed with distilled water, require for neutralization 1000 grain-measures of *the volumetric solution of soda.*" *Br.* For a very delicate method of detecting sulphurous acid and the oxides of nitrogen in sulphuric acid, see Mr. Robert Warrington, *Chem. News* (Feb. 14, 1868).

Tests. "On pouring the acid into 4 volumes of alcohol, no precipitate should be formed (lead). If there be carefully poured upon it, in a test tube, a layer of freshly prepared test-solution of ferrous sulphate, no brownish or reddish zone should appear at the line of contact of the two liquids (nitric acid). When diluted with 10 volumes of water, no precipitate should be formed by the addition of an aqueous solution of sulphate of silver (hydrochloric acid), nor by hydrosulphuric acid (lead, arsenic, copper), nor by excess of water of ammonia (iron); nor should this liquid, containing excess of ammonia, leave any fixed residue on evaporation and gentle ignition (non-volatile metals). When considerably diluted and treated with test zinc, it evolves a gas which should not blacken paper moistened with test-solution of nitrate of silver (arsenious or sulphurous acid). To neutralize 2·45 Gm. of Sulphuric Acid, diluted with about 10 volumes of water, should require not less than 48 C.c. of the volumetric solution of soda." *U. S.*

The following table by Kolb shows how much hydrated sulphuric acid of the standard specific gravity and of oxide (SO_3) is contained in acid of any given density.

Kolb's table of Percentage and Specific Gravity of Sulphuric Acid.

Specific Gravity.	100 Parts contain at 15° C. (59° F.)		Specific Gravity.	100 Parts contain at 15° C. (59° F.)	
	H_2SO_4.	SO_3.		H_2SO_4.	SO_3.
1·000	0·9	0·7	1·308	40·2	32·8
1·007	1·9	1·5	1·320	41·6	33·9
1·014	2·8	2·3	1·332	43·0	35·1
1·022	3·8	3·1	1·345	44·4	36·2
1·029	4·8	3·9	1·357	45·5	37·2
1·037	5·8	4·7	1·370	46·9	38·3
1·045	6·8	5·6	1·383	48·3	39·5
1·052	7·8	6·4	1·397	49·8	40·7
1·060	8·8	7·2	1·410	51·2	41·8
1·067	9·8	8·0	1·424	52·6	42·9
1·075	10·8	8·8	1·438	54·0	44·1
1·083	11·9	9·7	1·453	55·4	45·2
1·091	13·0	10·6	1·468	56·9	46·4
1·100	14·1	11·5	1·483	58·3	47·6
1·108	15·2	12·4	1·498	59·6	48·7
1·116	16·2	13·2	1·514	61·0	49·8
1·125	17·3	14·1	1·530	62·5	51·0
1·134	18·5	15·1	1·540	64·0	52·2
1·142	19·6	16·0	1·563	65·5	63·5
1·152	20·8	17·0	1·580	67·0	54·9
1·162	22·2	18·0	1·597	68·6	56·0
1·171	23·3	19·0	1·615	70·0	57·1
1·180	24·5	20·0	1·634	71·6	58·4
1·190	25·8	21·1	1·652	73·2	59·7
1·200	27·1	22·1	1·671	74·7	61·0
1·210	28·4	23·2	1·691	76·4	62·4
1·220	29·6	24·2	1·711	78·1	63·8
1·231	31·0	25·3	1·732	79 9	65·2
1·241	32·2	26·3	1·753	81·7	66·7
1·252	33·4	27·3	1·774	84·1	68·7
1·263	34·7	28·3	1·796	86·5	70·6
1·274	36·0	29·4.	1·819	89·7	73·2
1·285	37·4	30·5	1·842	100·0	81·6
1·297	38·8	31·7			

Composition. The hydrated acid of the sp. gr. 1·842 (1·8485, Ure) consists of one mol. of oxide 80, and one mol. of water 18 = 98 mol. wt. As the hydrogen acts the part of a metal in the compound, the systematic name would be hydrogen sulphate. The oxide consists of one atom of sulphur 32, and three atoms of oxygen 48 = 80. The ordinary commercial acid consists, according to Phillips, of one mol. of oxide, and one and a quarter mol. of water. The hydrated acid of Nordhausen has a density as high as 1·89 or 1·9, and consists of two mols. of oxide, and one mol. of water ($2SO_3 + H_2O$). This acid is particularly adapted to the purpose of dissolving indigo for dyeing the Saxon blue. When heated gently in a retort, connected with a dry and refrigerated receiver, sulphuric oxide or anhydride distils over, and the common monohydrated acid remains behind. In performing this operation, much difficulty from concussion is avoided, and the product of oxide increased, by introducing a coil of platinum wire into the retort. The oxide may also be obtained by the action of phosphoric oxide on concentrated sulphuric acid, according to the method of Ch. Barreswil. The mixture must be made in a refrigerated retort, and afterwards distilled by a gentle heat into a refrigerated receiver. *Sulphuric oxide* (*solid sulphuric acid*) under 18° C. (64° F.) is in small colorless crystals, resembling asbestos. It is tenacious, difficult to cut, and may be moulded in the fingers like wax, without acting on them. Exposed to the air, it emits a thick opaque vapor of an acid smell. Above 18° C. (64° F.) it is a liquid, very nearly of the density 2.

Medical Properties. For the therapeutic powers and uses of sulphuric acid, when administered internally, see *Acidum Sulphuricum Dilutum.* Externally it is sometimes employed as a caustic; but, from its liquid form, it is very inconvenient for that purpose, and should be applied with caution. A plan, however, has been proposed by Prof. Simpson by which it becomes very manageable. This consists in mixing it with dried and powdered sulphate of zinc sufficient to give it a pasty consistence. *Michel's Paste* consists of strong sulphuric acid three parts, and finely powdered asbestos one part, thoroughly rubbed together. When mixed with saffron to the consistence of a ductile paste, Velpeau found it a convenient caustic, not liable to spread or be absorbed, and producing an eschar which is promptly detached. It is sometimes incorporated with charcoal. It is used also as an ointment, mixed with lard, in the proportion of a drachm to an ounce, in swellings of the knee-joint and other affections. Charpie, corroded by it, is a good application to gangrene.

Toxicological Properties. The symptoms of poisoning by this acid are the following. Burning heat in the throat and stomach, extreme fetidness of the breath, nausea and excessive vomitings of black or reddish matter, excruciating pains in the bowels, difficulty of breathing, extreme anguish, a feeling of cold on the skin, great prostration, constant tossing, convulsions, and death. Sometimes there is no pain whatever in the stomach; sensibility being apparently destroyed by the violence of the caustic action. The intellectual faculties remain unimpaired. Frequently the uvula, palate, tonsils, and other parts of the fauces are covered with black or white sloughs. The treatment consists in the administration of large quantities of magnesia, or, if this be not at hand, of solution of soap. The safety of the patient depends upon the greatest promptitude in the application of the antidotes. After the poison has been neutralized, mucilaginous and other bland drinks must be taken freely. According to Dr. Geoghegan, the acid may be detected, after death, in the blood and the parenchymatous viscera, especially the liver. It is found, not as a sulphate, but combined severally with the coloring matter and tissues.

The holes burnt in linen by sulphuric acid, so long as the texture is undisturbed, are distinguished from those produced by red-hot coals, by the paste-like characters of their edges.

Uses in the Arts. Sulphuric acid is more used in the arts than any other acid. It is employed to obtain many of the other acids; to extract soda from common salt; to make alum and sulphate of iron, when these salts command a good price, and the acid is cheap; to dissolve indigo; to prepare skins for tanning; to prepare phosphorus, chlorinated lime, sulphate of magnesium, etc. The arts of bleaching and dyeing cause its principal consumption.

Pharm. Uses. In preparing Acidum Citricum, *Br.;* Acidum Hydrochloricum, *Br.;* Acidum Hydrocyanicum Dilutum; Acidum Tartaricum, *Br.;* Chloroformum, *Br.;* Chloroformum Purificatum, *U. S.;* Ferrum Redactum, *Br.;* Pyroxylon, *U. S.;* Sodæ Phosphas, *Br.;* Sodæ Valerianas, *Br.;* Spiritus Ætheris Nitrosi.

Off. Prep. Acidum Sulphuricum Aromaticum; Acidum Sulphuricum Dilutum; Acidum Sulphurosum; Beberiæ Sulphas, *Br.;* Cupri Sulphas, *Br.;* Ferri Sulphas; Ferri Sulphas Granulata, *Br.;* Hydrargyri Sulphas, *Br.;* Liquor Ferri Persulphatis, *Br.;* Liquor Ferri Subsulphatis, *U. S.;* Liquor Ferri Tersulphatis, *U. S.;* Zinci Sulphas, *Br.*

ACIDUM SULPHURICUM AROMATICUM. *U. S., Br.* *Aromatic Sulphuric Acid.*

(ĂÇ′Ị-DŬM SŬL-PHŪ′RỊ-CŬM ĂR-Ọ-MĂT′Ị-CŬM.)

Tinctura Aromatica Acida, *P. G.;* Elixir Vitrioli Mynsichti *G.;* Elixir of Vitriol; Elixir vitriolique. Teinture (alcoolé) aromatique sulphurique. *Fr.;* Saure Aromatische Tinctur, Mynsicht's Elixir, *G.*

"Sulphuric Acid, *two hundred parts* [or two fluidounces]; Tincture of Ginger, *forty-five parts* [or one fluidounce]; Oil of Cinnamon, *one part* [or eight minims]; Alcohol, *a sufficient quantity,* To make *one thousand parts* [or twenty fluidounces]. Add the Sulphuric Acid gradually to seven hundred (700) parts [or fourteen fluidounces] of Alcohol, and allow the mixture to cool. Then add to it the Tincture of Ginger and the Oil of Cinnamon, and afterward enough Alcohol to make the product weigh *one thousand* (1000) *parts* [or measure twenty fluidounces.]" *U. S.*

"Take of Sulphuric Acid *three fluidounces,* or 2419 grains by weight; Rectified Spirit *two pints* [Imperial measure]; Cinnamon Bark, in coarse powder, *two ounces* [avoirdupois]; Ginger, in coarse powder, *one ounce and a quarter* [av.]. Mix the Sulphuric Acid gradually with the Spirit, add the Cinnamon and Ginger, macerate for seven days, agitating frequently, then filter." *Br.*

"It should be preserved in glass-stoppered bottles. Aromatic Sulphuric Acid has the sp. gr. 0·955, and contains about 20 per cent. of officinal Sulphuric Acid, partly in the form of Ethyl-sulphuric Acid. On diluting 9·8 Gm. of Aromatic Sulphuric Acid with 20 volumes of Water, and filtering, the filtrate (with washings) should require for complete neutralization not less than 36 C.c. of the volumetric solution of soda." *U. S.*

The U. S. acid is somewhat stronger than that of the British Pharmacopœia, and a very different preparation. The British has the sp. gr. 0·927; and "6 fluidrachms [Imp. meas.] or 304·2 grains by weight of it require for neutralization 830 grain-measures of the *volumetric solution of soda,* corresponding to 10·91 per cent. of anhydrous sulphuric acid. Six fluidrachms [Imp. meas.], therefore, correspond to 33·2 grains of anhydrous acid." *Br.*

A very important, and we think improper, change has been made in this preparation by the late Committee of Revision U S. P. 1880, who have adopted the plan recommended by Thomas N. Jamieson (*A. J. P.,* 1867, p. 201). This method entirely destroys the individuality of Aromatic Sulphuric Acid, and is preferred solely on account of the precipitation of some inert matter which takes place when sulphuric acid is brought into contact with the portions of cinnamon bark soluble in diluted alcohol; an objection not sufficient to warrant so radical a change in an old, well-known, and much used preparation.

Properties. Aromatic sulphuric acid of the older Pharmacopœias was of a deep reddish brown, but it is a straw-colored liquid when freshly prepared according to the direction of the U. S. Pharmacopœia of 1880, of a peculiar aromatic odor, and, when sufficiently diluted, of a grateful acid taste. It has been supposed by some to contain ethylic ether or sulphovinic acid, its main ingredients justifying such a suspicion; but the late Dr. Duncan, of Edinburgh, who originally held this opinion, satisfied himself that the alcohol and sulphuric acid, in the proportions here employed, do not generate a single particle of ethylic ether; and Prof. Attfield has shown that there is no ethyl-sulphuric acid in the officinal preparation. (*P. J. Tr.,* 1869, p. 471.) It cannot, however, be viewed merely as a sulphuric acid diluted with alcohol and containing the essential oils of ginger and cinnamon, for the difference in odor between fresh and old preparations is quite marked, and a peculiar and agreeable ethereal odor is developed by age.

Medical Properties and Uses. This valuable preparation, commonly called *elixir of vitriol*, is a simplification of *Mynsicht's acid elixir.* It is tonic and astringent, and affords an agreeable form of sulphuric acid for administration. It acts precisely as does the *Acidum Sulphuricum Dilutum.* The dose is from ten to thirty drops (0·6–1·9 C.c.), in a wineglassful of water, repeated two or three times a day. Care must be taken that the teeth are not injured.

Off. Prep. Infusum Cinchonæ Flavæ, *U.S.;* Infusum Cinchonæ Rubræ, *U.S.*

ACIDUM SULPHURICUM DILUTUM. *U.S., Br.* *Diluted Sulphuric Acid.*

(ĂÇ'Ị-DŬM SŬL-PHŪ'RỊ-CŬM DỊ-LŪ'TŬM.)

Acide sulphurique dilué, *Fr.;* Verdünnte Schwefelsäure, *G.*

"Sulphuric Acid, *one part* [one fluidounce]; Distilled Water, *nine parts* [sixteen and a half fluidounces]. Pour the Acid gradually, with constant stirring, into the Distilled Water, and preserve the product in glass-stoppered bottles. Diluted Sulphuric Acid contains 10 per cent. of officinal Sulphuric Acid, and has the sp. gr. 1·067 nearly. It should respond to the same reactions and tests as Sulphuric Acid. To neutralize 9·8 Gm. of diluted sulphuric acid should require 19·2 to 20 C.c. of the volumetric solution of soda." *U. S.*

"Take of Sulphuric Acid 7 *fluidounces* [Imperial measure]; Distilled Water *a sufficiency.* Dilute the Acid with 77 fluidounces of the Water, and when the mixture has cooled to 60° add more Water, so that it shall measure 83½ fluidounces. Or as follows:

"Take of Sulphuric Acid 1350 grains; Distilled Water *a sufficiency.* Weigh the Acid in a glass flask, the capacity of which, to a mark on the neck, is one pint [Imp. meas.], then gradually add Distilled Water until the mixture, after it has been shaken and cooled to 60°, measures a pint [Imp. meas.]. Sp. gr. 1·094. Six fluidrachms [Imp. meas.] or 359 grains by weight require for neutralization 1000 grain-measures of the *volumetric solution of soda*, corresponding to 10·14 per cent. of anhydrous sulphuric acid. Six fluidrachms, therefore, correspond to 40 grains of the anhydrous acid (one eq. of SO_3)." *Br.*

This preparation is sulphuric acid diluted to such an extent as to make it convenient for prescription. It is not exactly coincident in strength as directed in the two Pharmacopœias, the U. S. acid being weaker than the British, and slightly weaker than that formerly officinal; but the difference is not so great as to be of practical importance. The strong acid is added gradually to the water, to guard against the too sudden production of heat, which might cause the fracture of the vessel. During the dilution, when commercial sulphuric acid is used, the liquid becomes slightly turbid, and in the course of a few days deposits a grayish white powder, which is sulphate of lead, and from which the diluted acid should be poured off. This noxious salt is thus got rid of; but sulphate of potassium, another impurity in the strong acid, still remains. The presence of a little sulphate of potassium will do no harm; but, if it should be fraudulently introduced into the strong acid to increase its specific gravity, its amount may be ascertained by saturating the acid, after dilution, with ammonia, and expelling by a red heat the sulphate of ammonium formed. Whatever sulphate of potassium is present will remain behind. If the directions of the Pharmacopœias are strictly carried out, and the kind of sulphuric acid is used which is known in commerce as chemically pure, responding to the tests given under the head of *Acidum Sulphuricum*, the officinal manipulations will be all-sufficient.

Medical Properties and Uses. Diluted sulphuric acid is tonic, refrigerant, and astringent. It is given in typhoid fevers, and often with advantage. In the convalescence from protracted fevers it acts beneficially as a tonic, exciting the appetite and promoting digestion. As an astringent, it is employed in colliquative sweats, passive hemorrhages, and diarrhœas dependent on a relaxed state of the mucous membrane of the intestines, *i.e.*, in serous diarrhœas. In 1851, Mr. Buxton, of London, called attention to its great value in choleraic diarrhœas; his assertions have received abundant confirmation both in this country and in England. (See *Med. Times and Gaz.*, Oct. 1853; *Med. and Surg. Rep.*, ix. 199; *Phila. Med. Times*, iii. 649.) In incipient *cholera* it is an efficient remedy; diluted with water, it may be given every twenty minutes in ordinary cases, every quarter of an hour in severe cases. For bilious diarrhœa the acid is not a suitable remedy. In calculous affections attended with phosphatic sediments it is the proper remedy, being preferable to hydrochloric acid, as less apt, by continued use, to disorder the stomach. The dose is from ten to thirty drops (0·6–1·9 C.c.), three times a day, in a wineglassful of plain or sweetened water. It is added with advantage to infusions of cinchona, the organic alkalies of which it tends to hold in solution. As it is apt to injure the teeth, it is best taken by sucking it through a glass tube or quill. It is much less used in the United States than the elixir of vitriol. An elegant form of administration is the Compound Infusion of Roses, *U. S.* 1870.

Pharm. Uses. Potassæ Permanganas, *Br.*

Off. Prep. Atropiæ Sulphas, *Br.;* Beberiæ Sulphas, *Br.;* Infusum Rosæ Acidum, *Br.*

ACIDUM SULPHUROSUM, *U. S.*, *Br.* *Sulphurous Acid.*

(ĂÇ'Ị-DŬM SŬL-PHŪ-RŌ'SŬM.)

Acide sulfureux, *Fr.;* Schweflige Säure, *G.*

"A liquid composed of about 3·5 per cent. of Sulphurous Acid Gas [**SO_2; 64.**—SO_2; 32], and about 96·5 per cent. of Water." *U. S.*

"Sulphuric Acid, *fourteen parts* [or five fluidounces]; Charcoal, in coarse powder, *two parts* [or one and one-quarter ounces, av.]; Distilled Water, *one hundred parts* [or four pints]. Pour the Acid upon the Charcoal which has been previously introduced into a glass flask, and mix the two well together. By means of a glass tube and well-fitting corks, connect the flask with a wash-bottle, which is one-third filled with water, and fitted with a cork having three perforations. Into one of these perforations insert a safety tube, which should reach nearly to the bottom of the bottle; into the remaining perforation fit a glass tube, and connect it with a bottle which is about three-fourths filled by the Distilled Water. This tube should dip about an inch below the surface of the water. By means of a second tube connect this bottle with another bottle containing a dilute solution of carbonate of sodium, to absorb any gas which may not be retained by the distilled water. Having ascertained that all the connections are air-tight, apply a moderate heat to the flask until the evolution of gas has nearly ceased, and, during the passage of the gas, keep the bottle containing the Distilled Water at or below 10° C. (50° F.) by surrounding it with cold water or ice. Finally, pour the Sulphurous Acid into glass-stoppered, dark amber-colored bottles, and keep them in a cool and dark place." *U. S.*

"Take of Sulphuric Acid *four fluidounces;* Wood Charcoal, broken into small pieces, *one ounce;* Water *two fluidounces;* Distilled Water *twenty fluidounces.* Put the Charcoal and the Sulphuric Acid into a glass flask, connected by a glass tube with a wash-bottle containing the two fluidounces of Water, whence a second tube leads into an [Imperial] pint bottle containing the Distilled Water, to the bottom of which the gas-delivery tube should pass. Apply heat to the flask until gas is evolved, which is to be conducted through the Water in the wash-bottle, and then into the Distilled Water, the latter being kept cold, and the process being continued until the bubbles of gas pass through the solution undiminished in size. The product should be kept in a stoppered bottle, in a cool place." *Br.* The strength of this preparation has been reduced about one-half: the sulphurous acid of the U. S. P. 1870 contained about six per cent. of sulphurous acid gas, that now officinal 3·5 per cent. In our opinion there was no good reason for the change.

The processes of the two Pharmacopœias are essentially the same, and both are based upon that of Wittstein. The sp. gr. of the U. S. preparation is about 1·022, of the British, 1·04. Of the latter "34·7 grains mixed with an ounce of distilled water and a little mucilage of starch do not acquire a permanent blue color with the *volumetric solution of iodine* until 1000 grain-measures of the latter have been added." *Br.*

The rationale of the process is simple. When the sulphuric acid (H_2SO_4) and charcoal are heated together, two molecules of the former give up each an atom of oxygen to the latter, and there are thus produced sulphurous and carbonic acid gases, which, having been first passed through a wash-bottle containing a little water to absorb impurities, are received into the distilled water, where the sulphurous acid is absorbed, whilst the greater part of the carbonic acid escapes, $4H_2SO_4 + C_2 = 2CO_2 + 4H_2O + 4SO_2$. The excess of sulphurous acid gas which escapes absorption is in the U. S. process received into a solution of carbonate of sodium, and condensed. In the Br. process the point of saturation is roughly indicated by the bubbles formed by the escape of the gas from the distilled water being equal in size to those formed in the wash-bottle. If there be any difficulty in getting the solution up to the officinal strength, the proportionate amount of sulphuric acid and of charcoal should be increased, and care exercised that the gas pass through the water in an abundant stream. The direction to keep the acid in well-stoppered bottles, in a cool place, is necessary in consequence of the strong tendency of the gas to escape and to undergo oxidation. An incidental advantage of the U. S. process is the production of sulphite of sodium. Old sulphurous acid often contains sulphuric acid, which may be nearly all removed by the cautious addition of sulphite of barium and the removal by filtration of the precipitated sulphate.

According to Mr. W. L. Scott (*P. J. Tr.*, Oct. 1869, p. 217), the best results are obtained when sulphuric acid containing 75 per cent. of anhydrous acid is employed; when a too concentrated acid is used, a part of it is entirely reduced and sulphur deposited, while a too dilute acid causes the evolution of sulphuretted hydrogen. The same authority also affirms that a purer gas is obtained by placing a little sulphite of lead and a few pieces of charcoal in the wash-bottles.

Prof. F. C. Calvert gives a process for preparing this acid on a large scale, by which he avoids all the inconveniences usually attendant on its manufacture, and has prepared thousands of gallons daily of a saturated solution. It consists in burning sulphur in a small furnace, and conducting the acid gas through earthenware tubes surrounded with water so as to cool them. The gas is then made to ascend through a wooden tube 40 feet high and about 4 feet wide, sometimes called a coke scrubber, filled with pumice stone previously washed first with hydrochloric acid and then with water. A certain amount of water is introduced into the tube from above, which, in its descent, meets and dissolves the gas, and runs out saturated from the bottom of the tube into an air-tight reservoir. (*P. J. Tr.*, xvii. 512.) Where sulphurous acid is to be used as a disinfectant, bisulphide of carbon, either pure or mixed with petroleum, may be burned in the room to be disinfected. Keates (*Chem. News*, Dec. 8, 1876) suggests the use of a suitable lamp. Stevenson uses an open copper dish or porcelain capsule, and simply ignites the liquid: care should be used, however, as the bisulphide is very inflammable and volatile.

Properties. The officinal sulphurous acid is a strong solution of sulphurous oxide gas. The oxide is an irrespirable gas, of a suffocating odor familiar to every one as that of burning sulphur, which is converted into it by combustion. If inhaled in the concentrated state, it proves fatal. Cold reduces it to a colorless liquid, which, according to M. Is. Pierre, boils at 0° C. (32° F.). (*Journ. de Pharm.*, 4e sér., xvii. 435.) It consists of one volume of sulphur, and two volumes of oxygen (SO_2), condensed to two volumes, and has the sp. gr. 2·21, liquefies at —10° C. (14° F.), has a strong acid reaction, extinguishes burning bodies, has the power of bleaching many colored substances, and has a strong affinity for oxygen, with which it combines in the presence of water, forming sulphuric acid. Water at 18° C. (65° F.) takes up about 50 volumes of the gas, and the solution has the sp. gr. 1·04. (*Brande and Taylor.*) Liquefied sulphurous acid gas (oxide) is now manufactured by Pictet in Geneva, and is sent into commerce in copper cylinders.

The following table, founded on the researches of Mr. Scott (*Pharm. Journ.*, xi. 218), gives the strength of acids of various specific gravity.

Per Cent. of SO_2.	Sp. Gr. at 60°.	Per Cent. of SO_2.	Sp. Gr. at 60°.	Per Cent. of SO_2.	Sp. Gr. at 60°.
5	1·0275	7	1·0377	9	1·0474
5·5	1·0302	7·5	1·0401	9·5	1·0497
6	1·0328	8	1·0426	10	1·0520
6·5	1·0353	8·5	1·0450		

Sulphurous acid sometimes exists as an impurity in hydrochloric, acetic, and other acids; according to P. Schweitzer, the minutest quantity may be detected by dissolving zinc in the suspected acid; when, if sulphurous acid be present, the odor of sulphuretted hydrogen will be at once perceived. (*Chem. News*, xxiii. 293.)

Officinal sulphurous acid is a colorless liquid, having the smell of burning sulphur, and a sulphurous somewhat astringent taste. When exposed to the air it slowly absorbs oxygen, with the formation of sulphuric acid, and acquires a sour taste, and the property of changing vegetable blues to red. When kept in closed vessels exposed to the sunlight, a portion of it is decomposed, sulphur being deposited and sulphuric acid formed by the union of the liberated oxygen with other portions of the acid. (*A. J. P.*, xlii. 352.) It should be entirely volatilized by heat. It decolorizes iodine by producing hydriodic acid, and on this fact is based the Br. test before given. It decomposes the bone phosphate of calcium.

"A colorless liquid, of the characteristic odor of burning sulphur, a very acid, sulphurous taste, and a strongly acid reaction. Sp. gr. 1·022–1·023. By heat it is completely volatilized. Litmus paper brought in contact with the acid is at first turned red, and afterward bleached. On pouring a few drops of the acid into a test tube containing diluted hydrochloric acid and some test zinc, a gas is evolved which blackens paper wet with solution of acetate of lead. If to 10 C.c. of sulphurous acid there be added 1 C.c. of diluted hydrochloric acid, followed by 1 C.c. of test-solution of chloride of barium, not more than a very slight turbidity should be produced (limit of sulphuric acid). If 1·28 Gm. of sulphurous acid be diluted with 20 volumes of water and a little gelatinized starch be added, at least 14 C.c. of the volumetric solution of iodine should be required, before a permanent blue tint is developed." *U. S.*

Medical Properties and Uses. Sulphurous acid has been introduced into use in consequence of its fatal influence upon the lower forms of animal and vegetable life. It is supposed to be thus destructive by its anti-oxygenizing or reducing influence; suffocating organic beings by denying them the oxygen necessary to their existence; but it probably acts also by a physiological property independently of its mere chemical effect. It is perhaps by the same property that it prevents fermentation, destroying the microscopic organisms essential to that process. In reference to its parasiticide property, it was brought before the notice of the profession by Dr. Jenner of London; though to Prof. Graham, we believe, belongs the first suggestion of its applicability to such purposes. In pyrosis and in cases of sarcinæ ventriculi it may be taken internally; but one of the sulphites, as sulphite of sodium, is perhaps preferable for the purpose, as it yields the acid always by decomposition in the stomach. Dr. Robt. Bird affirms that it is a powerful antipyretic. (*Amer. Journ. Med. Sci.*, lviii. 236.) As an external application, it is used in psora, the different forms of porrigo, trichosis of the scalp, pityriasis versicolor, and the thrush of children,—all parasitic affections, either animalcular or cryptogamous, generally yielding to it, if proper care be taken, by previous removal of the scabs or scales, to bring it into contact with the morbific cause. The dose for internal use is a fluidrachm (3·75 C.c.), largely diluted with water. When locally used it should be diluted with two or three measures of water or of glycerin, and applied as a lotion, or by cloths wet with it, or in the form of cataplasm. Dr. James Dewar, of Kirkaldy, has found very great advantage from the inhalation of sulphurous acid, in the form of the fumes of burning sulphur, in typhus and typhoid fevers, scarlatina, diphtheria, catarrhal fever, hay fever, gout, and rheumatism. (*N. O. Med. and Surg. Journ.*, 1867, p. 523; from *Dub. Med. Press*, Sept. 5, 1866.) Dr. Hjatelin believes that he arrested an epidemic of smallpox by the free use of the acid as a disinfectant. (*Brit. Med. Journ.*, 1871, ii. 519.) According to Rabuteau (*Neues Repert.*, xviii. 307), in the system sulphurous acid and the sulphites are converted into sulphuric acid and sulphates.

ACIDUM TANNICUM. *U. S., Br.* *Tannic Acid.*

$C_{14}H_{10}O_9$ (chiefly); 322. (ĂÇ'Ị-DŬM TĂN'NỊ-CŬM.) $C_{28}H_{10}O_{18}$; 322.

Tannin, Digallic Acid, Acidum Gallo-tannicum, Tanninum; Acido tannique, Tannin, *Fr.;* Gerbsäure, Tannin, *G.*

The process for preparing Tannic Acid, officinal in U. S. P. 1870, is as follows: "Take of Nutgall, in fine powder, Ether, each, *a sufficient quantity.* Expose the Nutgall to a damp atmosphere for twenty-four hours, and then mix it with sufficient Ether, previously washed with water, to form a soft paste. Set this aside, covered closely, for six hours; then, having quickly enveloped it in a close canvas cloth, express it powerfully between tinned plates, so as to obtain the liquid portion. Reduce the resulting cake to powder, and mix it with sufficient Ether, shaken with one-sixteenth of its bulk of water, to form again a soft paste, and express as before. Mix the liquids, and expose the mixture to spontaneous evaporation, until it assumes a syrupy consistence; then spread it on glass or tinned plates, and dry it quickly in a drying closet. Lastly, remove the dry residue from the plates with a spatula, and keep it in a well-stopped bottle." *U. S.**

The British Pharmacopœia has abandoned its former process, and adopted a new one in close conformity with the above, both being essentially the process of Leconnet, modified by Dominé, which has been substituted, in the existing Pharmacopœias, for that of Pelouze previously employed in both.

While the Pelouze process yields the tannic acid probably in a somewhat purer state than Leconnet's, it is less easy of performance, and much less productive; and the product of the existing formula is sufficiently pure for all practical purposes. The addition of a little alcohol, 8 per cent. for example, to the ethereal menstruum, still further increases the product, and, we are informed, is practised to a considerable extent; but we doubt the propriety of this deviation from the directions given in the process, as the resulting product may not be in all respects identical. There appear to be two coloring principles in galls, one soluble in ether and not in alcohol, the other in alcohol and not in ether. Hence, while the tannic acid, in whichever way procured, is yellowish, that obtained by ether has a greenish tint, while that obtained by the addition of alcohol is slightly brownish. In consequence of the mode in which the acid is dried, in thin layers, on tinned or glass plates, and equally exposed to heat above and below, it froths up on the escape of the ether, and concretes in a soft, cellular, friable form, which is strikingly characteristic of the preparation made in strict accordance with the formula.

From a superficial examination of this process, it might appear that the result can be nothing more than an ethereal extract; but it is necessary that the ether employed should contain water, as it is directed to be washed; and yet the quantity of water is so small that it can hardly operate by its mere solvent power. The circumstances attendant upon the process of Pelouze afford the means of a satisfactory explanation, which was first suggested by M. Beral. In this, the powdered galls are submitted to percolation by watered ether, and the liquid which passes separates into two layers, a heavier which sinks to the bottom and a lighter which floats upon the surface. It is the heavier which contains the tannic acid, and from which it is obtained by evaporation. The most probable explanation is that ether, water, and tannic acid unite to form a definite compound, in which the affinities are too feeble to resist the tendency of the ether to rise in vapor, and which is, therefore, decomposed by its evaporation. The proportion of the menstruum to the galls is very small, much smaller than would be employed to obtain an extract; and the whole or

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[*] For the preparation of tannin from Chinese galls, Oscar Rothe proposes the following as a superior process. Macerate eight parts of the powdered galls with twelve of ether and three of strong alcohol for two days, decant, renew the menstruum, and finally express. Mix the liquids, and after standing decant from the sediment, add twelve parts of water, recover the alcohol and ether by distillation, rapidly filter the aqueous solution, and quickly evaporate by means of a steam bath; dry, and pulverize the residue. (*A. J. P.*, xlii. 403.)

nearly the whole of both liquids is probably occupied in the formation of the definite compound referred to, thus leaving little or none to act merely as solvents. Hence the exclusion from the resulting acid, in great measure, of the other soluble constituents of the galls; and the slight amount of impurity really present in the acid is probably owing to the action of that small quantity of the menstruum not occupied in forming the liquid compound. Opinion is not altogether united in this explanation; but it is that which appears to us the best to account for the phenomena of the case. It has been stated that the tannic acid obtained by either of the officinal processes has a more or less yellowish tint. From this, according to F. Kummel, it may be freed by the percolation, through recently ignited animal charcoal, of its solution in a mixture of ether and alcohol. It has, too, a slight odor, which, according to Prof. Procter, is derived from a volatile odorous principle existing in galls, which he succeeded in separating from the acid by the action of benzol. From 30 to 35 per cent. of tannic acid is obtained from galls by Pelouze's method; while that of Leconnet is said to yield 60 per cent.

The term *tannin* was originally applied to a principle or principles existing in many vegetables, having a very astringent taste, and the property of producing a white flocculent precipitate with solution of gelatin, and a black precipitate with ferric salts. As obtained, however, from different plants, it was found to exhibit some difference of properties; and chemists have recognized two kinds, one existing in oak bark, galls, etc., distinguished by producing a bluish-black precipitate with ferric salts, and the other existing in Peruvian bark, catechu, etc., and characterized by producing a greenish black or dark olive precipitate with the same salts. The former is the one which has received most attention, and from an examination of which the characters of tannin have generally been given. It is the substance described in this article. It will probably be found that the latter is essentially distinct from the tannin of galls, and different in different vegetables. One striking peculiarity of the tannin of galls is its facility of conversion into gallic acid, which is wanting in the other varieties. Since the publication of the experiments of M. Pelouze in relation to tannin, this substance has been universally admitted to rank with the acids, and is now, therefore, denominated *tannic acid.* The ordinary variety procured from galls is called, for the sake of distinction, *gallotannic acid.* According to Pettenkofer, it is found only in perennial plants, indicating some relation to the production of woody fibre. (*Buchner's Neues Repert.*, iii. 74–76.) R. Wagner (*Bull. Soc. Chim.*, 1866, ii. 461) divides tannin into two great classes, pathological, found only in diseased vegetable tissue, as gallotannic acid, etc.; and physiological, occurring in leaves, bark, wood, etc., in a natural state, as quercitannic acid, etc.

Properties. Pure tannic acid is solid, uncrystallizable,* white or slightly yellowish, inodorous,† without bitterness, very soluble in water, much less soluble in alcohol and ether, especially when anhydrous, and insoluble in the fixed and volatile oils. It may be kept unchanged in the solid state; but its aqueous solution, when exposed to the air, gradually becomes turbid, and deposits a crystalline matter, consisting chiefly of gallic acid. During the change, oxygen is absorbed, and an equal volume of carbonic acid disengaged. But, according to M. E. Robiquet, this change does not always take place, and, when it does happen, is ascribable to the presence of pectase in the tannin. If the solution of tannic acid be boiled for a long time, the pectase loses its property of acting as a ferment, and the solution may be kept indefinitely without change. (*Journ. de Pharm.*, Avril, 1853, p. 246.)

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* E. Schering has put upon the market a "*crystalloid*" tannin which has a very deceptive appearance, leading a careless observer to believe that tannin is crystallizable. It is produced by dropping a small portion of a concentrated solution a distance of about 16 feet through a warmed atmosphere, upon a revolving cylinder. It is thus practically spun into threads more or less fine, which are afterwards scraped carefully off the cylinder. (*Neueste Erfind. und Erfahr.*, 1880.)

† Commercial tannic acid often has a decided odor, which Prof. Procter, after a practical investigation, believed to be owing chiefly to the presence of the odorous principle of the galls, though sometimes to matter derived from the ether with which it is prepared. (*A. J. P.*, 1865, p. 53.) According to M. Heinz, the odor is due to a greenish resinous principle, which may be separated by dissolving the acid in twice its weight of hot water, adding one-fourth part of ether, agitating slowly, allowing the coagulated coloring matter to precipitate, filtering, and evaporating. (*Journ. de Pharm.*, xv. 308.)

The Pharmacopœia thus describes Tannic Acid: "light-yellowish scales, permanent in the air, having a faint, peculiar odor, a strongly astringent taste, and an acid reaction. Soluble in 6 parts of water and 0·6 part of alcohol at 15° C. (59° F.). Very soluble in boiling water and in boiling alcohol; also soluble in 6 parts of glycerin; sparingly soluble in absolute alcohol, freely in diluted alcohol; moderately in washed ether; and almost insoluble in absolute ether, chloroform, benzol, and benzin. When heated on platinum foil, it is completely volatilized. With solution of ferric chloride, Tannic Acid forms a bluish-black ink. In aqueous solution it causes precipitates with alkaloids, gelatin, albumen, gelatinized starch, and solution of tartrate of antimony and potassium (distinction from gallic acid)." *U. S.*

Exposed to heat, tannic acid partly melts, swells up, blackens, takes fire, and burns with a brilliant flame. Thrown on red-hot iron, it is entirely dissipated. Its solution reddens litmus, and it combines with most of the salifiable bases. It forms with potassa a compound but slightly soluble, and is, therefore, precipitated by this alkali or its carbonates from a solution which is not too dilute, though a certain excess of alkali will cause the precipitate to be redissolved. Its combination with soda is much more soluble; and this alkali affords no precipitate, unless with a very concentrated solution of tannic acid. With ammonia its relations are similar to those with potassa. Lime and magnesia, added in the state of hydrates, form with it compounds of little solubility. The same is the case with most of the metallic oxides, when presented, in the state of salts, to a solution of the tannate of potassium. Many of the metallic salts are precipitated by tannic acid even in the uncombined state, especially those of lead, copper, silver, uranium, chromium, mercury, teroxide of antimony, and stannous oxide. With ferric salts it forms a black precipitate, which is a compound of tannic acid and the iron, and is the basis of ink. It does not disturb the solutions of the pure salts of ferrous oxide. Several of the alkaline salts precipitate it from its aqueous solution, either by the formation of insoluble compounds, or by simply abstracting the solvent. Chlorate of potassium when rubbed up with it explodes with great violence, and several serious accidents have occurred during the attempt to dispense such a mixture.

Tannic acid unites with all the vegetable alkaloids, forming compounds which are for the most part of a whitish color, and but very slightly soluble in water; though they are soluble in the vegetable acids, especially acetic, and in alcohol. In this latter respect they differ from most of the compounds which tannic acid forms with other vegetable principles. On account of this property of tannic acid, it has been employed as a test of the vegetable alkaloids; and it is so delicate that it will throw down a precipitate from their solution, even when too feeble to be disturbed by ammonia.

It has an affinity for several acids, and when in solution affords precipitates with sulphuric, nitric, hydrochloric, phosphôric, and arsenic acids, but not with oxalic, tartaric, lactic, acetic, or citric. The precipitates are considered as compounds of tannic acid with the respective acids, and are soluble in pure water, but insoluble in water with an excess of acid. Hence, in order to insure precipitation, it is necessary to add the acid in excess to the solution of tannic acid. Strecker, however, denies that the precipitates are compounds of the tannin with the acid, and maintains that they are tannin imbued with free acid. (*Chem. Gaz.*, No. 287, p. 370.)

When tannic acid, iodine, and water are mixed, a reaction takes place, by which the water is decomposed; its hydrogen forming with the iodine hydriodic acid, which combines with a portion of the tannic acid and remains in solution; while the oxygen of the water combines with another portion of the tannic acid, to form a compound, which, being insoluble, is precipitated. The iodized solution thus obtained is capable of dissolving more iodine, and holding it in permanent solution, however much diluted. (Socquet and Guilliermond, *Journ. de Pharm.*, xxvi. 280.) Iodine in a liquid containing tannic acid cannot be detected by starch; but if the liquid is placed in a watch-glass, sulphate of iron added, and the glass covered with a starched paper, tannate of iron being precipitated, the blue color soon appears. (*A. J. P.*, xlvii. 398.)

Griessmayer (*Zeitschr. f. Chemie*, 1873) proposes a test for tannin and free alkalies. On mixing a drop of a solution of tannin with 1 C.c. of $\frac{1}{100}$ normal solution of iodine, the reddish color of the iodine solution instantly disappears; if one drop of solution of ammonia be now added (previously diluted with ten times its bulk of water), a brilliant red color is produced which is quite permanent.

Tannic acid precipitates solutions of starch, albumen, and gluten, and forms with gelatin an insoluble compound, which is the basis of leather.

Its ultimate constituents are carbon, hydrogen, and oxygen; and its formula, according to Liebig, was $C_{13}H_3O_{12}$. Mulder, however, considered it isomeric with gallic acid, and gave for its formula $C_{14}H_{10}O_9$; and both Julius Löwe and Hugo Schiff confirmed the correctness of this formula. (*A. J. P.*, xxv. 223; xlvii. 208.) Strecker looked upon it as a compound of gallic acid and glucose, the latter of which is destroyed in the spontaneous change that moistened galls undergo by time. (See *Acidum Gallicum.*) M. E. Robiquet denied the complex nature ascribed to tannic acid by Strecker, and maintained that, when transformed into gallic acid by the pectic ferment or by sulphuric acid,[*] it is simply by a molecular change, and not by the destruction of one of its constituents. (*Journ. de Pharm.*, xxvi. 31.) But, whether consisting of glucose and gallic acid, or simply resolvable by certain agencies, through a new arrangement of its molecules, into these substances, it will equally rank among the glucosides; differing in this respect essentially from the varieties of tannic acid which precipitate the salts of iron greenish black, as the tannin of rhatany and catechu.[†] Hugo Schiff, however, asserts that it is not a glucoside; that glucose exists in commercial tannic acid as an impurity, and is not a necessary part of it, and that it is a "first anhydride," formed from two molecules of gallic acid by the abstraction of water, according to the reaction, $2C_7H_6O_5—H_2O=C_{14}H_{10}O_9$, and is consequently digallic acid, and this view at this time prevails. (See *Acidum Gallicum.*) (*Chem. News*, xxix. 73; also *A. J. P.*, xlvi. 234.)

Medical Properties and Uses. Tannic acid is the chief principle of vegetable astringents, and has an advantage over the astringent extracts in the comparative smallness of its dose, which renders it less apt to offend an irritable stomach. In most of the vegetable astringents it is associated with more or less bitter extractive, or other principle which modifies its operation, and renders the medicine less applicable than it otherwise would be to certain cases in which there is an indication for pure astringency without any tonic power. Such is particularly the case in the active hemorrhages; and tannic acid, in its separate state, is here preferable to the native combinations in which it ordinarily exists. In diarrhœa it is probably more beneficial than ordinary astringents, as less liable to irritate the stomach and bowels. Owing to its very powerful coagulant action upon albumen, it is, however, absorbed only after conversion into gallic acid, and consequently has been superseded by the latter agent in all cases in which it must reach the diseased surface through the blood, or in which a general astringent action is desired. Locally applied, it is much more powerful than gallic acid, and is very largely employed (see *Collodium Stypticum*), as in hemorrhages from external surfaces or from mucous membranes which can be reached from without, relaxation of the uvula, coryza, chronic inflammation of the fauces, diphtheria, toothache, aphthæ, excessive salivation, leucorrhœa, chapped nipples, gleet, gonorrhœa, flabby and phagedænic ulcers, piles, chilblains, etc. It may be applied in solution of varying concentration according to the necessities of the case. When a very powerful influence is desired, the solution in glycerin may be used, either the *glycerite of tannin*, formerly officinal, made by dissolving two troyounces of tannic acid in half a pint of glycerin with the aid of a gentle heat, or a still stronger preparation. In affections of the rectum it may be used in the form of a suppository. In diseases of the uterus it has been recommended in the form of a cylindrical pencil about an inch long and two lines thick, made with 4 parts of the acid to 1 part of tragacanth, with a little crumb of bread to give the mixture due flexibility. (*Journ. de Pharm.*, Fév. 1, 1860, p. 128.)

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[*] The tannic acid of the European alder, when boiled with sulphuric acid, splits into alnic red and sugar. (*A. J. P.*, xlii. 402.)

[†] Various plans have been proposed of estimating the quantity of tannic acid, which is an object of importance to tanners, as enabling them to judge of the value of their tanning materials; but on this point we must content ourselves, from want of space, with referring to *A. J. P.* (1859, p. 427; 1861, p. 164; 1863, p. 519; 1864, p. 314); also a paper by Mr. John Watts in the *P. J. Tr.* (1867, p. 515); also one by H. R. Procter, in the *Chem. News* (1874, p. 51); and one by MM. A. Muntz and Ramspacher (*Journ. de Pharm.*, xx. 287): also *Journ. de Pharm.*, 1874, pp. 445–447; *A. J. P.*, March, 1874, and Aug. 1877; *N. R.*, Aug. 1878.

As already stated, tannic acid is probably converted into gallic acid before absorption; it is eliminated through the kidneys in the form of gallic and pyrogallic acids. (*Chem. Gaz.*, No. 136, p. 231.) In the largest amounts it is very feebly poisonous, producing only a mild gastro-intestinal irritation.

Pharm. Uses. In preparing Digitalinum, *Br.*

Off. Prep. Collodium Stypticum, *U. S.;* Glycerinum Acidi Tannici, *Br.;* Suppositoria Acidi Tannici, *Br.;* Trochisci Acidi Tannici; Unguentum Acidi Tannici, *U. S.**

ACIDUM TARTARICUM. *U. S., Br.* *Tartaric Acid.*

$\dot{H}_2 C_4 H_4 O_6$; 150. (ĂÇ'Ị-DŬM TÄR-TĂR'Ị-CŬM.) 2 HO, $C_8 H_4 O_{10}$; 150.

"A crystalline acid prepared from the acid tartrate of potash." *Br.*

Sal Essentiale Tartari; Acide du Tartre, Acide tartrique, *Fr.;* Weinsteinsäure, Weinsäure, *G.;* Acido tartarico, *It., Sp.*

No formula for the preparation of tartaric acid is given in the U. S. Pharmacopœia. In the Br. Pharmacopœia a process is given for its preparation. It is extracted from *tartar*, a peculiar substance which concretes on the inside of wine casks, being deposited there during the fermentation of the wine. Tartar, when purified and reduced to powder, is the cream of tartar of the shops, and consists of acid potassium tartrate. (See *Potassæ Bitartras.*) The following is the British process.

"Take of Acid Tartrate of Potash *forty-five ounces* [av.]; Distilled Water *a sufficiency;* Prepared Chalk *twelve ounces and a half* [av.]; Chloride of Calcium *thirteen ounces and a half* [av.]; Sulphuric Acid *thirteen fluidounces.* Boil the Acid Tartrate of Potash with two gallons [Imperial measure] of the Water, and add gradually the Chalk, constantly stirring. When the effervescence has ceased, add the Chloride of Calcium dissolved in two pints [Imp. meas.] of the Water. When the tartrate of lime has subsided, pour off the liquid, and wash the tartrate with Distilled Water until it is rendered tasteless. Pour the Sulphuric Acid, first diluted with three pints [Imp. meas.] of the Water, on the tartrate of lime, mix thoroughly, boil for half an hour with repeated stirring, and filter through calico. Evaporate the filtrate at a gentle heat until it acquires the sp. gr. of 1·21, allow it to cool, and then separate and reject the crystals of sulphate of lime which have formed. Again evaporate the clear liquor till a film forms on its surface, and allow it to cool and crystallize. Lastly, purify the crystals by solution, filtration (if necessary), and recrystallization." *Br.*

Tartaric acid was first obtained in a separate state by Scheele in 1770. The process consists in saturating the excess of acid in bitartrate of potassium or cream of tartar with carbonate of calcium, and decomposing the resulting insoluble tartrate of calcium by sulphuric acid, which precipitates in combination with the lime, and liberates the tartaric acid. The equivalent quantities are two mols. of the acid tartrate and one of carbonate of calcium. The process, when thus conducted, furnishes the one half only of the tartaric acid. The other half may be procured, as in the British process, by decomposing the neutral tartrate of potassium, remaining in the solution after the precipitation of the tartrate of calcium, by chloride of calcium in excess. By double decomposition, chloride of potassium will be formed in solution, and a second portion of tartrate of calcium will precipitate, which may be decomposed by sulphuric acid together with the first portion. The process, when thus conducted, will, of course, furnish twice as much tartaric acid as when the acid salt only is decomposed.

The reactions are as follows: $2\ KHC_4H_4O_6 + CaCO_3 = K_2C_4H_4O_6 + CaC_4H_4O_6 + H_2O + CO_2$, then $CaC_4H_4O_6 + H_2SO_4 = CaSO_4 + H_2C_4H_4O_6$, and $K_2C_4H_4O_6 + CaCl_2 = (KCl)_2 + CaC_4H_4O_6$, then $CaC_4H_4O_6 + H_2SO_4 = CaSO_4 + H_2C_4H_4O_6$.

Formerly all of the tartaric acid used in America was imported from England

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* For the percentage of tannin in a large number of vegetable drugs and substances, see 14th ed. *U. S. D.*, 1020; *A. J. P.*, 1869, p. 194; *P. J. Tr.*, viii. 548.

and France, the amount in some years being as much as 500,000 lbs. annually. Scarcely any is imported now. In 1877 the amount was only 183 lbs. It is now made in the United States, not only of better quality, but actually cheaper than the imported acid costs in bond.

Preparation on the Large Scale. The process pursued on the large scale is different from that above given. The decompositions are effected in a wooden vessel, closed at the top, called a generator, of the capacity of about 2000 gallons, and furnished with an exit-pipe for carbonic acid, and with pipes, entering the sides of the generator, for the admission of steam and of cold water respectively. Into the generator, about one-fourth filled with water, 1500 pounds of washed chalk (carbonate of calcium) are introduced, and the whole is heated by a jet of steam, and thoroughly mixed by an agitator, until a uniform mass is obtained. About two tons of tartar are now introduced by degrees, and thoroughly mixed. The carbonate of calcium is decomposed, the carbonic acid escapes by the exit-pipe, and the lime unites with the excess of tartaric acid to form tartrate of calcium, which precipitates; while the neutral tartrate of potassium remains in solution. The next step is to decompose the tartrate of potassium, so as to convert its tartaric acid into tartrate of calcium. This is effected by the addition of sulphate of calcium in the state of paste, which, by double decomposition, forms a fresh portion of tartrate of calcium, while sulphate of potassium remains in solution. The solution of sulphate of potassium, when clear, is drawn off into suitable reservoirs, and the remaining tartrate of calcium is washed with several charges of cold water, the washings being preserved. The tartrate of calcium, mixed with sufficient water, is now decomposed by the requisite quantity of sulphuric acid, with the effect of forming sulphate of calcium, and liberating the tartaric acid, which remains in solution. The whole is now run off into a wooden back, lined with lead, furnished with a perforated false bottom, and covered throughout with stout twilled flannel. Through this the solution of tartaric acid filters, and the filtered liquor passes through a pipe, leading from the bottom of the back to suitable reservoirs. The sulphate of calcium is then washed until it is tasteless, and the whole acid liquor is evaporated, in order to crystallize. The evaporation is effected in wooden vessels, lined with lead, by means of steam circulating in coils of lead-pipe, care being taken that the heat does not exceed 93·8° C. (165° F.). The vacuum-pan is used with advantage in evaporating the acid solution; as it furnishes the means of concentration at a lower temperature. When the acid liquor has attained the sp. gr. of about 1·5, it is drawn off into sheet-lead, cylindrical crystallizing vessels, capable of holding 500 pounds of the solution. These crystallizers are placed in a warm situation, and, in the course of three or four days, a crop of crystals is produced in each, averaging 200 pounds. These crystals, being somewhat colored, are purified by redissolving them in hot water. The solution is then digested with purified animal charcoal, filtered, again concentrated, and crystallized. The crystals, having been washed and drained, are finally dried on wooden trays, lined with thin sheet-lead, placed in a room heated by steam. The mother-liquors of the first crystallization are again concentrated, and the crystals obtained, purified by animal charcoal as before. When the residuary liquors are no longer crystallizable, they are saturated with chalk, and converted into tartrate of calcium, to be added to the product of a new operation. In order to obtain fine crystals of tartaric acid, it is necessary to use a slight excess of sulphuric acid in decomposing the tartrate of calcium. The merit of this process consists in the greater economy of sulphate of calcium over chloride of calcium for decomposing the tartrate of potassium.

Dr. Price, of England, has made some improvements in the above process (for details see *P. J. Tr.*, Jan. 1854). The main point in his improvements is to convert the crude tartar into tartrate of potassium and ammonium by means of ammoniacal liquor, which gives a soluble double salt, comparatively free from organic coloring matter and other impurities, and, therefore, favorable for conversion into tartrate of calcium by the usual methods. Mr. Pontifex, of England, has obtained a patent for an improvement in manufacturing tartaric acid, which consists in evaporating in vacuo. (*Ibid.*, Feb. 1857, p. 430.)

Liebig has succeeded in preparing tartaric acid artificially by the oxidation of sugar of milk, and other substances, by nitric acid; and the resulting product has been found to be identical in all respects, even in its influence on polarized light, with the acid derived from grapes.

Oscar Ficinus, of Bensheim, proposes the following process to procure a pure tartaric acid. Saturate the crude tartar with carbonate of calcium, and decompose the resulting calcium tartrate with solution of zinc chloride, whereby calcium chloride and tartrate of zinc are produced. The latter is almost insoluble, and is completely decomposed by sulphuretted hydrogen. The residuary sulphide of zinc may again be converted by means of hydrochloric acid into chloride of zinc and sulphuretted hydrogen, so that the expense of the process is very small. The liquid filtered from the precipitated sulphide of zinc, containing tartaric and sulphydric acids in solution, is heated for some time to 60°–80° C. (140°–176° F.), in order to dissipate the latter acid, filtered from the precipitated sulphur, and concentrated to the point of crystallization. (*Arch. d. Pharm.*, April, 1879, p. 310.) It is asserted that in Hungary and Southern Italy tartaric acid of extreme purity is prepared; that occurring in flat, crystalline crusts being chemically pure, that in pointed crystals containing a little sulphuric acid.

Properties. "Nearly or entirely colorless, transparent, monoclinic prisms, permanent in the air, odorless, having a purely acid taste and an acid reaction. Soluble in 0·7 part of water and 2·5 parts of alcohol at 15° C. (59° F.); in 0·5 part of boiling water, and 0·2 part of boiling alcohol; also soluble in 36 parts of absolute alcohol, in 23 parts of ether and 250 parts of absolute ether, and nearly insoluble in chloroform, benzol, and benzin. When heated for two hours at 100° C. (212° F.), the crystals do not lose more than a trace in weight. On ignition they should not leave more than 0·05 per cent. of ash." *U. S.* The powder is generally directed to be kept in well-stoppered vials; but Prof. Otto has shown that this direction tends to spoil rather than to preserve it, by preventing the evaporation of some water of crystallization which is set free by a commencing chemical reaction. A better plan is to keep the powder in ordinary boxes. (*Proc. A. P. A.*, 1856, p. 52.)

As found in the shops, it is in the form of a fine white powder, prepared by pulverizing the crystals. A weak solution undergoes spontaneous decomposition by keeping, becoming covered with a mouldy pellicle; but, if boiled and filtered, it is said to lose this tendency. (W. H. Wood, *Chem. News*, 1871, p. 246.) It is asserted that the addition of $\frac{1}{1000}$ of salicylic acid will effectually preserve solutions of tartaric acid. In uniting with bases it has a remarkable tendency to form double salts, several of which constitute important medicines. It combines with several of the vegetable organic alkalies, so as to form salts. It is distinguished from all other acids by forming a crystalline precipitate, consisting of bitartrate of potassium, when added to a neutral salt of that alkali. When associated with an excess of boric acid, it is detected with difficulty; potassa not precipitating it, even with the addition of acetic or hydrochloric acid. Its separation, however, may be effected, according to Barfoed, by means of fluoride of potassium, which detaches the boric acid, to form the fluoborate of potassium, and renders free the tartaric acid, which then responds to the ordinary test. (*Journ. de Pharm. et de Chim.*, 4e sér., ii. 70.) Its most usual impurity is sulphuric acid, which may be detected by the solution affording with acetate of lead a precipitate only partially soluble in nitric acid. When incinerated with red oxide of mercury, it leaves no residuum, or a mere trace. The British Pharmacopœia directs that it should give no precipitate with solution of sulphate of calcium, showing the absence of racemic and oxalic acids, or with solution of oxalate of ammonium, which would detect lime, sometimes present in minute proportion. Its solution should not be affected by sulphuretted hydrogen. "An aqueous solution of 1 part of Tartaric Acid in 3 parts of cold water, when mixed with a solution of 1 part of acetate of potassium in 3 parts of cold water, followed by the addition of a volume of alcohol equal to the whole mixture, yields a white crystalline precipitate. If, after standing two hours at the ordinary temperature, the liquid is separated by filtration, and the precipitate well washed with diluted alcohol and dried at 100° C. (212° F.), in an air-bath, it should weigh between 1·25 and 1·26 parts. A concentrated aqueous solution should not be blackened, at the line of contact, by the careful addition of test-solution of hydrosulphuric acid (lead and copper). If the crystals have left, on ignition, some ash (see above), this ash should not turn blue by treatment with a few drops of water of ammonia (copper), nor should the further addition of one drop of test-solution of sulphide of ammonium cause any black coloration (lead, copper, iron). 10 C.c. of a concentrated solution should show no precipitate within 5 minutes after the addition of 1 C.c. of test-solution of chloride of barium with an excess of hydrochloric acid (sulphuric acid). To neutralize 3·75 Gms. of Tartaric Acid should require 50 C.c. of the volumetric solution of soda." *U. S.* "Seventy-five grains dissolved in water require for neutralization 1000 grain-measures of *the volumetric solution of soda.*" *Br.*

Tartaric acid is incompatible with salifiable bases and their carbonates; with salts of potassa, with which it produces a crystalline precipitate of bitartrate; and with the salts of lime and lead, with which it also forms precipitates. It consists of four atoms of carbon 48, six of hydrogen 6, and six of oxygen 96 = 150. Of the six hydrogen atoms, however, only two are replaceable by metal, so that it is dibasic, and can form both acid and neutral salts with monad elements like potassium and sodium. Thus, cream of tartar is the acid potassium tartrate (bitartrate of potassium), and so-called "soluble tartar," the neutral potassium tartrate.

MODIFICATIONS OF TARTARIC ACID. Five distinct modifications of tartaric acid exist. Their chief physical and chemical differences are as follows:

a. Dextro-tartaric acid, or ordinary tartaric acid, forms anhydrous, hemihedral, rhombic crystals, the aqueous solution of which turns the plane of polarization of a luminous ray to the *right.* The crystals fuse at 135° C. (275° F.), have a sp. gr. of 1·74 to 1·75, and are readily soluble in absolute and in aqueous alcohol.

b. Lævo-tartaric acid forms anhydrous, hemihedral, rhombic crystals, the aqueous solution of which turns the plane of polarization of a luminous ray to the *left.*

c. Racemic or *para-tartaric* acid forms hydrated, holohedral, triclinic crystals of $H_2C_4H_4O_6 + H_2O$, which are optically *inactive.* The crystals have a sp. gr. of 1·69, and are soluble in five parts of cold water and with difficulty in cold alcohol. The calcium racemate is less soluble in water than calcium dextro-tartrate, and is also distinguished by its insolubility in acetic acid and in chloride of ammonium solution. Racemic acid can be prepared by mixing *a* and *b* tartaric acids, and can be resolved into them by appropriate methods. Racemic acid exists naturally in small proportion in the juice of grapes growing in particular localities, and was first obtained artificially in 1853 by M. Pasteur.

d. Inactive or *meso-tartaric* acid, optically inactive, but not resolvable into *a* and *b* acids.

e. Meta-tartaric acid, produced by fusing the ordinary variety. It is deliquescent and uncrystallizable. Its solution and the solutions of its salts are converted by boiling into those of the ordinary modification.

Medical Properties. Tartaric acid, being cheaper than citric acid, forms, when dissolved in water and sweetened, an available substitute for lemonade. It may be improved by adding a drop of fresh volatile oil or a few drops of essence of lemon. Dried by a gentle heat, and then mixed with bicarbonate of sodium, in the proportion of thirty-five grains of the acid to forty of the bicarbonate, it forms a good effervescing powder, the dose of which is a teaspoonful (3·75 C.c.) stirred in a tumbler of water. Tartaric acid resembles citric acid in its medical properties, but is more irritant, and taken in large amount and concentrated form has caused fatal gastro-intestinal inflammation. It is chiefly used in medicine in the preparation of effervescing draughts. It is about equal to citric acid in neutralizing power. In cases of poisoning it has been detected in the blood and liver. In searching for it, absolute alcohol should be used for the purpose of extraction, in order to avoid the error of mistaking the tartrates for it.*

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* *Solution of Tartrate of Magnesium as a Purgative.* From the relatively high price of citric acid, attempts have been made to substitute for that acid, in the solution of citrate of magnesium, a cheaper acid, which might yield with magnesia an equally acceptable solution. M. E. Leger thinks he has accomplished this object by means of tartaric acid. The ordinary tartaric acid, however, will not answer; as the solution of the magnesian tartrate made with it, though at first limpid, soon

Off. Prep. Ferri et Ammonii Tartras, *U. S.;* Pulvis Effervescens Compositus, *U. S.;* Sodæ Citrotartras Effervescens, *Br.*

ACONITIA. *Br. Aconitia.*

(ĂC-Ọ-NĬ′′TỊ-Ạ—ăk-ọ-nĭsh′ẹ-ạ.)

Aconitine, Aconitina, Aconitinum; Aconitin, *E.;* Aconitine, *Fr.;* Aconitin, *G.*

Formerly a process for the manufacture of aconitine was given in the U. S. Pharmacopœia, but in the 1880 revision the so-called alkaloid was dropped from the officinal preparations, because the process of 1870* does not yield a definite proximate principle. The British officinal process is as follows:

"Take of Aconite Root, in coarse powder, *fourteen pounds* [av.]; Rectified Spirit, Distilled Water, Solution of Ammonia, Pure Ether, Dilute Sulphuric Acid, of each *a sufficiency.* Pour upon the Aconite Root three gallons of the Spirit, mix them well, and heat until ebullition commences; then cool, and macerate for four days. Transfer the whole to a displacement apparatus, and percolate, adding more Spirit, when requisite, until the root is exhausted. Distil off the greater part of the Spirit from the tincture, and evaporate the remainder over a water-bath until the whole of the alcohol has been dissipated. Mix the residual extract thoroughly with twice its weight of boiling Distilled Water, and, when it has cooled to the temperature of the atmosphere, filter through paper. To the filtered liquid add Solution of Ammonia in slight excess, and heat them gently over a water-bath. Separate the precipitate on a filter, and dry it. Reduce this to coarse powder, and macerate it in successive portions of the Pure Ether with frequent agitation. Decant the several products, mix, and distil off the ether until the extract is dry. Dissolve the dry extract in warm Distilled Water acidulated with the Sulphuric Acid; and, when the solution is cold, precipitate it by the cautious addition of Solution of Ammonia diluted with four times its bulk of Distilled Water. Wash the precipitate on a filter with a small quantity of cold Distilled Water, and dry it by slight pressure between folds of filtering paper." *Br.*

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becomes turbid, and most of the salt is deposited. But by employing a metatartaric acid he prepared a solution having all the desired properties. He prepares the *metatartaric acid* in the following manner.

Heating over a gentle fire, in a porcelain or preferably silver capsule, a little tartaric acid until it melts, stirring carefully from time to time, he adds successively small portions of fresh acid, taking care not to use so much as to cause the liquid to cool and solidify, and continuing to add until the vessel is two-thirds full. The heat is maintained until the mass, at first pasty and puffed up, becomes completely liquid. When bubbles are formed on the surface, the acid assumes a slight amber hue, and the desired modification has been effected. The vessel is now removed from the fire, and the contents allowed to cool until the acid can be handled without adhering to the fingers, when it is pressed into cakes, quickly cooled, and put into stopped bottles.

In the preparation of the magnesian solution, three-fourths of the water to be used is poured, cold, on a mixture of the acid and carbonate of magnesium (two parts of the former and one of the latter); a very brisk reaction takes place, and in less than ten minutes the solution is complete. Heat must be avoided; as otherwise the acid returns to the former state, and the salt is precipitated. When the acid has been completely modified, the solution will keep unchanged for several weeks. The cathartic action of the tartrate of magnesium is, according to M. Leger, much more certain than that of the citrate, and nearly equal to that of the sulphate. The solution is without unpleasant taste. (*P. J. Tr.*, 12, 1873, p. 29; from *Répertoire de Pharm.*, Juin 25, 1873.)

* "Take of Aconite Root, in moderately fine powder, *forty-eight troyounces;* Diluted Sulphuric Acid *a fluidounce and a half;* Alcohol, Stronger Water of Ammonia, Stronger Ether, Distilled Water, each, *a sufficient quantity.* Digest the powder in eight pints of Alcohol, in a close vessel, at the temperature of 120°, for twenty-four hours. Introduce the mixture into a cylindrical percolator, and gradually pour Alcohol upon it until twenty-four pints of the liquid have slowly passed. Distil off the Alcohol from the filtered liquid until this is reduced to the measure of a pint. Then add to the concentrated liquid a pint of Distilled Water, to which has been added the Diluted Sulphuric Acid, and mix thoroughly. Remove from the liquid the fixed oil and resin which separate on standing, and evaporate it to four fluidounces. When the liquid has cooled, pour it into a glass-stoppered pint bottle, and wash it, by agitation and decantation, with six fluidounces of Stronger Ether, to remove the remainder of the fixed oil and resin. Now add Stronger Water of Ammonia until, after agitation, it remains in slight excess. Next, treat the resulting mixture with six fluidounces of Stronger Ether, and, having closed the bottle, agitate briskly for a few minutes. Allow the liquid to stand until it separates into two layers, the lighter being an ethereal solution of Aconitia. Decant this carefully, and treat what remains, twice successively, with the same quantity of Stronger Ether, decanting each time as before. Mix the several ethereal solutions in a porcelain capsule, and allow the mixture to evaporate spontaneously to dryness. Lastly, reduce the dry residue to powder, and keep it in a well-stopped bottle." *U. S. Pharm.*, 1870.

This process was given to the Pharmacopœia Committee of the British Council by a manufacturer who had been in the habit of preparing the alkaloid, but it does not yield a reliable, medicinally pure alkaloid.[*] The English aconitine is frequently in great part composed of pseudo-aconitine,[†] originally discovered by Von Schroff, of Vienna.

Pure aconitine may exist in an amorphous or in a crystalline form. The officinal product is always amorphous, but even of amorphous aconitine there are two varieties, the hydrated and the anhydrous. When, as in the officinal processes, the alkaloid is dried at ordinary temperature, it retains 20 (Hager) or 25 (Hottot) per cent. of water; but when dried at the temperature of the water-bath it is anhydrous, and is then *not* soluble in 50 parts of boiling water. (Hager, *A. J. P.*, xlvii. 210.)

Aconitine as obtained by the Br. Pharmacopœia process is inodorous, and of a bitter and acrid taste, producing a benumbing impression on the tongue. It is unalterable in the air. and fusible by a gentle heat. It has been usually considered as not volatilizable, being decomposed at a high temperature, with the escape of ammonia, and by a continuance of the heat entirely dissipated. This statement, however, is contradicted by the results obtained by Mr. Guy, who found it to melt at 60° C. (140° F.), and to sublime unchanged at about 205° C. (400° F). (*P. J. Tr.*, Feb. 1868, p. 374.) It is sparingly soluble in water, requiring for solution 150 parts of cold and 50 of boiling water. (*Phillips.*) Alcohol, ether, and chloroform dissolve it readily. It restores the blue color of litmus reddened by acids, and neutralizes the acids, forming crystallizable salts. The solution of these salts produces a white precipitate with bichloride of platinum, a yellowish with terchloride of gold, and a yellowish brown with free iodine. Aconitine is precipitated from the solution by the caustic alkalies, but not by carbonate of ammonium, or the bicarbonates of potassium and sodium. A spurious substance has sometimes been sold under the same name, which is nearly or quite inert; and at best the alkaloid is apt to be of uncertain strength, as found in commerce.[‡]

Crystallized aconitine[§] was first made known by the researches of Mr. Groves (*P. J. Tr.*, 2d ser., viii. 121), but it was elaborately studied by Duquesnel. The methods of obtaining it differ, but, according to Patrouillard (*Journ. de Pharm.*, 4e sér., xix. 151), that of Duquesnel gives much the larger yield.[‖] It occurs in regular rhombic tables, sometimes having the angles modified so as to look like hexagons, or else in small, short, four-sided prisms; it is anhydrous, nearly insoluble in water, insoluble in glycerin, but soluble in alcohol, ether, acetic acid, and benzin, and freely so in chloroform, inodorous, of an intensely bitter taste, followed by the characteristic tingling, not volatile at 100° C. (212° F.), and forms with most acids crystallizable salts. The formula, as obtained in the laboratory of the École de Pharmacie, is $C_{27}H_{40}NO_{10}$, that of amorphous aconitine, as given by Stahlschmidt, being $C_{30}H_{47}NO_7$. The reactions of crystallized aconitine are elaborately given by M. Duquesnel, but for details the reader is referred to *P. J. Tr.*, ii. 1872, p. 623. Its only peculiar color reaction is obtained with difficulty, by dissolving in dilute phosphoric acid and evaporating; at a certain degree of concentration a violet coloration appears.

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[*] A process has been published by M. E. Hottot, of France, which is believed by the author to yield the alkaloid pure. The powdered root is macerated for eight days in alcohol of 85°; the liquid is separated by percolation; slaked lime is added, and the mixture shaken from time to time; the liquid is filtered, precipitated by a slight excess of sulphuric acid, and evaporated to a syrupy consistence; twice or three times its weight of water is added to the residue, the mixture allowed to rest, and the green oil which rises to the surface and solidifies at 20° C. (68° F.) removed; the liquid, having been passed through a moist filter to separate the last portion of oil, is treated with ammonia, and raised to the boiling point; the aconitine, which is deposited in a compact mass, and contains much resin, is washed, and treated with pure ether, and the ethereal solution allowed to evaporate; the residue is dissolved in water acidulated with sulphuric acid, and precipitated by ammonia; the coagulum which forms is collected on a filter, dried, and dissolved in ether; the ethereal solution is evaporated to dryness, the residue treated with a very little dilute sulphuric acid, and the solution precipitated by dilute solution of ammonia added drop by drop. The first portion deposited, being colored, is separated, and the precipitation continued till the ammonia is in slight excess. The precipitate now formed is washed until freed from ammoniacal odor, and dried at a low temperature. Ten kilogrammes (about 26 lbs. troy) of the root yield a mean product of from 4 to 6 grammes (℥i to ℥iss) of perfectly white alkaloid. (*Ann. de Thérap.*, 1864, p. 46.)

[†] *Pseudo-aconitine* has largely entered into the commercial English aconitine because the English manufacturers have, on account of its superior yield, employed to a great extent an aconite root from Nepaul, believed to be derived from *A. ferox*. Mr. Groves has shown that the chief alkaloid of this root is pseudo-aconitine. Like aconitine, it may be obtained in an amorphous or in a crystalline form. According to Flückiger, the most distinguishing characters separating it from aconitine are the absence of all bitterness and its ready solubility. It is, however, very much less soluble in ammonia than is aconitine. For further particulars the reader is referred to *P. J. Tr.*, Oct. 1873, p. 294. It has been investigated physiologically by Böhm and Ewens, and found to exert a similar influence to aconitine, except that it is more powerful.

[‡] M. O. Zinoffsky gives, in *P. J. Tr.*, 1873, vol. iv. p. 442, a method for the quantitative estimation of aconitine.

[§] The experiments made by MM. Grehaul and Duquesnel upon dogs indicate very strongly that "crystallized aconitine" is essentially different from true aconitine. (See H. C. Wood's *Therapeutics*, 4th ed., p. 182.)

[‖] The method of Duquesnel is as follows. 100 parts of the powdered roots having been mixed with one part of tartaric acid, and the whole exhausted by repeated percolation with cold alcohol, the liquid is evaporated at a low temperature on a water-bath to the consistence of a fluid extract.

The most elaborate investigations upon the *Aconitum* species are those which have been made by Dr. C. R. A. Wright during the years 1876–80, with grants made by the British Pharmaceutical Conference.

In *Aconitum Napellus* he found two distinct alkaloids; *aconitine*, a crystalline base possessing the formula $C_{33}H_{43}NO_{12}$, which possesses high physiological activity. It is crystallizable, anhydrous, and melts at 185° C. (365° F.); it is readily dehydrated by heating in contact with acids (preferably tartaric), forming *apo-aconitine*, $C_{33}H_{41}NO_{11}$, which closely resembles the parent alkaloid; on saponification with alkali it splits up into benzoic acid and a new base, *aconine*, $C_{26}H_{39}NO_{11}$, according to the reaction: $C_{33}H_{43}NO_{12} + H_2O = C_7H_6O_2 + C_{26}H_{39}NO_{11}$; and *picraconitine*, $C_{31}H_{45}NO_{10}$, an uncrystallizable base, which, however, forms crystallized salts of an intensely bitter taste but comparatively inert. This base also splits up upon saponification into benzoic acid and a new base, *picraconine*, much resembling aconine: $C_{31}H_{45}NO_{10} + H_2O = C_7H_6O_2 + C_{24}H_{41}NO_9$.

Besides these well-defined alkaloids, *Aconitum Napellus* yields a considerable quantity of non-crystalline alkaloids, which contain more carbon and are of lower molecular weight than aconitine. These are very likely in great part alteration products. In *Aconitum ferox*, he found chiefly the alkaloid *pseudaconitine*, $C_{36}H_{49}$, NO_{12}. It crystallizes in transparent needles and sandy crystals, but is apt to separate as a varnish if not evaporated extremely slowly. It forms crystallized salts with difficulty. It can be dehydrated, forming *apo-pseudaconitine*, $C_{36}H_{47}NO_{11}$, and when saponified yields dimethyl-protocatechuic acid instead of benzoic and a new base, *pseudaconine*: $C_{36}H_{49}NO_{12} + H_2O = C_9H_{10}O_4 + C_{27}H_{41}NO_9$. Wright considers that pseudaconitine is closely related to the opium alkaloids narceine, narcotine, and oxy-narcotine, which all give rise to derivatives of dimethyl-protocatechuic acid. Pseudaconitine crystallizes with H_2O and melts at 104°–105° C. (220° F.). In Japanese aconite roots (species not certainly known) Wright found a larger percentage of active alkaloids than in either of the other varieties. He also considers that he has obtained here a new base, *japaconitine*, $C_{66}H_{88}N_2O_{21}$. This base on saponification splits up into benzoic acid and a base, *japaconine*, $C_{26}H_{41}NO_{10}$.

Aconitine exists in the root in combination with aconitic acid.

Medical Properties and Uses. It is practically true that the various products which are sold under the name of aconitine represent the activity of aconite, but it is well known that commercial aconitine is a very improper remedy for internal use, varying immensely in its purity, its composition, and its powers. Two and a half grains have been taken almost with impunity, and 1-50th of a grain has nearly proved fatal. M. Hottot found that 0·46 of a grain of alkaloid, prepared by his process, produced very serious symptoms, and gave the fifth of a milligramme ($\frac{1}{333}$ of a gramme) as the dose. It is very plain that so uncertain and powerful

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To this distilled water is added, and the precipitated resinous and oily matters removed by filtration. The solution of tartrate of aconitine is then precipitated with a slight excess of bicarbonate of potassium, agitated with washed ether, and the two fluids separated with the siphon. The ethereal solution, one-fourth of its volume of petroleum benzin (sp. gr. 0·650) having been added to it, is then allowed to evaporate spontaneously. The crystals thus obtained may be purified by dissolving in water acidulated with nitric acid, decolorizing as rapidly as possible with animal charcoal at a temperature of 50° C. (122° F.), adding to the filtered liquid an excess of the bicarbonate of potassium, and proceeding as before. Patrouillard suggests the use of the bicarbonate of sodium instead of that of potassium, on account of the greater insolubility of its tartrate.

a remedy ought not to be used at all internally, especially as it possesses no advantages whatever over the other preparations of aconite.

Dr. Turnbull was the first to recommend the external use of aconitine; and his favorable report has been abundantly confirmed by others. By this writer it is said to produce in the skin a sensation of heat and prickling, followed by numbness; and the effect continues, according to the quantity applied, from two to twelve hours or more. He found it not to act as a rubefacient, or at least but slightly so. Applied much diluted and in minute quantity to the eye, it causes contraction of the pupil, with an almost intolerable sense of heat and tingling. Dr. Turnbull employed it with benefit in neuralgia, gout, and rheumatism. He recommends it either in alcoholic solution, in the proportion of a grain to a fluidrachm, or in the form of an ointment, made by rubbing two grains of the alkaloid first with six drops of alcohol and then with a drachm of lard. These proportions are sufficiently large to begin with, but may be gradually increased to four or five, or even eight, grains to the drachm. The application should be made by friction over the part affected, to be continued till the peculiar sensation above described is produced, and may be repeated three or four times, or more frequently, during the day. No good can be expected unless the sensation alluded to be experienced in a greater or less degree. Care should be taken not to apply the medicine to an abraded surface, or to a mucous membrane, for fear of dangerous constitutional effects. It has gradually come into use, and has the advantages, as an external remedy, over other preparations of aconite, of greater neatness and precision.

Off. Prep. Unguentum Aconitiæ, *Br.*

ACONITI FOLIA. *Br.* *Aconite Leaves.*

(ĂC-Ọ-NĪ'TĪ FŌ'LỊ-Ạ.)

The fresh leaves and flowering tops of Aconitum Napellus, gathered when about one-third of the flowers are expanded. *Br.*

Herba Aconiti; Feuilles d'Aconit, Coqueluchon, *Fr.;* Eisenhutblätter, Sturmhutblätter, *G.*

ACONITUM. *U. S.* *Aconite.*

(ĂC-Ọ-NĪ'TŬM.)

"The tuberous root of Aconitum Napellus, *Linné.* (*Nat. Ord.* Ranunculaceæ.)" *U. S.* The dried root; collected in the winter or early spring before the leaves have appeared. *Br.*

Aconiti Radix, *Br.*, Aconite Root; Tubera Aconiti, *P. G.;* Racine d'Aconit, *Fr.;* Eisenhut, Eisenhutknollen, Mönchskappe, *G.;* Aconito Napello, *It.;* Aconito, *Sp.*

As Aconite Leaves are no longer officinal in the U. S. Pharmacopœia, the former title of "Aconiti Radix" has been abandoned, and "Aconitum" substituted.

Gen. Ch. Calyx none. *Petals* five, the highest arched. *Nectaries* two, peduncled, recurved. *Pods* three or five. *Willd.*

The plants belonging to this genus are herbaceous, with divided leaves, and violet, yellow, or white flowers, in spikes, racemes, or panicles. In the Paris Codex three species were recognized as officinal, *A. Anthora*, *A. Cammarum*, and *A. Napellus;* but the French authorities unite at present with our own and the British in acknowledging only *A. Napellus.* There has been much difference of opinion as to the plant originally employed by Störck. Formerly thought to be *A. Napellus*, it was afterwards generally believed to be *A. neomontanum* of Willdenow, and by De Candolle was determined to be a variety of his *A. paniculatum*, designated as *Störckianum.* It is probable that this species, which is not infrequent in the Alps, yields much of the aconite of commerce, as probably does also *A. lycoctonum.*[*] But, according to Geiger, *A. neomontanum* is possessed of little acrimony; and Dr. Christison states that *A. paniculatum*, raised at Edinburgh from seeds sent by De Candolle himself, was quite destitute of that property. Neither of these, therefore, could have been Störck's plant, which is represented as extraordinarily acrid. Dr. Christison found *A. Napellus*, *A. Sinense*, *A. Tauricum*, *A. uncinatum*, and *A. ferox* to have intense acrimony; and Geiger states that he has found none equal, in this respect, to *A. Napellus.* This species is said to yield aconitine most largely. (*Répert. de Pharm.*, Nov. 1859.) *A. uncinatum* and *A. reclinatum* (Gray) are our only indigenous species. Most of the others are natives of the Alpine regions of Europe and Siberia. Those used in medicine appear to be indiscriminately called by English writers *wolfsbane* or *monkshood.* Under the name of Bish or Bikli, *Nepaul aconite** is largely sold in the bazaars in India. It is probably often a mixed product of a number of indigenous species, such as *A. lucidum*, *A. Napellus*, and *A. palmatum*, but is chiefly derived from *A. ferox*, which grows in the Himalayas, attaining a height of 3 to 6 feet, and having large dull blue flowers. The tuberous roots of *A. heterophyllum* are also met with in the bazaars. This native of the Himalayas has dull yellow flowers veined with blue or purple.

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[*] M. Hubschmann is said to have extracted two alkaloids from *A. lycoctonum;* one in the form of a white powder, insoluble in ether, but soluble in water and alcohol, which he names *acolytine:* the other crystallizable, very soluble in alcohol, and but slightly so in ether or water, and named by him *lycoctonine.* (*A. J. P.*, 1866. p. 376.) According to Prof. Flückiger, *lycoctonine* is in white acicular crystals, melting like aconitine in boiling water, though at a somewhat higher heat. On cooling it crystallizes only when moistened with water, when the amorphous mass is converted into tufted crystals. It leaves no water upon melting, and combines with none on crystallizing. It readily dissolves in chloroform, and upon evaporation is left as an amorphous varnish, which, on the addition of a little water, becomes strikingly crystalline. It is largely dissolved by sulphide

Aconitum Napellus. Linn., *Flor. Suec.*, ed. 1755, p. 168.—*A. neubergense.* De Candolle, *Prodrom.* i. 62.—*A. variabile neubergense.* Hayne, *Darstel. u. Beschreib.*, etc., xii. 14. This is a perennial herbaceous plant, with a spindle-shaped, tapering root, seldom exceeding at top the thickness of the finger, three or four inches or more in length, brownish externally, whitish and fleshy within, and sending forth numerous long, thick, fleshy fibres. When the plant is in full growth, there are usually two roots joined together, of which the older is dark brown and supports the stem, while the younger is of a light yellowish brown, and is destined to furnish the stem of the following year, the old root decaying. The stem is erect, round, smooth, leafy, usually simple, and from two to six or even eight feet high. The leaves are alternate, petiolate, divided almost to the base, from two to four inches in diameter, deep green upon their upper surface, light green beneath, somewhat rigid, and more or less smooth and shining on both sides. Those on the lower part of the stem have long footstalks and five or seven divisions; the upper, short footstalks and three or five divisions. The divisions are wedge-form, with two or three lobes, which extend nearly or quite to the middle. The lobes are cleft or toothed, and the laciniæ or teeth are linear or linear-lanceolate and pointed. The flowers are of a dark violet blue color, large and beautiful, and are borne at the summit of the stem upon a thick, simple, straight, erect, spike-like raceme, beneath which, in the cultivated plant, several smaller racemes arise from the axils of the upper leaves. Though without calyx, they have two small calycinal stipules, situated on the peduncle within a few lines of the flower. The petals are five, the upper helmet-shaped and beaked, nearly hemispherical, open or closed, the two lateral roundish and internally hairy, the two lower oblong-oval. They enclose two pediceled nectaries, of which the spur is capitate, and the lip bifid and revolute. The fruit consists of three, four, or five pod-like capsules.

The plant is abundant in the mountain forests of France, Switzerland, and Germany. It is also cultivated in the gardens of Europe, and has been introduced into this country as an ornamental flower. All parts of the plant are acrid and poison-

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of carbon, ether, alcohol, the fixed and volatile oils, amylic alcohol, and petroleum spirit; but requires 600 parts of boiling water for solution. The solution is bitter and has an alkaline reaction, and with bromine water produces fine yellow crystals; and this effect results, though the solution contain only one part of the alkaloid in 30,000. Lycoctonine is an alkaloid quite distinct from aconitine and pseudaconitine; and is much less poisonous than either. (Flückiger, *P. J. Tr.*, 1870, p. 122.)

* Under the name of *Utees*, *Atees*, or *Atis*, the root of *Aconitum heterophyllum* is said to be largely used in India as an antiperiodic. It is stated that it is free from poisonous properties, and is given in doses of 20 grains. The plant grows in the western Himalaya, at an elevation of 8000 to 13,000 feet. The roots are ovoid, oblong, or conical, ½ to 1½ inches in length, $\frac{3}{10}$ to $\frac{6}{10}$ of an inch in diameter, bitter without acridity, of a light ash-color. Their transverse section shows a white, farinaceous, homogeneous tunic, traversed by 4 to 7 yellowish vascular bundles. According to Wasowicz, the root yielded $\frac{6}{100}$ of 1 per cent. of *atesine*, an amorphous, *not* poisonous alkaloid (the same alkaloid was previously pointed out by Broughton), aconitic acid, an acid similar to tannic acid, a soft fat, cane sugar, mucilage, and pectinous substances.

ous. The leaves and root are used. The leaves should be collected when the flowers begin to appear, or shortly before. After the fruit has formed, they are less efficacious. The root is much more active than the leaves; and an extract from the latter is said to have only one-twentieth of the strength of one made from the former. It should be gathered in autumn or winter after the leaves have fallen, and is not perfect until the second year. It has been mistakenly substituted for horse-radish root, as a condiment, with fatal effect. The wild plant is said to be more active than the cultivated. (*Schroff.*) Prof. Wm. Procter found the roots of the plant cultivated in this country richer in the active alkaline principle than the imported roots; having obtained as much as 0·85 per cent. from the former. (*Proc. A. P. A.*, 1860.)

The aconite root is brought into market in packages or bales, originally, in general, either from the continent of Europe or from India. It is of variable quality; some parcels being unobjectionable, while others contain a considerable proportion of inert or defective roots. Among these roots that of *Imperatoria ostruthium* has been expressly noted. (*P. J. Tr.*, vii. 749.) The best test is the taste; and roots should be rejected which have not in a fair degree the characteristic properties in this respect described below, especially the sensation of numbness and tingling on the tongue, lips, and fauces.

Nepaul aconite is composed of elongated, conical, tuberous, or nearly cylindrical roots, 3 to 4 inches long, ½ to 1¾ inches in diameter at the base; unbranched; often abruptly broken off below; more or less flattened; shrivelled chiefly in a longitudinal direction, and sparsely marked with the scars of rootlets. *Japanese aconite* has also been largely sold in London.* It consists of plump, oblong or ovoid, dark grayish or blackish tubers, from half an inch to an inch in length, and ⅕ to ⅔ of an inch in diameter.

Properties. The *fresh leaves* have a faint narcotic odor, most sensible when they are rubbed. Their taste is at first bitterish and herbaceous, afterwards burning and acrid, with a feeling of numbness and tingling on the inside of the lips, tongue, and fauces, which is very durable, lasting sometimes many hours. When long chewed, they inflame the tongue. The *dried leaves* have a similar taste, but the acrid impression commences later. Their sensible properties and medicinal activity are impaired by long keeping. They should be of a green color, and free from mustiness. The *root* has a feeble earthy smell. Though sweetish at first, it has afterwards the same effect as the leaves upon the mouth and fauces. It shrinks much in drying, and becomes darker, but does not lose its acrimony. Those parcels, whether of leaves or roots, should always be rejected which are destitute of this property. As found in commerce, the aconite root is described as being "from a half to three-quarters of an inch (12 to 20 m.m.) thick at the crown; conically contracted below; from two to three inches (50 to 70 m.m.) long, with scars or fragments of radicles; dark brown externally; whitish internally; with a rather thick bark, enclosing a star-shaped pith about seven-rayed; without odor; taste at first sweetish, soon becoming acrid, and producing a sensation of tingling and numbness." *U. S.* The seeds also are acrid. For an account of the chemistry of aconite, see *Aconitia*, page 122.

Medical Properties and Uses. Aconite was well known to the ancients as a powerful poison, but was first employed as a medicine by Baron Störck, of Vienna, whose experiments with it were published in the year 1762. In moderate doses, it produces warmth in the stomach and sometimes nausea, general warmth of the body, numbness and tingling in the lips and fingers, muscular weakness, diminished force and frequency of the pulse, and diminished frequency of respiration. From larger doses all these effects are experienced in an increased degree. The stomach is more nauseated; the numbness and tingling extend over the body; headache, vertigo, and dimness of vision occur; the patient complains occasionally of severe neuralgic pains; the pulse, respiration, and muscular strength are greatly reduced; and a state of general prostration may be induced, from which the patient may not quite recover in less than two or three days. The effects of remedial doses begin to be felt in twenty or thirty minutes, are at their height in an hour or two, and continue with little abatement from three to five hours.

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* *Japanese Aconite.*—Seven varieties of aconite tubers are said by Dr. Langaard to be found in the Japanese drug stores, usually preserved in vinegar or child's urine, or by drying. The botanical source of these aconite roots is not accurately determined, but they are probably, at least in part, yielded by *A. japonicum*, Thunb., and *A. Fischeri*, Reich., believed by many botanists to be respectively identical with *A. lycoctonum*, Linn., and *A. Chinense*, Sieb. Several alkaloids have been separated, but have not been studied at all, with the exception of *Japaconitia*, which is said to be the most poisonous of the known aconite alkaloids. (See *P. J. Tr.*, 3 ser., xi. 149, 1021.)

In poisonous doses, besides the characteristic tingling in the mouth and elsewhere, aconite occasions burning heat of the œsophagus and stomach, thirst, violent nausea, vomiting and purging, severe gastric and intestinal spasms, headache, dimness of vision, with contracted or expanded pupils, numbness or paralysis of the limbs, diminished sensibility in general, stiffness or spasm of the muscles, great prostration, pallid countenance, cold extremities, an extremely feeble pulse, and death in a few hours, sometimes preceded by delirium, stupor, or convulsions. All these effects are not experienced in every case; but there is no one of them which has not been recorded as having occurred in one or more instances. The proper treatment of aconite poisoning consists in the maintenance of absolute rest in a position horizontal, or with the head lower than the feet; the evacuation of the stomach by the siphon tube or stomach-pump, if free vomiting do not occur; the administration of stimulus, and the use of external heat to keep up the bodily temperature. Whisky or brandy should be given freely in a concentrated form by the mouth and rectum; when the symptoms are very urgent, it may be injected under the skin. Ammonia should be employed *pro re nata.* In severe cases the tincture of digitalis should be given hypodermically (gtt. xv to xxv); and ammonia may be injected into the veins. We have known life to be apparently saved by laudanum given in drachm doses; and there is sound reasoning as well as some clinical experience (*Boston Med. and Surg. Jour.*, Sept. 1861) in justification of the use of tincture of nux vomica in combination with that of digitalis.

The symptoms produced by aconite are chiefly due to its action upon the circulation and the nervous system. It is a direct and powerful depressant of the heart, if in sufficient amount completely paralyzing the cardiac muscle. The lowering of the force of the circulation is certainly in large part due to this action; but it is probable, although not proved, that it also paralyzes the vaso-motor system. Upon the cerebrum the drug exerts very little if any direct influence. Upon the peripheral sensory nerves it acts as a powerful depressant, thereby causing the characteristic tingling and numbness of aconite poisoning. The influence upon the spinal marrow seems to be less pronounced than that upon the sensory nerves; but, if in sufficient amount, the poison depresses the motor centres of the cord. To this, and not to any effect upon the motor trunks or the muscles, is due the loss of reflex activity and of voluntary power caused by toxic doses.

As an internal remedy, aconite is very valuable in sthenic fever from any cause; when the condition is asthenic it should never be administered. It is also useful in some cases for the purpose of benumbing sensitive nerves; thus it will sometimes arrest the vomiting of pregnancy, and has often been used with excellent results in rheumatic neuralgia. To obtain such effects it must be given boldly. Applied locally to a sensitive or painful part, it is very efficient, owing to its being brought in a concentrated state into contact with the irritated nerves. It is a favorite application in neuralgias, and will probably achieve good more often than any other narcotic local remedy. Applied to the skin, aconite occasions heat and prickling or tingling, followed by numbness, and, if in contact with a wound, produces its peculiar constitutional effects. Applied to the eye, it causes contraction of the pupil. It may be administered in powder, extract, or tincture. The dose of the powdered leaves is one or two grains (0·065–0·13 Gm.), of the extract from half a grain to a grain (0·03–0·065 Gm.), of the tincture of the leaves twenty or thirty drops (1·25–1·9 C.c.), to be repeated twice or three times a day, and gradually increased till the effects of the medicine are experienced. The preparation now almost exclusively employed is the tincture of the root, *Tinctura Aconiti. U.S.* Of this, from 3 to 5 drops (0·18–0·3 C.c.) may be given every two to four hours until its effects become obvious. It is very important to distinguish between the tincture of the leaves formerly officinal and still used and the much stronger tincture of the root just referred to. Few patients will bear at first more than four minims of the latter. Very properly, we think, the tincture of the leaves was abandoned at the revision of the U. S. P. 1860. Aconite may be used externally in the form of the saturated tincture of the root, of extract mixed with lard, of a plaster or liniment, or of aconitine ointment. The tincture may be applied by means of a soft piece of sponge on the end of a stick.

Off. Prep. of the Root. Abstractum Aconiti Radicis, *U. S.;* Aconitia; Emplastrum Aconiti, *U. S.;* Extractum Aconiti Radicis, *U. S.;* Extractum Aconiti Radicis Fluidum, *U. S.;* Linimentum Aconiti; Tinctura Aconiti, *Br.;* Tinctura Aconiti Radicis, *U. S.*

ADEPS. *U. S. Lard.*

(Ā'DĔPS.)

"The prepared internal fat of the abdomen of Sus scrofa, Linné (Class, *Mammalia;* Ord., *Pachydermata*), purified by washing with water, melting, and straining." *U. S.* "The purified fat of the hog, Sus scrofa." *Br.*

Adeps Præparatus, *Br.* Adeps Suillus, *P. G.;* Axungia Porci, s. Porcina, Axungia, *Lat.;* Prepared Lard, Hog's Lard, *Eng.;* Axonge, Graisse, Graisse de Porc, Saindoux, *Fr.;* Schweineschmalz, *G.;* Grasso di Porco, Lardo, *It.;* Manteca de Puerco, Lardo, *Sp.*

Preparation. Lard is the prepared fat of the hog. The Br. Pharmacopœia gives a process for its preparation; but in this country it is generally purchased by the druggists already prepared. The adipose matter of the omentum and mesentery, and that around the kidneys, are usually employed; though the subcutaneous fat is said to afford lard of a firmer consistence. In the crude state it contains membranes and vessels, and is more or less contaminated with blood, from all which it must be freed before it can be fit for use. For this purpose, the fat, having been deprived as far as possible by the hand, of membranous matter, is cut into pieces, washed with water till the liquor ceases to be colored, and then melted, usually with a small portion of water, in a copper or iron vessel, over a slow fire.* The heat is continued till all the moisture is evaporated, which may be known by the transparency of the melted fat, and the absence of crepitation when a small portion of it is thrown into the fire. Care should be taken that the heat be not too great; as otherwise the lard might be partially decomposed, acquire a yellow color, and become acrid. This may be guarded against by using a water-bath in melting the lard. The process is completed by straining the liquid through linen, and pouring it into suitable vessels, in which it concretes upon cooling. To render it, however, perfectly free from particles of membrane and tissue, which are often the cause of rancidity, and unfit lard for its finer and more permanent uses, Mr. Ed. Smith, of Torquay, insists on the necessity of filtering the lard through paper, after freeing it from its coarser impurities by straining through linen. By this author it is recommended that the process of purification should be completed by remelting the lard, by means of a water-bath, and then carefully filtering it through paper in a warm closet. (*P. J. Tr.*, 1869, p. 131.) Lard may be rendered quite inodorous by melting it, when fresh, by means of a salt-water bath, adding a little alum or common salt, continuing the heat till a scum rises which is to be skimmed off, and, after the lard has concreted, separating the saline matter by washing it thoroughly with water. For a particular account of the process, see *A. J. P.*, xxviii. 176.

The following is the process of the British Pharmacopœia for preparing lard. "Take of the internal fat of the abdomen of the hog, perfectly fresh, *fourteen pounds.* Remove as much of the membranes as possible, cut the fat into small pieces, put it into a suitable vessel with about four gallons of cold water, and, while a current of water is running through the vessel, break up the masses of fat with the hands, exposing every part to the water, so that whatever is soluble may thus be dissolved and carried away. Afterwards collect the washed fat on a sieve or in a cloth, drain away as much as possible of the water, liquefy the fat at a heat not exceeding 212°, and strain through flannel, pressing the residue while hot; then put it into a pan heated by steam, and keep it at a temperature a little but not much above 212°, stirring it continually, until it becomes clear and entirely free from water; finally strain it through flannel." *Br.*

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* Prof. Procter recommends the following method of operating. After careful removal of the membranes and adhering flesh, the crude lard is to be cut into small pieces, malaxated with successive portions of cold water until this remains clear, and then heated moderately, in a tinned vessel, until the melted fat becomes perfectly clear and anhydrous. Lastly, it is to be strained into earthen pots, being occasionally stirred as it cools; and the pots should be securely covered with waxed or varnished paper, and kept in a cool, dry cellar. (*A. J. P.*, xxxv. 114.)

Lard, as offered for sale, often contains common salt, which renders it unfit for pharmaceutic purposes. This may be detected, when the quantity is insufficient to be sensible to the taste, by means of nitrate of silver, which will produce a precipitate of chloride of silver with water in which the salted lard has been boiled, after cooling and filtration. To free it from this impurity, it may be melted with twice its weight of boiling water, the mixture well agitated and set aside to cool, and the fat then separated. Lard is sometimes adulterated with water, starch, and a small proportion of alum and quicklime, which render it whiter, but unfit for medical use. Considerable quantities of lard have been imported into France from the United States, adulterated with 25 per cent. of a jelly-like substance, supposed to be extracted from Irish moss. This was separated by treating the lard with boiling water. (*Journ. de Pharm.*, 1855, p. 455.)

Properties. Lard is "a soft, white, unctuous solid, of a faint odor, free from rancidity, having a bland taste and a neutral reaction. Entirely soluble in ether, benzin, and disulphide of carbon. Sp. gr. about 0·938. It melts at or near 35° C. (95° F.) to a clear, colorless liquid, and at or below 30° C. (86° F.) it is a soft solid. Distilled water, boiled with lard, should not acquire an alkaline reaction, (abs. of alkalies), nor should another portion be colored blue by solution of iodine (abs. of starch). A portion of the water, when filtered, acidulated with nitric acid, and treated with test-solution of nitrate of silver, should not yield a white precipitate soluble in ammonia (abs. of common salt). When heated for several hours on the water-bath, under frequent stirring, lard should not diminish sensibly in weight (abs. of water)." *U. S.* When melted, it readily unites with wax and resins. Like most animal fats and oils, it consists of stearin, palmitin, and olein; its consistence, when pure, depending largely upon the relative proportions of these principles; olein, being the liquid principle, can readily be separated from the other two, by subjecting lard in cold weather to strong pressure, when the *olein* (*lard oil*) is pressed out, the solid residue (*stearin*) being used for various purposes, more particularly the manufacture of candles. Olein may also be separated by means of boiling alcohol, which, on cooling, deposits the concrete principles of the lard. It is extensively employed for burning in lamps, and other purposes in the arts. Vast quantities of it are prepared in Cincinnati, Ohio, and much is exported. In France it is said to be largely used for adulterating olive oil, and is itself now often adulterated by a heavy lubricating petroleum.

Exposed to the air, lard absorbs oxygen and becomes rancid. It should, therefore, be kept in well-closed vessels, or procured fresh when wanted for use. In the rancid state, it irritates the skin, and sometimes exercises an injurious reaction on substances mixed with it. Rancidity in lard and other fats is prevented by digesting them with benzoin or poplar buds, and rancid lard may often be greatly improved by washing it with lime-water. (See *Unguenta.*)

Medical Properties and Uses. Lard is emollient, and is occasionally employed by itself in frictions, or in connection with poultices to preserve their soft consistence; but its chief use is in pharmacy as an ingredient of ointments and cerates. It is frequently added to laxative enemata.

Off. Prep. Adeps Benzoatus, *Br.;* Adeps Benzoinatus, *U. S.;* Ceratum, *U. S.;* Ceratum Cantharidis, *U. S.;* Ceratum Extracti Cantharidis, *U. S.;* Ceratum Resinæ, *U. S.;* Unguentum, *U. S.;* Ung. Hydrargyri, *U. S.;* Ung. Mezerei, *U. S.;* Ung. Iodi, *U. S.;* Ung. Simplex, *Br.*

ADEPS BENZOINATUS. *U. S.* *Benzoinated Lard.*

(Ā'DĔPS BĔN-ZŌ-Ị-NĀ'TŬS.)

Adeps Benzoatus, *Br.;* Benzoated Lard; Unguentum Benzoini, *U. S.* 1870; Axungia Balsamica, s. Benzoinata, s. Benzoata; Ointment of Benzoin, *E.;* Axonze (Graisse) benzoinée (balsamique), *Fr.:* Benzoinirtes Schmalz, *G.*

Preparation. "Benzoin in coarse powder *two parts* [or one hundred and forty grains]; Lard *one hundred parts* [or sixteen ounces, av.] Melt the Lard by means of a water-bath, and, having loosely tied the Benzoin in a piece of coarse muslin, suspend it in the melted Lard, and, stirring them together frequently, continue the heat for two hours, covering the vessel and not allowing the temperature to rise above 60° C. (140° F.). Lastly, having removed the Benzoin, strain the Lard and stir while cooling." *U. S.*

"Take of prepared Lard *one pound;* Benzoin reduced to coarse powder *one hundred and sixty grains;* melt the lard by the heat of a water-bath, add the benzoin, and, frequently stirring them together, continue the application of heat for two hours; finally remove the residual benzoin by straining." *Br.* That the balsamic or resinous principles, in certain substances like benzoin, exercise a valuable function in preserving fats has been proved by abundant experience. It has been shown that when made, as originally suggested by Doliber and directed in the U. S. Pharmacopœia of 1870, by incorporating the tincture with lard, ointment of benzoin was irritating to the skin in certain diseases; hence the return to the old process of digesting the benzoin in lard, kept at a temperature of 60° C. (140° F.). The present U. S. formula does not differ materially from the British, except in the directions to enclose the benzoin in a muslin bag and the regulation of the temperature; the first improvement has for its object the prevention of the hard cake of benzoin, which otherwise collects at the bottom of the water-bath, and is apt to be imperfectly acted upon. A much pleasanter and more agreeable product is insured by heeding the U. S. directions as to limiting the temperature, a high heat volatilizing the odorous principles, and communicating an empyreumatic odor.

ÆTHER. *U. S., Br.* *Ether.*

(Æ'THẸR—ē'thẹr.)

Æther Sulphuricus, *Ed., Dub.;* Ether, Hydric Ether, Naphtha Vitrioli, Hydrate of Ethylen, Oxide of Ethyl; Ether hydrique, ou vinique, ou sulfurique, *Fr.;* Æther, Schwefeläther, *G.*

"A liquid composed of about 74 per cent. of Ethyl Oxide [$(\mathbf{C_2H_5})_2\mathbf{O}$; **74.**—$\mathbf{C_4H_5O}$; **37**] and about 26 per cent. of Alcohol containing a little water. Sp. gr. about 0·750 at 15° C. (59° F.)." *U. S.* "A volatile liquid prepared from Alcohol. and containing not less than 92 per cent. by volume of pure ether, C_4H_5O or $C_4H_{10}O$." *Br.*

Preparation. The present U. S. Pharmacopœia has abandoned the process for preparing ether.*

"Take of Rectified Spirit *fifty fluidounces* [Imp. meas.]; Sulphuric Acid *ten fluidounces* [Imp. meas.]; Chloride of Calcium *ten ounces* [avoird.]; Slaked Lime

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* The following is the process of U. S. P. 1870. "Take of Stronger Alcohol *six pints;* Sulphuric Acid *thirty-six troyounces;* Potassa *three hundred and sixty grains;* Distilled Water *three fluidounces.* To two pints of the Alcohol, contained in a six-pint tubulated retort, gradually add the Acid, stirring constantly during the addition. By means of a cork fitted to the tubulure, adapt a long funnel-shaped tube, with the lower end drawn out so as to form a narrow orifice, and reaching nearly to the bottom of the retort, and also a thermometer tube, graduated from 260° F. [126·6° C.] to 300° F. [148·8° C.], with its bulb reaching to the middle of the liquid. Having placed the retort on a sand-bath, connect it with a Liebig's condenser, and this with a well-cooled receiver. Then raise the heat quickly until the liquid boils, and attains a temperature between 266° F. [130° C.] and 280° F. [137·7° C.]. By means of a flexible tube, connected with the stop-cock of an elevated vessel containing the remainder of the Alcohol, introduce that liquid into the retort, through the funnel-shaped tube, in a continuous stream; the quantity supplied being so regulated that the temperature of the boiling liquid shall continue between the degrees mentioned. After all the Alcohol has been added, proceed with the distillation until the temperature rises to 286°, when the process should be discontinued. To the distilled liquid add the Potassa, previously dissolved in the Distilled Water, and shake them occasionally together. At the end of twenty-four hours, pour off the supernatant liquid, introduce it into a retort, and, with a gentle heat, distil into a well-cooled receiver three pints, or until the liquid attains the specific gravity 0·750. Lastly, keep the Ether in a well-stopped bottle."

half an ounce [avoird.]; Distilled Water *thirteen fluidounces* [Imp. meas.]. Mix the Sulphuric Acid with twelve fluidounces of the Spirit in a glass matrass capable of containing at least two pints [Imp. meas.], and, not allowing the mixture to cool, connect the matrass by means of a bent glass tube with a Liebig's condenser, and distil with a heat sufficient to maintain the liquid in brisk ebullition. As soon as the ethereal fluid begins to pass over, supply fresh Spirit through a tube into the matrass in a continuous stream, and in such quantity as to equal the volume of the fluid which distils over. For this purpose use a tube furnished with a stop-cock to regulate the supply, connecting one end of the tube with a vessel containing the Spirit raised above the level of the matrass, and passing the other end through a cork fitted into the matrass. When the whole of the Spirit has been added, and forty-two fluidounces have distilled over, the process may be stopped. Dissolve the Chloride of Calcium in the Water, add the Lime, and agitate the mixture in a bottle with the impure ether. Leave the mixture at rest for ten minutes, pour off the light supernatant fluid, and distil it with a gentle heat until a glass bead of specific gravity 0·735 placed in the receiver begins to float. The ether and spirit retained by the chloride of calcium, and by the residue of each rectification, may be recovered by distillation and used in a subsequent operation." *Br.*

The preparation of ether embraces two stages: its generation, and its subsequent rectification to remove impurities. The formulas agree in obtaining it by the action of sulphuric acid on alcohol. In the former United States process, which was adopted, with modifications, from the French Codex, one-third of the alcohol taken is mixed with the acid, and, while still hot from the reaction, distilled from a glass retort, by a heat quickly applied, into a refrigerated receiver. When the heat of the mixture has risen to between 130° C. (266° F.) and 137·7° C. (280° F.), the remainder of the alcohol is allowed to enter the retort in a continuous stream, the supply being so regulated that the heat shall be maintained between the degrees mentioned. By a complicated reaction which will be explained presently, the acid converts the alcohol into ether; and, were it not that the acid becomes more and more dilute as the process proceeds, it would be able to etherize an unlimited quantity of alcohol. Although the acid, before it becomes too dilute, is capable of determining the decomposition of a certain amount of alcohol, yet it is not expedient to add this amount at once; as a considerable portion of it would distil over undecomposed with the ether. The proper way of proceeding, therefore, is that indicated in the formulas; namely, to commence the process with the use of part of the alcohol, and, when the decomposition is fully established, and a portion of ether has distilled, to add the remainder in a gradual manner, so as to replace that which, every moment of the progress of the distillation, is disappearing by its conversion into ether.

In the U. S. process of 1850, the point at which the distillation should cease was determined by the proportion of the ether distilled to that of the alcohol employed, or by the appearance in the retort of white vapors, which indicate the generation of other products besides the ether; but, in the 1870 plan, arrangements having been made by which the temperature can be determined, the degree of heat has been adopted as a better criterion; as it is only when the temperature exceeds the point of 141·1° C. (286° F.) indicated, that the production of injurious impurities is to be apprehended. The modifications of the old process were made in conformity with suggestions by Dr. Squibb, contained in a paper published in the *Proc. A. P. A.*, 1858, p. 390. The direction in the 1850 process to reserve a small portion of acid, to be added gradually with the reserved alcohol, upon the supposition that the acid in the retort might be too much weakened to perform its part duly, has been found upon trial to result in no practical advantage. As the proper proportion between the acid and alcohol is that which requires for ebullition a temperature somewhat above 130° C. (266° F.), or that at which the ether is formed, there is an obvious propriety in supplying the alcohol just so rapidly as may be sufficient to maintain this temperature in the liquid of the retort. If the alcohol be supplied so rapidly as to reduce the temperature below the point mentioned, alcohol will distil over in undue proportion; if too slowly supplied, the temperature will rise so high as to produce other reactions in the materials than that required for etherification, and various other products will result. The rising of the temperature to 141·1° C. (286° F.), after all the alcohol has been added, is, therefore, an indication that the process should be suspended. Nevertheless, the caution to check the process when white vapors appear in the retort is not amiss, as affording an additional security that it shall not be carried too far. At the temperature of 160° C. (320° F.), there would be generated sulphurous acid, heavy oil of wine, olefiant gas, and a large quantity of resino-carbonaceous matter, blackening and rendering thick the residuary liquid; all of them products arising from the decomposition of a portion of sulphuric acid, alcohol, and ether.

The *British* process is that of the Edinburgh Pharmacopœia slightly modified. The principles are the same as those of the U. S. 1870 process; but the directions about temperature are wanting; and the regulation of the supply of alcohol, and the cessation of the operation, are made to depend on the less reliable method of determining the measure of liquid, in the first place in the retort, and in the second place in the receiver; as in the U. S. process of 1850.

In both processes, whatever care may be taken in conducting them, and to stop them in due time, the ether obtained is apt to be contaminated with sulphurous acid, heavy oil of wine, alcohol, and water; and hence its purification becomes necessary. The U. S. Pharmacopœia of 1870 directed for this purpose an aqueous solution of potassa, the British a saturated solution of chloride of calcium, to which a portion of recently slaked lime has been added. In both cases, the crude ether is agitated with the purifying agent, and submitted to a new distillation at a gentle heat, called the *rectification.*

The purifying substances are potassa for sulphurous acid and water, and water for alcohol in the U. S. formula; lime for acid, and a saturated solution of chloride of calcium for alcohol and water, in the British. The British substances for purifying are stated by Dr. Christison to be convenient, and to act perfectly and promptly. The chloride of calcium solution, after having been used, yields on distillation a further portion of ether of the officinal density; and, by concentrating it, filtering while hot, and separating the crystals of sulphite of calcium which form on cooling, the chloride may be recovered for future operations.

The process for forming ether is conducted with most advantage on a large scale. At Apothecaries' Hall, where the operation is performed in this way, the apparatus employed is thus described by Mr. Brande. It "consists of a leaden still, heated by means of high-pressure steam carried through it in a contorted leaden pipe. A tube enters the upper part of the still for the purpose of suffering alcohol gradually to run into the acid. The still-head is of pewter, and is connected, by about six feet of tin pipe, with a very capacious condensing apparatus, duly cooled by a current of water. The receivers are of pewter, with glass lids, and have a side tube to connect them with the delivering end of the condensing pipe." (*Manual of Chemistry*, edition of 1848.) For an account of the apparatus used in the U. S. Naval Laboratory for obtaining ether by steam on a large scale, see an article by E. R. Squibb, M.D., contained in *A. J. P.* for Sept. 1856.

Properties of Officinal Ether. "The properties of Ether are given under Stronger Ether (see *Æther Fortior*). It dissolves in about five times its volume of water. Tested, as directed under Stronger Ether, the reaction should be neutral; on evaporation it should leave no fixed residue, and the last portion should have not more than a very slight foreign odor; a volume of 10 C.c., upon agitation with an equal volume of glycerin, should not be reduced to less than 7·5 C.c." *U. S.* Notwithstanding the officinal directions for purifying ether, it is not absolutely pure as obtained by either of the formulas here given. Both contain a considerable portion of alcohol, the U. S. about 26 per cent., or, according to Dr. Squibb, 25 per cent. of 88 per cent. alcohol, the British, according to the Pharmacopœia, 8 per cent. of alcohol by measure. In both, there is a little of the light oil of wine. They should, however, be free from various impurities, which are too often found in commercial ether, the result of careless operation, or the employment of imperfect processes. As both Pharmacopœias give special directions for the purification of ether, we shall postpone an account of the chemical and remedial properties of the medicine till the pure preparation is treated of. (See *Æther Fortior.*) In the mean time, it will be proper to indicate the means of determining the purity of the proper officinal ethers. Commercial ether varies in sp. gr. from 0·733 to 0·765. The impurities found in it are excess of alcohol, water, sulphurous and other acids, heavy oil of wine, and various fixed substances.

The U. S. ether should have the sp. gr. 0·750, and, if heavier than this, must contain too much alcohol or water. When shaken with an equal bulk of water it should not lose more than from one-fifth to one-fourth of its volume. The statement that water takes up only one-tenth has been shown by Dr. Squibb to be erroneous. If it take up more than one-fourth, the ether must contain too much of alcohol or of water, or both. If the alcohol be in excess, it may be removed by agitating the liquid with twice its bulk of water, which unites with the alcohol, forming a heavier stratum, from which the ether may be poured off. The ether, however, takes up about one-tenth of water, which may be removed by agitation with freshly burned lime, and subsequent distillation. An easy method for detecting and measuring any alcohol present in ether, was given by the Edinburgh College; namely, to agitate it, in a minim measure, with half its volume of a concentrated solution of chloride of calcium. This will remove the alcohol; and the reduction of the volume of the ether, when it rises to the surface, will indicate the amount. The use of glycerin to separate the alcohol and water is for the first time officinal. Heavy oil of wine may be discovered by the ether becoming milky upon being mixed with water. If the ether is pure, it wholly evaporates in the air, leaving no solid residue. All non-volatile impurities are thus detected. It should not redden litmus, showing the absence of acids. The point of ebullition is also an indication of the strength of the ether. When evaporating from bibulous paper, it should offer only a slight degree of foreign odor, aromatic and free from pungency, and should leave the paper, when dry, nearly or quite odorless. This test proves the absence of volatile impurities, except a slight and not inadmissible proportion of light oil of wine. (*Squibb.*)

"Ether should be preserved in well-stopped bottles, or in soldered tins, in a cool place remote from lights and fire." *U. S.*

The British ether should have the sp. gr. 0·735. Fifty measures, agitated with an equal volume of water, are reduced to 45 by an absorption of 10 per cent. It boils below 105°. It is, therefore, considerably stronger than the U. S. ether. In other respects it should answer to the tests above given.

Officinal ether may answer for external application, and may even be given by the mouth, yet for purposes of inhalation it is scarcely fitted without further purification.

Pharm. Uses. In preparing Acidum Tannicum; Ceratum Sabinæ, Extractum Ergotæ Liquidum, *Br.;* Extract. Filicis Liquid., *Br.;* Extract. Mezerii Æthereum, *Br.;* Extract. Stramonii, *Br.;* Oleoresina Capsici, *U. S.;* Oleoresina Cubebæ, *U. S.;* Oleoresina Filicis, *U. S.;* Oleoresina Lupulinæ, *U. S.;* Oleoresina Piperis, *U. S.;* Oleoresina Zingiberis, *U. S.;* Tinctura Opii Deodorata, *U.S.*

Off. Prep. Æther Purus, *Br.;* Collodium, *Br.;* Liquor Epispasticus, *Br.;* Spiritus Ætheris, *Br.*

ÆTHER ACETICUS. *U. S. Acetic Ether. Acetate of Ethyl.*

$C_2H_5, C_2H_3O_2$; 88. (ÆʹTHER A-ÇĔTʹI-CŬS.) $C_4H_5O, C_4H_3O_3$; 88.

Naphtha Acete; Ethyl Acetate; Ether acétique, Naphte acétique, *Fr.;* Essigaether, Essignaphtha, *G.*

Preparation. This newly officinal ether may be formed by several processes, the chief of which are the following. 1. Mix 100 parts of alcohol (sp. gr. 0·83) with 63 parts of concentrated acetic acid, and 17 parts of strong sulphuric acid, and distil 125 parts into a receiver, kept cold with wet cloths. 2. Distil to dryness a mixture of three parts of acetate of sodium, three of alcohol, and two of sulphuric acid, mix the distilled product with one-fifth of sulphuric acid, and distil a second time an amount of ether equal to the alcohol employed. 3. Distil two parts of effloresced acetate of lead with one part of alcohol, and a little more than one part of sulphuric acid. In the last two processes, the acetic acid is set free by the action of the sulphuric acid on the acetate employed. J. A. Pabst has devised a process for acetic ether in imitation of that for the preparation of common ether. 50 C.c. of sulphuric acid and the same quantity of alcohol are heated together in a retort to 140° C. (284° F.), and then a mixture of one litre of 96 per cent. alcohol and one litre acetic acid (93 per cent.) is allowed to flow in slowly. At first some ethyl ether goes over, and then a liquid which contains, with considerable uniformity, 85 per cent. acetic ether. The reaction takes place between 130° C. (266° F.) and 135° C. (275° F.); at 145° C. (293° F.) some sulphurous acid is produced. The yield is about 1350 grammes, or 78 per cent., which is 90 per cent. of the theoretical amount. With reference to the solubility of acetic ether in saturated calcium chloride solution, it is to be remarked that pure acetic ether is not dissolved, although it is if mixed with 90 per cent. alcohol. One volume acetic ether, one volume alcohol, and two volumes calcium chloride solution give a homogeneous liquid. The methyl acetic ether can be prepared exactly as the ethyl compound, but in the attempt to prepare the amyl acetic ether in an analogous manner side reactions were found to interfere. In order to study the proportional power of combination possessed by the two alcohols, Mr. Pabst allowed a mixture of 100 C.c. methyl alcohol and 100 C.c. acetic acid to flow into a mixture of 50 C.c. sulphuric acid and 50 C.c. ethyl alcohol. The first distillates contained essentially methyl acetate and the latter pure ethyl acetate. In the flask were found remaining nearly equal amounts of sulphuric and ethyl sulphuric acids, and in addition alcohol, acetic acid, and some residual ethyl acetate. (*Bull. Soc. Chim.*, vol. xxxiii. pp. 350, 351; *A. J. P.*, 1880.)

"A transparent and colorless liquid, of a strong, fragrant, ethereal, and somewhat acetous odor, a refreshing taste, and neutral action. Soluble, in all proportions, in alcohol, ether, and chloroform, and in about 17 parts of water. Sp. gr. 0·889 to 0·897. It boils at about 76° C. (168.8° F.). It is inflammable, burning with a bluish yellow flame, and acetous odor. Acetic Ether should not change the color of blue litmus paper previously moistened with water, nor leave any fixed residue upon evaporation. When 10 C.c. are agitated with an equal volume of water, in a graduated test-tube, the upper, ethereal layer, after its separation, should not measure less than 9 C.c." *U. S.* It should be kept away from lights or fire.

Medical Properties and Uses. Acetic ether is occasionally used in medicine as a stimulant and antispasmodic. Its action upon the system is probably very similar to that of ether; but as it is less volatile it is less rapidly absorbed and eliminated, and consequently is much less prompt and fugacious in its influence than is ether. It is locally irritating. It has been found by Dr. H. C. Wood to be capable of being used as an anæsthetic, but is too slow in its action for practical purposes. The dose by the mouth is from fifteen to thirty drops (0·9–1·9 C.c.), sufficiently diluted with water. It is sometimes employed externally, by friction, as a resolvent, and for rheumatic pains.

Off. Prep. Spiritus Odoratus, *U. S.;* Tinctura Ferri Acetatis, *U. S.*

ÆTHER FORTIOR. *U.S.* *Stronger Æther.*

(Æ′THẸR FÖR′TỊ-Ọ̈R.)

"A liquid composed of about 94 per cent. of Ethyl Oxide [$\mathbf{(C_2H_5)_2O}$; **74**—C_4H_5O; 37] and about 6 per cent. of Alcohol containing a little Water. Sp. gr. not higher than 0·725 at 15° C. (59° F.), or 0·716 at 25° C. (77° F.)." *U. S.* "Ether, C_4H_5O or $C_4H_{10}O$, free from alcohol or water." *Br.*

Preparation. As in the case of ether, no process is given for the preparation of stronger ether in the present U. S. Pharmacopœia.*

Æther Purus, *Br.;* Pure Ether; Ether hydrique pur, *Fr.;* Reiner Æther, *G.*

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* "The following is the process of U. S. P. 1870. "Take of Ether, Water, each, *three pints;* Chloride of Calcium, in fine powder, Lime, in fine powder, each, *a troyounce.* Shake the Ether and the Water thoroughly together, and when the Water has subsided, separate the supernatant ether. Agitate this well with the Chloride of Calcium and the Lime in a well-stopped bottle, and allow the mixture to stand for twenty-four hours. Then decant the Ether into a retort, and, having adapted thereto a Liebig's condenser, distil a pint and a half of Stronger Ether into a receiver refrigerated with ice-cold water. Lastly, keep the liquid in a well-stopped bottle. By continuing the distillation, a portion of weaker ether may be obtained." *U. S.*

"Take of Ether, Distilled Water, of each, *two pints* [Imperial measure]; Lime, recently burned, *a quarter of an ounce* [avoirdupois]; Chloride of Calcium, *four ounces* [av.]. Put the Ether with one pint [Imp. meas.] of the Water into a bottle, and shake them together; allow them to remain at rest for a few minutes, and, when the two liquids have separated, decant off the supernatant ether. Mix this with the remainder of the Water, and again, after separation, decant as before. Put now the washed ether, together with the Lime and Chloride of Calcium, into a retort to which a receiver is closely attached, let them stand for 24 hours, then distil with the aid of a gentle heat. Sp. gr. not exceeding 0·720." *Br.*

The formulas of 1870 are essentially the same; the U. S. limiting the amount distilled by the measure, the British by the sp. gr. The ether is first shaken with the water, in order that the latter, by its superior affinity for alcohol, may take it from the former; and afterwards with the chloride of calcium and lime, to separate from the ether the water with which it has itself united in the first step of the process. Of course, the lime, for this purpose, must be in its freshly calcined state, so that it may have had no opportunity to absorb water from the air. The subsequent distillation is intended still further to strengthen the ether, the less volatile liquids being left in the retort. The lime answers the further purpose of neutralizing any sulphurous or other acid which the ether may have happened to contain. The weaker ether obtained at the end of the process may be kept for subsequent purification. It will be noticed that this separate process accomplishes more perfectly what is effected by the British formula for ether.

Even thus prepared, however, the ether, though sufficiently pure for all pharmaceutical or remedial purposes, is not absolutely pure, still containing a little alcohol. To meet the intentions of the U. S. process, it must have the sp. gr. 0·725 (0·720, *Br.*).

Properties. "A thin and very diffusive, clear, and colorless liquid, of a refreshing characteristic odor, a burning and sweetish taste, with a slightly bitter after-taste, and a neutral reaction. It is soluble, in all proportions, in alcohol, chloroform, benzol, benzin, fixed, and volatile oils, and dissolves in eight times its volume of water at 15° C. (59° F.). It boils at 37° C. (98·6° F). Ether is highly inflammable, and its vapor, when mixed with air and ignited, explodes violently. If a piece of pale blue litmus paper moistened with water be immersed ten minutes in a portion of the Ether, the color should not change. On evaporating at least 50 C.c. in a glass vessel, no fixed residue should appear, and, on evaporating a portion dropped upon blotting paper no foreign odor should be developed. When 10 C.c. are agitated with an equal volume of glycerin in a graduated test-tube, the Ether layer, when fully separated, should not measure less than 8·6 C.c. It should boil actively, in a test-tube half filled with it and held a short time in the hand, on the addition of small pieces of broken glass. It should be preserved in well-stopped bottles, or in soldered tins in a cool place remote from lights or fires." *U. S.*

Its extreme volatility causes it to evaporate speedily in the open air, with the production of considerable cold. Its inflammability is very great, and the products of its combustion are water and carbonic acid. In consequence of this property the greatest care should be used not to bring it in the vicinity of flame, as, for example, a lighted candle. One of the great advantages of using steam as the source of heat is that it obviates, in a great measure, the danger of its accidental inflammation. When too long kept it undergoes decomposition, and is converted in part into acetic acid. It dissolves iodine and bromine freely, and sulphur and phosphorus sparingly. Its power to dissolve corrosive sublimate makes it a useful agent in the manipulations for detecting that poison. It is also a solvent of volatile and fixed oils, many resins and balsams, tannic acid, caoutchouc, and most of the organic vegetable alkalies. It does not dissolve potassa and soda, in which respect it differs from alcohol. It was formerly believed that when water dissolves more than a tenth of its volume, the ether is shown to contain an undue quantity of water or alcohol, or of both; but according to Dr. Squibb this is not correct, water readily taking up one-fourth of its volume of ether. Ether unites in all proportions with alcohol. According to Prof. R. Boettger, water may be detected in ether by agitating the suspected liquid with bisulphide of carbon; if water be present the mixture becomes milky and turbid, otherwise it remains clear. A small piece of hydrate of potassium immersed in ether becomes coated with a yellowish film and imparts a yellowish color to the liquid, after standing twenty-four hours, if any alcohol be present. (*A. J. P.*, 1872.) Stefanelli (*Ber. d. Chem. Ges.*, 8, 439) proposes to shake ether with a small fragment of anilin-violet, which does not impart color to ether free from alcohol. One per cent. of alcohol may be thus detected.

On filtering an ethereal liquid with free access of air, a frost-like congelation is observed on the upper part of the filter, its appearance and quantity depending upon the temperature and the hygrometric state of the atmosphere. Tanret has collected some of this *hydrate of ether*, and found that after it had been completely freed from ether by strongly blowing upon it, it had the temperature 3·5° C. (25·7° F.), and on fusion yielded 17 to 18 parts of water for 37 of ether; the formula $(C_2H_5)_2O.2H_2O$ requires 18 parts. (*A. J. P.*, 1878.)

Composition and Theory of its Production. The empirical formula of ether is $C_4H_{10}O$, and this is the result both of analysis and a determination of its vapor density, whereby the molecular weight is established. This formula, however, is better understood when we examine the conditions of its formation. Ether is then found to be the oxide of ethyl (C_2H_5). This is the group which gives character to common alcohol and all its salts, whether with organic or inorganic acids. The group C_2H_5 acts as a monad radical, and common alcohol is its hydrate, C_2H_5,OH. Its oxide then would be $(C_2H_5)_2O$, and all the reactions by which ether is produced show it to be this oxide. It is commonly formed from common alcohol (ethyl hydrate) by the action of sulphuric acid, according to the following reactions:

$$C_2H_5,OH + SO_2,OH,OH = SO_2,OH,OC_2H_5 + H,OH;$$

that is, alcohol reacting with sulphuric acid yields ethyl-sulphuric acid (sulphovinic acid) and water. In the presence of an excess of alcohol and at the proper temperature the ethyl-sulphuric acid then reacts with another molecule of alcohol as follows:

$$C_2H_5,OH + SO_2.OH,OC_2H_5 = C_2H_5.OC_2H_5 + SO_2,OH,OH,$$

whereby ethyl oxide (ether) is formed, and sulphuric acid is regenerated. These reactions take place best at a temperature of about 140° C. (284° F.), and if the mixture in the flask is kept at this temperature a steady stream of alcohol can be converted into ether, whence the process has been called "the continuous etherification process."

Medical Properties and Uses. The chief use of ether in medicine is as an anæsthetic; although when taken into the stomach, it is absorbed and exerts its narcotic powers. Locally applied it acts at first as a stimulant and afterwards as a narcotic. If it be on an exposed surface its evaporation occurs so rapidly as to mask by refrigeration the direct action of ether. It was at one time employed for freezing parts about to be operated upon, but has been superseded by the more volatile and cheaper petroleum products. It is frequently employed in nausea dependent upon gastric depression, and also in flatulent or even biliary colic; it is sometimes effective in gastrodynia, in neuralgia of the gums, earache, etc. When applied locally its evaporation should be prevented if possible. When ether is taken into the general system it produces an increase of the force and frequency of the pulse, which appears to be due to a stimulant action both upon the heart and vaso-motor system. The augmentation of the force of the circulation is remarkably well maintained even during profound etherization, and after death from ether poisoning the heart is usually, if not always, found to be beating. When the drug causes a fatal result, it is almost always by paralyzing the centres of respiration. In sufficient amount ether acts powerfully as a narcotic, suspending consciousness and also lessening reflex activity. In some subjects there is a stage of etherization in which sensibility is destroyed, although consciousness is preserved. The influence of ether upon the nervous system is a direct one, and the usual order of the involvement of the nerve centres as shown by Flourens is: first the cerebrum, next the sensory centres of the cord, next the motor centres of the cord, next the sensory centres of the medulla, and finally the motor centres (including that of respiration) of the medulla.

For external use, the unrectified ether is sufficiently pure. The internal dose of ether is from fifty drops to a teaspoonful, to be repeated frequently when the full effect of the remedy is desired. It may be given in capsules, or simply floating upon the surface of ice-cold water or incorporated in an aqueous mixture, to be made by first rubbing it up with spermaceti, employed in the proportion of two grains for each fluidrachm of the ether.

A *syrup of ether* is directed by the French Codex. MM. J. Regnault and Adrian, after a thorough investigation of the solubility of ether in solutions of sugar, offer the following formula. Take of sugar 440 parts, distilled water 490 parts, alcohol at 90° 50 parts, pure ether 20 parts. Put into a bottle, shake, and preserve. The whole of this might be given at a dose, if the parts taken are represented by grains.

Capsules of ether, also called *pearls of ether*, are inodorous, will keep for a year at least without loss, and furnish the means of introducing ether into the stomach without irritating the mouth and throat. In a few seconds after they arrive in the stomach, they burst and diffuse their effects with singular rapidity. Analogous effects are produced when they are introduced into the rectum or vagina. Ether may be gelatinized by the process of M. Grimault. This consists in briskly shaking, in a stoppered bottle, four measures of ether, free from alcohol and acid, with one measure of white of egg. *Gelatinized ether* is an opaline trembling jelly, which may be spread with the greatest facility. It may be used as a local anæsthetic, applied to the seat of pain, spread on linen, and covered with a piece of cloth or of sheet caoutchouc. Gelatinized ether will not keep, but must be prepared at the time it is wanted.

Etherization. Ether may be exhibited by inhalation. Many years ago, its use in this way was proposed by Drs. Beddoes, Pearson, and Thornton, of England, in certain diseases of the lungs. As early as 1805, the late Dr. Warren, of Boston, employed ethereal inhalation to relieve the distress attending the last stage of pulmonary inflammation. About the year 1812, in Philadelphia, at a time when the nitrous oxide was the subject of popular lectures, the vapor of ether was frequently breathed from a bladder for experiment or diversion; and its effects in producing transient intoxication, analogous to that caused by the nitrous oxide, were observed. It was not, however, until October, 1846, that attention was particularly drawn to ethereal inhalation as a remedy for pain. In that month, Dr. Warren, of Boston, was applied to by Dr. W. T. G. Morton, dentist of that city, to ascertain by trial whether an agent which he had successfully employed to render painless the extracting of teeth would be equally successful in preventing the pain of surgical operations. This agent was the vapor of ether. Dr. Warren acceded to this request, and shortly afterwards, at the Massachusetts General Hospital, performed a severe operation, without pain to the patient, under the influence of ether, administered by Dr. Morton. A few days subsequently, Dr. C. T. Jackson, of Boston, in conversation with Dr. Warren, claimed to have first made known to Dr. Morton the use of ethereal vapor for the prevention of pain in dental operations.

From this beginning, the employment of ether by inhalation for the prevention and removal of pain has spread throughout the civilized world. The effect produced, called *etherization*, is usefully resorted to in all severe operations, not merely for the prevention of pain, but also of the shock which the system would otherwise suffer as a consequence of the pain, and also as a means of producing muscular relaxation in dislocation, strangulated hernias, etc. It has been employed for the detection of feigned diseases, by suspending the operation of the will; in neuralgia, biliary or renal colic, dysmenorrhœa, etc., as a palliative; in tetanus, and in the spasms produced by an overdose of strychnia, as an antispasmodic; and in asthma and chronic bronchitis, as an antispasmodic expectorant. In midwifery it is extensively employed; and, while it does not seem materially to interfere with the due contraction of the uterus, it promotes the relaxation and lubricating secretions of the soft parts. In vivisections, humanity calls for the use of it as an anæsthetic.

Ethereal vapor is most conveniently inhaled through a soft sponge, hollowed out on one side to receive the projection of the nose, and saturated with ether of the purest quality. The sponge, thus prepared, is applied over the nostrils, through which the inhalation should be made in preference to the mouth. When the inhalation is thus conducted through a sponge, the ethereal vapor is copiously mixed with air, and there is no fear of inducing asphyxia. At first a short cough is generally produced, but this soon disappears; and, after the lapse of from two to five minutes, and the expenditure of about two fluidounces of ether, the quantity being very variable in different cases, the patient becomes insensible, and appears as if in a deep, almost apoplectic sleep. The usual signs of the full effect of the ether are the closure of the eyelids, muscular relaxation, and inability to answer questions. During the whole process of etherization, the fingers should be kept on the pulse; and, if it become feeble, or very slow, or very rapid, the sponge should be removed until the circulation improves. At first there is redness, afterwards paleness of the face and neck, succeeded by cold perspirations. The danger in etherization is very rarely, if ever, through failure of the circulation, but by arrest of the respiration, and the state of the latter function should be closely watched; should it become very slow, or shallow, or irregular, the anæsthetic should be withdrawn, and, if necessary, appropriate measures of relief adopted. This is the mode of proceeding in surgical operations; in midwifery cases, partial etherization is often sufficient. One of the drawbacks to the use of ether is that vomiting is very apt to occur and be severe during the recovery from the narcosis. To lessen the gastric disturbance as much as possible, no food should be allowed for some hours before etherization, and a moderate dose of brandy or whisky should be administered at the beginning of the latter process. In a few instances etherization has produced alarming remote effects. Dr. F. D. Lente has reported three cases of this kind. (*New York Journ. of Med.*, Nov. 1856.) Sometimes death has ensued; but the instances are extremely rare in which a fatal result could be clearly traced to the direct influence of ether.

Pharm. Uses. Digitalinum, *Br.;* Oleoresina, *U. S.*

Off. Prep. Collodium, *U. S.;* Collodium cum Cantharide, *U. S.;* Oleum Æthereum, *U. S.;* Spiritus Ætheris, *U. S.;* Spiritus Ætheris Compositus, *U. S.*

ALCOHOL. *U. S.* *Alcohol.*

(ĂL′CỌ-HŎL.)

"A liquid, composed of 91 per cent. by weight (94 per cent. by volume) of Ethyl Alcohol [$\mathbf{C_2H_5.HO}$; 46 — C_4H_5O,HO; 46], and 9 per cent. by weight (6 per cent. by volume) of Water. Sp. gr. 0·820 at 15·6° C. (60° F.), and 0·812 at 25° C. (77° F.). Alcohol should be preserved in well-closed vessels, in a cool place, remote from lights or fire." *U. S.* "Alcohol, $C_4H_6O_2$, with 16 per cent. of water, of the sp. gr. 0·838." *Br.*

Spiritus Rectificatus, *Br.*, Rectified Spirit; Spiritus, *P. G.;* Spiritus Vini Rectificatissimus, Alcohol Vini; Spirit of Wine; Alcool, Esprit de Vin, *Fr.;* Rectificirter Weingeist, *G.;* Alcoole, Aquavite rectificata, *It.;* Alcohol, Espiritu rectificado de Vino, *Sp.*

ALCOHOL DILUTUM. *U. S.* *Diluted Alcohol.*

(ĂL′CỌ-HŎL DỊ-LŪ′TŬM.)

"A liquid composed of 45·5 per cent. by weight (53 per cent. by volume) of Ethyl Alcohol and 54·5 per cent. by weight (47 per cent. by volume) of Water. Sp. gr. 0·928 at 15·6° C. (60° F.) and 0·920 at 25° C. (77° F.)." *U. S.* "Made by mixing five pints of Rectified Spirit with three pints of Distilled Water. Sp. gr. 0·920." *Br.*

Spiritus Tenuior, *Br.*, Proof Spirit; Spiritus Dilutus, *P. G.;* Spiritus Vini Rectificatus: Alcool dilué, *Fr.;* Verdünnter Spiritus, *G.*

From the titles and definitions above given, which include all the forms of alcohol recognized by the U. S. and Br. Pharmacopœias, it will be perceived that there are two officinal strengths of Alcohol, those being considered the same which approach nearly in specific gravity and are employed for similar purposes.

In the present U. S. Pharmacopœia, 1880, the title *Alcohol* now means a spirit of the sp. gr. 0·820; this replaces both the *Alcohol Fortius* (stronger alcohol, sp. gr. 0·817), and the *Alcohol* (sp. gr. 0·835) of the Pharmacopœia of 1870. This change is undoubtedly a wise one, as the use of two comparatively strong alcohols led to some confusion in practice. The consolidation, as it may be termed, makes officinal an alcohol as strong as it can easily be obtained, and strong enough for all pharmaceutical purposes.

Alcohol, in the chemical sense, is a peculiar liquid, generated for the most part in vegetable juices and infusions by a *fermentation*, called the *vinous* or *alcoholic.* The liquids which have undergone it are called vinous liquors, and are of various kinds. Thus, the fermented juice of the grape is called wine; of the apple, cider; and the fermented infusion of malt, beer.

With regard to the nature of the liquids susceptible of the vinous fermentation, however various they may be in other respects, one general character prevails; that, namely, of containing sugar in some form or other. It is found, further, that, after they have undergone the vinous fermentation, the sugar they contain has either wholly or in part disappeared; and it was long believed that the only new products are alcohol which remains in the liquid, and carbonic acid which escapes during the process; and that these, when taken together, are equal in weight to the sugar lost. It was hence inferred that sugar is the subject-matter of the changes that occur during the vinous fermentation, and that it is resolved into alcohol and carbonic acid. More recently, however, it has been shown by M. Pasteur that, along with alcohol and carbonic acid, glycerin and succinic acid are generated in small amount, and that the process is not so simple as at first supposed. Indeed, a peculiar alkaloid is said to have been detected as a result of vinous fermentation. (Oser, *Journ. de Pharm.*, 1868, p. 80.)

Sugar will not undergo the vinous fermentation by itself; but requires to be dissolved in water, subjected to the influence of a ferment, and kept at a certain temperature. Accordingly, sugar, water, the presence of a ferment, and the maintenance of an adequate temperature may be deemed the prerequisites of the vinous fermentation. The water acts by giving fluidity, and the ferment and temperature by commencing and maintaining the chemical changes. The precise manner in which the ferment operates has not been positively determined; but the fermentative change seems to be intimately connected with the multiplication of a microscopic vegetable, *torula cerevisiæ.* Pasteur has shown that the yeast plant lives and grows at the expense of the sugar, which is converted partly into the tissue of the plant, partly into alcohol and other products. The proper temperature for conducting the vinous fermentation ranges from 15·5° C. to 32·2° C. (60° to 90° F.).

Certain vegetable infusions, as those of potatoes and rice, readily undergo vinous fermentation, on account of the ease with which their starch is changed into sugar under the influence of certain ferments. Taking the formula of starch as $(C_6H_{10}O_5)_3$, as at present accepted, it is first changed under the influence of dilute acids or ferments according to the reaction,

$$(C_6H_{10}O_5)_3 + H_2O = C_{12}H_{22}O_{11} + C_6H_{10}O_5,$$

and these products are both changed under the continued action of the same agents into a *glucose* sugar, $C_6H_{12}O_6$, which is then fermentable:

$$C_{12}H_{22}O_{11} + H_2O = (C_6H_{12}O_6)_2, \text{ and}$$
$$C_6H_{10}O_5 + H_2O = C_6H_{12}O_6.$$

The intermediate product, $C_{12}H_{22}O_{11}$, known as *maltose* or *saccharose*, according to the conditions of its formation, is not directly fermentable. According to Berthelot, mannite, glycerin, and similar substances may be made to ferment by contact, for several weeks, with chalk and cheese at 40° C. (104° F.); and the change takes place without the production of sugar, provided chalk be present. M. Arnoult has succeeded in obtaining alcohol by fermenting sugar (glucose), formed by the action of sulphuric acid on poplar wood sawdust, which yielded from 70 to 80 per cent. of this kind of sugar.

Alcohol, being the product of the vinous fermentation, necessarily exists in all vinous liquors, and may be obtained from them by distillation. Formerly it was supposed that these liquors did not contain alcohol, but were merely capable of furnishing it, in consequence of a new arrangement of their ultimate constituents, the result of the heat applied. Brande, however, disproved this idea, by showing that alcohol may be obtained from all vinous liquors without the application of heat, and therefore must pre-exist in them. His method of separating it consists in precipitating the acid and coloring matter from each vinous liquor by subacetate of lead, and removing the water by carbonate of potassium. According to Gay-Lussac, litharge, in fine powder, is the best agent for precipitating the coloring matter.

In vinous liquors, the alcohol is largely diluted with water, and associated with coloring matter, volatile oil, extractive, ethereal substances, and various acids and salts. In purifying it, we take advantage of its volatility, which enables us to separate it by distillation, combined with some of the principles of the vinous liquor employed, and more or less water. The distilled product of vinous liquors forms the different *ardent spirits of commerce.* When obtained from wine, it is called brandy; from fermented molasses, rum; from cider, malted barley, or rye, whisky; from malted barley and rye-meal with hops, and rectified from juniper berries, Holland gin; from malted barley, rye, or potatoes, and rectified from turpentine, common gin; and from fermented rice, arrack. These spirits are of different strengths, that is, contain different proportions of alcohol, and have various peculiarities by which they are distinguished by the taste. Their strength is accurately judged of by the specific gravity, which is always less in proportion as their concentration is greater.* When they have the sp. gr. 0·920 (0·91984, *Drinkwater*), they are designated in commerce by the term *proof spirit.* If lighter than this, they are said to be above proof; if heavier, below proof; and the percentage of water, or of spirit of 0·825, necessary to be added to any sample of spirit to bring it to the standard of proof spirit, indicates the number of degrees the given sample is above or below proof. Thus, if 100 volumes of a spirit require 10 volumes of water to reduce it to proof spirit, it is said to be "10 over proof." On the other hand, if 100 volumes of a spirit require 10 volumes of spirit of 0·825 to raise it to proof, it is said to be "10 under proof."

Proof spirit is still very far from being pure; being a dilute alcohol, containing about half its weight of water, together with a peculiar oil and other foreign matters. It may be further purified and strengthened by redistillation, or *rectification* as it is called. Whisky is the spirit usually employed for this purpose; and from every hundred gallons, between fifty-seven and fifty-eight may be obtained, of the average strength of rectified spirit (sp. gr. 0·835), corresponding very nearly with the *Spiritus Rectificatus* of the British. When this is once more cautiously distilled, it will be further purified from water, and the sp. gr. attained will be about 0·825, which is the lightest spirit that can be obtained by ordinary distillation, and is the pure spirit of the British system of excise. It still, however, contains 11 per cent. of water. In the mean while, the spirit, by these repeated distillations, becomes more and more freed from the contaminating oil, called *grain oil* or *fusel oil.* (See *Alcohol Amylicum.*) We shall first consider the general properties of alcohol, and afterwards the different officinal forms.

Properties. Alcohol, using this term in a generic sense, is a colorless, transparent, volatile liquid, of a penetrating, agreeable odor, and burning taste. It should be free from foreign odor, which, when present, is owing to fusel oil. When free from water, it is called *anhydrous* or *absolute alcohol.* It is inflammable, and burns without smoke or residue, forming water and carbonic acid. Its flame is bluish when strong, but yellowish when weak. It combines in all proportions with water and ether; and, when diluted with distilled water, preserves its transparency. Its density varies with the proportion of water it contains. When of the sp. gr. 0·820, its boiling point is at 78° C. (183° F.). Its value depends upon the quantity of absolute alcohol contained in it; and, as this is

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* H. Grouven (*Vortr. über Agriculturchemie,* i. 425; *N. R.,* May, 1879) gives the following average percentages of alcohol, as contained in the ordinary liquors:

	Vol. per cent.	Weight per cent.
Scotch Whisky	50·3	42·8
Irish "	49·9	42·3
American " (old)	60·0	52·2
English "	49·4	41·9
French Cognac (Brandy)	55·0	47·3
Rum	49·7	42·2
Gin	47·8	40·3
German "Schnapps"	45·0	37·9
Russian "Dobry Wutky"	62·0	54·2

The percentage of alcohol in American whisky is usually lower than that given above.

greater in proportion as the sp. gr. is less, it is found convenient to take the density of a sample in estimating its strength. This is done by instruments called hydrometers, which, when allowed to float in the spirit, sink deeper into it in proportion as it is lighter. Each hydrometer strength has a corresponding specific gravity; and, by referring to tables constructed for the purpose, the percentage of absolute alcohol is at once shown. Dr. W. H. Pile & Son, makers of hydrometers in Philadelphia, graduate instruments showing specific gravity at once, which are exceedingly convenient.

Alcohol is capable of dissolving a great number of substances; as, for example, sulphur and phosphorus in small quantity, iodine and ammonia freely, and the hydrates of potassium, sodium, and lithium, but not the carbonates of these metals. Among organic substances, it is a solvent of the organic vegetable alkalies, urea, tannic, citric, and tartaric acids, sugar, mannite, camphor, resins, balsams, volatile oils, and soap. It dissolves the fixed oils sparingly, except castor oil, which is abundantly soluble in it. It reacts chemically with some acids, forming the ethyl ethers, but with others acts only as a solvent. All deliquescent salts are soluble in alcohol, except carbonate of potassium; while the efflorescent salts, and those either insoluble or sparingly soluble in water, are mostly insoluble in it. It dissolves ammonium chloride, and most of the chlorides readily soluble in water; also some nitrates, but none of the metallic sulphates.

A method of detecting alcohol in small proportions has been proposed by M. Carstanjin. The liquid supposed to contain it, having been mixed with platinum black in a small flask, is heated to 51·1° C. (124° F.), well shaken, and filtered. To the filtrate a few drops of solution of potassa are added, and the liquor evaporated to dryness on a water-bath. The residue is then heated with a little arsenious acid; when, if alcohol be present, a garlicky odor will be perceived, owing to the production of cacodyl. According to M. Nickles, however, propylic alcohol would produce the same result. (*A. J. P.*, 1865, p. 334.) A very delicate test for small quantities of alcohol is that of Lieben as modified by Hager. (*Zeitsch. Anal. Chem*, ix. 492.) It depends on the fact that alcohol under the influence of iodine and an alkali yields iodoform, CHI_3, the properties of which are very characteristic. To 10 C.c. of the clear suspected liquid five or six drops of a 10 per cent. solution of caustic potash or soda are added, and the liquid is warmed to about 50° C. (122° F.). A solution of iodide of potassium fully saturated with free iodine is next added drop by drop, with agitation, until the liquid becomes permanently yellowish brown, when it is carefully decolorized by a further cautious addition of the caustic alkali solution. If alcohol be present, iodoform is gradually deposited at the bottom of the tube in yellow crystals, which, after standing, may be examined with a lens. Spirit diluted with 2000 parts of water, when treated as above and allowed to stand twelve hours, gives a distinct dust-like deposit of iodoform. Unfortunately, the above delicate reaction is not peculiar to alcohol, being produced by acetone, aldehyde, propylic and butyric alcohols, various ethers, etc. On the other hand, it is not given by pure methyl or amyl alcohol, chloroform, chloral, glycerin, or ether, nor by acetic, formic, or oxalic acid. (Allen, *Commercial Org. Anal.*, p. 80; see also *A. J. P.*, Feb. 1877, Feb. 1879, Nov. 1879; *N. R.*, Aug. 1876.) Prof. Barfoed, of Copenhagen, recommends for an approximate simple test, to moisten small slips of filtering paper thoroughly with the alcohol, and set fire to them. If, when the alcohol has burned out, the paper slip catches fire readily, the latter must be stronger than 80 per cent.; if the paper barely catches fire, the strength may be presumed to be between 75 to 80 per cent.; if it does not catch fire at all, the alcohol cannot be stronger than 73 to 75 per cent. (*A. J. P.*, Jan. 1875.)

The table on the next page, constructed by Lowitz and improved by Thomson, gives the sp. gr. of different mixtures by weight of absolute alcohol and water. H. von Baumhauer has inferred from his experiments that the results in the table are not entirely correct. The inaccuracies, however, admitting the results of Baumhauer, are not so great as to be of much importance in a pharmaceutic point of view.

Table of the Specific Gravity of different Mixtures by Weight of Absolute Alcohol and Distilled Water, at the Temperature of 60°.

100 parts.		Sp. Gr. at 60°.	100 parts.		Sp. Gr. at 60°.	100 parts.		Sp. Gr. at 60°.	100 parts.		Sp. Gr. at 60°.
Alc.	Wat.		Alc.	Wat.		Alc.	Wat.		Alc.	Wat.	
100	0	·796[*]	76	24	·857	52	48	·912	28	72	·962
99	1	·798	75	25	·860	51	49	·915	27	73	·963
98	2	·801	74	26	·863	50	50	·917	26	74	·965
97	3	·804	73	27	·865	49	51	·920[**]	25	75	·967
96	4	·807	72	28	·867	48	52	·922	24	76	·968
95	5	·809	71	29	·870	47	53	·924	23	77	·970
94	6	·812	70	30	·871	46	54	·926	22	78	·972
93	7	·815	69	31	·874	45	55	·928[††]	21	79	·973
92	8	·817[†]	68	32	·875	44	56	·930	20	80	·974
91	9	·820[‡]	67	33	·879	43	57	·933	19	81	·975
90	10	·822	66	34	·880	42	58	·935	18	82	·977
89	11	·825[§]	65	35	·883	41	59	·937	17	83	·978
88	12	·827	64	36	·886	40	60	·939	16	84	·979
87	13	·830	63	37	·889	39	61	·941[‡‡]	15	85	·981
86	14	·832	62	38	·891	38	62	·943	14	86	·982
85	15	·835[‖]	61	39	·893	37	63	·945	13	87	·984
84	16	·838[¶]	60	40	·896	36	64	·947	12	88	·986
83	17	·840	59	41	·898	35	65	·949	11	89	·987
82	18	·843	58	42	·900	34	66	·951	10	90	·988
81	19	·846	57	43	·903	33	67	·953	9	91	·989
80	20	·848	56	44	·904	32	68	·955	8	92	·990
79	21	·851	55	45	·906	31	69	·957	7	93	·991
78	22	·853	54	46	·908	30	70	·958	6	94	·992
77	23	·855	53	47	·910	29	71	·960			

1. Absolute Alcohol. *Anhydrous Alcohol.* This, though formerly directed by the Edinburgh and Dublin Colleges, is not now officinal. By the term is implied pure alcohol, entirely free from water. In this state it cannot be obtained by ordinary distillation alone; the purest alcohol thus procured still containing 11 per cent. of water. To separate this it is customary to have recourse to substances having a very strong affinity for water, sufficient not only to abstract it from the alcohol, but to retain it at a temperature at which alcohol will distil over. Soubeiran recommends the following as an easy method for obtaining it, free from water, abundantly and economically. 1st. Rectify alcohol marking 86° of the centesimal alcoholmeter of Gay-Lussac (rectified spirit), by distilling it from carbonate of potassium. This operation raises its strength to 94° or 95°. 2d. Raise this alcohol to 97° by distilling it with fused chloride of calcium, or by digesting it with quicklime (from which it must be afterwards poured off), in the proportion of a pint of the alcohol to 1½ ounces of the chloride, or 2¼ ounces of the lime. 3d. Distil the product of this operation slowly with quicklime, in the proportion of 3¾ ounces to the pint. The product will be absolute alcohol. The operation may be shortened to two steps, by distilling the alcohol of 94° or 95° with an excess of quicklime (7¼ ounces to the pint). In all cases, before decanting or distilling, the alcohol must be digested for two or three days with the lime, at a temperature between 95° and 100° F. Lime will not answer as a substance to be distilled from, unless it be in sufficient excess; for otherwise, towards the end of the distillation, the hydrate of lime formed will yield up its water to the alcohol, and weaken the distilled product. Prof. J. Lawrence Smith (*Amer. Chemist*, Oct. 1874) procures an alcohol of 98 to 100 per cent. by macerating 3 pints of alcohol, 94 per cent., in a four-pint bottle with about six troyounces of well-burned lime; well corked and agitated at intervals for ten days, the strengthened alcohol, at the end of this time, is drawn

[*] Absolute Alcohol.

[†] Alcohol Fortius, Stronger Alcohol, *U. S.* 1870.

[‡] Alcohol, *U. S.* 1880.

[§] Lightest spirit obtained by ordinary distillation.

[‖] Alcohol, *U. S.* 1870.

[¶] Spiritus Rectificatus, *Br.*

[**] Spiritus Tenuior, Proof Spirit, *Br.*

[††] Alcohol Dilutum, *U. S.* 1880.

[‡‡] Alcohol Dilutum, *U. S.* 1870.

off by a siphon, and may be freed, if desired, of the small trace of lime by redistillation.

Properties. Absolute alcohol is a colorless, volatile liquid, of an agreeable odor and burning taste. It boils at 78·4° C. (173·1° F.), and is not congealed by a cold of 166° below zero. Its sp. gr. is 0·7978 at 68°, according to Regnault; 0·79381 at 60°, according to Drinkwater. The sp. gr. of its vapor is 1·59. Its freedom from water may be ascertained by dropping into it a piece of anhydrous baryta, which will remain unchanged if the alcohol be free from water; but otherwise will fall to powder. Another method for determining the same point is to allow alcohol to stand for some time, in a stoppered bottle, on anhydrous sulphate of copper. If the alcohol be anhydrous, the salt will remain white; otherwise it will become blue. (*Casoria.*) Görgeu's test of forming a clear solution when mixed with an equal bulk of pure benzol is more delicate. Absolute alcohol should be free from fusel oil.

Absolute alcohol burns with a pale flame without residue, the products being carbonic acid and water. Its vapor, passed through a porcelain tube filled with pumice-stone and heated to redness, yields carbon, gaseous hydrocarbons, aldehyde, naphthalen, benzen, phenol, and various other substances. (*Berthelot.*) It unites in all proportions with ether and water. Its union with water is attended by condensation and a rise of temperature. When 52·6 volumes of alcohol are mixed with 47·4 of water, corresponding with one mol. of the former to three of the latter, the decrease of volume is at the maximum, amounting to 3·4 per cent. Berthelot has announced the formation of alcohol synthetically, by the union of olefiant gas with water. In this discovery he was anticipated by the late Mr. Hennel, who published it in 1828.

Composition. Absolute alcohol consists of two atoms of carbon 24, six of hydrogen 6, and one of oxygen 16 = 46. Its empirical formula is, therefore, C_2H_6O. It is, however, recognized as the hydrate of the radical ethyl (C_2H_5), so that its rational formula would be C_2H_5,OH.

During the vinous fermentation sugar disappears, and the sole products were supposed to be alcohol and carbonic acid, which, taken together, were believed to equal in weight the lost sugar. Now, the comparative composition of the substances concerned supports the opinion that these are the sole derivatives of a portion of the sugar lost. Preparatory to the fermentation, the cane sugar is changed into *grape sugar*, or into a mixture of equal molecules of *dextrose* and *levulose*, called *invert* sugar, according to the reaction given on the preceding page. These two sugars, dried at 100° C. (212° F.), consist of $C_6H_{12}O_6$. Supposing one mol. of this fermentable sugar to be the subject of the change, it will be found to have a composition which admits of its being broken up into two mols. of alcohol and two of carbonic acid; for $C_6H_{12}O_6 = 2(C_2H_6O) + 2(CO_2)$. But it does not follow that all the sugar has been converted into alcohol and carbonic acid; and Pasteur, as before stated, has shown that a portion lost has not been thus converted, but has been partly appropriated to the growth of the yeast plant of the ferment, and partly changed into glycerin and succinic acid.

2. ALCOHOL. *U. S. Alcohol*, sp. gr. 0·820. This was an officinal of the Dublin College, which gave a formula for its preparation, and stated its sp. gr. at 0·818. The Stronger Alcohol introduced into the Materia Medica of the U. S. Pharmacopœia, at the revision of 1860, though of the sp. gr. 0·817, and therefore a little stronger than the late Dublin preparation, may for all practical purposes be considered as identical with it. To prepare it on a small scale, carbonate of potassium, previously ignited in a heated mortar, may be mixed with ordinary alcohol (sp. gr. 0·835) in a bottle, and shaken occasionally for about four hours; the mixture being, in the mean time, maintained at the temperature of about 100°. Upon resting, the liquid divides into two strata, the lower consisting of a watery solution of carbonate of potassium, the upper of the stronger alcohol, which is to be separated, and distilled so as to obtain the measure of about nine-tenths of the original alcohol employed.

It is described as " a transparent, colorless, mobile and volatile liquid, of a characteristic, pungent and agreeable odor, and a burning taste. It should not change the color of blue or red litmus paper, previously moistened with water. It boils at 78° C. (172·4° F.), and is readily inflammable, giving a blue flame without smoke.

"If a portion of at least 50 C.c. be evaporated to dryness in a glass vessel, no residue or color should appear. If mixed with its own volume of water, and one-fifth its volume of glycerin, a piece of blotting-paper, on being wet with the mixture, after the vapor of Alcohol has wholly disappeared, should give no irritating or foreign odor (fusel oil). And if a portion be evaporated to one-fifth its volume, the residue should not turn reddish upon the addition of an equal volume of sulphuric acid (amyl alcohol). When treated, in a test-tube, with an equal volume of solution of potassa, there should not be an immediate darkening of the liquid (methyl alcohol, aldehyde, and oak tannin). If a portion of about 150 C.c. be digested for an hour with 20 Gm. of carbonate of lead, and filtered, the filtrate then distilled from a water-bath, and the first 20 C.c. of the distillate treated with 1 C.c. of test-solution of permanganate of potassium, the color should not disappear within one or two minutes (abs. of methyl alcohol). If 20 C.c. are shaken in a glass-stoppered vial, previously well rinsed with the same Alcohol, with 2 C.c. of test-solution of nitrate of silver, the mixture should not be rendered more than faintly opalescent during one day's exposure to direct sunlight (abs. of more than traces of foreign organic matters, fusel oil, etc.)." *U. S.*

On a large scale, we are informed that alcohol of this strength is now prepared in the United States, very abundantly, by simple distillation by means of a modified distillatory apparatus. The modification consists in substituting for a single refrigerated receiver, a series of receivers, kept at such temperatures that, in the first of them, the watery vapor shall condense with comparatively little of the alcoholic, which, as it passes through the successive recipients, is more and more deprived of water, until, when condensed in the last, it yields a spirit at least as strong as the officinal Alcohol of the sp. gr. 0·820. At the same time that the spirit is thus strengthened, it becomes, on the same principle, more and more freed from fusel oil, until at length almost wholly deprived of it.

The British preparation contains 16, the U. S. only 9 per cent. of water. Officinal alcohol, though of standard strength, may still be impregnated with a volatile principle, called *fusel oil.* This is usually removed by digesting the alcohol with charcoal. It may also be removed, as well as other impurities, by passing the impure spirit through a filtering bed, composed of sand, wood-charcoal, boiled wheat, and broken oyster-shells, arranged in layers according to the method of Mr. W. Schaeffer. (*A. J. P.*, 1854, p. 536.) Another method, proposed by M. Breton, is to add a few drops of olive oil to the spirit in a bottle, which is then to be shaken, allowed to settle, and decanted. The olive oil dissolves and retains the fusel oil. (*Chem. Gaz.*, April 15, 1859, p. 160.) If 5 C.c. of alcohol be mixed with 6 times its volume of water and then agitated with about 20 drops of chloroform, the latter will, if separated and allowed to evaporate spontaneously, leave the fusel oil perceptible by its odor; and by treating with a little sulphuric acid and potassium acetate, its peculiar ether may be recognized by its odor. (*Ber. Chem. Ges.*, viii.; *A. J. P.*, 1875, p. 304.) If a little of the solution of nitrate of silver be added to alcohol, and the mixture exposed to a bright light, a black powder will be precipitated, if fusel oil be present. Officinal alcohol will not withstand this test; as the best contains a little of the foreign oil. According to Mr. E. N. Kent, of New York, nitrate of silver will not detect fusel oil, but affords its indications by reacting with other organic substances. For detecting fusel oil, Mr. Kent finds pure sulphuric acid the best test. To apply it he half fills a test-tube with the spirit to be tested, and then fills it up very slowly with pure concentrated sulphuric acid. If the spirit be pure, it will remain colorless, otherwise it will become colored, the tint being deeper in proportion to the amount of the impurity. (*New York Journ. of Pharm.*, Aug. 1854.) "Four fluidounces, with thirty grain-measures of *the volumetric solution of nitrate of silver*, exposed for 24 hours to bright light, and then decanted from the black powder which has formed, undergoes no further change when again exposed to light with more of the test." *Br.*

This admits the presence of a small but limited proportion of fusel oil. The U. S. Pharmacopœia directs that officinal alcohol, when diluted with 20 parts of distilled water, should have little or no foreign odor; the Br. Pharmacopœia, that its odor and taste should be purely alcoholic.

The best alcohol made in Philadelphia is that manufactured under Atwood's patent process, in which manganic acid is used to destroy the fusel oil and other foreign substances. This alcohol withstands the tests of nitrate of silver and sulphuric acid remarkably well. Pure fused sodium acetate has been proposed as a substance particularly adapted to retain fusel oil, and has been used by adding it to the alcohol to be rectified in the proportion of about 10 pounds to the barrel of forty-five gallons, and redistilling.

Medical Properties and Uses. Probably all the soft tissues of the body are capable of being impressed by alcohol, if it be in sufficient amount and concentration. Locally applied it is irritant even to the skin, and much more so to the more delicate organs: hence the various abdominal inflammations which are so frequent in habitual drunkards. When it is taken internally in proper quantity, it causes a feeling of exhilaration, with distinct increase in the force and frequency of the pulse. When larger amounts are ingested, the well-known phenomena of drunkenness follow. A single dose of it, if large enough, may produce death, preceded by loss of consciousness, profound muscular relaxation, and diminished respiration. The temperature of the body may be elevated slightly by small doses of the drug, the rise being due to the excitement of the circulation and not to any direct action. After toxic amounts the temperature is usually lowered, and the fall may be very marked. The action of the drug upon the bodily temperature of those who use it habitually is very slight. The nervous symptoms caused by alcohol show that it has a very powerful and direct influence upon the nerve centres. This action, at first stimulant, after large doses soon becomes depressant, many of the phenomena of intoxication being really due to a loss of control by the paralyzed will over the lower nerve centres. The order of involvement by the nerve centres is probably the same as in etherization. The arterial pressure and the pulse rate are both increased by moderate doses of alcohol; the way in which this increase is produced is not positively determined, but it is probably by a direct influence upon the heart itself. After toxic amounts the force of the circulation is greatly lessened, partly by vaso-motor paralysis and partly by a direct depression of the heart. Alcohol is undoubtedly absorbed, and is in part burnt up in the system and in part eliminated by the lungs, skin, and especially the kidneys. The organism seems to have the power of destroying only a certain amount of the drug, and consequently elimination increases disproportionately with the dose. The amount of alcohol that the system can consume varies very greatly not only with the individual, but in different bodily conditions of the same individual: in conditions of exhaustion, and especially in the "typhoid state," very much more can be appropriated than in health. There is good ground for believing that alcohol lessens the excretion of nitrogenous material from the body; it would seem most probable that this is achieved by checking tissue waste; but it may be that, as suggested by Dr. Geo. B. Wood, alcohol simply renders the digestion of the food more perfect and lessens the production of food urea.

In acute diseases associated with debility, alcohol is often an invaluable remedy. Of all medicines it is the one most frequently employed as a stimulant. Taken along with food in small quantity, it favors digestion by its local effect upon the stomach, and possibly also by stimulating the nerve and arterial centres. It does not directly elevate temperature, and hence is not contraindicated by fever; in typhoid and other low fevers it is of great value. In all conditions of depression the system tolerates much more of it than in health: hence in snake-bite, typhoid and typhus fever, diphtheria, etc., enormous quantities are often exhibited with great benefit. So long as it is not perceptible in the breath, and does not cause nervous or circulatory excitement, alcohol in these cases is probably not in excess. In chronic diseases great care is necessary in the exhibition of the remedy for fear of begetting intemperate habits. This is especially the case in neuralgia and other painful affections in which the narcotic influence of alcohol may be very soothing; under these circumstances there is a constant tendency to an increase of the frequency and size of the dose. Taken habitually in excess, alcohol produces the most deplorable results, and is a very common cause of fatal maladies. For the symptoms and treatment of chronic alcoholism, the reader is referred to H. C. Wood's Treatise on Therapeutics. In acute poisoning, the stomach should be at once emptied, the respiration be maintained by the use of atropia and other methods (see *Opium Poisons*), and the bodily heat sustained by external warmth. In some cases it may be well to employ ammonia or digitalis to act upon the nearly paralyzed heart. Locally, alcohol is sometimes used for the purpose of hardening the skin and as an antiseptic dressing for wounds, the wound being washed out with it until all bleeding has ceased, the edges then united, and the whole surrounded by an alcoholic dressing. As an internal remedy alcohol is very rarely employed in the pure state, but only in the form of spirits, wines, or fermented liquors, which are described elsewhere.

3. ALCOHOL DILUTUM. *U. S.* "A liquid composed of 45·5 per cent. by weight (53 per cent. by volume) of Ethyl Alcohol, and 54·5 per cent. by weight (47 per cent. by volume) of Water. Sp. gr. 0·928 at 15·6° C. (60° F.) and 0·920 at 25° C. (77° F.).

"Alcohol *fifty parts* [or seventeen fluidounces]; Distilled Water *fifty parts* [or fourteen fluidounces], To make *one hundred parts.* Diluted Alcohol of this strength may be prepared from Alcohol of any higher percentage by the following rule, in which all terms denote weight. Divide the alcoholic percentage of the alcohol to be diluted by 45·5, and subtract 1 from the quotient. This gives the number of parts of water to be added to *one* (1) *part* of the alcohol. Diluted Alcohol should respond to the tests of purity given under *Alcohol.*" *U. S.*

Spiritus Tenuior, *Br.*, Proof Spirit.

The U. S. preparation consists of equal weights of officinal alcohol and water, and has the sp. gr. 0·9303; the British, for which a process is given, is made by mixing five pints of Rectified Spirit with three pints of Distilled Water, and has the sp. gr. 0·920. The latter is the stronger of the two, containing only 51 per cent. of water, while the U. S. preparation contains nearly 55 per cent.*

The purer forms of alcohol, whether strong or diluted, are employed almost exclusively in pharmacy; as in the preparation of medicines, such as ether, into the composition of which they enter; for the preservation of organic substances; in the extraction of the active principles of vegetables, as in the tinctures; for dissolving bodies soluble in alcohol much more readily than in water, or insoluble in the latter fluid; and for various other pharmaceutic purposes. Nélaton, however, uses rectified spirit as a local application to wounds to be healed by the first intention, washing the surface with the liquid, before bringing them together, until hemorrhage ceases. Dr. Sempleton, in the *British Medical Journal*, 1879, proposes an undiluted benzoated alcohol, made by dissolving half an ounce of benzoic acid prepared

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* *Table showing the Strength of Commercial Alcohols, and of different mixtures, by weight, of Commercial 95 p. c. Alcohol and Distilled Water, at 60° F.* By Alonzo Robbins.

	Per cent. by vol.	Per cent. by weight.	Spe. grav.		Per cent. by vol.	Per cent. by weight.	Spe. grav.
Absolute alcohol	99·60	99·19	·7962	95 per ct. alc. 2 parts, water 1 part	67·50	59·90	·8959
Extra cologne spirit	94·75	92·03	·8170	“ “ 1 “ “ 1 “	52·00	44·50	·9303
Cologne spirit	93·75	91·02	·8199	“ “ 2 “ “ 3 “	43·00	36·10	·9469
95 per cent. alcohol	93·25	90·19	·8223	“ “ 1 “ “ 2 “	36·00	29·90	·9579
Neutral sweet spirit	41·50	44·80	·9494	“ “ 1 “ “ 3 “	27·00	27·17	·9689
95 per ct. alc. 10 parts, water 1 part	87·00	82·07	·8433	“ “ 1 “ “ 4 “	23·00	18·77	·9731
“ “ 9 “ “ 1 “	85·75	80·58	·8469	“ “ 1 “ “ 5 “	19·00	15·43	·9772
“ “ 8 “ “ 1 “	85·50	80·26	·8477	“ “ 1 “ “ 6 “	17·00	13·78	·9791
“ “ 7 “ “ 1 “	84·00	78·53	·8521	“ “ 1 “ “ 7 “	15·00	12·13	·9814
“ “ 6 “ “ 1 “	82·75	76·94	·8559	“ “ 1 “ “ 8 “	13·00	10·50	·9834
“ “ 5 “ “ 1 “	81·50	75·38	·8595	“ “ 1 “ “ 9 “	12·00	9·68	·9844
“ “ 4 “ “ 1 “	78·25	71·43	·8685	“ “ 1 “ “ 10 “	10·00	8·05	·9869
“ “ 3 “ “ 1 “	74·00	66·80	·8798				

from gum benzoin in a pint of alcohol, to be used as a lotion, gargle, or in the form of spray.

Diluted alcohol is employed as an addition to the compound infusion of gentian, and to some of the distilled waters and preparations of vinegar, in order to preserve them from decomposition; as a menstruum for extracting the virtues of plants, preparatory to the formation of extracts and syrups; and in preparing many of the spirits, and a few of the medicated wines. But it is in forming the tinctures that diluted alcohol is chiefly used. Some of these are made with officinal alcohol (rectified spirit), but the majority with diluted alcohol (proof spirit) as the menstruum. As the latter contains more than half its weight of water, it is well fitted for acting on these vegetables, the virtues of which are partly soluble in water and partly in alcohol. The apothecary, however, should never substitute the commercial proof spirit for diluted alcohol, even though it may be of the same strength, on account of the impurities in the former; but, when it is recollected how variable the so-called proof spirits are in strength, the objection to their use in pharmacy becomes still stronger.

Pharm. Uses. 1. Of *Alcohol Fortius*, U. S. In the preparation of Aloe Purificata, *U. S.;* Ceratum Extracti Cantharidis, *U. S.;* Chloroformum Purificatum, *U.S.;* Hydrargyri Iodidum Viride, *U. S.*—2 Of *Alcohol*, U. S., *Spiritus Rectificatus*, *Br.* In the preparation of Ammonii Iodidum, *U. S.;* Aqua Camphoræ, *U. S.;* Beberiæ Sulphas, *Br.;* Digitalinum, *Br.;* Emplastrum Aconiti, *U. S.;* Emplast. Asafœtidæ, *U. S.;* Emplast. Belladonnæ, *Br.;* Extracta; Extracta Alcoholica, *U. S.;* Extracta Fluida, *U. S.;* Extracta Liquida, *Br.;* Purificatum, *Br.;* Ferri Sulphas Granulata, *Br.;* Hydrargyri Iodidum Viride, *Br.;* Quiniæ Sulphas, *U. S.;* Resinæ; Santoninum, *Br.;* Strychnia, *U. S.;* Unguentum Aconitiæ, *Br.;* Unguentum Atropiæ, *Br.*—3. Of *Alcohol Dilutum*, U. S., *Spiritus Tenuior*, or *Proof Spirit*, Br. In the preparation of Extracta; Extracta Alcoholica, *U. S.;* Extracta Fluida, *U. S.;* Syrupi; Unguentum Iodi, *Br.*

Off. Prep. 1. Of *Alcohol Fortius,* U.S. Æther, *U.S.;* Collodium, *U.S.;* Collodium cum Cantharide, *U. S.;* Spiritus Ætheris Nitrosi, *U. S.;* Spiritus, *U. S.*—2. Of *Alcohol*, U. S., *Spiritus Rectificatus*, Br. Acidum Sulphuricum Aromaticum; Æther, *Br.;* Chloroformum, *Br.;* Collodium, *Br.;* Essentiæ, *Br.;* Infusum Gentianæ Comp., *U. S.;* Linimentum Aconiti; Liniment. Belladonnæ, *Br.;* Liniment. Camphoræ Comp., *Br.;* Liniment. Crotonis, *Br.;* Liniment. Iodi, *Br.;* Liniment. Saponis; Liniment. Sinapis Comp., *Br.;* Liquor Atropiæ, *Br.;* Liquor Morphiæ Acetatis, *Br.;* Liquor Morphiæ Hydrochloratis, *Br.;* Liquor Plumbi Subacetatis Dilutus, *Br.;* Liquor Strychniæ, *Br.;* Spiritus; Succus Conii; Succus Scoparii, *Br.;* Succus Taraxaci; Syrupi; Tincturæ.—3. Of *Alcohol Dilutum*, U. S., *Spiritus Tenuior*, or *Proof Spirit*, Br. Mistura Gentianæ Comp., *Br.;* Spiritus, *U. S.;* Spiritus Armoraciæ Compositus, *Br.;* Syrupus Rhei Aromaticus, *U. S.;* Tincturæ; Vina; Vinum Rhei, *U. S.*

ALCOHOL AMYLICUM. *Br.* (*U. S.* 1870.) *Amylic Alcohol.*

$C_5 H_{11} HO$; 88. (ĂL'CO̱-HŎL A̱-MȲL'I̱-CŬM.) $C_{10} H_{11}O, HO$; 88.

"A peculiar alcohol obtained from fermented grain or potatoes, by continuing the distillation after the ordinary spirit has ceased to come over." *U. S.* 1870.

"Amylic alcohol, $C_{10}H_{12}O_2$, with a small proportion of other spirituous substances. An oily liquid contained in the crude spirit produced by the fermentation of saccharine solutions with yeast, and separated in the rectification of such crude spirit." *Br.*

Hydrated Oxide of Amyl, Amylic Alcohol, Grain Oil, Potato Spirit Oil; Alcohol Amylique, Huile de Grain, *Fr.;* Amylalcohol, Fuselöl, *G.;* Fousel Oil.

This oil is always present in the products of alcoholic fermentation. It is an ingredient in the ardent spirit obtained from various grains, but is most abundant in that procured from fermented potatoes. In grain spirit it is present in the proportion of about one part in five hundred by measure. When grain or potato whisky is distilled for the purpose of obtaining alcohol, the pure spirit will continue to come over for a certain time, after which, if the distillation be continued, a milky liquid will be obtained, which, upon standing, will be covered with a stratum of this peculiar oil.

Subjected to distillation, the milky liquid will at first boil at a comparatively low temperature, and yield water and a little of the oil; but after a time the boiling point will rise to 132° C. (269° F.), when the oil will come over pure. By changing the receiver when the oil begins to distil free from water, the oil is collected separate.

Properties. Amylic alcohol is an oily, colorless liquid, of a strong, offensive odor, and acrid, burning taste. As usually prepared it has a pale yellow color. Its sp. gr. is 0·818; that of its vapor 3·15. It boils at 132° C. (269° F.), and congeals at —20° C. (—4° F.) in the form of crystalline leaves. It is very sparingly soluble in water, but unites in all proportions with alcohol, ether, and essential oils. It dissolves iodine, sulphur, and phosphorus, and is a good solvent for fats, resins, and camphor. When dropped upon paper it does not leave a permanent greasy stain. It does not take fire like alcohol by the contact of flame, but requires to be heated to a temperature of about 54·5° C. (130° F.) before it begins to burn. Pasteur first observed that the ordinary amyl alcohol of fermentation was a mixture of two distinct alcohols, one optically active, lævogyrate, and the other optically inactive. Their boiling points are very close, but they may be separated by the difference in solubility of the barium amyl-sulphates, and yield different sets of derivatives. (*Compt.-Rend.*, 41, p. 296.) Amyl alcohol consists of five atoms of carbon 60, twelve of hydrogen 12, and one of oxygen 16 = 88. It is recognized as the hydrate of the radical amyl (C_5H_{11}), and its formula is, therefore, C_5H_{11},OH. Heated with phosphoric oxide, it loses a molecule of water, and forms a hydrocarbon, C_5H_{10}, homologous with ethylen, called amylen or valeren, which has been proposed as an anæsthetic. Amyl alcohol should not affect the color of litmus paper, previously moistened with water, should leave no fixed residue upon evaporation; should require to dissolve it about 40 parts of distilled water at 15° C. (59° F.), and should become not more than slightly turbid upon mixture with benzin (absence of more than a little alcohol, or water). (See *Amylen* in Part II.) When subjected to oxidizing agents, it loses two atoms of hydrogen and gains one of oxygen, and becomes $C_5H_{10}O_2$, or *amylic acid*, which is identical with *valerianic acid*, the acid found in valerian. Hence the test given in the Br. Pharmacopœia; "exposed to the air in contact with platinum-black, it is slowly oxidized, yielding valerianic acid." *Br.* This acid bears the same relation to amylic alcohol that acetic acid does to ethylic alcohol, and formic acid to methylic alcohol. The free amyl, $(C_5H_{11})_2$, has been isolated by Dr. E. Frankland. It is a colorless pellucid liquid, of the sp. gr. 0·7704. (*Chem. Gaz.*, March 15, 1850.) Its hydride, C_5H_{11},H, has been discovered to be an energetic anæsthetic by Dr. Simpson, of Edinburgh.

Crude fusel oil may be obtained from the alcohol distillers. Mr. Kent, of New York, found in it, as impurities, water, alcohol, acetic and amylic acids, oxide of iron, and an amyl compound, analogous to œnanthic ether. According to Messrs. T. and H. Smith, the crude oil is a mixture of propylic, butylic, and amylic alcohols, and of other alcohols much higher in the series. Fusel oil is now used largely by the manufacturers of cinchona alkaloids as a solvent.

Fusel oil was made officinal by the Dublin College, in its Pharmacopœia of 1850, as an artificial source of valerianic acid, to be used in forming valerianate of sodium, from which, by double decomposition, three other valerianates, namely, those of iron, zinc, and quinia, were directed by the College to be prepared. It was introduced into the U. S. Pharmacopœia for a similar purpose, but at the late revision, valerianic acid was dismissed, and amylic alcohol being no longer wanted for its preparation, shared its fate.

Amylic alcohol is an active irritant poison.

Off. Prep. Sodæ Valerianas, *Br.*

ALLIUM. *U. S.* *Garlic.*

(ĂL'LỊ-ŬM.)

"The bulb of Allium sativum. Linné. (*Nat. Ord.* Liliaceæ.)" *U. S.*

Bulbus Allii; Ail, *Fr.;* Knoblauch, *G.;* Aglio, *It.;* Ajo, *Sp.*

Gen. Ch. Corolla six-parted, spreading. *Spathe* many-flowered. *Umbel* crowded. *Capsule* superior. *Willd.*

This is a very extensive genus, including more than sixty species, most of which are European. Of the nine or ten indigenous in this country, none are officinal. Dr. Griffith states that the bulb of *A. Canadense* has been substituted for the cultivated garlic, and found equally efficient. (*Med. Bot.*, p. 653.) Of the European species several have been used from a very early period, both as food and medicine. *A. sativum*, or garlic, is the only one now officinal; and to this we shall here confine our observation, simply stating that there are few genera of which the several species resemble one another more closely in sensible and medical properties than the present. For an account of *A. cepa*, or onion, and *A. Porrum*, or leek, see Part II.

Allium sativum. Willd. *Sp. Plant.* ii. 68; Woodv. *Med. Bot.* p. 749, t. 256. This is a perennial plant, and, like all its congeners, bulbous. The bulbs are numerous, and enclosed in a common membranous covering, from the base of which the fibres that constitute the proper root descend. The stem is simple, and rises about two feet. The leaves are long, flat, and grass-like, and sheathe the lower half of the stem. At the termination of the stem is a cluster of flowers and bulbs mingled together, and enclosed in a pointed spathe, which opens on one side and withers. The flowers are small and white, and make their appearance in July. This species of garlic grows wild in Sicily, Italy, and the south of France, and is cultivated in all civilized countries.

The part employed, as well for culinary purposes as in medicine, is the bulb, which is described in the U. S. Pharmacopœia as follows. "Bulb subglobular, compound, consisting of about eight compressed, wedge-shaped bulblets, which are arranged in a circle around the base of the stem, and covered by several dry, membranaceous scales. It has a pungent, disagreeable odor, and a warm, acrid taste. It should be preserved in a dry place, and used only in the fresh state." The bulbs are dug up with a portion of the stem attached, and, having been dried in the sun, are tied together in bunches, and thus brought to market. They are said to lose, by drying, nine parts of their weight out of fifteen, with little diminution of their sensible properties. This species of Allium is commonly called *English garlic*, to distinguish it from those which grow wild in our fields and meadows. Garlic bulbs are apt to germinate and thus to undergo serious injury. Mr. A. P. Sharp preserves them by placing them in a bottle, pouring on them a little alcohol, about two fluidounces to a quart, and securely closing the bottle by a stopper of glass or cork. All tendency to germinate is thus destroyed, and the bulbs will retain their peculiar smell and taste unchanged for years. (*Proc. A. P. A.*, 1864.)

Properties. Garlic, as found in the shops, is somewhat spherical, flattened at the bottom, and drawn towards a point at the summit, where a portion of the stem several inches in length projects. It is covered with a white, dry, membranous envelope, consisting of several delicate laminæ, within which the small bulbs are arranged around the stem, having each a distinct coat. These small bulbs, commonly called *cloves* of garlic, are usually five or six in number, of an oblong shape, somewhat curved, and in their interior are whitish, moist, and fleshy.* They have a disagreeable pungent odor, so peculiar as to have received the name of *alliaceous*. Their taste is bitter and acrid. The peculiar smell and taste, though strongest in the bulb, are found to a greater or less extent in all parts of the plant. They depend on an *essential oil*, which is very volatile, and may be obtained by distillation, passing over with the first portions of water. As first obtained, the oil is of a dark brownish yellow color, heavier than water, and decomposed at its boiling temperature. It may be purified by repeated distillation in a salt-water bath, and is then lighter than water, of a pale yellow color, and not decomposed by boiling. According to Wertheim, it consists of a peculiar organic radical, called *allyl*, (C_3H_5), combined with sulphur, and is therefore sulphide of allyl, $(C_3H_5)_2S$. From one hundred-weight of garlic Wertheim obtained from three to four ounces of the impure oil, and about two-thirds as much of the rectified. (*Chem. Gaz.*, iii. 177.) The impure oil has an exceedingly pungent odor, and strong acrid taste, and, when applied to the skin, produces much irritation, and sometimes even blisters. The pure oil combines with nitrate of silver, forming a precipitate, soluble in heated alcohol and afterwards separating in crystals. This compound consists of one eq. of the oil and two eqs. of the salt, and on the addition of ammonia gives up the oil unchanged. (*Journ. de Pharm. et de Chim.*, 4e sér., v. 237, 1867.) Besides this oil, fresh garlic, according to Cadet-Gassicourt, contains, in 1406 parts, 520 of mucilage, 37 of albumen, 48 of fibrous matter, and 801 of water. Bouillon-Lagrange mentions, among its constituents, sulphur, a saccharine matter, and a small quantity of fecula. The fresh bulbs yield upon pressure nearly a fourth part of juice, which is highly viscid, and so tenacious as to require dilution with water before it can be easily filtered. When dried, it serves as a lute for porcelain. It has the medical properties of the bulbs. Water, alcohol, and vinegar extract the virtues of garlic. Protracted boiling renders it inert.

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* A variety of garlic, sometimes seen in the market, having larger and fewer cloves or small bulbs than the officinal, has been shown by Prof. Robert P. Thomas to be the product of a hybrid, probably between *A. sativum* and *A. Porrum.* (*Proc. A. P. A.*, 1860.)

Medical Properties and Uses. The use of garlic as a medicine and condiment ascends to the highest antiquity. When it is taken internally, and even when applied externally, the oil is absorbed, and imparts its odor to the breath, urine, and perspiration, etc. Its effects on the system are those of a general stimulant. It quickens the circulation, excites the nervous system, promotes expectoration in debility of the lungs, produces diaphoresis or diuresis according as the patient is kept warm or cool, and acts upon the stomach as a tonic and carminative. It is said also to be emmenagogue. Applied to the skin, it is irritant and rubefacient, and moreover exercises, in some degree, its peculiar influence upon the system, in consequence of absorption. Moderately employed, it is beneficial in enfeebled digestion and flatulence; and by many it is habitually used as a condiment. It has been given with advantage in chronic catarrh, and other pectoral affections in which the symptoms of inflammation have been subdued, and a relaxed state of the vessel remains. We have used it habitually, and with great benefit, in such affections in children, as well as in the nervous and spasmodic coughs to which the very young are peculiarly liable. It is thought also to be an excellent anthelmintic, especially in cases of ascarides, in which it is given both by the mouth and the rectum. The juice is said sometimes to check nervous vomiting in the dose of a few drops. If taken too largely, or in excited states of the system, garlic is apt to occasion gastric irritation, flatulence, hemorrhoids, headache, and fever. As a medicine, it is at present more used externally than inwardly. Bruised, and applied to the feet, it acts very beneficially, as a revulsive, in disorders of the head, and is especially useful in the febrile complaints of children, by quieting restlessness and producing sleep. Its juice mixed with oil, or the garlic itself bruised and steeped in spirit, is frequently used as a liniment in infantile convulsions and other spasmodic or nervous affections in children. The same application has been made in cutaneous eruptions.

Garlic clove may be swallowed either whole, or cut into pieces of a convenient size, but the officinal syrup has replaced all other methods of administration. The dose in substance is from half a drachm to two drachms (1·95–7·8 Gm.) of the fresh bulb. That of the juice is half a fluidrachm (1·9 C.c.).

Off. Prep. Syrupus Allii, *U. S.*

ALOE. *U. S.* *Aloes.*

(ĂL'Ọ-Ẹ.)

"The inspissated juice of the leaves of Aloe Socotrina. Lamarck. (*Nat. Ord.* Liliaceæ.)" *U. S.*

ALOE SOCOTRINA, *Br.* *Socotrine Aloes.*

"The inspissated juice of the leaf of one or more undetermined species of Aloe. Produced chiefly in Socotra." *Br.*

Aloès socotrin, ou sucotrin, *Fr.;* Socotora, oder Socotrinische Aloe, *G.;* Musebber, *Ar.*

ALOE BARBADENSIS. *Br.* *Barbadoes Aloes.*

"The inspissated juice of the leaves of Aloe vulgaris (*Lamarck*)." *Br.*

Aloès hépatique des Barbades, *Fr.;* Barbadoes Aloe, *G.*

Most of the species belonging to the genus Aloe are said to yield a bitter juice, which has all the properties of the officinal aloes. It is impossible, from the various and sometimes conflicting accounts of writers, to determine exactly from which of the species the drug is in all instances actually derived. *Aloe spicata*, however, is generally acknowledged to be an abundant source of it. In Lindley's Flora Medica, *A. purpurascens*, *A. arborescens*, *A. Commelyni*, and *A. multiformis*, all natives of the Cape of Good Hope, are enumerated as yielding aloes; *A. leptocaulon* and *A. Sahnudra*, found in Madagascar (*P. J. Tr.*, July 16, 1881), and other species are, without doubt, occasionally resorted to. We shall confine ourselves to a description of the three species which probably yield most of the aloes of commerce.

Gen. Ch. Corolla erect, mouth spreading, bottom nectariferous. *Filaments* inserted into the receptacle. *Willd.*

Aloe spicata. Willd. *Sp. Plant.* ii. 185. This species of Aloe was first described by Thunberg. The stem is round, three or four feet high, about four inches in diameter, and leafy at the summit. The leaves are spreading, subverticillate, about two feet long, broad at the base, gradually narrowing to the point, channelled upon their upper surface, and with remote teeth upon their edges. The flowers are bell-shaped, and spread horizontally in very close spikes. Beneath each flower is a broad, ovate, acute bract, white, with three green streaks, and nearly as long as the corolla. Of the six petals, the three inner are ovate, obtuse, white, with three green lines, and broader than the outer, which otherwise resemble them. The stamens are much longer than the corolla. The *spiked aloe* is a native of Southern Africa, growing near the Cape of Good Hope, and, like all the other species, preferring a sandy soil. In some districts of the colony it is found in great abundance, particularly at Zwellendam, near Mossel Bay, where it almost covers the surface of the country. Much of the Cape aloes is said to be derived from this species.

A. Socotrina. Lamarck, *Encycl.* i. 85; De Cand. *Plantes Grasses, fig.* 85; Curtis's *Bot. Mag. pl.* 472; Carson's *Illust. of Med. Bot.* ii. 48, *pl.* 92.—*A. vera.* Miller, *Dict.*, *ed.* 8, *No.* 55. The stem of this species is erect, eighteen inches or more in height, woody, and leafless below, where it is very rough from the remains of former leaves. At top it is embraced by green, sword-shaped, ascending leaves, somewhat concave on their upper surface, convex beneath, curved inward at the point, with numerous small white serratures at their edges. The flowers, which are in a cylindrical, simple raceme, are scarlet near the base, pale in the centre, and greenish at the summit, and have unequal stamens, of which three are longer than the corolla. The plant received its name from the island of Socotra, of which it is said to be a native; and is supposed to be the source of the Socotrine aloes.

A. vulgaris. Lamarck, *Encycl.* i. 86; De Cand. *Plantes Grasses, fig.* 27; Carson's *Illust. of Med. Bot.* ii. 46, *pl.* 90. This species has a very short woody stem, and lanceolate embracing leaves, which are first spreading, then ascending, of a glaucous green color, somewhat mottled with darker spots, flat on the upper surface, convex beneath, and armed with hard reddish spines, distant from each other, and perpendicular to the margin. The flower-stem is axillary, of a glaucous reddish color, and branched, with a cylindrical-ovate spike of yellow flowers, which are at first erect, then spreading, and finally pendulous, and do not exceed the stamens in length. *A. vulgaris* is a native of southeastern Europe, the north of Africa, and Madagascar. It is cultivated in Italy, Sicily, Malta, and especially in the West Indies, where it contributes largely to furnish the Barbadoes aloes.

The proper aloetic juice was formerly thought to exist in longitudinal vessels beneath the epidermis of the leaves, and readily flows out when these are cut transversely; but, according to M. Edmond Robiquet, who has made elaborate researches in relation to this drug, these vessels are air-ducts, and the juice flows in the intercellular passages between them. The liquid obtained by expression from the parenchyma is mucilaginous, and possessed of little medicinal virtue. The quality of the drug depends much upon the mode of preparing it. The finest kind is that obtained by exudation, and subsequent inspissation in the sun. Most of the better sorts, however, are prepared by artificially heating the juice which has spontaneously exuded from the cut leaves. The chief disadvantage of this process is the conversion of a portion of the soluble active principle into an insoluble and comparatively inert substance, through the influence of an elevated temperature. The plan of bruising and expressing the leaves, and boiling down the resulting liquor, yields a much inferior product; as a large portion of it must be derived from the mucilaginous juice of the parenchyma. The worst plan of all is to boil the leaves themselves in water, and evaporate the decoction. The quality of the drug is also affected by the careless or fraudulent mixture of foreign matters with the juice, and the unskilful management of the inspissation.

Commercial History and Varieties. Three chief varieties of aloes are known in commerce; the Cape aloes, the Socotrine, and the Barbadoes, of which the first two are most used in this country.

1. CAPE ALOES (*Shining Aloes*) was dropped from the U. S. Pharmacopœia at the recent revision. It is imported from the Cape of Good Hope, either directly, or through the medium of English commerce. It is collected by the Hottentots and Dutch boors indiscriminately from *A. spicata* and other species, which grow wild in great abundance. Mr. Backhouse (1838), Dr. L. Pappe, of Cape Town, and Mr. P. MacOwan (1871), all state that the best aloes is derived from *Aloe ferox* (*Lam.*), and, according to Dr. L. Pappe, a weaker product is obtained from *A. Africana* and *A. plicatilis* of Miller. (*Flor. Capens.* 28.) The process is very simple. As stated by Hallbeck, a Moravian missionary who resided at the Cape, a hole is made in the ground, in which a sheep-skin is spread with the smooth side upward. The leaves are then cut off near the stem, and arranged around the hole, so that the juice which runs out may be received into the skin. The juice flows most freely in hot weather. (*United Breth. Mission. Intelligencer, N. Y.*, vi. 436.) When a sufficient quantity of the liquor has been collected, it is inspissated in iron caldrons, and, when sufficiently concentrated, is poured into boxes or skins, where it concretes upon cooling. The finest kind is collected at the Missionary Institution at Bethelsdorp, and hence called *Bethelsdorp aloes.* Its superiority is owing exclusively to the greater care observed in its preparation.

According to the recent descriptions in *Pharmacographia*, the process just described is still followed in its essential details throughout the Cape. Cape aloes differs from Socotrine aloes especially in its brilliant conchoidal fracture and peculiar odor, which is strong, but neither nauseous nor aromatic. When freshly broken, it has a very dark olive or greenish color approaching to black, presents a smooth bright almost glassy surface, and, if held up to the light, appears translucent at its edges. The small fragments also are semi-transparent, and have a tinge of yellow or red, mixed with the deep olive of the opaque mass. The same tinge is sometimes observable in the larger pieces. The powder is of a fine greenish yellow color, and, being generally more or less sprinkled over the surface of the pieces as they are kept in the shops, gives them a somewhat yellowish appearance. Cape aloes, when quite hard, is very brittle, and readily powdered; but in very hot weather it is apt to become somewhat soft and tenacious, and the interior of the pieces is occasionally more or less so even in winter. It is usually imported in casks or boxes. Dr. Pereira says that a variety is sometimes imported into England from the Cape, of a reddish brown color like hepatic aloes. *Natal aloes* is a variety coming from Natal, on the southeast coast of Africa, which occurs in irregular pieces, with a fracture much less shining than that of Cape aloes and a totally different color, having a greenish slate hue. It is less soluble than Cape aloes, and has a peculiar composition, which will be adverted to under the chemistry of the drug.

2. SOCOTRINE ALOES. This aloes, which has been very long known and highly esteemed under its present name, is nominally produced in the island of Socotra, which lies in the Straits of Babelmandel, about forty leagues to the east of Cape Guardafui; but we are told by Ainslie that the greater part of what is sold under that name is prepared in the kingdom of Melinda, upon the eastern coast of Africa; and Wellsted states that the aloes of the neighboring parts of Arabia is the same as that of Socotra. The commerce in this variety of aloes is carried on chiefly by the maritime Arabs, who convey it either to India, or up the Red Sea by the same channel through which it reached Europe before the discovery of the southern passage into the Indian Ocean. Mr. Vaughan states that nearly the whole product of the island

is carried to Maculla, on the southern coast of Arabia, and thence transhipped to Bombay. (*P. J. Tr.*, xii. 268.) The species of Aloe which yields it is not certainly known, but is probably *A. Socotrina.* According to Wellsted, the plant grows on the sides and summits of mountains, from five hundred to three thousand feet above the level of the plains. It is found in all parts of the island, but most abundantly on the western portion, where the surface is thickly covered with it for miles. It appears to thrive best in parched and barren places. The whole produce was formerly monopolized by the Arabian Sultan of Kisseen; but at present the business of collecting the drug is entirely free to the inhabitants. The leaves are plucked at any period of the year, and are placed in skins into which the juice is allowed to exude. In what way the inspissation is effected we are not informed by Wellsted; but, according to Hermann, it is by exposure to the heat of the sun. The aloes is exported in skins, or in kegs or tin-lined boxes. Its quality differs much according to the care taken in its preparation.

Socotrine aloes is in pieces of a yellowish or reddish brown color, wholly different from that of the former variety. Sometimes the color is very light, especially in the fresh and not fully hardened parcels; sometimes it is a deep brownish red like that of garnets. It is rendered much darker by exposure to the air; and the interior of the masses is consequently much lighter-colored than the exterior. Its surface is somewhat glossy, and its fracture smooth and conchoidal, with sharp and semi-transparent edges. The color of its powder is a bright golden yellow. It has a peculiar, not unpleasant odor, and a taste which, though bitter and disagreeable, is accompanied with an aromatic flavor. Though hard and pulverulent in cold weather, it is somewhat tenacious in summer, and softens by the heat of the hand. "It dissolves entirely in proof spirit, and during solution exhibits under the microscope numerous minute crystals." *Br.* "It is almost entirely soluble in alcohol and in 4 times its weight of boiling water." *U. S.*

Under the name of Socotrine aloes, are occasionally to be met with in the market small parcels beautifully semi-transparent, shining, and of a yellowish, reddish, or brownish red color. These, however, are very rare, and do not deserve to be considered as a distinct variety. They are probably portions of the juice carefully inspissated in the sun, and may accompany the packages brought from any of the commercial sources of aloes. When in mass, as imported from the East, Socotrine aloes is soft and plastic, and of a very light yellowish brown color in the interior. It becomes hard and brittle when broken into pieces; and the London dealers hasten the result by exposing it to a very gentle heat, so as to evaporate the moisture. Pereira tells us that impure and dirty pieces of the drug are melted and strained, and that the skins from which the best portions have been removed are washed with water, which is then evaporated. Occasionally the juice has been imported into London in casks, not thoroughly inspissated. In this state it is of the consistence of molasses, of an orange or yellowish color, and of a strong fragrant odor. It separates, upon standing, into a transparent liquid, and an opaque, lighter-colored, granular portion which subsides. Pereira found the latter portion to consist of innumerable minute prismatic crystals, which he believed to be identical with or closely analogous to the aloin of the Messrs. Smith. When the juice is heated, the deposit dissolves, and the whole being evaporated yields a solid, transparent product, having the properties of fine Socotrine aloes. (*P. J. Tr.*, xi. 439.)

Much of the aloes sold as Socotrine consists simply of superior specimens of other varieties falsely labelled to enhance the value.

Much confusion and uncertainty have prevailed in relation to the term *Hepatic Aloes.* The name was originally applied to a product from the East Indies, of a reddish brown or liver color, and has been extended to similar aloes from the West Indies. The hepatic aloes of the present London markets is simply a dark, opaque, liver-colored Socotrine aloes.

3. BARBADOES ALOES. This is the name by which the aloes produced in the West Indies is generally designated. The aloe plants are largely cultivated in the poorer soils of Jamaica and Barbadoes, especially of the latter island. The species from which most of the drug is procured is *A. vulgaris;* but *A. Socotrina*, *A. pur-*

purascens, and *A. arborescens* are also said to be cultivated. The process employed appears to be somewhat different in different places, or at least as described by different authors. A fine kind was formerly prepared by the spontaneous inspissation of the juice, placed in bladders or shallow vessels, and exposed to the sun. The common Barbadoes aloes, however, is now made either by boiling the juice to a proper consistence, or by first forming a decoction of the leaves, chopped and suspended in water in nets or baskets, and then evaporating the decoction. In either case, when the liquor has attained such a consistence that it will harden on cooling, it is poured into calabashes and allow to concrete. A gentleman from Barbadoes, who had seen the aloes prepared, informed Mr. Squire that the leaves are cut transversely, and so placed that the juice flows from the incised surfaces into a trough, which inclines to the boiler. (*Med. T. and Gaz.*, Jan. 1868, p. 75.) It is imported into England in gourds weighing from 60 to 70 pounds, or even more, or sometimes in boxes. A variety known as "*Capey Barbadoes*," having a smooth glassy fracture, occurs in the London markets. In consequence of the great demand for it in veterinary practice, it commands a high price in Great Britain.

The color of Barbadoes aloes is not uniform. Sometimes it is dark brown or almost black, sometimes of a reddish brown or liver color, and again of some intermediate shade. It has usually a dull fracture, and is almost perfectly opaque, even at the edges, and in thin layers. It is also distinguishable by its odor, which is disagreeable and even nauseous. The powder is of a dull olive-yellow. According to Mr. Giles, it yields 80 per cent. of aqueous extract, and is even more active than the Socotrine. (*P. J. Tr.*, Dec. 1860, p. 301.) "It dissolves almost entirely in proof spirit, and during solution exhibits under the microscope numerous crystals." *Br.* According to M. Marais, Barbadoes aloes, from whatever part of the West Indies derived, and however differing in color, when dissolved in distilled water in the proportion of one part to 100,000 parts, has, in a high degree, the property of giving rise to a fine rose-color on the addition of chloride of gold or tincture of iodine; while all other varieties, whether African or Indian, with the exception of the hepatic, produce with these reagents either a feeble color, slow in occurring, or no change of color whatever. (*Journ. de Pharm.*, 4e sér., v. 326.)

Besides these varieties of aloes, others are mentioned by authors. A very inferior kind, supposed to consist of the dregs of the juice which furnished the better sorts, almost black, quite opaque, hard, of a rough fracture and very fetid odor, and full of various impurities, was formerly sold under the name of *fetid*, *caballine*, or *horse aloes*. It was used exclusively for horses; but, in consequence of the cheapness of better kinds, it has been banished from veterinary practice, and is not now found in the market. Aloes has been imported from Muscat, and a considerable quantity came over in a vessel sent by the Sultan to the United States. Some of a similar origin has been called *Mocha aloes* in London. *Jafferbad aloes*, supposed to be the same as *Mocha aloes* (*A. J. P.*, 1881, p. 175), has been shown to be the product of *A. Abyssinica*. *Curaçoa aloes*, resembling Barbadoes aloes but having a different odor, comes into European commerce through Holland from the Dutch West Indies.

General Properties. The odor of aloes is different in the different varieties. The taste is in all of them intensely bitter and very tenacious. The color and other sensible properties have been sufficiently described.* Several distinguished chemists have investigated the nature and composition of aloes. Braconnot found a bitter principle, which he named *resino-amer* (*resinous bitter*), and another substance in smaller proportion, which he designated by the name of *flea-colored principle*. These results were essentially confirmed by Trommsdorff, Bouillon-Lagrange, and Vogel. Berzelius considers aloes to be made up of a *bitter extractive* and products from this by the alterations in the air. Robiquet obtained a product which he called *aloëtin.* (For details, see 14th ed. U. S. D.)

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* Hugo Bornträger claims that one part of aloes in 5000 can be detected in the following manner. A little of the suspected liquid is shaken with about twice its bulk of benzin, which is allowed to separate, decanted, and shaken with a few drops of strongest water of ammonia. On separation the ammonia will be of a clear red color. With solids a tincture should first be made. According to Mr. R. H. Groves (*P. J. Tr.*, 3d ser., xi. 1045), this test will never succeed with a less concentration than 1 part in 250, and with some aloes 1 in 100, and is due to the tannin-like substance of aloes; he also states that extreme care is necessary to have the benzin solution perfectly clear.

Aloïns. The bitter substances noticed above, viz., the *resino-amer* of Braconnot, the *bitter extractive* of Berzelius and others, and the *aloetin* of Robiquet, probably contain the active principle of aloes, but combined with impurities which render it insusceptible of crystallization. It is probable that there exists not one compound, but a set of three closely related compounds, to which the general name of *aloïns* is now given. The first of these, found exclusively in Barbadoes aloes, and discovered by T. and H. Smith, is called *barbaloïn;* the second, discovered by Flückiger in Natal aloes, is called *nataloïn;* the third, found by Histed and Flückiger in Socotrine aloes, is called *socaloïn.*

Barbaloïn. This is a neutral substance crystallizing in tufts of small yellow prisms. These crystals represent hydrated aloïn, and part with one mol. of water (= 2·69 per cent.) by desiccation in vacuo, or by the prolonged heat of a water-bath. Barbaloïn, $C_{34}H_{36}O_{14} + H_2O$, dissolves sparingly in water or alcohol, but very freely if either liquid be even slightly warmed; it is insoluble in ether.

By oxidation with nitric acid, barbaloïn yields, as Tilden has shown, about one-third of its weight of chrysammic acid, besides aloëtic, oxalic, and picric acids. It combines easily with bromine to form yellow needles of *bromaloïn*, $C_{34}H_{30}Br_6O_{14}$; *chloraloïn*, $C_{34}H_{30}Cl_6O_{14} + 6H_2O$, has also been obtained. (*Pharmacographia*, 2d ed., p. 687.) According to Tilden, from 20 to 25 per cent. of barbaloïn can be extracted from good qualities of the drug, by agitating with seven or eight parts of boiling water slightly acidulated with hydrochloric acid, allowing to stand for twenty-four hours, filtering, setting aside for a day or two, putting the resulting mass in a calico bag, and squeezing out the liquid. The barbaloïn thus obtained is purified by solution in alcohol and crystallization. (*P. J. Tr.*, ii. 845.)

Nataloïn. This exists naturally in Natal aloes, from which it can be easily prepared in the crude state if the drug be triturated with an equal weight of alcohol at a temperature not exceeding 48° C. This will dissolve the amorphous portion, from which the crystals should be separated by a filter and washed with a small quantity of cold spirit. From 16 to 25 per cent. of crude nataloïn in pale yellow crystals may be thus extracted. Its formula is $C_{25}H_{28}O_{11}$. It is scarcely more soluble in warm than in cold spirit of wine, so that to obtain crystals it is best to allow the solution to evaporate spontaneously. Water, hot or cold, dissolves it very sparingly. Nataloïn gives off no water when exposed over oil of vitriol, or to a temperature of 100° C. By the action of nitric acid it affords both oxalic and picric acids, but no chrysammic acid.

Socaloïn. In the Socotrine or Zanzibar aloes, the crystals are of comparatively large size, such as are not seen in Natal aloes. They cannot, however, be so easily separated as the nataloïn, since they are nearly as soluble as the amorphous matter surrounding them. Histed recommends treating the powdered crude drug with a little alcohol, sp. gr. 0·960, and strongly pressing the pasty mass between several thicknesses of calico; then dissolving the yellow crystalline cake in warm weak alcohol, and collecting the crystals which are formed by cooling and repose.

Socaloïn forms tufted acicular prisms, which by solution in methylic alcohol may be obtained 2 to 3 millimetres in length. It is much more soluble than nataloïn. Socaloïn is a hydrate, losing, when dried over oil of vitriol, 11 to 12 per cent. of water, but slowly regaining it if afterwards exposed to the air. Its elementary composition is $C_{34}H_{38}O_{15} + 5H_2O$.

The three aloïns, *Barbaloïn*, *Nataloïn*, and *Socaloïn*, are easily distinguished by the following beautiful reaction, first noticed by Histed. A drop of nitric acid on a porcelain slab gives, with a few particles of barbaloïn or nataloïn, a vivid crimson (rapidly fading in the case of barbaloïn, but permanent with nataloïn unless heat be applied), but produces little effect with socaloïn. To distinguish barbaloïn from nataloïn, test each by adding a minute quantity to a drop or two of oil of vitriol, then allowing the *vapor* from a rod touched with nitric acid to pass over the surface. Barbaloïn (and socaloïn) will undergo no change, but nataloïn will assume a fine blue. (*Pharmacographia*, 2d ed., p. 688.) E. von Sommaruga and Egger consider that the three aloïns form a homologous series possessing the formulas: barbaloïn, $C_{17}H_{20}O_7$; nataloïn, $C_{16}H_{18}O_7$; socaloïn, $C_{15}H_{16}O_7$, and that they are all derived from anthracene, $C_{14}H_{10}$.

Aloes yields its active matter to cold water, and when good is almost wholly dissolved by boiling water; but the inert portion, or apothême of Berzelius, is deposited as the solution cools. It is also soluble in alcohol, rectified or diluted. Long boiling impairs its purgative properties by oxidizing the aloïn and rendering it insoluble. The alkalies, their carbonates, and soap alter in some measure its chemical nature, and render it of easier solution. It is inflammable, swelling up and decrepitating when it burns, and giving out a thick smoke which has the odor of the drug.

Those substances only are incompatible with aloes which alter or precipitate the soluble matter; as the insoluble portion is without action upon the system. Among these is the infusion of galls, which we have found, probably through its tannic acid, to afford a copious precipitate with an aqueous solution of aloes. It is said that such a solution will keep a long time, even for several months, without exhibiting mouldiness or putrescence, though it becomes ropy.

Medical Properties and Uses. Aloes was known to the ancients. It is mentioned in the works of Dioscorides and Celsus, the former of whom speaks of two kinds. The varieties are similar in their mode of action. They are all cathartic, operating very slowly but certainly, and having a peculiar affinity for the large intestine, and especially its pelvic portion. Their action, moreover, appears to be directed rather to the muscular coat than to the exhalant vessels; and the discharges which they produce are, therefore, seldom very thin or watery. In a full dose they quicken the circulation, and produce general warmth. When frequently repeated, they are apt to irritate the rectum. Aloes has a decided tendency to the uterine system. Its emmenagogue effect, which is often very considerable, is generally attributed to a sympathetic extension of irritation from the rectum to the uterus; but we can see no reason why the medicine should not act specifically upon this organ; and its influence in promoting menstruation is by no means confined to cases in which its action upon the neighboring intestine is most conspicuous. A peculiarity in the action of this cathartic is, that an increase of the quantity administered, beyond the medium dose, is not attended by a corresponding increase of effect. Its tendency to irritate the rectum may be obviated, in some measure, by combining with it soap or an alkaline carbonate; but it does not follow, as supposed by some, that this modification of its operation is the result of increased solubility; for aloes given in a liquid state produces the same effect as when taken in pill or powder, except that it acts somewhat more speedily. Besides, when externally applied to a blistered surface, it operates exactly in the same manner as when internally administered, thus proving that its peculiarities are not dependent upon the particular form in which it may be given, but on specific tendencies to particular parts. (Gerhard, *N. Am. Med. and Surg. Journ.*, x. 155.) With its other powers, aloes combines the property of slightly stimulating the stomach. It is, therefore, in minute doses, an excellent remedy in habitual costiveness attended with torpor of the digestive organs. It has been supposed to stimulate the hepatic secretion, and certainly acts sometimes very happily in jaundice, producing bilious stools even after calomel has failed. From its special direction to the rectum, it has been found peculiarly useful in the treatment of ascarides, and is useful in hemorrhoids without inflammation. In amenorrhœa it is perhaps more frequently employed than any other remedy, entering into almost all the numerous empirical preparations habitually resorted to by females in that complaint, and much used in regular practice. It is frequently combined with more irritating cathartics, in order to regulate their liability to excessive action. In amenorrhœa it is said to be peculiarly efficacious, when given, in the form of enema, about the period when the menses should appear. Aloes is unsuitable, unless modified by combination, to the treatment of inflammatory diseases.

The medium dose is 10 grains (0·65 Gm.); but as a laxative it will often operate in the quantity of 2 or 3 grains (0·13–0·20 Gm.); and when a decided impression is required, the dose may be augmented to 20 grains (1·3 Gm.). In consequence of its excessively bitter and somewhat nauseous taste, it is most conveniently administered in pills. There has been a very curious difference of observation in regard to the purgative action of aloïn, which is not easily explained. Kondracki (Draggendorf's *Jahrb.*, 1874, p. 47) denies all activity to it, and in this has been sustained by some other observers. The numerous experiments of Craig, Nelson, Dobson, W. A. Tilden, etc., have shown, however, that both the socaloïn, barbaloïn, and nataloïn are active in doses of 2 to 4 grains; the barbaloïn is affirmed to be the most powerful. Fronmüller (*Lond. Med. Rec.*, 1879, p. 70) affirms that aloïn, dissolved in twenty-five times its weight of water, acts as an efficient although slow purgative, when given hypodermically, without causing any local irritation. Although aloïn is no doubt purgative, it is not certain that it is the only purgative principle in aloes. Dose, 2 to 4 grains (0·13–0·26 Gm.).

Off. Prep. Aloe Purificata, *U. S.;* Enema Aloës, *Br.;* Extractum Aloes Aquosum, *U. S.;* Extractum Aloës Barbadensis, *Br.;* Ext. Aloës Socotrinæ, *Br.;* Pil. Aloës Barbadensis, *Br.;* Pil. Aloës Socotrinæ, *Br.;* Pil. Cambogiæ Comp., *Br.;* Pil. Colocynth. Comp., *Br.;* Pil. Colocynthidis et Hyoscyami, *Br.*

ALOE PURIFICATA. *U. S.* *Purified Aloes.*

(ĂL′Ọ-Ẹ PŪ-RỊ-FỊ-CĀ′TẠ.)

Aloès dépuré, *Fr.;* Gereinigte Aloe, *G.*

"Aloes, *one hundred parts* [or sixteen ounces av.]; Alcohol, *fifteen parts* [or three fluidounces]. Heat the Aloes, by means of a water-bath, until it is completely melted. Then add the Alcohol, and, having stirred the mixture thoroughly, strain it through a fine sieve, which has just been dipped into boiling water. Evaporate the strained mixture by means of a water-bath, constantly stirring, until a thread of the mass becomes brittle on cooling. Lastly, break the product, when cold, into pieces of a convenient size, and keep it in well-stopped bottles." *U. S.*

Aloes, even of good quality, is so often mixed as found in the market with various accidental impurities, such as fragments of wood, vegetable remains, pieces of leather, and earthy matter, that it has been thought advisable to have an officinal process by which it may be freed from these, should its purification be found necessary in any particular instance. The use of alcohol in the formula is simply to render the melted aloes more liquid, and thus facilitate the straining; and it is subsequently got rid of by evaporation; but care should be taken not to use too great a heat, or to continue it too long, for fear of impairing the virtues of the drug.

Thus prepared, purified aloes is in irregular, brittle pieces of a dull brown or reddish brown color, and having the peculiar aromatic odor of Socotrine aloes. It is almost entirely soluble in alcohol.

Off. Prep. Pilulæ Aloes; Pilulæ Aloes et Asafœtidæ; Pilulæ Aloes et Ferri; Pilulæ Aloes et Mastiches; Pilulæ Aloes et Myrrhæ, *U. S.;* Tinctura Aloes; Tinctura Aloes et Myrrhæ; Vinum Aloes; Extractum Colocynthidis Compositum, *U. S.*

ALTHÆA. *U. S.* *Althæa. Marshmallow.*

(ĂL-THÆ′Ạ.)

"The root of Althæa officinalis. Linné. (*Nat. Ord.* Malvaceæ.)" *U. S.*

Radix Althææ, *P.G.;* Racine de Guimauve, Guimauve, *Fr.;* Althiewurzel, Eibischwurzel, Eibisch, *G.;* Altea, *It.;* Altea, Malvavisco, *Sp.*

Gen. Ch. Calyx double, the exterior six or nine-cleft. *Capsules* numerous, one-seeded. *Willd.*

Althæa officinalis. Willd. *Sp. Plant.* iii. 770; Woodv. *Med. Bot.* p. 552, t. 198. Marshmallow is an herbaceous perennial, with a perpendicular branching root, and erect woolly stems, from two to four feet or more in height, branched and leafy towards the summit. The leaves are alternate, petiolate, nearly cordate on the lower part of the stem, oblong-ovate and obscurely three-lobed above, somewhat angular, irregularly serrate, pointed, and covered on both sides with a soft down. The flowers are terminal and axillary, with short peduncles, each bearing one, two, or three flowers. The corolla has five spreading, obcordate petals, of a pale purplish color. The fruit consists of numerous capsules united in a compact circular form, each containing a single seed. The plant grows throughout Europe, inhabiting salt marshes, the banks of rivers, and other moist places. It is found also in this country on the borders of salt marshes. In some parts of the continent of Europe, it is largely cultivated for medical use. The whole plant abounds in mucilage. The flowers, leaves, and root are mucilaginous, and were formerly officinal; but the last only is employed to any considerable extent in this country.

The roots should be collected in autumn from plants at least two years old. They are usually prepared for the market by removing the epidermis. The article in commerce is supplied from Europe.

Properties. Althæa occurs "in cylindrical or somewhat conical pieces, from three to six inches (7 to 15 centimetres) long, about half an inch (12 millimetres) in diameter, deeply wrinkled; deprived of the brown, corky layer and small radicles; externally white, marked with a number of circular spots, and of a somewhat hairy appearance from the loosened bast-fibres; internally whitish and fleshy. It breaks with a short, granular and mealy fracture, has a faint aromatic odor, and a sweetish mucilaginous taste." *U. S.* Sections of the root assume a bright yellow tint when an alkali is added to them. Those pieces are to be preferred which are plump and but slightly fibrous. The woody part, on examination with the microscope, is seen to consist of scalariform or pitted vessels, and a few ligneous cells embedded in a loose parenchymatous tissue. The bark is composed of numerous branched liber cells, in bundles of 3 to 30 fibres separated by parenchymatous tissue. The abundant mucilage is situated chiefly in the parenchymatous cells, and can be seen to be in layers when alcohol is added. It, with starch and saccharine matter, is taken out by boiling water. The mucilage, without the starch, is extracted by cold water, which thus becomes ropy. Marshmallow is said to become somewhat acid by decoction. Those pieces should be rejected which are woody, discolored, mouldy, of a sour or musty smell, or a sourish taste. A principle was discovered in the root by M. Bacon, which has been ascertained to be identical with the *asparagin* of Robiquet. MM. Boutron-Charland and Pelouze found it to belong to that class of organic principles which are convertible by strong acids, and other agencies, into ammonia and organic acids, and which are designated by the termination *amide*, being compounds of acid radicals with the group NH_2 derived from ammonia by the withdrawal of an atom of hydrogen. When such an amide is acted upon by acids, it is decomposed, the acid radical taking OH to form the free acid and the amide group taking H to form ammonia. Thus asparagin, which in this view should be called *asparamide*, is converted into ammonia and *asparmic*, or, as it was formerly named, *aspartic acid;* and one mol. of the resulting asparmate of ammonium corresponds with one mol. of asparamide and one of water. (*Journ. de Pharm.*, xix. 208.) Asparagin, being now considered as a derivative of succinic acid, is called *amido-succinamide*, and the asparmic acid is called *amido-succinic* acid. It is found in various other plants besides the marshmallow, as in the shoots of asparagus, in vetches grown in the dark, in all the varieties of the potato, and in the roots of the comfrey and liquorice plant. According to Professor Pira, asparagin has acid properties. It has no therapeutical value.

The roots of other Malvaceæ are sometimes substituted for that of marshmallow, without disadvantage, as they possess similar properties. Such are those of *Althæa rosea*, or *hollyhock*, and *Malva Alcea.* The dark purple flowers of a variety of *A. rosea* are proposed by Prof. Aitkens, of the University of Maryland, as a test for acids and alkalies. A strong infusion of these flowers imparts to slips of white filtering paper immersed in it a permanent purplish blue color, which is reddened by acids, and rendered bluish green by alkalies.

Medical Properties and Uses. The virtues of marshmallow are exclusively those of a demulcent. The decoction of the root is much used in Europe in irritation and inflammation of the mucous membranes. A syrup of althæa is officinal in the German Pharmacopœia, and was introduced into the last U. S. Pharmacopœia. The roots themselves, as well as the leaves and flowers, boiled and bruised, are sometimes employed as a poultice. In France, the powdered root is much used in the preparation of pills and electuaries.

Off. Prep. Syrupus Althææ, *U. S.*

ALUMEN. *U. S.* *Alum.*

$K_2 Al_2 (SO_4)_4, 24H_2 O$; 948. (Ạ-LŪ'MẸN.) $KO, SO_3, Al_2 O_3, 3SO_3, 24HO$; 474.

Aluminii et Potassii Sulphas, *U. S.* 1870, Potassa Alum; Sulphas Aluminico-potassicus; Alun, *Fr., Dan., Swed.;* Sulfate d'Alumine et Potasse, *Fr.;* Alaun, *G.;* Allume, *It.;* Allumbre, *Sp.*

ALUMEN, *Br.* ALUM.

"A sulphate of ammonia and alumina crystallized from solution in water, $NH_4O, SO_3, Al_2O3SO_3 + 24HO$." *Br.*

Aluminii et Ammonii Sulphas, Sulphas Aluminico-Ammonicus; Alumen, *U. S.* 1870; Ammonia Alum; Alum, *U. S.* 1870; Alun ammoniacal, *Fr.;* Ammoniak Alaun, *G.*

The name alum has been applied indifferently to two salts, one consisting of tersulphate of aluminium combined with sulphate of ammonium, the other of the same salt of alumina combined with sulphate of potassium; and distinguished as *ammonia-alum* and *potassa-alum.* The former was officinal in the U. S. P. 1870, but has been replaced by *potassa-alum. Ammonia-alum* is still retained under the title *Alumen* in the British Pharmacopœia.

ALUM (SULPHATE OF ALUMINIUM AND POTASSIUM. *U. S.* 1870). Potassa-alum is manufactured occasionally from earths which contain it ready formed, but most generally from minerals which, from the fact of their containing most or all of its constituents, are called *alum ores.* The principal alum ores are the *alum stone,* which is a native mixture of sulphate of aluminium and sulphate of potassium, found in large quantities at Tolfa and Piombino in Italy; and certain natural mixtures of bisulphide of iron with alumina, silica, and bituminous matter, called *aluminous schist* or *alum-slate.*

At the Solfaterra, and other places in Southern Italy, alum was formerly extracted from earths containing it ready formed. The ground being of volcanic origin, and having a temperature of about 104°, an efflorescence of pure alum formed upon its surface. This was collected and lixiviated, and the solution crystallized by slow evaporation in leaden vessels sunk in the ground.

The alum stone is manufactured into alum by calcination, and subsequent exposure to the air for three months; the mineral being frequently sprinkled with water, in order that it may be brought to the state of a soft mass. This is lixiviated, and the solution obtained crystallized by evaporation. The alum stone may be considered as consisting of alum united with a certain quantity of hydrate of alumina. The latter, by the calcination, loses its water, and becomes incapable of remaining united with the alum of the mineral, which is consequently set free. Alum of the greatest purity is obtained from this ore.

Alum-slate, when compact, is first exposed to the air for a month. It is then stratified with wood, which is set on fire. The combustion which ensues is slow and protracted. The sulphur is in part converted into sulphuric acid, which unites with the alumina; and the sulphate of aluminium thus formed generates a portion of alum with the potassa derived from the ashes of the wood. The iron, in the mean time, is almost wholly converted into sesquioxide, and thus becomes insoluble. The matter is lixiviated, and the solution crystallized into alum by evaporation. The mother-waters, containing sulphate of aluminium, are then drawn off, and made to yield a further portion of alum by the addition of sulphate of potassium or chloride of potassium; the latter being obtained from the soap-boilers, or from the native potassium chloride of the Stassfurt deposits.

When the alum-slate is easily disintegrated, it is not subjected to combustion, but merely placed in heaps, and occasionally sprinkled with water. The bisulphide of iron gradually absorbs oxygen, and passes into ferrous sulphate, which effloresces on the surface of the heap. Part of the sulphuric acid formed unites with the alumina; so that, after the chemical changes are completed, the heap contains both the sulphate of iron and the sulphate of aluminium. At the end of about a year, the matter is lixiviated, and the solution of the two sulphates produced is concentrated to the proper degree in leaden boilers. The sulphate of iron crystallizes, while the sulphate of aluminium, being a deliquescent salt, remains in the mother-waters. These are drawn off, and treated with sulphate of potassium in powder, heat being at the same time applied. The whole is then allowed to cool, that the alum may crystallize. The crystals are then separated from the solution, and purified by a second solution and crystallization. They are next treated with water, just sufficient to dissolve them at the boiling temperature; and the saturated solution is run into casks or tubs, so constructed as to be easily taken to pieces, and set up again. In the course of ten or fifteen days, the alum concretes into a crystalline mass, from which the mother-liquor is let off. The vessel is then taken to pieces, and the salt, having been broken up, is packed in barrels for sale. This process for forming the alum in large masses is called *rocking*.

Alum is now largely manufactured by the direct combination of its constituents. With this view, clays are selected as free from iron and carbonate of calcium as possible, and calcined to sesquioxidize the iron, and render them more easily pulverizable; after which they are dissolved, by the assistance of heat, in weak sulphuric acid. Advantage has been found from mixing the clay, previous to calcination, with powdered charcoal, coke, or other carbonaceous matter, in the proportion of about one to six of the clay, and then applying heat by a reverberatory furnace till all the carbon is consumed. It is asserted that the alumina is thus rendered more soluble in the acid. (*P. J. Tr.*, Dec. 1857, p. 328.) The sulphate of aluminium, thus generated, is next crystallized into alum by the addition of sulphate of potassium in the usual manner. Alum is made in this way from the ashes of the Boghead cannel-coal, which occurs near Edinburgh. These ashes, which form the residue of the combustion of the coke derived from the coal used for making gas, contain a considerable quantity of alumina in a state readily soluble in acids.

ALUMEN, *Br.* ALUMINII ET AMMONII SULPHAS. *Sulphate of Aluminium and Ammonium. Ammonia-alum.* Besides the potassa-alum, which is now the only U.S. officinal variety of this salt, there are several others, in which the potassa is replaced by some other base, as, for example, ammonia or soda. Of these, *ammonia-alum*, or the sulphate of aluminium and ammonium, was introduced into the U. S. Pharmacopœia at its revision in 1860; and in the Pharmacopœia of 1870, and Br. Pharmacopœia it was adopted under the name of alumen. It is made by adding sulphate of ammonium to the solution of sulphate of aluminium. This kind of alum has come into very general use, owing to the comparative cheapness of ammonia, obtained in the process for ferrocyanide of potassium, or derived from the liquor of gas-works. Ammonia-alum is extensively manufactured by Powers & Weightman of this city. *Scotch alum*, made near Paisley, generally contains both potassa and ammonia. Ammonia-alum resembles potassa-alum so exactly that it cannot be distinguished by simple inspection; and in composition it is perfectly analogous to the potassa-salt. It may, however, be distinguished by subjecting it to a strong calcining heat, after which alumina will be the sole residue; or by rubbing it with potassa or lime and a little water, when the smell of ammonia will be perceived.

Properties. Alum, as usually seen, is in "large, colorless, octahedral crystals, sometimes modified by cubes, acquiring a whitish coating on exposure to air, odorless, having a sweetish, astringent taste, and an acid reaction, soluble in 10·5 parts of water at 15° C. (59° F.) and in 0·3 part of boiling water; insoluble in alcohol. When gradually heated, the salt loses water; at 92° C. (197·6° F.) it melts, and if the heat be gradually increased to 200° C. (392° F.), it loses 45·57 per cent. of its weight (water of crystallization), leaving a bulky, white residue. The aqueous solution of the salt dissolves zinc and iron with evolution of hydrogen. Water of Ammonia produces a bulky, white precipitate, which is nearly insoluble in an excess of ammonia. With solutions of potassa or soda, Alum yields a white precipitate which is completely soluble in excess of the alkali, no odor of ammonia being evolved (difference from, and absence of ammonia-alum). The clear alkaline solution should yield no precipitate with test-solution of sulphide of ammonium (zinc or lead). A solution of 1 Gm. of Alum in 30 C.c. of water should not assume more than a bluish coloration on the addition of a drop of test-solution of ferrocyanide of potassium (limit of iron)." *U.S.* Its sp. gr. is 1·71. It reddens litmus, but changes the blue tinctures of the petals of plants to green. When heated a little above 100° C. (212° F.), it undergoes the aqueous fusion; and, if the heat be continued, it loses its water, swells up, becomes a white, opaque, porous mass, and is converted into the officinal *dried alum.* (See *Alumen Exsiccatum.*) Exposed to a red heat, it gives off oxygen, together with sulphurous and sulphuric oxides, and the residue consists of alumina and sulphate of potassium. When calcined with finely divided charcoal, it forms a spontaneously inflammable substance, called *Homberg's pyrophorus*, which consists of a mixture of sulphide of potassium, alumina, and charcoal.

The characters of the ammonia-alum, as stated in the British Pharmacopœia, are that its solution gives with caustic potassa or soda a white precipitate, soluble in an excess of the reagent, with the evolution of ammonia, especially when heated; and an immediate precipitate with chloride of barium; and does not acquire a blue color from the addition of yellow or red prussiate of potassium, proving the absence of iron.

Several varieties of alum are known in commerce. *Roche alum*, so called from its having come originally from Rocca, in Syria, is a sort which occurs in fragments about the size of an almond, and of a pale rose color, which is given to it, according to Pereira, by bole or rose-pink. *Roman alum*, which is the purest variety found in commerce, also occurs in small fragments, covered with a reddish brown powder, resembling ochre, which is put on by the manufacturers. It has been supposed that the powder contains iron; but this is probably a mistake. Roman alum crystallizes in cubes, from the fact that the crystals are deposited from a solution always containing an excess of alumina, which decomposes any iron salt that may be present. This crystalline form of alum is, therefore, an index of its freedom from iron.

All the alums of commerce contain more or less sulphate of iron, varying from five to seven parts in the thousand. The iron is readily detected by adding to a solution of the suspected alum a few drops of the ferrocyanide of potassium, which will cause a greenish blue tint, if iron be present. It may be detected also by precipitating the alumina as a subsulphate with a solution of potassa, and afterwards adding the alkali in excess. This will redissolve the precipitate, with the exception of any iron, which will be left in the state of sesquioxide. The proportion of iron usually present, though small, is injurious when the salt is used in dyeing. It may, however, be purified, either by dissolving it in the smallest quantity of boiling water, and stirring the solution as it cools, or by repeated solutions and crystallizations.*

Incompatibles. Alum is incompatible with the alkalies and their carbonates, lime and lime-water, magnesia and its carbonate, tartrate of potassium, and acetate of lead.

Composition. Alum was regarded as a sulphate of aluminium, until it was proved by Descroizilles, Vauquelin, and Chaptal to contain also sulphate of potassium, sulphate of ammonium, or both these salts. When its second base is potassa, it consists of one mol. of aluminium sulphate 343, one of sulphate of potassium 174·2, and twenty-four of water 432 = 949·2. In the ammonia-alum, the mol. of sulphate of potassium is replaced by one of the sulphate of ammonium. *Alumina* is classed as an earth, and may be obtained by subjecting ammonia-alum to a strong calcining heat. It consists of two atoms of a metal called *aluminium* 55, and three of oxygen 48 = 103. It is, therefore, a sesquioxide. The existence of this metal was rendered probable by Sir H. Davy in 1808; but it was not fairly obtained until 1828, when Wöhler procured it in an impure state, in globules of the size of a pin's head, by the action of potassium on chloride of aluminium.

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* A preparation called *chloralum*, or solution of chloride of aluminium, has been largely vaunted as an antiseptic. According to Mueller (*Berichte d. Chem. Gesellsch. zu Berlin*, 1872, p. 519), it contains 16·1 per cent. chloride of aluminium, 1·7 per cent. chloride of calcium, 0·1 per cent. sulphates of alkalies, 1·2 per cent. hydrochloric acid, 80·9 per cent. water. It is made by acting upon slightly roasted porcelain clay with crude hydrochloric acid, and is inferior to many antiseptics now in use. (See *Chloride of Aluminium*, Part II.)

In 1854, Deville succeeded in obtaining the pure metal in ingots by decomposing the same chloride with sodium. Aluminium is silver-white, sonorous, unalterable in the air, and lighter than glass, having the sp. gr. 2·56 only. Its fusing point is somewhat lower than that of silver. It is not attacked by sulphuric or nitric acid, nor tarnished by sulphuretted hydrogen. Its proper solvent is hydrochloric acid. After silver, gold, and platinum, it is the least alterable of the metals. According to Mr. A. Monier, of Camden, N.J., who first obtained the metal in this country, it is not in the least oxidized by fusion with nitre, a property which affords a ready means of purifying it from other metals. (*A. J. P.*, March, 1857.) It could be applied to many purposes if it were obtainable at a moderate cost. W. P. Thompson, of Tranmere, has obtained a patent for obtaining aluminium, sodium, etc., by a novel process and apparatus, similar to that for making Bessemer steel.

Medical Properties, etc. Alum is a powerful astringent, with very decided irritant qualities, owing to which, when taken internally in sufficient quantity, it is emetic and purgative, and may even cause fatal gastro-intestinal inflammation. It may be employed in passive relaxations of the mucous membranes or skin, hemorrhages, serous diarrhœa, colliquative sweats, etc., but is not much used internally, except in *colica pictonum.* The latter employment of it was introduced by Grashuis, a Dutch physician, in 1752, was imitated by Dr. Percival with great success, and has been revived in recent times with the happiest results. It allays nausea and vomiting, relieves flatulence, mitigates the pain, and opens the bowels with more certainty than any other medicine. Sometimes it is advantageously conjoined with opium and camphor. It is also efficacious in nervous colic. Sir James Murray found it a useful remedy in gastrorrhœa. He gave it in doses of ten or twelve grains (0·65–0·809 Gm.) three or four times a day, mixed with an equal quantity of cream of tartar to prevent constipation, and a little ginger to obviate flatulence. By Dr. C. D. Meigs alum has been strongly recommended, in doses of a teaspoonful (3·9 Gm.), in pseudo-membranous croup as a mechanical emetic, but it is not as certain or powerful as is the sulphate of zinc.

Alum is a powerful astringent when topically applied, and has been largely used as such. In various anginas it has been a favorite remedy, but on account of its destructive influence upon the teeth it should never be used in gargles, but be applied in powder or concentrated solution with the brush. Bretonneau, Vulpian, etc., strongly recommend it in pseudo-membranous angina, applied by insufflation in the case of children. When used in the latter way, a drachm of finely powdered alum may be placed in one end of a tube, and then blown by means of the breath into the throat of the child. Alum coagulates blood very rapidly and firmly, and is frequently used as a local styptic in external hemorrhages and in epistaxis and other bleedings from mucous membranes to which it can be applied directly. In hæmoptysis its saturated solution may be used by atomization. It is sometimes applied locally in the form of *cataplasm*, made by coagulating the whites of two eggs with a drachm of alum. In *colica pictonum* from 20 to 30 grains of alum in molasses (or thick syrup) may be given three or four times a day. The emetic dose is one to two teaspoonfuls, repeated, if necessary, in fifteen minutes. An elegant mode of giving alum in solution is in the form of *alum-whey*, made by boiling two drachms of alum with a pint of milk, and then straining to separate the curd. The dose is a wineglassful (60 C.c.), containing about 15 grains (1 Gm.) of alum. As a collyrium, the solution is made of various strengths; as 4, 6, or 8 grains to the fluidounce of water. A solution, containing from half an ounce to an ounce in a pint of water, and sweetened with honey, is a convenient gargle. Solutions for gleet, leucorrhœa, ulcers, etc., must vary in strength according to the state of the parts to which they are applied.*

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* Alum enters as an ingredient into the famous *Wickersheimer Preserving Liquid.* The formula, as purchased by the German government from the originator, is as follows. Alum 100 grammes, sodium chloride 25 grammes, potassium nitrate 12 grammes, potassium carbonate 60 grammes, arsenious acid 10 grammes; these are to be dissolved in 3000 grammes (3 litres) of boiling water, the solution allowed to cool, filtered, and to every 10 litres of the liquid 4 litres of glycerin and 1 litre of wood naphtha added. Owing to the precipitation of the alumina in this preparation, it is frequently the practice to substitute for the alum the same quantity of potassium sulphate.

In a case recorded by Dr. Ricquet, of Liège, death resulted from about an ounce of alum taken in solution by mistake for Epsom salts. A sensation of burning in the mouth, throat, and stomach occurred immediately upon the swallowing of the poison, followed by bloody vomiting, and death in the midst of inexpressible suffering. Upon post-mortem examination there was found a grayish yellow coating covering the mucous membrane of the mouth, pharynx, and œsophagus; the tongue and uvula were swollen; and the stomach, bowels, and kidneys were injected. (*Journ. de Pharm.*, Oct., 1873, p. 333.)

Alum is sometimes used to adulterate bread, with the view to increase its whiteness, and to conceal the defects of the flour.

Off. Prep. Alumen Exsiccatum.

ALUMEN EXSICCATUM. *U.S., Br.* *Dried Alum.*

$K_2 Al_2 (SO_4)_4$; 516. (Ạ-LŪ'MẸN ĔX-SỊC-CĀ'TŬM.) $KO, SO_3 Al_2 O_3 3SO_3$; 258.

Alumen Ustum, Burnt Alum; Alun calciné, desséché, brûlé, *Fr.;* Gebrannter Alaun, *G.*

"Alum, in small pieces, *one hundred and eighty-four parts*, To make *one hundred parts.* Expose the Alum for several days to a temperature of about 80° C. (176° F.) until it has thoroughly effloresced. Then place it in a porcelain capsule, and gradually heat it to a temperature of 200° C. (392° F.), being careful not to allow the heat to rise above 205° C. (401° F.). Continue heating at the before-mentioned temperature until the mass becomes white and porous, and weighs *one hundred parts.* When cold, reduce it to a fine powder, and preserve it in well-stopped vessels." *U. S.*

"Take of Alum *four ounces.* Heat the Alum in a porcelain dish, or other suitable vessel, till it liquefies, then raise and continue the heat, not allowing it to exceed 400°, till aqueous vapor ceases to be disengaged, and the salt has lost 47 per cent. of its weight. Reduce the residue to powder, and preserve it in a well-stoppered bottle." *Br.*

The object of these processes is to obtain the alum free from its water of crystallization, without otherwise in the least decomposing it. For this purpose a certain degree of heat is necessary; and yet, if the heat be too great, the salt itself is decomposed, and the desired end is not attained. If the alum employed be the potassa-alum, the old indefinite directions will generally be sufficient to secure the requisite result, as this salt will resist a heat short of redness; but this is not the case with the ammonia-salt, which is officinal in the Br. P. To guard against failure from this cause, the Pharmacopœias now prescribe 205° C. (400° F.) as the highest heat to be employed, and check the operation when nearly all the water has been driven off, as indicated by the weight of the residue. Prof. John M. Maisch has satisfactorily determined by experiment that, whichever alum may be used, this temperature is quite high enough; and the direction of the Pharmacopœias, as to the weight of the residue, insures that a sufficient heat will be employed. By the officinal process there is left behind half a drachm or about 4 per cent. of the water of crystallization, when potassa-alum is used; and Prof. Maisch has ascertained that this in no degree injures the properties of the dried salt. (*A. J. P.* 1860, p. 21.)

Properties. Dried alum is officinally described as "a white, granular powder, attracting moisture when exposed to the air, odorless, having a sweetish, astringent taste, very slowly but completely soluble in 20 parts of water at 15° C. (59° F.), and quickly soluble in 0·7 part of boiling water. It answers to the same reactions as Alum. (See *Alumen.*)" *U. S.* Before pulverization, it is a light, white, opaque, porous mass. During the exsiccation, alum loses from 41 to 46 per cent. of its weight in dissipated water. Dried alum resists the action of cold water for a long time, showing its altered aggregation. In composition it differs from crystallized alum merely in the absence of water.

Medical Properties and Uses. Dried alum has the same medical properties as ordinary alum, excepting that it is more powerful and irritant. It is used as a mild escharotic to destroy exuberant granulations, on which it should be freely dusted.

ALUMINII HYDRAS. *U. S.* *Hydrate of Aluminium. Hydrated Alumina.*

$Al_2(HO)_6$; 156. (ĂL-U̇-MĬN'Ị-Ī HȲ'DRĂS.) $Al_2O_3, 3HO$; 78.

Hydrate de l'Alumine, *Fr.;* Thonerdehydrat, *G.;* Argilla Pura, s. Hydrata, *P. G.*

"Alum, *eleven parts;* Carbonate of Sodium, *ten parts;* Distilled Water, *a sufficient quantity.* Dissolve each salt in *one hundred and fifty* (150) *parts* of Distilled Water, filter the solutions and heat them to boiling. Then having poured the hot solution of Carbonate of Sodium into a capacious vessel, gradually pour in the hot solution of Alum with constant stirring, and add about *one hundred* (100) *parts* of boiling Distilled Water. Let the precipitate subside, decant the clear liquid and pour upon the precipitate *two hundred* (200) *parts* of hot Distilled Water. Again decant, transfer the precipitate to a strainer, and wash it with hot Distilled Water until the washings give but a faint cloudiness with test-solution of chloride of barium. Then allow it to drain, dry it with a heat not exceeding 40° C. (104° F.), and reduce it to a uniform powder." *U. S.*

This new officinal is identical with the "Alumina Hydrata" of the German Pharmacopœia, and has been introduced probably out of respect to the large number of German practitioners in this country who may use it.

Properties. It is "a white, light, amorphous powder, permanent in dry air, odorless and tasteless, and insoluble in water or alcohol. Soluble, without residue, in hydrochloric and sulphuric acids, and also in solution of potassa or soda. When heated to redness it loses 34·6 per cent. of its weight (water of hydration)." *U. S.*

Tests. "A solution of 1 Gm. of Hydrate of Aluminium in 30 C.c. of diluted hydrochloric acid should not be colored blue by a drop of test-solution of ferrocyanide of potassium (iron), and should not give more than a faint cloudiness with test-solution of chloride of barium (limit of sulphate). When dissolved in solution of potassa or of soda, it should yield no precipitate with test-solution of sulphide of ammonium (zinc or lead). When Hydrate of Aluminium is boiled with 20 parts of water, and filtered, the filtrate should not leave more than a slight residue on evaporation (limit of salts of alkalies)." *U. S.*

Medical Properties. This is a very feebly astringent and desiccant powder, sometimes used externally as an application in inflammatory affections of the skin. So far as our experience goes, it is very rarely employed in this country.

ALUMINII SULPHAS. *U. S.* *Sulphate of Aluminium.*

$Al_2(SO_4)_3 . 18H_2O$; 666. (ĂL-U̇-MĬN'Ị-Ī SŬL'PHĂS.) $Al_2O_3, 3SO_3 . 18HO$; 333.

Sulfate d'Alumine, *Fr.;* Schwefelsaure Thonerde, *G.*

A process was given in the U. S. P. 1870 for the preparation of this salt:* the Committee of Revision, 1880, have very properly omitted the process, merely giving a description and tests for the salt. In the process of 1870, the soda of the carbonate unites with the sulphuric acid of the aluminium sulphate, with the escape of the carbonic acid, and the precipitation of the alumina in the form of a hydrate; while the undecomposed sulphate of ammonium of the alum, and the newly formed sulphate of sodium, remain in solution. The alumina is then washed in order to separate any portion of the sulphates adhering to it, the absence of which is shown by the non-action of chloride of barium on the washings. It now remains to unite the hydrate of alumina and sulphuric acid, which is effected by heating them with water; and the salt, which is formed in solution, is obtained by evaporating the solution to dryness. It may also be obtained from the solution by the addition of alcohol, which precipitates it. In the process the several substances are used in very nearly saturating proportions. See paper on Sulphate of Aluminium by Prof. J. U. Lloyd. (*N. R.*, Aug. 1879, p. 237.) Sulphate of aluminium may be prepared also by the process of MM. Huria and Brunel, which consists in exposing, in an iron cylinder, sulphate of aluminium and ammonium (ammonia-alum), first dried to separate its water of crystallization, to a cherry-red heat. Sulphate of aluminium remains in the cylinder, and the volatilized products are collected in water. The chief of these is sulphite of ammonium, which serves for the preparation of a fresh portion of alum, after having been changed into the sulphate by oxidation in the air. (*Chem. Gaz.*, Sept. 15, 1852, p. 359.) It is now also obtained in enormous quantities, for use in the place of alum as a mordant in dyeing, as one of the by-products in the manufacture of soda from cryolite.

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* "Take of Alum, Carbonate of Sodium, each, *four troyounces;* Sulphuric Acid *a troyounce and one hundred and fifty grains;* Water *a sufficient quantity.* Dissolve the salts separately, each in six fluidounces of boiling water, and pour the solution of the Alum gradually into that of the Carbonate of Sodium; then digest with a gentle heat until the evolution of carbonic acid ceases. Collect upon a filter the precipitate formed, and wash it with water, until the washings are no longer affected by chloride of barium. Next, with the aid of heat, dissolve the precipitate in the Sulphuric Acid, previously diluted with half a pint of Water, and, having filtered the solution, evaporate it until a pellicle begins to form. Then remove it to a water-bath, and continue the evaporation, with constant stirring, until a dry salt remains. Lastly, preserve this in a well-stopped bottle." *U. S.* 1870.

Sometimes free sulphuric acid exists in sulphate of aluminium. It may be recognized by the salt imparting a strongly acid reaction to alcohol, also by the fact that the dark violet color imparted to decoction of logwood by sulphate of aluminium changes to brown in the presence of free acid. (*A. J. P.*, Nov. 1873.) Prof. Wittstein treats the finely powdered salt with absolute alcohol; if the latter does not become acid, no free acid is present.

Properties. As procured by the process of 1870, sulphate of aluminium is in the form of a white powder. It may, however, be obtained in lamellar crystals. As seen in commerce, it is usually in flattened crystalline cakes, which appears as though formed by the cooling of soft masses of minute crystals. It has a sour as well as sweet and very astringent taste, is soluble in twice its weight of water, and has an acid reaction.

The salt is "soluble, without leaving more than a trifling residue, in 1·2 parts of water at 15° C. (59° F.), and very soluble in boiling water; almost insoluble in alcohol. When heated, the salt melts in its water of crystallization, and at or near 200° C. (392° F.) it loses the whole of it, amounting to 48·6 per cent. of its weight. The aqueous solution of the salt yields with water of ammonia a white, gelatinous precipitate, soluble in solution of potassa or soda, and, with test-solution of chloride of barium, a white precipitate insoluble in hydrochloric acid." *U. S.*

It is formed by the union of one mol. of alumina, which is a sesquioxide of aluminium, and three mols. of sulphuric acid, $Al_2(SO_4)_3$, and, when crystallized, contains eighteen mols. of water. The salt is, therefore, a tersulphate of aluminium. It is known to be a sulphate by giving a precipitate with chloride of barium insoluble in nitric acid, and a salt of alumina by forming octahedral crystals of alum when its solution is evaporated with sulphate of potassium or ammonium. In consequence of its strong affinity for potassa, it is coming into use in the arts as a means of separating that alkali.

Tests. "A solution of 1 Gm. of the salt in 30 C.c. of water should not give more than a faint blue coloration with a drop of test-solution of ferrocyanide of potassium (limit of iron). If 1 Gm. of the salt be dissolved in 50 C.c. of water, a slight excess of water of ammonia added, the liquid heated until all odor of ammonia has disappeared, and then filtered, the precipitate well washed with water, and the filtrate and washings evaporated to dryness and gently ignited, the residue should not weigh more than 0·05 Gm. (abs. of more than 5 per cent. of sulphates of alkalies)." *U. S.*

Medical Properties and Uses. The soluble simple salts of alumina have the property of opposing animal putrefaction, but the sulphate is probably the most powerful and certainly the most used. It is often employed in solution (ʒiiss–fʒvi up to saturation *pro re nata*) as an antiseptic, detergent application to foul ulcers, and as an injection in fetid discharges from the vagina. M. Homolle employs a saturated solution with much advantage as a mild caustic in enlarged tonsils, nasal polypi, nævi, scrofulous and cancerous ulcers, diseases of the os uteri, and various chronic enlargements. He applies it daily by means of a hair pencil. He has sometimes found the solution to answer still better by the addition of oxide of zinc. Solution of sulphate of aluminium is capable of dissolving a considerable quantity of recently precipitated gelatinous alumina. Such a solution, impregnated with benzoin, has been proposed by M. Mentel as a hæmostatic, under the name of *benzoinated solution of alumina*. It resembles the *styptic liquid* of *Pagliari*. It is prepared by saturating, with gelatinous alumina, a solution made of eight ounces of sulphate of aluminium dissolved in a pint of water. To the saturated solution six drachms of bruised amygdaloid benzoin are added, and the whole is kept at a temperature of about 150° F. for six hours, with occasional agitation; so that the liquid, after filtration, may have about the density 1·26. This liquid, put in a cool place for several days, so as to deposit some crystals of alum, forms the benzoinated solution, remarkable for its very sweet odor and astringent balsamic taste. Benzoinated solution of alumina, diluted in the proportion of from two to five fluidrachms to the pint of water, has been found useful as an injection in leucorrhœa, and in ulcerations of the neck of the uterus, accompanied by fetid discharges. (See *A. J. P.*, 1857, p. 128.)

Sulphate of alumina has been used to preserve cadavers for dissection, but is much inferior to the chloride of zinc. The solution for injection should be a pound to the quart.

AMMONIACUM. *U. S., Br.* *Ammoniac.*

(ĂM-MỌ-NĪ′Ạ-CŬM.)

"The gum-resin obtained from Dorema Ammoniacum. Don. (*Nat. Ord.* Umbelliferæ Orthospermæ.)" *U. S.*

Gummi-resina Ammoniacum; Ammoniacum; Ammoniaque, Gomme-résine ammoniaque, Gomme ammoniaque, *Fr.;* Ammoniak, Ammoniakgummi, *G.;* Gomma ammoniaco, *It.;* Gomma amoniaco, *Sp.;* Ushek, *Ar.;* Semugh belsheren, *Pers.*

Much uncertainty long existed as to the ammoniac plant. It was generally believed to be a Ferula, till Willdenow raised, from some seeds mixed with the gum-resin found in the shops, a plant which he ascertained to be a Heracleum, and named *H. gummiferum*, under the impression that it must be the source of the medicine. On this authority the plant was adopted by the British Colleges, and recognized in former editions of our national Pharmacopœia. Willdenow expressly acknowledged that he could not procure from it any gum-resin, but ascribed the result to the influence of climate. The Heracleum, however, did not correspond exactly with the representations given of the ammoniac plant by travellers; and Sprengel ascertained that it was a native of the Pyrenees, and never produced gum. Mr. Jackson, in his account of Morocco, imperfectly described a plant of that country, supposed to be a *Ferula*, from which gum-ammoniac is procured by the natives. This plant was ascertained by Dr. Falconer to be *Ferula Tingitana* (Royle's *Mat. Med.*), and its product is thought to be the ammoniacum of the ancients, which was obtained from Africa; but this is not the drug now used under that name, which comes exclusively from Persia.[*] M. Fontaniér, who resided many years in Persia, saw the ammoniac plant growing in the province of Fars, and sent a drawing of it with specimens to Paris. From these it was inferred to be a species of Ferula; and Mérat and De Lens proposed for it the name, originally given to it by Lemery, of *F. ammonifera.* It was subsequently, however, ascertained, from specimens obtained in Persia by Col. Wright, and examined by Dr. David Don, that it belonged to a genus allied to Ferula, but essentially different, which was named by Dr. Don, *Dorema.* It is described in the 16th vol. of the Linn. Transactions, under the name of *Dorema Ammoniacum.* This is now acknowledged by the officinal authorities. The same plant was described and figured by Jaubert and Spach, in their "*Illustrations of Oriental Plants*" (Paris, 1842, t. 40, p. 78), by the name of *Diserneston gummiferum*, under the erroneous impression that it belonged to a previously undescribed genus.

The ammoniac plant grows spontaneously in Farsistan, Irauk, Chorassan, and other Persian provinces. Dr. Grant found it abundantly in Syghan near Bameean, on the northwest slope of the Hindoo-Koosh Mountains. It attains the height of six or seven feet, and in the spring and early part of summer abounds in a milky juice, which flows out upon the slightest puncture. From the accounts of travellers, it appears that, in the month of May, the plant is pierced in innumerable places by an insect of the beetle kind. The juice, exuding through the punctures, concretes upon the stem, and when quite dry is collected by the natives. M. Fontanier states that the juice exudes spontaneously, and that the harvest is about the middle of June. According to Dr. Grant, the drug is collected in Syghan, like asafetida, from the root of the plant. The gum-resin is sent to Bushire, whence it is transmitted to India, chiefly to Bombay. A small portion is said to be taken to the ports of the Levant, and thence distributed. The name of the drug is thought to have been derived from the temple of Jupiter Ammon in the Libyan desert, where the ammoniac of the ancients is said to have been collected; but Dr. Don considers it a corruption of *Armeniacum*, originating in the circumstance that the gum-resin was formerly imported into Europe through Armenia.

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[*] The *African Ammoniac*, which is said to have appeared in the London market only in the years 1857 and 1871, has been described by Mr. Daniel Hanbury as follows. It is "in large, compact, dark, heavy masses, formed of agglutinated tears of a gum-resin of hard, waxy consistence. The tears are opaque, white or of a pale greenish yellow, mixed with others of a blackish brown, which, with vegetable and earthy impurities, constitute a large portion of the mass." The odor of the drug is feeble, and quite different from that of the Persian gum-resin; its taste slightly acrid and very persistent. (*P. J. Tr.*, March, 1873, p. 741.) Examined by Mr. John Moss, it was found to consist of 67·76 per cent. of resin, 9·014 of gum, 4·29 of water and volatile oil, and 18·85 of bassorin and insoluble matters. (*Ibid.*, p. 742.) It is used chiefly for incense in Mohammedan countries, and sent eastward by the caravans, or in vessels from the ports of Morocco to Alexandria.

Properties. Ammoniac comes either in the state of tears, or in aggregate masses, and in both forms is frequently mixed with impurities. That of the tears, however, is preferable, as the purest may be conveniently picked out and kept for use. These are of an irregular shape, usually more or less globular, from two to eight lines in diameter, opaque, yellowish on the outside, whitish within, compact, homogeneous, brittle when cold, and breaking with a conchoidal, shining, waxy fracture. The masses are of a darker color and less uniform structure, appearing, when broken, as if composed of numerous white or whitish tears, embedded in a dirty-gray or brownish substance, and frequently mingled with foreign matters, such as seeds, fragments of vegetables, and sand or other earth. We have seen masses composed of agglutinated tears alone.

The smell of ammoniac is peculiar, and stronger in the mass than in the tears. The taste is slightly sweetish, bitter, and somewhat acrid. The sp. gr. is 1·207. When heated, the gum-resin softens and becomes adhesive, but does not melt. It burns with a white flame, swelling up, and emitting a smoke of a strong, resinous, slightly alliaceous odor. It is partly soluble in water, alcohol, ether, vinegar, and alkaline solutions. Triturated with water, it forms an opaque milky emulsion, which becomes clear upon standing. The alcoholic solution is transparent, but is rendered milky by the addition of water. Bucholz obtained from 100 parts of ammoniac, 22·4 parts of gum, 72·0 of resin, 1·6 of bassorin, and 4·0 of water including volatile oil and loss. Braconnot obtained 18·4 per cent. of gum, 70·0 of resin, 4·4 of a gluten-like substance (bassorin), and 6·0 of water, with 1·2 per cent. of loss. Hager succeeded in procuring the volatile oil in a separate state by repeated distillation with water. It has a penetrating disagreeable odor, and a taste at first mild, but afterwards bitter and nauseous. Flückiger says that the oil contains no sulphur, and this result was confirmed by Przeciszewski, while, on the other hand, Vigier asserts that it blackens silver, and that when oxidized with nitric acid it yields sulphuric acid. The resin ammoniacum usually amounts to about 70 per cent. Unlike the gum-resin of allied plants, ammoniacum yields no umbelliferone. When melted with caustic potash it affords a little resorcin. (*Pharmacographia*, 2d ed., p. 326.) The resin of ammoniac is dissolved by alcohol, and by the fixed and volatile oils; but it is divided by ether into two resins, of which one is soluble, the other insoluble in that menstruum.

Medical Properties and Uses. This gum-resin is stimulant and expectorant, in large doses cathartic, and, like many other stimulants, may be so given as occasionally to prove diaphoretic, diuretic, or emmenagogue. It has been employed in medicine from the highest antiquity, being mentioned in the writings of Hippocrates, but is now seldom administered. The complaints in which it was most frequently used were chronic catarrh, asthma, and other pectoral affections attended with deficient expectoration without acute inflammation, or with a too copious secretion from the bronchial mucous membrane, dependent upon debility of the vessels. It is usually administered in combination with other expectorants, with tonics, or with emmenagogues. Externally applied, in the shape of a plaster, it is thought to be useful as a discutient or resolvent in white swellings of the joints, and other indolent tumors. (See *Emplastrum Ammoniaci.*) It is given in substance, in the shape of pill or emulsion. The latter form is preferable. (See *Mistura Ammoniaci.*) The dose is from ten to thirty grains (0·65–1·95 Gm.).

Off. Prep. Emplastrum Ammoniaci, *U. S.;* Emplast. Ammoniaci cum Hydrargyro; Emplast. Galbani, *Br.;* Mistura Ammoniaci; Pilula Ipecacuanhæ cum Scilla, *Br.;* Pil. Scillæ Composita, *Br.*

AMMONII BENZOAS. *U. S.* *Benzoate of Ammonium.*

$NH_4, C_7H_5O_2$; 139. (ẠM-MŌ′NỊ-Ī BĔN′ZỌ-ĂS.) $NH_4O, C_{14}H_5O_3$; 139.

Ammoniæ Benzoas, *Br.;* Ammonium Benzoicum, Benzoas Ammonicus; Benzoate d'Ammoniaque, *Fr.;* Benzöesaures Ammonium, *G.*

The process for the preparation of this salt was omitted in the last U. S. revision.* The British process is as follows. "Take of Solution of Ammonia *three fluidounces* [Imperial measure], or *a sufficiency;* Benzoic Acid *two ounces* [avoirdupois]; Distilled Water *four fluidounces.* Dissolve the Benzoic Acid in three fluidounces of Solution of Ammonia previously mixed with the Water; evaporate at a gentle heat, keeping ammonia in slight excess; and set aside that crystals may form. $NH_4O.C_{14}H_5O_3$ or $NH_4C_7H_5O_2$." *Br.*

Although the amount of ammonia ordered in the formula is in excess, yet, from the feeble affinity between the constituents, and the consequent escape of ammonia during the evaporation, a portion of the acid benzoate would be formed, if it were not that a little solution of ammonia is from time to time added during or near the close of the evaporation, so as to maintain the alkali in slight excess. The crystals, for the same reason, should be dried without heat. If slightly evaporated, and then allowed to cool, the solution becomes a mass of crystals, retaining so much water as to render it necessary to dry them by bibulous paper.

Properties. "Thin, white, four-sided, laminar crystals, permanent in the air, having a slight odor of benzoic acid, a saline, bitter, afterwards slightly acrid taste and a neutral reaction. Soluble in 5 parts of water and 28 parts of alcohol at 15° C. (59° F.); in 1·2 parts of boiling water and 7·6 parts of boiling alcohol. When strongly heated, the salt melts, emits vapors having the odor of ammonia and of benzoic acid, and is finally wholly dissipated. The aqueous solution of the salt, when heated with potassa, evolves ammonia. On mixing the aqueous solution with a dilute solution of ferric sulphate, a flesh-colored precipitate is thrown down. If the benzoic acid be separated from the salt by precipitating with diluted nitric acid and thoroughly washed, it should answer to the reactions of purity mentioned under *Acidum Benzoicum.*" *U. S.* Gmelin states that, if the solution be boiled, the salt is converted into the acid benzoate, which crystallizes in feathery tufts of needles. (*Handbook,* xii. 38.) According to Lichtenstein, it deliquesces in the air. It gives a copious yellow precipitate with ferric salts; and is known to contain benzoic acid and ammonia, by depositing the former when the solution is acidulated with hydrochloric acid, and giving off the latter when it is heated with potassa. According to Mr. Squire, it is the acid salt that is commonly met with in the shops, which is less soluble than the officinal salt, requiring 60 parts of water and 12 of alcohol for solution. This is a decided objection to it.

Medical Properties and Uses. Benzoate of ammonium is a slightly stimulant diuretic, which acts chiefly through its benzoic acid; it being decomposed by the gastric acids, which combine with the ammonia, while the benzoic acid is absorbed, and passes out through the kidneys in the form of hippuric acid. (See *Benzoic Acid.*) The salt has been found useful as a diuretic in defective action of the kidneys, as an alterative to the mucous membrane of the urinary passages in chronic inflammation of that tissue, and as a solvent of the phosphatic deposits, through the hippuric acid into which it is converted. It has been employed in gouty affections with a view to the removal of the deposits of urate of sodium about the joints; but it has been shown to have no effect on the elimination of uric acid. The salt does not appear to produce any injurious effects even in considerable quantities. (Garrod, *Med. Times and Gaz.*, Feb. 1864, p. 146.) The dose is from 10 to 30 grains (0·65–1·95 Gm.), which may be taken dissolved in water.

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* "Take of Benzoic Acid *two troyounces;* Water of Ammonia *three fluidounces and a half,* or *a sufficient quantity;* Distilled Water *four fluidounces.* Dissolve the Acid in three fluidounces and a half of the Water of Ammonia, previously mixed with the Distilled Water; evaporate with a gentle heat, occasionally adding Water of Ammonia, if necessary, to maintain a slight excess of the alkali; then set aside to crystallize, and dry the crystals without heat." *U. S.* 1870.

AMMONII BROMIDUM. *U.S., Br.* *Bromide of Ammonium.*

NH_4Br; 97·8. (ẠM-MŌ'NỊ-Ī BRỌ-MĪ'DŬM.) NH_4Br; 97·8.

Ammonium Bromatum; Bromure d'Ammonium, *Fr.;* Brom-Ammonium, *G.*

In the present U. S. Pharmacopœia and in the British Pharmacopœia no directions whatever are given for the preparation of bromide of ammonium. The salt may be made by dissolving bromine in water of ammonia; but, in accordance with the researches of Prof. Procter, the U. S. Pharmacopœia of 1870* preferred the method of first forming bromide of iron, precipitating with water of ammonia, separating by filtration the oxide of iron, and obtaining by evaporation the bromide of ammonium from the solution. This process, it will be seen, is completely parallel with that by which bromide of potassium is prepared. According to Prof. Procter, a still better method consists in adding to bromine and water sufficient solution of sulphide of ammonium to discharge the color, filtering to separate the sulphur, and then evaporating to dryness. Charles Rice (*A. J. P.*, 1873, p. 249) recommends making bromide of ammonium by double decomposition between hot solutions of bromide of potassium and sulphate of ammonium, assisting the precipitation of sulphate of potassium by alcohol. Dr. W. H. Pile (*Proc. A. P. A.*, 1874, p. 434) published a simple process for this salt. Pour the bromine (one pound) carefully into four times its weight of distilled water in a stone jar, add *very gradually* about one quart of solution of ammonia, cover the top of the jar with a glass plate when vapors arise, and when all of the ammonia has been added, and the solution is free from the smell of bromine, it is evaporated and the salt granulated; the yield is about twenty ounces.

Properties. Bromide of ammonium may be obtained in colorless crystals, but the officinal salt is a white, granular powder. Whether in crystal or powder, on exposure to the air it gradually becomes yellowish, in consequence of a partial decomposition, by which hydrobromic acid appears to be liberated, as it now changes litmus red. The salt has a saline, pungent taste. Exposed to heat, it sublimes unchanged. It is "soluble in 1·5 parts of water, and in 150 parts of alcohol at 15° C. (59° F.); in 0·7 part of boiling water and in 15 parts of boiling alcohol." *U.S.* It is sparingly soluble in ether, and is incompatible with acids, acid salts, and spirit of nitrous ether. (*Squire.*)

Tests. The Br. Pharmacopœia directs that it should preserve a brownish color, and give no tint of blue when mixed with mucilage of starch and chlorine, thus proving the absence of an iodide.

"The aqueous solution, when heated with potassa, evolves ammonia. If disulphide of carbon be poured into the solution, then chlorine water added drop by drop, and the whole agitated, the disulphide will acquire a yellow or yellowish brown color without a violet tint. If diluted sulphuric acid be dropped on the salt, the latter should not at once assume a yellow color (bromate). If 1 Gm. of the salt be dissolved in water, some gelatinized starch added, and then a few drops of chlorine water carefully poured on top, no blue zone should make its appearance at the line of contact of the two liquids (iodide). On adding to 1 Gm. of the salt dissolved in 20 C.c. of water, 5 or 6 drops of the test-solution of chloride of barium, no immediate cloudiness or precipitate should make its appearance (limit of sulphate). If 3 Gm. of the well-dried salt be dissolved in distilled water to 100 C.c. and 10 C.c. of this solution treated with a few drops of test-solution of bichromate of potassium, and then volumetric solution of nitrate of silver be added, not more than 31·4 C.c. of the latter should be consumed, before the red color ceases to disappear on stirring (abs. of more than 3 per cent. of chloride). 1 Gm. of the powdered and dry salt, when completely precipitated by nitrate of silver, yields, if perfectly pure, 1·917 Gm. of dry bromide of silver." *U. S.*

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* "Take of Bromine *two troyounces;* Iron, in the form of wire and cut in pieces, *a troyounce;* Water of Ammonia *four fluidounces and a half;* Distilled Water *a sufficient quantity.* Add the Iron and then the Bromine to half a pint of Distilled Water, contained in a glass flask having the capacity of two pints; loosely cork the flask, and agitate the mixture until the odor of Bromine can no longer be perceived, and the liquid assumes a greenish color. Mix the Water of Ammonia with half a pint of Distilled Water, and add it to the mixture in the flask; agitate the mixture, and heat it by means of a water-bath for half an hour; then filter, and, when the liquor ceases to pass, wash the precipitate on the filter with boiling distilled water. Evaporate the solution, in a porcelain capsule, until a pellicle begins to form, then stir it constantly with a glass rod, at a moderate heat, until it granulates." *U.S.* 1870.

Medical Properties and Uses. This bromide resembles the bromide of potassium in its physiological powers, but probably has a less depressing effect upon the arterial muscular system. It has been used by various practitioners for exactly the same purposes as is the bromide of potassium. Brown-Séquard claims that it does not produce bromism; and commends very highly the combination of it with the potassium salt in epilepsy. It may be substituted for the latter in various functional disorders (see *Potassii Bromidum*), and has been specially recommended by Dr. Gibbs in the milder forms of ovaritis. (*Lancet*, Jan. 3, 1863, p. 121.) The dose is one to two drachms a day (3·9–7·8 Gm.) in dilute solution.

AMMONII CARBONAS. *U. S.* *Carbonate of Ammonium.*

(ẠM-MŌ′NỊ-Ī CÄR-BŌ′NĂS.)

NH_4HCO_3. $NH_4NH_2CO_2$; 157. $NH_4O, HO, 2CO_2$. $2NH_3CO_2$; 157.

Ammoniæ Carbonas, *Br.;* Ammoniæ Sesquicarbonas, *Lond., Dub.;* Ammonium Carbonicum, *P. G.;* Carbonas Ammonicus, Sal Volatile Siccum, Volatile Salt; Sal Volatile; Carbonate d'Ammoniaque, Alkali volatil concret, Sal volatil d'Angleterre, *Fr.;* Kohlensaures Ammonium, Flüchtiges Laugensalz, Reines Hirschhornsalz, *G.*

There have been many methods of obtaining carbonate of ammonium, in all of which the ammonia originated in organic decomposition. It was probably originally prepared from putrid urine, and it is sometimes made in Scotland now from this source. A patent was taken out in England for manufacturing it from guano, and another for making it by the direct combination of its constituents; the carbonic acid and ammoniacal gases being introduced simultaneously into leaden chambers. (*Chem. News*, Dec. 29, 1865.) But at present the salt is manufactured by subliming a mixture of either the chloride or sulphate with chalk. Chloride of ammonium and chalk (carbonate of calcium) are heated together in iron pots or retorts, and sublimed into large earthen or leaden receivers. By the reciprocal action of the salts employed, the carbonic acid of the chalk unites with the ammonia of the chloride, generating carbonate of ammonium, and the hydrochloric acid with the lime, forming water and chloride of calcium. The carbonate and water sublime together as hydrated carbonate of ammonium, and the residue is chloride of calcium. The relative quantities of chalk and chloride of ammonium, for mutual decomposition, are 50 of the former, and 53·5 of the latter, or one mol. of each. But a great excess of chalk is usually taken, in order to insure the perfect decomposition of the chloride of ammonium, any redundancy of which would sublime with the carbonate and render it impure.

Sulphate of ammonium may be substituted for the chloride with much economy, as was shown by Payen. This double decomposition between sulphate of ammonium and carbonate of calcium takes place in the dry way only, that is, by sublimation. In the wet way, the double decomposition is reversed; carbonate of ammonium and sulphate of calcium reacting so as to form sulphate of ammonium and carbonate of calcium. Large quantities of this carbonate are manufactured indirectly from *coal-gas liquor* and *bone-spirit;* the ammoniacal products in these liquors being converted successively into sulphate, chloride, and carbonate of ammonium. (See *Ammonii Chloridum.*) The salt as first obtained has a slight odor of tar, and leaves a blackish carbonaceous matter when dissolved in acids. Hence it requires to be purified, which is effected in iron pots surmounted with leaden heads. The American carbonate has almost supplanted the English article, formerly exclusively used.

Properties. Commercial carbonate of ammonium, recently prepared, is in "white, translucent masses, consisting of Bicarbonate (Acid Carbonate) and Carbamate of Ammonium, losing both ammonia and carbonic acid gas on exposure to air, becoming opaque and finally converted into friable porous lumps, or a white powder (Acid Carbonate of Ammonium). The salt has a pungent ammoniacal odor, free from empyreuma, a sharp, saline taste, and an alkaline reaction. Soluble in 4 parts of water at 15° C. (59° F.), and in 1·5 parts at 65° C. (149° F.). Alcohol dissolves the carbamate and leaves the acid carbonate of ammonium. When heated the salt is wholly dissipated, without charring. If the aqueous solution is heated to near 47° C. (116·6° F.), it begins to lose carbonic acid gas, and at 88° C. (190·4° F.) it begins to give off vapor of ammonia. Dilute acids wholly dissolve the salt with effervescence. On acidulating the aqueous solution with nitric acid, no turbidity should be produced by test-solution of chloride of barium (sulphate), or nitrate of silver (chloride), nor by hydrosulphuric acid (metals). If 1 Gm. of the salt be supersaturated with diluted sulphuric acid, then diluted to 20 C.c. with distilled water, and treated with a few drops of test-solution of permanganate of potassium, the color should not be perceptibly changed by standing for five minutes, at the ordinary temperature (abs. of empyreumatic substances). To neutralize 2·616 Gm. of Carbonate of Ammonium should require 50 C.c. of the volumetric solution of oxalic acid." *U. S.* If commercial ammonium carbonate be treated with 90 or 91 per cent. alcohol, it is decomposed into the two salts of which it is composed, ammonium carbamate going into solution while the acid ammonium carbonate remains undissolved. This latter compound also remains undissolved when the commercial carbonate is treated with an amount of water insufficient for complete solution. The result of the complete solution of the commercial salt in water is a mixture of acid and neutral carbonates, the carbamate having been decomposed according to the reaction, $(\mathrm{NH_4})\mathrm{HCO_3} + \mathrm{CO}\left\{\begin{matrix}\mathrm{ONH_4}\\ \mathrm{NH_2}\end{matrix}\right. + \mathrm{H_2O} = (\mathrm{NH_4})\mathrm{HCO_3} + (\mathrm{NH_4})_2\mathrm{CO_3}$. When long or insecurely kept, it gradually passes into the state of bicarbonate, becoming opaque and friable, and falling into powder. When heated on a piece of glass, the commercial carbonate should evaporate without residue, and, if turmeric paper held over it undergoes no change, it has passed into bicarbonate. As prepared from coal-gas liquor, it sometimes contains traces of tarry matter, which give a dark color to its solution in acids, but a refined carbonate, made by resubliming the commercial article, is now in the market, and this alone should be dispensed in preparations for internal use. When it is saturated with nitric acid, neither chloride of barium nor nitrate of silver causes a precipitate. The non-action of these tests shows the absence of sulphate and chloride of ammonium. It is decomposed by acids, the fixed alkalies and their carbonates, lime-water and magnesia, solution of chloride of calcium, alum, acid salts such as bitartrate and bisulphate of potassium, solutions of iron (except the tartrate of iron and potassium and analogous preparations), corrosive sublimate, the acetate and subacetate of lead, and the sulphates of iron and zinc. "Fifty-nine grains dissolved in one [fluid]ounce of distilled water, will be neutralized by 1000 grain-measures of *the volumetric solution of oxalic acid.* Twenty grains neutralize 23·5 grains of citric acid and 25·5 grains of tartaric acid." *Br.* Traces of chlorine have been noticed in some samples of commercial carbonate, and a sublimed salt which had been sold as carbonate, was *devoid of odor,* hard, crystalline, yet having the external appearance of carbonate, was proved by Prof. Bridges to be anhydrous bicarbonate of ammonium. (*A. J. P.*, Nov. 1874.)

Composition. This salt, which used to be considered a sesquicarbonate of ammonium of the formula $2(\mathrm{CO_3}(\mathrm{NH_4})\mathrm{H}) + \mathrm{CO_3}(\mathrm{NH_4})_2 + \mathrm{H_2O}$, is now generally recognized as a mixture of either one or two mols. of acid ammonium carbonate, $(\mathrm{NH_4})\mathrm{HCO_3}$, with one mol. of *carbamate* of ammonium, $\mathrm{CO}\left\{\begin{matrix}\mathrm{ONH_4}\\ \mathrm{NH_2}\end{matrix}\right.$. When the salt is dissolved in water, the reaction given above converts it into a mixture of acid and neutral carbonates, and when water of ammonia is added in sufficient amount, it converts the acid carbonate into neutral carbonate, which is used frequently as a laboratory reagent, or by passing carbonic acid gas into a solution of the commercial salt, the whole may be converted into acid carbonate or bicarbonate.

Medical Properties and Uses. Locally applied, carbonate of ammonium is an irritant, and when taken internally in sufficient amount it acts as an irritant poison. When administered in therapeutic doses it is a powerful cardiac stimulant, acting not so rapidly and fugaciously as the solutions of ammonia, but still in a very prompt and temporary manner. It is employed in low conditions of the system as a stimulant, but it should always be remembered that its influence lasts only for a short time, and that there is reason for believing that when continuously given it is apt to impair the crasis of the blood. It is probably eliminated in part by the lungs, and certainly is a stimulant to the respiratory centres. It seems also to exert some influence upon the pulmonary mucous membrane, and is largely employed in adynamic pneumonias and bronchitis, in the last stages of phthisis, etc. In some of these cases it does good by increasing muscular power and aiding in the expulsion of the sputa.

Coarsely bruised with the addition of half its bulk of strongest water of ammonia, and scented with oil of lavender, it constitutes the common smelling salts, so much used as a nasal stimulant in syncope and hysteria.* The ordinary dose is five grains (0·33 Gm.), given in mixture, and repeated at not longer intervals than two hours. It should never be given in powder or in pill, on account of its volatile nature, and its irritant action on mucous membranes.

Carbonate of ammonium is sometimes employed to make effervescing draughts, 20 grains of the salt requiring for this purpose 6 fluidrachms of lemon-juice, 24 grains of citric acid, or 25½ grains of tartaric acid.

Off. Prep. Liquor Ammoniæ Acetatis, *Br.;* Liquor Ammonii Acetatis, *U. S.;* Spiritus Ammoniæ Aromaticus. *U. S.*

AMMONII CHLORIDUM. *U. S., Br.* *Chloride of Ammonium.*

NH_4 Cl; 53·4. (A̤M-MŌ′NI̤-Ī ȻHLŌ′RI̤-DŬM.) NH_4 Cl; 53·4.

Ammonia Muriatica, Ammonium Muriaticum s. Hydrochloratum, Chloruretum Ammonicum, Sal Ammoniacum, Ammoniæ Hydrochloras s. Murias; Sal Ammoniac, Hydrochlorate of Ammonia; Hydrochlorate d'Ammoniaque, Muriate d'Ammoniaque, Sel Ammoniac, Chlorure d'Ammonium, Clorure d'Ammonium pur; Ammonium Muriaticum Depuratum, Sal Ammoniacum Depuratum, *Fr.;* Ammonium Chloratum, *P. G.;* Salmiak Chlorammonium; Reiner (gereinigter) Salmiak, *G.;* Sale Ammoniaco, *It.;* Sal Ammoniaco, *Sp.*

In the Pharmacopœia of 1870 both the crude and the purified chloride of ammonium were officinal, under the names *Ammonii Chloridum* and *Ammonii Chloridum Purificatum.* The Pharm. 1880 recognizes but one, *Ammonii Chloridum,* but it transfers this title, which formerly was given to the crude sal ammoniac, to the purified salt without giving a process for preparing it.† It originally came from Egypt, where it was obtained by sublimation from the soot resulting from the burning of camels' dung, which is used in that country for fuel, and it is still to be found in the Indian bazaars in an impure state, as it has been obtained from the unburnt extremity in the interior of brick-kilns in which camels' manure is used for fuel. It has long been known in China, where it is obtained from the water of certain volcanic springs, and exists in commerce in various states of purity. It is found in the fumeroles of Vesuvius, Etna, Hecla, and other volcanoes, as well as in the cracks and fissures in recent lava streams.

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* In Mounsey's recipe for the English *Preston salts,* the essence to be added to the carbonate is made as follows. Take of oil of cloves ʒss; oil of lavender ʒj; oil of bergamot ʒiiss; stronger water of ammonia (sp. gr. 0·880) f℥x. Mix. The bottles are to be filled with carbonate of ammonium, half with the salt coarsely bruised, and the remainder with it in fine powder; and then as much of the above essences as the salt will absorb is to be added. (*P. J. Tr.,* xiii. 628.)

† The process (Pharm. 1870) for purifying sal ammoniac is here given as found in 14th ed. U. S. D.

"Take of Chloride of Ammonium, in small pieces, *twenty troyounces;* Water of Ammonia *five fluidrachms;* Water *two pints.* Dissolve the Chloride of Ammonium in the Water, in a porcelain dish, with the aid of heat; add the Water of Ammonia, and continue the heat for a short time; filter the solution while hot, and evaporate to dryness, with constant stirring, at a moderate heat, until it granulates." *U. S.* 1870.

The object of this process is to free the drug from chloride of iron, which is a frequent impurity of the crude salt, derived from the subliming vessels.

Preparation. At present chloride of ammonium is derived from two principal sources, the ammoniacal liquor, called *gas liquor*, found in the condensing vessels of coal-gas works, and the brown, fetid ammoniacal liquor, known under the name of *bone-spirit*, which is a secondary product, obtained from the destructive distillation of bones, in the manufacture of bone-black. These two liquors are the chief sources of ammoniacal compounds; for they are both used to procure chloride of ammonium, and this salt is employed directly or indirectly for obtaining all the other salts of ammonia. Other sources are stale urine, coal soot, guano, peat, and bituminous schist.

Gas liquor contains carbonate, cyanide, sulphide, and sulphate of ammonium, but principally the carbonate. It is saturated with sulphuric acid, and the solution obtained, after due evaporation, furnishes brown crystals of sulphate of ammonium. These are then sublimed with chloride of sodium in iron pots, lined with clay, and furnished with a leaden dome or head. By the mutual action of the sulphate, water, and chloride, there are formed chloride of ammonium which sublimes, and sulphate of sodium which remains behind. Thus $(NH_4)_2SO_4$ and $(NaCl)_2$ become $(NH_4Cl)_2$ and Na_2SO_4. Sometimes, instead of the ammonia of the gas liquor being first converted into the sulphate, it is made at once into chloride by the addition of hydrochloric acid or chloride of calcium. When chloride of calcium is employed, the chief reaction takes place between carbonate of ammonium and the chloride, whereby chloride of ammonium is formed in solution, and carbonate of calcium precipitated. The solution is duly evaporated, whereby brown crystals of the chloride are obtained. These, after having been dried, are purified by sublimation in an iron subliming pot, coated with a composition of clay, sand, and charcoal, and covered with a dome of lead. These pots are sometimes sufficiently large to hold five hundred pounds. "A gentle fire is kept up under the subliming pot for seven or eight days, when, the dome having cooled down, and the sal ammoniac somewhat contracted, so as to loosen from the sides, the dome is thrown off from the iron pot, and about two or three hundred weight of white, semi-transparent sal ammoniac are knocked off in cakes." (Pereira, *Mat. Med.*, 3d ed., p. 446.)

In the destructive distillation of bones for making bone-black, the distilled products are the bone-spirit already mentioned, being chiefly an aqueous solution of carbonate of ammonium, and an empyreumatic oil, called *animal oil*. Chloride of ammonium may be obtained from the bone-spirit in the manner just described for procuring it from gas liquor. Sometimes, however, the sulphate of ammonium is not made by direct combination, but by digesting the bone-spirit with ground plaster of Paris. By double decomposition, sulphate of ammonium and carbonate of calcium are formed. The sulphate of ammonium is then converted into the chloride by sublimation with common salt. The chloride "may be formed by neutralizing hydrochloric acid with ammonia, and evaporating to dryness." *Br.*

Other processes have been proposed or practised for obtaining chloride of ammonium. For an account of the manufacture of ammoniacal salts, and for a list of the patents issued in Great Britain, since 1827, for their preparation, the reader is referred to the *P. J. Tr.* (xii. 29, 63, and 113).

Commercial History. Nearly all the chloride of ammonium used in the United States is obtained from abroad. Its commercial varieties are known under the names of the *crude* and *refined*. The crude is imported from Calcutta in chests containing from 350 to 400 pounds; and is consumed almost exclusively by coppersmiths and other artisans in brass and copper, being employed for the purpose of keeping the metallic surfaces bright, preparatory to brazing. The refined comes to us exclusively from England, packed in casks containing from 5 to 10 cwt. The importations of ammonium chloride at the port of New York for the year 1880 were valued at $31,802, and for 1882 at $32,416.

Properties. Commercial chloride of ammonium is a white, translucent, tough, fibrous salt, occurring in large cakes, about two inches thick, convex on one side and concave on the other, due to the shape of the dome of the subliming apparatus: the pieces frequently are tinged on the surface with iron stains, owing to the contact with the iron dome. It has a pungent, saline taste, but no smell. Its sp. gr. is

1·45. This salt is very difficult to powder in the ordinary way. Its pulverization, however, may be readily effected by making a boiling saturated solution of the salt, and stirring it as it cools. The salt is thus made to granulate, and in this state, after having been drained from the remaining solution and dried, may be easily powdered. At a red heat it sublimes without decomposition, and without residue. Exposed to a damp atmosphere it becomes slightly moist. It has the property of increasing the solubility of corrosive sublimate in water. It is decomposed by the strong mineral acids, and by the alkalies and alkaline earths; the former disengaging hydrochloric acid, the latter ammonia, both sensible to the smell. Chloride of ammonium is usually employed for obtaining gaseous ammonia, which is conveniently disengaged by lime. It is incompatible with acetate of lead and nitrate of silver, producing precipitates respectively, of the chlorides of lead and silver.

Chloride of ammonium is little subject to adulteration. If not entirely volatilized by heat and soluble in water, it contains impurity. Still, as ordinarily prepared, it contains ferrous chloride. This metal may be detected by boiling a small portion of a saturated solution of the salt with a drop or two of nitric acid, and then adding ferrocyanide of potassium, when the characteristic blue color occasioned by iron will be produced. If the salt is entirely volatilized by heat, and yet produces a precipitate with chloride of barium, the presence of sulphate of ammonium is indicated. The description and tests of the officinal purified salt are as follows.

"A snow-white crystalline powder, permanent in the air, odorless, having a cooling saline taste and a slightly acid reaction. Soluble in 3 parts of water at 15° C. (59° F.) and in 1·37 parts of boiling water; very sparingly soluble in alcohol. On ignition, the salt volatilizes, without charring, and without leaving a residue. The aqueous solution of the salt, when heated with potassa, evolves vapor of ammonia. Test-solution of nitrate of silver added to the aqueous solution previously acidulated with nitric acid, produces a white precipitate soluble in ammonia. The aqueous solution of the salt should remain unaffected by diluted sulphuric acid (abs. of barium), hydrosulphuric acid, or sulphide of ammonium (metals), and, after being acidulated with hydrochloric acid, it should not be rendered turbid by test-solution of nitrate of barium (sulphate). A one per cent. aqueous solution should not be rendered blue by test-solution of ferrocyanide of potassium (iron)." *U. S.*

Composition. Chloride of ammonium consists of one atom of chlorine and one of ammonium, $(NH_4) = NH_4Cl$. Viewed as *hydrochlorate of ammonia or muriate of ammonium*, it is composed of one mol. of hydrochloric acid 36·5, and one of ammonia 17 = 53·5.

Medical Properties. Chloride of ammonium has the stimulant properties of ammonia, and probably differs little in its physiological powers from the carbonate, but it is believed by many to be less fugacious in its action, and to be less stimulant to the circulation than is the latter salt. Clinical experience has also led to a somewhat particular use of it in diseases. It is one of the most employed of the stimulant expectorants in the advanced stages of acute bronchitis and in chronic bronchitis, also in catarrhal pneumonia. It has been very highly recommended of late years in chronic hepatic torpor and engorgement, and even in acute hepatitis, by Dr. W. Stewart, who gives 20 grains of it three times a day, and continues its use for weeks. We have seen catarrhal jaundice apparently very much benefited by it. Many years ago it was a favorite remedy as a resolvent in chronic glandular enlargements, but at present is rarely so employed. There is much testimony as to the value of chloride of ammonium in various obscure nervous affections, especially hemicrania, ovaralgia, dysmenorrhœa, sciatica, and various other neuralgic disorders. The usual expectorant dose of the chloride is 5 to 10 grains (0·33–0·65 Gm.) every two hours, administered in sweetened mucilage; but formerly in prostatic and other glandular enlargements it was recommended to increase the dose until half an ounce a day was ingested. When such amounts are given, the remedy is prone to produce disordered digestion, a miliary eruption, profuse sweats, and scorbutic symptoms.

Externally, chloride of ammonium is used in solution, as a stimulant and resolvent, in contusions, indolent tumors, etc. An ounce of the salt, dissolved in nine fluidounces of water and one of alcohol, forms a solution of convenient strength.

When the solution is to be used as a wash for ulcers, or an injection in leucorrhœa, it should not contain more than from one to four drachms of the salt to a pint of water. Such a solution, with addition of wine of opium, had been advantageously employed by M. Guinau de Mussy in milky engorgement and scrofulous swellings of the breast, being applied upon cataplasms. A case of decided senile gangrene in a woman of 83 has been recorded, in which the immersion of the feet in a pediluvium consisting of half a pound of chloride of ammonium dissolved in water, afforded relief in two hours; and, being followed by fomentations with the same solution, resulted in cure. (*Annuaire de Thérap.*, 1868, p. 105.)

The vapor of chloride of ammonium has been administered by inhalation, employed several times a day, in chronic catarrh, with marked advantage, by Dr. Gieseler, of Germany. Dr. Hermann Beigel, of London, strongly recommends its inhalation in the nascent state, resulting from a mixture of the two gases composing it. Three bottles are used, one containing water of ammonia, the second an equivalent quantity of liquid hydrochloric acid, and the third half filled with water, connected with the first two by tubes, and supplied itself with a tube for inhalation. By inhalation the patient draws the two gases from their respective bottles into the third, where they combine to form the chloride of ammonium, which is freed from any excess of either gas by the water. The greater or less force of the inspiration will determine the depth to which the medicine will penetrate; and this will depend on the part of the respiratory passages specially affected. (*Lancet*, Oct. 1867, p. 512.) Another mode of inhaling chloride of ammonium is in *spray*, by means of the atomizer; from 10 to 20 grains being dissolved for the purpose in a fluidounce of water.

Off. Prep. Trochisci Ammonii Chloridi, *U. S.*

AMMONII IODIDUM. *U.S.* *Iodide of Ammonium.*

NH_4I; 144·6. (A̤M-MŌ′NI̤-Ī Ī-ŎD′I̤-DŬM.) NH_4I; 144·6.

Iodure d'Ammonium, *Fr.;* Ammonium jodatum, Ioduretum Ammonicum, Jodammonium, *G.*

No process is given in the Pharm. 1880 for this salt; that of the Pharm. 1870 will be found below.*

This salt was formerly prepared according to the method of Mr. Jno. A. Spencer, of London, the formula for which is as follows. Add to a portion of iodine, placed in a flask with a little water, a solution of ammonium sulphydrate, until the mixture loses its red color, and is turbid from the separation of sulphur only. Shake the flask, which causes the sulphur, for the most part, to agglomerate; and, having poured off the liquid, boil it until all odor of sulphuretted hydrogen and of ammonia is lost. Then filter the liquid, and, constantly stirring, evaporate it, first with a naked flame until it becomes pasty, and then in a water-bath until it forms a dry salt. In 1864 (*A. J. P.*, May, 1864), Dr. Jacobson proposed a plan in which double decomposition between the sulphate of ammonium and the iodide of potassium was brought about. Mr. James F. Babcock (*Proc. A. P. A.*, 1866) stated that on trial of the first of the above processes, and of all others in which sulphuretted hydrogen or an alkaline sulphide was employed, the resulting iodide of ammonium retained a portion of sulphur, which caused its color to change with time to yellow and ultimately to brown, and rendered it unfit for the accurate preparations required in photography. Having tried also other formulas, which he found objectionable on the score of time, cost, etc., he at length satisfied himself that the process of Dr. Jacobson above described was the best in use, and with slight modifications would yield an absolutely pure product.

In a former edition of the Dispensatory may be found the exact process finally adopted by Mr. Babcock. It is substantially that which was officinal in Pharm.

[* "Take of Iodide of Potassium, in coarse powder, *four troyounces;* Sulphate of Ammonium, in coarse powder, a *troyounce* [this should be 867 grains]; Boiling Distilled Water *two fluidounces;* Alcohol, Water, each, a *sufficient quantity.* Mix the salts, add them to the Boiling Water, stir well, and allow the mixture to cool; then add a fluidounce of Alcohol, mix well, and reduce the temperature, by a bath of iced water, to about 40°; throw the mixture into a cool glass funnel, stopped with moistened cotton, and, when the clear solution has passed, pour upon the salt a fluidounce of a mixture containing two parts of Water and one part of Alcohol. Lastly, evaporate the solution rapidly to dryness, stirring constantly; and preserve the residue in a well-stopped bottle." *U. S.*, 1870.

1870, and is in close accord with that of Dr. Jacobson. The object of the first step of the process is sufficiently evident. After the double decomposition has occurred, the alcohol is added to complete the precipitation of the sulphate of potassium; the pouring of alcohol upon the cotton filter is to remove completely from the sulphate all of the iodide. As made by this process, iodide of ammonium always contains a minute proportion of sulphate of potassium. Charles Rice (*A. J. P.*, 1873, p. 249) calls attention to the fact that the process officinal in U. S. Pharm. 1870 is deficient in the amount of sulphate of ammonium required, and therefore wasteful of the more expensive iodide; instead of one ounce of sulphate of ammonium the quantity should be 867 grains. The view taken by Mr. Rice, however, is that the reaction takes place between single molecules of the respective salts, which is no doubt correct, whereas the view of the Pharmacopœia committee was that two mols. of the iodide reacted with one of sulphate of ammonium, $2KI + (NH_4)_2SO_4 = K_2SO_4 + 2NH_4I$.

Properties. Iodide of ammonium is "a white, granular salt, or minute crystalline cubes, very deliquescent, and soon becoming yellow or yellowish brown on exposure to air; odorless when white, but emitting a slight odor of iodine when colored, having a sharp, saline taste and a neutral reaction. Soluble in 1 part of water and in 9 parts of alcohol at 15° C. (59° F.), in 0·5 part of boiling water, and in 3·7 parts of boiling alcohol. When heated on platinum foil, the salt evolves vapor of iodine and volatilizes without melting. The aqueous solution of the salt, when heated with potassa, evolves vapor of ammonia. If disulphide of carbon be poured into the solution, then chlorine water added drop by drop, and the whole agitated, the disulphide will acquire a violet color." On adding to 1 Gm. of the salt, dissolved in 20 C.c. of water (with a few drops of diluted hydrochloric acid), 5 or 6 drops of test-solution of nitrate of barium, no immediate cloudiness or precipitate should make its appearance (limit of sulphate). If 1 Gm. of the salt be dissolved in 10 Gm. of water of ammonia, then shaken with a solution of 1·3 Gm. of nitrate of silver in 20 Gm. of water, and the filtrate be supersaturated with 8 Gm. of nitric acid, no cloudiness should make its appearance within 10 minutes (abs. of more than about 0·5 per cent. of chloride and bromide)." *U. S.* Prof. Prescott states, in connection with the last test, that it is based on the careful trial tests of Biltz, who "found the time reaction to exclude more than 0·5 per cent. of bromine and chlorine," although, as the test stands, it would theoretically indicate as much as 6 per cent. (nearly) of chlorine. But the *dilution*, the *acid*, and the *short time* operate as retarding or preventive measures.

100 parts of NH_4I require of $AgNO_3$ 117·3 parts.
100 parts of $NH_4I + 1\ NH_4Cl$ require of $AgNO_3$ 119·38 parts.
94 parts of $NH_4I + 6\ NH_4Cl$ require of $AgNO_3$ 128·91 parts.

"A one per cent. aqueous solution should not be colored blue by test-solution of ferrocyanide of potassium (abs. of iron), nor, after being mixed with gelatinized starch, should it assume a deep blue color (limit of free iodine). 1 Gm. of the dried salt, when completely precipitated with nitrate of silver, yields, if perfectly pure, 1·62 Gm. of dry iodide of silver." *U. S.* The salt should be preserved in small well-stopped vials, protected from the light. "When deeply colored it should not be dispensed, but it may be deprived of all but traces of free iodine by washing with stronger ether and rapidly drying." *U. S.*

Medical Properties. Iodide of ammonium is employed, both externally and internally, as a resolvent, and resembles closely, in its action, iodine and iodide of potassium. Dr. B. W. Richardson, of London, has prescribed it, in the dose of from one to three grains, with considerable success, in secondary syphilis, chronic rheumatism, incipient phthisis, and in a variety of forms of scrofulous disorder, attended with glandular enlargements. Dr. Richardson found a liniment, made by dissolving half a drachm of the iodide in an ounce of glycerin, very efficacious in enlarged tonsils, applied every night with a large camel's-hair brush, and his practice has been followed to some extent by other members of the profession.* Externally, this salt has been used as a substitute for iodide of potassium. By Dr. Pennock it is considered as a good remedy in certain cases of lepra and psoriasis, in the form of ointment, applied by friction in the quantity of half an ounce, morning and evening. The proportions employed are from a scruple to a drachm of the salt to an ounce of lard; the weaker preparation being used when the disease is recent, the stronger when it is chronic. As the iodide is decomposed by the air, the ointment should be kept in well-stopped bottles. For internal use, the dose of iodide of ammonium is from three to five grains (0·20–0·33 Gm.).

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* Theodore G. Davis (*A. J. P.*, 1877, p. 305) gives a formula for *Liniment of Iodide of Ammonium* which he says closely corresponds with a proprietary liniment largely sold at one time;

AMMONII NITRAS. *U.S.* *Nitrate of Ammonium.*

NH_4NO_3; 80. (A̤M-MŌ'NI̤-Ī NĪ'TRĂS.) NH_4O, NO_5; 80.

Ammoniæ Nitras, *Br.;* Nitrate of Ammonia; Ammonium Nitricum, Nitrum Flammans; Azotate d'Ammoniaque, Nitre inflammable, Nitre ammoniacal, Sal ammoniacal nitreux, *Fr.;* Saltpetersaures Ammon, Ammonium, Ammoniak, *G.*

An extraordinary property possessed by this salt of absorbing ammoniacal gas, and giving it out again at a moderate heat unchanged, renders it capable of useful pharmaceutical application; but the chief cause of its introduction into the U. S. Pharmacopœia was as the source whence nitrogen protoxide is produced.

Nitrate of ammonium may be prepared by treating commercial ammonium carbonate by nitric acid so long as effervescence takes place, or to saturation, filtering, and evaporating the solution. By careful evaporation and slow refrigeration, the salt may be obtained in well-defined crystals. If crystallized after rapid concentration by boiling, and sudden cooling, it forms long flexible and elastic threads. If the solution be heated till all the water is driven off, the nitrate of ammonia forms, on cooling, an opaque mass.

Properties. "Colorless crystals, generally in the form of long, thin, rhombic prisms, or in fused masses, somewhat deliquescent, odorless, having a sharp, bitter taste and a neutral reaction. Soluble in 0·5 part of water and 20 parts of alcohol at 15° C. (59° F.); very soluble in boiling water and in 3 parts of boiling alcohol. When gradually heated, the salt melts at 165° C.–166° C. (329° F.–331° F.), and at about 185° C. (365° F.) it is decomposed into nitrous oxide gas and water, leaving no residue. The aqueous solution of the salt, when heated with potassa, evolves vapor of ammonia. On heating the salt with sulphuric acid, it emits nitrous vapors." *U. S.*

At all temperatures between —15° C. (5° F.) and 25° C. (77° F.), if exposed to a current of dry ammoniacal gas, its crystals absorb the gas and melt, yielding a colorless liquid, which, if the absorption has taken place at —10° C. (14° F.), contains two mols. of the gas for each mol. of the salt, and would be represented by the formula $NH_4NO_3 + 2NH_3$. It is not frozen by a mixture of salt and snow. Its sp. gr. is 1·05. Heated moderately it boils, with loss of ammonia, and is changed into a crystalline mass, containing 21·25 parts of the gas in 100 of the salt by weight, and corresponds with the formula, $NH_4NO_3 + NH_3$, thus retaining one-half the gas absorbed. By exposure to increased heat, this loses ammonia, and at 80° C. (176° F.) has been reconverted to pure nitrate of ammonium. This preparation may be used for obtaining small quantities of pure ammonia, when wanted, by exposing it to a gentle heat in a small retort. To be fit for this purpose, it must be kept at a low temperature. (*P. J. Tr.*, June, 1872.)

Tests. "The aqueous solution, when acidulated with nitric acid, should not be rendered cloudy by test-solutions of nitrate of silver (chloride), or of nitrate of barium (sulphate)." *U. S.*

For the mode of preparing nitrogen monoxide (hyponitrous oxide) or nitrous oxide gas from nitrate of ammonium, the reader is referred to the article on Nitrogen Monoxide in Part II. of this work.

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but it cannot be regarded as correctly named, for it contains but 2 grains of iodide in a *pint* of liniment. Water of Ammonia 10 per cent. f℥ij, Soap Liniment f℥ij, Tinct. Iodine fʒviij, Alcohol f℥iv. Mix the soap liniment with the tincture of iodine, and add the alcohol and ammonia; shake, and add alcohol to make 1 pint. Let it stand two or three days before using.

AMMONII PHOSPHAS. *U.S.* *Phosphate of Ammonium.*

$(NH_4)_2 HPO_4$; 132. (AM-MŌ′NI-Ī PHŎS′PHĂS.) $2NH_4 O, HO, PO_5$; 132.

Ammoniæ Phosphas, *Br.;* Ammonium Phosphoricum, *P. G.;* Phosphas Ammonicus; Phosphate d'Ammoniaque, *Fr.;* Phosphorsaures Ammoniak, *G.*

This salt was introduced into the U. S. Pharmacopœia at the late revision without a process for making it. The following is the British process. "Take of Diluted Phosphoric Acid *twenty fluidounces;* Strong Solution of Ammonia *a sufficiency.* Add the Ammonia to the Phosphoric Acid, until the solution is slightly alkaline, then evaporate the liquid, adding more Ammonia from time to time, so as to keep it in slight excess, and when crystals are formed on the cooling of the solution, dry them quickly on filtering paper placed on a porous tile, and preserve them in a stoppered bottle. $2NH_4O,HO,PO_5$ or $(NH_4)_2HPO_4$." *Br.*

The variety of phosphoric acid employed in this formula is the tribasic, which forms three salts with ammonia, one containing three atoms of ammonium without basic hydrogen, which is called the neutral phosphate, the second, two mols. of ammonium and one of basic hydrogen, forming an acid phosphate, and the third, one mol. of ammonium and two of basic hydrogen, forming also an acid phosphate. The second of these is the one intended by the British Council, and is represented by the formula $(NH_4)_2HPO_4$ or $2NH_4O,HO,PO_5$. To prepare it, a constant excess of ammonia must be maintained, and this is done by compliance with the process, if the materials are of due strength. Without such a precaution, more or less of the more acid phosphate would be generated, in consequence of the escape of the alkali.

Properties. Hydrogen di-ammonium phosphate, which is the officinal salt, occurs in "colorless, translucent, monoclinic prisms, losing ammonia on exposure to dry air, without odor, having a cooling, saline taste and a neutral or faintly alkaline reaction. Soluble in 4 parts of water at 15° C. (59° F.), in 0·5 part of boiling water, but insoluble in alcohol. When strongly heated, the salt fuses, afterward evolves ammonia, and at a bright red heat is wholly dissipated." *U. S.* The salt commonly found in commerce is either this acid phosphate, or a mixture of the two acid salts. The officinal salt may be made by saturating the excess of acid in acid phosphate of calcium by means of carbonate of ammonium. Phosphate of calcium is precipitated, and phosphate of ammonium obtained in solution, which, being duly concentrated by a gentle heat, affords the salt in crystals upon cooling. The method of obtaining the acid phosphate of calcium is given under the head of phosphate of sodium. (See *Sodii Phosphas.*) Phosphate of ammonium prepared in this way is a white salt, crystallizing in six-sided tables, derived from oblique quadrangular prisms, efflorescent, insoluble in alcohol, and soluble in 4 parts of cold water. The solution has an alkaline somewhat saline taste, and an alkaline reaction, and gives out ammonia when heated.

The other acid phosphate, $NH_4H_2PO_4$, is obtained by boiling a solution of either of the other salts so long as ammonia escapes, and then crystallizing. Its crystals are four-sided prisms, permanent in the air, of an acid taste and reaction, and soluble in 5 parts of cold water. (*Bridges.*) In a specimen of the common phosphate of ammonium of commerce which came under our notice, we recognized both the tabular crystals of the phosphate with two mols. of ammonium, having a saline slightly acrid taste, and neutral in reaction, and the prisms of the acid salt, with a sour and saline taste and decided acid reaction.

Tests. "The aqueous solution of the salt, when heated with potassa, evolves vapor of ammonia. Addition of test-solution of nitrate of silver to the aqueous solution produces a canary-yellow precipitate, soluble in nitric acid and in ammonia. The aqueous solution should remain unaffected by sulphide of ammonium, or, after being acidulated with hydrochloric acid, by hydrosulphuric acid (abs. of metals), or by test-solution of chloride of barium (sulphate). When acidulated with nitric acid, it should not be rendered turbid by test-solution of nitrate of silver (chloride). 2 Gm. of the salt dissolved in water and precipitated with test-mixture of magnesium, yields a crystalline precipitate, which, when washed with diluted water of ammonia, dried, and ignited, should weigh 1·68 Gm." *U. S.* This quantitative test is intended as a means of identifying the hydrogen di-ammonium salts. The British Pharmacopœia gives the following quantitative test. "If 20 grains be dissolved in water, and solution of ammonio-sulphate of magnesium be added, a crystalline precipitate falls, which, when well washed on a filter with solution of ammonia, diluted with an equal volume of water, dried, and heated to redness, leaves 16·08 grains." *Br.* The residue is pyrophosphate of magnesium, and its amount indicates the quantity of phosphoric acid contained in the salt.

Medical Properties and Uses. This salt was first brought to the notice of the profession, as a remedy for gout and rheumatism, by Dr. T. H. Buckler, of Baltimore, in a paper published in the *Am. Journ. of the Medical Sciences* for Jan. 1846. Since the publication of Dr. Buckler's paper, several practitioners, both in this country and in Europe, have employed the remedy with apparently useful results in chronic gout, and certain urinary diseases. The dose of the salt is from ten to forty grains (0·65–2·6 Gm.), three or four times a day, dissolved in a tablespoonful of water.

AMMONII SULPHAS. *U. S.* *Sulphate of Ammonium.*

$(NH_4)_2 SO_4$; 132. (A̩M-MŌ'NI̩-Ī SŬL'PHĂS.) $NH_4 O, SO_3$; 66.

Ammonium Sulphuricum, Sal Ammonium Secretum Glauberi; Sulfate d'Ammoniaque, Sel secret de Glauber, *Fr.;* Schwefelsaures Ammon, Ammonium, Ammoniak, *G.*

The impure salt resulting from the sublimation of gas liquor or fetid bone-spirit, saturated with sulphuric acid, is submitted repeatedly to solution and crystallization until obtained pure. Sulphate of ammonium may also be obtained by passing the gas liquor through powdered sulphate of calcium contained in a suitable vessel; carbonate of calcium remains, whilst the sulphate of ammonium is found in solution, which is evaporated. The crystals may be purified by redissolving, filtering, and recrystallizing. "Colorless, transparent, rhombic prisms, permanent in the air, odorless, having a sharp, saline taste and a neutral reaction. Soluble in 1·3 parts of water at 15° C. (59° F.) and in 1 part of boiling water; insoluble in absolute alcohol, but slightly soluble in alcohol of sp. gr. 0·817; when heated to about 140° C. (284° F.), the salt fuses, is gradually decomposed, and on ignition is wholly dissipated. The aqueous solution of the salt, when heated with potassa, evolves vapor of ammonia. With test-solution of chloride of barium it yields a white precipitate insoluble in hydrochloric acid. A one per cent. solution of the salt should not be blackened by test-solution of sulphide of ammonium (lead and iron), nor, when acidulated with nitric acid, should it be rendered more than opalescent by test-solution of nitrate of silver (limit of chloride)." *U. S.* It is not used as a medicine, but enters into the composition of ammonia-alum and the sulphate of iron and ammonium.

AMMONII VALERIANAS. *U. S.* *Valerianate of Ammonium.*

$NH_4 C_5H_9 O_2$; 119. (A̩M-MŌ'NI̩-Ī VA̩-LĒ-RI̩-Ā'NĂS.) $NH_4O, C_{10}H_9O_3$; 119.

Valérianate d'Ammoniaque, *Fr.;* Baldriansaures (Valeriansaures) Ammonium, *G.*

A process for preparing this salt is no longer officinal; that of the Pharm. 1870 is found below.*

Valerianate of ammonium was a new officinal of the U. S. Pharmacopœia of 1860; much difficulty was experienced by manufacturing chemists in procuring a crystallized valerianate of ammonium, until, after a series of experiments, Mr. B. J. Crew, of Philadelphia, ascertained that it was necessary to employ the *monohydrated* valerianic acid, as the ordinary acid with three mols. of water could not be successfully used for the purpose. The officinal formula is based upon that of Mr. Crew, published in the *A. J. P.* (1860, p. 109). In this formula the monohydrated valerianic acid, procured by a special process (see *Acidum Valerianicum*), is saturated with gaseous ammonia obtained in the usual manner from a mixture of chloride of ammonium and lime. The saturation is known to have been effected when litmus paper is no longer acted on. During the operation heat is developed sufficient to prevent premature crystallization, and, when the saturation is completed, nothing more is necessary than to allow the solution to cool. Crystallization soon begins, and in a few hours the contents of the vessel become a nearly solid mass of crystals.

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* "Take of Valerianic Acid *four fluidounces;* Chloride of Ammonium, Lime, each, *a sufficient quantity.* From a mixture of Chloride of Ammonium, in coarse powder, and an equal weight of Lime, previously slaked and in powder, contained in a suitable vessel, obtain gaseous ammonia, and cause it to pass, first through a bottle filled with pieces of Lime, and afterward into the Valerianic Acid, in a tall, narrow, glass vessel, until the Acid is neutralized. Then discontinue the process, and set the vessel aside that the Valerianate of Ammonium may crystallize. Lastly, break the salt into pieces, drain it in a glass funnel, dry it on bibulous paper, and keep it in a well-stopped bottle." *U. S.*

Properties. Thus prepared, valerianate of ammonium is in snow-white, pearly, four-sided, tabular crystals, perfectly dry, of an offensive odor like that of valerianic acid, and a sharp sweetish taste. Instead of liquefying whenever exposed to the air, as happened to the salt formerly procured, it undergoes this change only in a moist atmosphere, and effloresces when the air is dry. It is very soluble both in water and alcohol. Exposed to heat it is in great measure volatilized unchanged; but a small portion, by giving off a part of its ammonia, is converted into the acid valerianate. Hager (*Pharm. Centralb.*, 1879, p. 465) states that commercial valerianate of ammonium is always the acid salt, as is proved by the acid reaction and the strong rotation of the crystals, when placed upon cold water; the neutral salt is only obtained with difficulty, is in prismatic crystals, and is easily liquefied by moderate temperatures. Its formula is $NH_4C_5H_9O_2$. "The aqueous solution, if heated with potassa, evolves vapor of ammonia, and, if supersaturated with sulphuric acid, separates an oily layer of valerianic acid on the surface. If this mixture be neutralized with ammonia, the clear liquid should not be rendered deep red by test-solution of ferric chloride (abs. of acetate). The aqueous solution, when acidified by nitric acid, should not be precipitated by test-solution of nitrate of barium (sulphate), nor of nitrate of silver (chloride)." *U. S.*

Medical Properties. Valerianate of ammonium is not poisonous. Given to dogs in the dose of 150 grains, it produced no inconvenience. As a therapeutic agent it was first brought to the notice of the profession, in 1856, by M. Déclat, of Paris. The preparation which he used was a solution of valerianate of ammonium of uniform strength, made according to the recipe of M. Pierlot, an apothecary of Paris, which had been extensively given to the epileptics of the Salpêtrière and the Bicêtre. Since then it has been used in various diseases, principally of the nervous system, such as hysteria, epilepsy, chorea, neuralgia, and is certainly useful in various mild functional nervous affections, but in such grave maladies as epilepsy it is powerless. The dose of the salt is from two to eight grains (0·13–0·52 Gm.), dissolved in water. As now prepared, it may be made into pills without inconvenience; and, properly coated so as to conceal their disagreeable odor, they are probably the best form for the administration of the salt. *Pierlot's solution*, mentioned above, should be made by dissolving a drachm of valerianic acid in thirty-two drachms of distilled water, saturating the solution with carbonate of ammonium, and adding to the salt formed two scruples of the alcoholic extract of valerian. According to M. Pierlot, the latter addition is necessary in order to preserve the preparation from change; for a simple solution of the ammoniacal salt is rapidly decomposed. It will keep still better if the extract, when added to the solution, be mixed with a fluidounce of diluted alcohol, while but 24 drachms of distilled water are used, so as to preserve the measure. The solution of M. Pierlot is neutral, of a brown color, and a strong odor of valerian. It contains 1-25th of its weight of the pure salt. The dose is from six to thirty drops (0·36–1·9 C.c.), given in water or on a lump of sugar. (*Ann. de Thérap.*, 1857, p. 55.)

AMYGDALA AMARA. *U. S., Br.* *Bitter Almond.*

(A̦-MY̆G′DA̦-LA̦ A̦-MĀ′RA̦.)

"The seed of Amygdalus communis, *var.* amara. Linné. (*Nat. Ord.* Rosaceæ, Amygdaleæ.)" *U. S.*

"The seed of the bitter almond tree, Amygdalus communis, *var.* amara." *Br.*

Amygdalæ Amaræ, *P. G.;* Semen Amygdali Amarum; Amande amère, *Fr.;* Bittere Mandeln, *G.;* Mandorle amare, *It.;* Almendra amarga, *Sp.*

Bitter Almonds. These are smaller than the sweet almonds, and are thus described in the U. S. Pharmacopœia. "About one inch (25 m.m.) long, oblong lanceolate, flattish, covered with a cinnamon-brown scurfy testa, marked by about sixteen lines emanating from a broad scar at the blunt end. The embryo has the shape of the seed, is white, oily, consists of two plano-convex cotyledons, and a short radicle at the pointed end, has a bitter taste, and, when triturated with water, yields a milk-white emulsion, which emits an odor of hydrocyanic acid." They have the bitter taste of the peach kernel, and, though when dry inodorous or nearly so, have, when triturated with water, the fragrance of the peach blossom. They contain the same ingredients as sweet almonds, and like them form a milky emulsion with water. It was formerly supposed that they also contained hydrocyanic acid and volatile oil, to which their peculiar taste and smell, and their peculiar operation upon the system, were ascribed. It was, however, ascertained by MM. Robiquet and Boutron that these principles do not pre-exist in the almond, but result from the reaction of water; and Wöhler and Liebig proved, what was suspected by Robiquet, that they are formed out of a peculiar substance denominated *amygdalin*, which is the characteristic constituent of bitter almonds. This substance, which was discovered by Robiquet and Boutron in 1830, is white, crystallizable, inodorous, of a sweetish bitter taste, unalterable in the air, freely soluble in water and hot alcohol, very slightly soluble in cold alcohol, and insoluble in ether. It is decomposed by the action of dilute acids or in the presence of water by the nitrogenous ferments, like emulsin, which accompany it in the bitter almond. The reaction is as follows:

$$\underset{\text{Crystallized amygdalin.}}{C_{20}H_{27}NO_{11}} + 3H_2O = 2(\underset{\text{Dextro-glucose.}}{C_6H_{12}O_6}) + \underset{\text{Hydrocyanic acid.}}{HCN} + \underset{\text{Oil of bitter almonds.}}{C_7H_6O} + H_2O.$$

It is recognized as belonging to the *glucoside* class, compounds which, when decomposed by dilute acids, alkalies, or ferments, yield glucose and some other characteristic decomposition product. They may be considered as compound ethers of glucose analogous to the compound ethers of glycerin which exist in the fats under the name of *glycerides.* Liebig and Wöhler give the following process for obtaining amygdalin, in which the object of the fermentation is to destroy the sugar with which it is associated. Bitter almonds, previously deprived of their fixed oil by pressure, are to be boiled in successive portions of alcohol till exhausted. From the liquors thus obtained all the alcohol is to be drawn off by distillation; care being taken, near the end of the process, not to expose the syrupy residue to too great a heat. This residue is then to be diluted with water, mixed with good yeast, and placed in a warm situation. After the fermentation which ensues has ceased, the liquor is to be filtered, evaporated to the consistence of syrup, and mixed with alcohol. The amygdalin is thus precipitated in connection with a portion of gum, from which it may be separated by solution in boiling alcohol, which will deposit it upon cooling. If pure, it will form a perfectly transparent solution with water. Any oil which it may contain may be separated by washing with ether. One pound of almonds yields at least 120 grains of amygdalin. (*Annal. der Pharm.*, xxii. 329.)*

Amygdalin, mixed with emulsion of *sweet* almonds, gives rise, among other products, to the volatile oil of bitter almonds and hydrocyanic acid—the emulsin of the sweet almonds acting the part of a ferment, by causing a reaction between the amygdalin and water; and the same result is obtained when pure *emulsin* is added to a solution of amygdalin. It appears then that the volatile oil and hydrocyanic acid, developed in bitter almonds when moistened, result from the mutual reaction of amygdalin, water, and emulsin. Certain substances have the effect of preventing this reaction, as, for example, alcohol and acetic acid. It is asserted that emulsin procured from other seeds, as those of the poppy, hemp, and mustard, is capable of producing the same reaction between water and amygdalin, though in a less degree.

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* Amygdalin appears to be extensively diffused in plants, having been noticed not only in the different genera of the Amygdaleæ, as *Amygdalus, Cerasus*, and *Prunus*, but also by Wicke in various Pomaceæ, as *Pyrus Malus, Sorbus Aucuparia, Sorbus hybrida, Sorbus torminalis, Amelanchier vulgaris, Cotoneaster vulgaris*, and *Cratægus Oxycantha.* (*Ann. der Chem. und Pharm.*, lxxix. 79.) It may be advantageously procured from peach kernels, which have been found to yield 80 grains for each avoirdupois pound, or more than 1 per cent. (*A. J. P.*, xxvii. 227.)

(*Annal. der Pharm.*, xxviii. 290.) Amygdalin appears not to be poisonous when taken pure into the stomach; as there is nothing in the system capable of acting the part of emulsin. Nevertheless, large quantities given to a dog have produced narcotic effects.

Bitter almonds yield their fixed oil by pressure, and at the present time (1882) this oil is an article of commerce, and is frequently sold as oil of sweet almonds; the volatile oil, impregnated with hydrocyanic acid, may be obtained from the residue by distillation with water. (See *Oleum Amygdalæ Amaræ.*)

Confectioners employ bitter almonds for communicating flavor to the syrup of orgeat. (See *Syrupus Amygdalæ.*) The kernel of the peach possesses similar properties, and is frequently used as a substitute. It has been ascertained that bitter almond paste, and other substances which yield the same volatile oil, such as bruised cherry-laurel leaves, peach leaves, etc., have the property of destroying the odor of musk, camphor, most of the volatile oils, creasote, cod-liver oil, the balsams, etc.; and M. Mahier, a French pharmacist, has employed them successfully to free mortars and bottles from the odor of asafetida, and other substances of disagreeable smell. All that is necessary is first to remove any oily substance by means of an alkali, and then to apply the paste or bruised leaves.

Medical Properties and Uses. (See *Amygdala Dulcis.*)

Off. Prep. Syrupus Amygdalæ.

AMYGDALA DULCIS. *U.S., Br.* *Sweet Almond.*

(A̤-MY̆G'DA̤-LA̤ DŬL'CI̤S.)

"The seed of Amygdalus communis, var. dulcis. Linné. (*Nat. Ord.* Rosaceæ, Amygdaleæ.)" *U. S.* "The seed of the sweet almond tree." *Br.*

Amygdalæ Dulces, *P. G.;* Semen Amygdali Dulce; Amande douce, *Fr.;* Süsse Mandeln, *G.;* Mandorle dolci, *It.;* Almendra dulce, *Sp.*

Gen. Ch. *Calyx* five-cleft, inferior. *Petals* five. *Drupe* with a nut perforated with pores. *Willd.*

Amygdalus communis. Willd. *Sp. Plant.* ii. 982; Woodv. *Med. Bot.* p. 507, t. 183. The almond tree rises usually from fifteen to twenty feet in height, and divides into numerous spreading branches. The leaves stand upon short footstalks, are about three inches long and three-quarters of an inch broad, elliptical, pointed at both ends, veined, minutely serrated, with the lower serratures and petioles glandular, and are of a bright green color. The flowers are large, of a pale red color varying to white, with very short peduncles, and petals longer than the calyx, and usually stand in pairs upon the branches. The fruit is of the peach kind, with the outer covering thin, tough, dry, and marked with a longitudinal furrow, where it opens when fully ripe. Within this covering is a rough shell, containing the kernel or almond.

There are several varieties of this species of Amygdalus, differing chiefly in the size and shape of the fruit, the thickness of the shell, and the taste of the kernel. The two most important are *Amygdalus* (*communis*) *dulcis* and *Amygdalus* (*communis*) *amara*, the former bearing sweet, the latter bitter almonds. Another variety is the *fragilis* of De Candolle, which yields the *paper-shelled almonds.*

The almond-tree is a native of Persia, Syria, and Barbary, and is very extensively cultivated in various parts of the south of Europe. It has been introduced into the United States; but in the northern and middle sections the fruit does not usually come to perfection. We are supplied with sweet almonds chiefly from Spain and the south of France. They are separated into the soft-shelled and hard-shelled, the former of which come from Marseilles and Bordeaux, the latter from Malaga. From the latter port they are sometimes brought to us without the shell. In British commerce, the two chief varieties are the *Jordan* and *Valencia* almonds, the former imported from Malaga, the latter from Valencia.* The former are longer, narrower, more pointed, and more highly esteemed than the latter. The bitter almonds are obtained chiefly from Morocco, and are exported from Mogador.

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* In 1861, Dr. Geo. B. Wood was informed, when at Valencia, that the thin, paper-shelled almonds were produced, not in the immediate neighborhood, but chiefly in the Balearic Islands, and the province of Alicante, whence they are sent to Valencia; and, in a journey through the interior from Valencia to Alicante, he noticed that the almond-tree was very abundant in the region back of the latter city, while there were comparatively few near the former.

Properties. The shape and appearance of almonds are too well known to require description. Each kernel consists of two white cotyledons, enclosed in a thin yellowish brown, bitter skin, which is easily separable after immersion in boiling water. Deprived of this covering, they are called *blanched almonds.* On exposure to the air, they are apt to become rancid; but, if thoroughly dried, and kept in well-closed glass vessels, they may be preserved unaltered for many years. The two varieties each require a separate notice.

Sweet almonds are without smell when blanched, and have a sweet, very pleasant taste, which has rendered them a favorite article of diet in all countries where they are readily attainable. They are, however, generally considered difficult of digestion. The Pharmacopœia thus describes them. "Closely resembling the bitter almond (see *Amygdala Amara*), but having a bland, sweetish taste. When triturated with water, it yields a milk-white emulsion, free from the odor of hydrocyanic acid." *U.S.* By the analysis of M. Boullay, it appears that they contain, in 100 parts, 5 parts of pellicle, 54 of fixed oil, 24 of albumen, 6 of uncrystallizable sugar, 3 of gum, 4 of fibrous matter, 3·5 of water, and 0·5 of acetic acid comprising loss. The albumen is somewhat peculiar, and is called *emulsin.* It may be obtained separate by treating the emulsion of almonds with ether, allowing the mixture, after frequent agitation, to stand until a clear fluid separates at the bottom of the vessel, drawing this off by a siphon, adding alcohol to it so as to precipitate the emulsin, then washing the precipitate with fresh alcohol, and drying it under the receiver of an air-pump. In this state it is a white powder, inodorous and tasteless, soluble in water, and insoluble in ether and alcohol. Its solution has an acid reaction, and, if heated to 100° C. (212° F.), becomes opaque and milky, and gradually deposits a snow-white precipitate, amounting to about 10 per cent. of the emulsin employed. (*A. J. P.*, xxi. 354.) Its distinguishing characteristic is that of producing certain changes, noticed previously, in amygdalin, which property it loses when its solution is boiled, though not by exposure in the solid state to a heat of 100° C. (212° F.). (*Ibid.*, 357.) It consists of nitrogen, carbon, hydrogen, and oxygen, with a minute proportion of sulphur, and is probably identical with the *synaptase* of Robiquet. Mr. L. Portes announced the discovery of *asparagin* in sweet almonds. (*N. R.*, January, 1877.) The fixed oil is described under the head of *Oleum Amygdalæ*, to which the reader is referred. Sweet almonds, when rubbed with water, form a milky emulsion, free from the odor of hydrocyanic acid, the insoluble matters being suspended by the agency of the albuminous, mucilaginous, and saccharine principles.

Medical Properties and Uses. *Sweet almonds* have no other influence on the system than that of a nutrient and demulcent. The emulsion formed by triturating them with water is a pleasant vehicle for the administration of other medicines, and is itself useful in catarrhal affections. From their nutritive properties, and the absence of starch in their composition, they are much used in the diet of diabetic patients, as originally recommended by Dr. Pavy. (*Guy's Hosp. Rep.*, 1862, p. 213.) *Bitter almonds* are more active, and might be employed with advantage in pectoral and other complaints to which hydrocyanic acid is applicable. In some persons almonds produce urticaria, in the smallest quantities. Largely taken, they have sometimes proved deleterious. Landerer mentions the case of a lady, who was alarmingly affected by a bath, made from the residue of bitter almonds after expression of the fixed oil. (See *A. J. P.*, xxviii. 321.)

Wöhler and Liebig propose, as a substitute for cherry-laurel water, which owes its effects to the hydrocyanic acid it contains, but is objectionable from its unequal strength, an extemporaneous mixture, consisting of seventeen grains of amygdalin, and one fluidounce of an emulsion made with two drachms of *sweet* almonds, and a sufficient quantity of water. This mixture contains, according to the above named chemists, one grain of anhydrous hydrocyanic acid, and is equivalent to two fluidounces of fresh cherry-laurel water. If found to answer in practice, it will have the advantage of certainty in relation to the dose; as amygdalin may be kept any length of time unaltered. If the calculation of Wöhler and Liebig is correct as to the quantity of acid it contains, not more than a fluidrachm (3·75 C.c.) should be given as a commencing dose.

Off. Prep. of Sweet Almonds. Mistura Amygdalæ, *U. S.;* Pulvis Amygdalæ Compositus, *Br.;* Syrupus Amygdalæ, *U. S.*

AMYL NITRIS. *U. S., Br.* *Nitrite of Amyl.*

C_5H_{11},NO_2; 117. (Ā′MȲL NĪ′TRĬS.) $C_{10}H_{11}O,NO_3$; 117.

Amylum Nitrosum, Amylæther Nitrosus; Azotite d'Amyl, *Fr.;* Amyl Nitrit, *G.;* Amylo-nitrous Ether.

This substance, which was discovered by M. Balard in 1844, is for the first time officinal, and is included among the additions to the British Pharmacopœia. Nitrite of amyl should not be confounded with *nitrate of amyl*, $C_5H_{11}NO_3$, from which it differs both chemically and therapeutically. *Nitrate* of amyl is not used as a medicine.

Preparation. Nitrite of amyl may be prepared by passing a stream of nitrous acid (hyponitric acid) gas through purified amylic alcohol at a temperature of 132° C. (269·6° F.). As pointed out by Prof. John M. Maisch, this process is tedious and difficult, some hours being required for the saturation of the amylic alcohol, and the resultant containing not only the nitrite but also the valerianate of amyl, besides nitrate of ammonium and a black non-volatile substance, so that a complicated process of purification is necessary. For these reasons Prof. Maisch prefers acting upon amylic alcohol with nitric acid, as originally suggested by Balard. The alcohol should always first be purified according to the method of Hirsch (*A. J. P.*, 1862, pp. 139, 328), by agitating with an equal bulk of strong solution of common salt, then distilling in a retort with a thermometer, collecting what comes over between 125° C. (257° F.) and 140° C. (284° F.), and redistilling this until it has a boiling point near 132° C. (269·6° F.). The purified alcohol should be mixed with about an equal bulk of nitric acid in a capacious glass retort, being gradually heated until it approaches boiling, when the fire is to be removed. As soon as a thermometer inserted into the tubulures rises above 100° C. (212° F.) the receiver is changed, because both ethyl-amylic ether and nitrate of amyl at such temperatures come over freely and would contaminate the product. The distillate obtained below 100° C. (212° F.) is agitated with a solution of carbonate of potassium, and the oily liquid which separates is very slowly heated in a clean retort to 96° C. (204·8° F.), then the receiver is changed and the distillate collected as before, until the thermometer reaches 100° C. (212° F.). That which comes over between the two temperatures is pure nitrite of amyl. It is essential to this process that in every case the heating be very gradual. (*A. J. P.*, 1871, p. 148.) Prof. Maisch also attempted to produce nitrite of amyl by Redwood's process (*A. J. P.*, 1867, p. 330) for the production of nitrous ether, substituting amylic for ethylic alcohol. He found that the reactions occurred with such excessive violence as to render the preparation of the drug in this way impracticable. Subsequently, however, Mr. Alfred Tanner pointed out (*P. J. Tr.*, Nov. 1871, also *A. J. P.*, 1872, p. 21) that Prof. Maisch used a nearly anhydrous amylic alcohol, and that the reactions are equally violent with ethylic alcohol of similar strength. He finds no difficulty when the fusel oil is diluted with water, and prefers the process, especially for the production of the drug upon a small scale. Having introduced the purified amylic alcohol into a tubulated retort containing copper wire, he adds one-tenth of its bulk of strong sulphuric acid, and then the same quantity of nitric acid, previously diluted with an equal bulk of water, and heats gently to 63° C. (145·4° F.). At this temperature the reaction commences, and goes on very manageably, until a bulk about equal to double the quantity of nitric acid collects in the receiver. The chemical movement now ceases, and the temperature, which has risen to near 100° C. (212° F.), begins to fall. More dilute nitric acid is added, and the process carried out as before. These additions are repeated until the amylic alcohol is exhausted, which is known by the appearance of red fumes in the retort. The whole product is washed with caustic soda, to remove hydrocyanic and other acids, and rectified over carbonate of potassium, to get rid of moisture. The portion which distils over between 95° C. (203° F.) and 100° C. (212° F.) is medicinally pure nitrite of amyl. Mr. D. B. Dott (*P. J. Tr.*, Aug. 31, 1878) called attention to the difficulties in the way of fixing a standard boiling point for nitrite of amyl, and Dr. W. H. Greene (*A. J. P.*, 1879, p. 65) shows that nitropentane (see *N. R.*, 1877, p. 236) is almost invariably a constituent of nitrite of amyl, and he believes that commercial nitrite of amyl is frequently put upon the market unrectified, specimens examined having boiling points varying from 70° C. (158° F.) to 180° C. (356° F.).

Properties. "A clear, pale yellowish liquid, of an ethereal, fruity odor, an aromatic taste, and a neutral or slightly acid reaction. When freely exposed to the air it decomposes, leaving a large residue of amyl alcohol. It is insoluble in water, but soluble, in all proportions, in alcohol, ether, chloroform, benzol, and benzin. Its sp. gr. is 0·872 to 0·874, and it boils at about 96° C. (205° F.), giving an orange-colored vapor. It burns with a fawn-colored flame. Warmed with excess of solution of potassa it gives the odor of amyl alcohol. If this alkaline mixture be treated with a little test-solution of iodide of potassium, and then with acetic acid to an acid reaction, there is an immediate separation of iodine, and on the addition of gelatinized starch a deep blue color appears (distinction from nitrate). It should remain transparent, or nearly so, when exposed to the temperature of melting ice (abs. of water). On shaking 10 C.c. of Nitrite of Amyl with 2 C.c. of a mixture of 1 part of water of ammonia and 9 parts of water, the liquid should not redden blue litmus paper (limit of free acid). Nitrite of Amyl should be preserved in small glass-stoppered vials, in a cool and dark place." *U. S.*

Medical Properties and Uses. Owing to its excessive volatility and the ease with which it is absorbed, nitrite of amyl acts with great quickness upon the organism. As early as 1859, Guthrie investigated, to some extent, its physiological action; but the attention of the profession was really first directed to the drug by the researches of Dr. Richardson, of London, in 1865. Since this time elaborate studies of its physiological action have been made by various investigators. Want of space forbids more than a summarizing of them in this book; for a full account the reader is referred to Dr. H. C. Wood's Treatise on Therapeutics. When inhaled in doses of from 5 to 10 drops, nitrite of amyl produces in man violent flushing of the face, accompanied with a feeling as though the head would burst, and a very excessive action of the heart. Along with these symptoms, after a larger quantity, there is a sense of suffocation, and more or less marked muscular weakness. As no case of serious poisoning from nitrite of amyl has occurred in man, for a further knowledge of its action we are dependent upon the study made on the lower animals. In dogs, rabbits, cats, etc., it induces effects similar to those occurring in man, followed, after toxic doses, by violently hurried, panting respiration, progressive loss of muscular power and of reflex activity, and finally death from failure of respiration; sensation and consciousness being preserved to the last. Although the frequency of the pulse may be increased, the force of the circulation is always diminished. This decrease of the arterial pressure is in a great measure due to a dilatation of the capillaries. The vaso-motor palsy appears to be chiefly produced by a direct action upon the coats of the capillaries, but may in part be caused by an influence exerted upon the vaso-motor centres. The cause of the acceleration of the pulse has not been made out, but there is some evidence for the belief that the rise is due to a depressing action upon the inhibitory cardiac nerves, and it is also possible that small quantities of the drug are primarily stimulant to the cardiac muscle.

The diminution of voluntary movements and of reflex action is chiefly owing to a powerful depressing influence exerted upon the spinal centres, although the drug does act to some extent upon both motor nerve and muscle, lowering their functional activity. Upon the perceptive and conscious portions of the nervous system nitrite of amyl has almost no influence, so that, as already stated, both consciousness and sensation are preserved in poisoning by it almost to the close.

After toxic doses the animal temperature falls to a most remarkable degree. Very small doses produce in man a slight (½° F.) temporary increase of the bodily heat, probably caused by the vascular dilatation. The vapors of nitrite of amyl outside of the body have a very extraordinary power of checking oxidation, and the results of numerous experiments seem to show that in the body the drug lessens very decidedly the chemical interchanges. With the exception of the decrease of temperature, the general symptoms produced by the poison do not seem to be due to this lowered oxidation, but to a direct influence exerted upon the various tissues.

Locally applied, nitrite of amyl causes a progressive loss of power in every highly organized tissue; this may end in a total cessation of function, but, even after this, recovery is possible, provided the poison be withdrawn sufficiently early.

The chief indication for the employment of nitrite of amyl is to relax spasm, either of the vaso-motor muscular fibres or of the voluntary or involuntary muscles. A disease, probably associated with vaso-motor spasm, but whose pathology is not established, in which experience has demonstrated the extreme value of nitrite of amyl, is angina pectoris. Immediate and great relief is nearly always afforded, whether the heart-pain is or is not connected with organic cardiac disease. So far as experience goes, the cautious use of the remedy is safe, even when there is severe organic cardiac disease. In these cases it should always be administered by inhalation. Experience has also justified the use of the drug in many spasmodic diseases. In asthma the relief is often immediate; in convulsions occurring after labor the nitrite affords quiet, but its employment is dangerous, on account of its tendency to produce uterine relaxation and consequent flooding. In spasmodic dysmenorrhœa good may be expected from its use; in tetanus it will frequently temporarily arrest the spasm and aid other remedies in obtaining recovery; in strychnine poisoning, in hysterical convulsions, indeed, in almost any convulsive disorder, much is to be expected from its employment. The convulsive stage of the ordinary epileptic paroxysm is so short that the nitrite is usually not available; when, however, there is a marked epileptic stasis and the patient passes from one convulsion to another, the drug may be used with benefit. In those cases in which there is an aura of sufficient length, the epileptic attacks may be arrested by the patient carrying in the pocket a tightly-corked homœopathic vial containing five or ten drops of the remedy, and, as soon as the aura commences, inhaling deeply from the opened mouth of the bottle.

Nitrite of amyl is generally administered by inhalation, usually in doses of from three to five drops, although much larger quantities have been given without bad results. The rule is to commence with three drops on a handkerchief held close to the nose, and then gradually to increase *pro re nata.* The handkerchief should always be withdrawn so soon as the face flushes or the heart begins to become excited, as the effects always increase for some time, even if no more be inhaled. The best method, however, of administering the very volatile liquid is by the use of the glass pearls,—small flask-shaped vessels containing 2, 5, or 10 minims of the nitrite; these are crushed in a handkerchief or towel when wanted for inhalation, the very thin and friable glass causing no inconvenience. The drug may also be given by the mouth, in doses of three to five drops (0·18–0·3 C.c.) on sugar or dissolved in alcohol.

AMYLUM. *U.S., Br.* *Starch.*

(ĂM'Y̥-LŬM.)

"The fecula of the seed of Triticum vulgare. Villars. (*Nat. Ord.* Graminaceæ.)" *U. S.* "The starch procured from the seeds of common wheat, Triticum vulgare." *Br.*

Amylum Tritici; Wheat Starch, *E.;* Fécule (Amidon) de Froment, de Blé, Amidon, *Fr.;* Stärkmehl, Stärke, Kraftmehl, Weizenstärke, *G.;* Amido, *It.;* Almidon, *Sp.*

Starch is a proximate vegetable principle contained in most plants, and especially abundant in the various grains, such as wheat, rye, barley, oats, rice, maize, etc.; in other seeds, as peas, beans, chestnuts, acorns, etc.; and in numerous rhizomes and tuberous roots, as those of the potato (*Solanum tuberosum*), the sweet potato (*Convolvulus Batatus*), the arrow-root, etc. The starch is always in the form of grains, which are contained within the parenchymatous cells, and is procured by reducing the substances in which it exists to a state of minute division, agitating or washing them with cold water, straining or pouring off the liquid, and allowing it to stand till the fine fecula which it holds in suspension has subsided. This, when dried, is starch, more or less pure, according to the care taken in conducting the process. The starch of commerce is procured chiefly from potatoes and the cheaper grains.

Starch is white, pulverulent, opaque, and, as found in the shops, is usually in columnar masses, and produces a peculiar sound when pressed between the fingers. Its specific gravity is 1·505 at 67° F. (*Payen.*) "Under the microscope appearing as granules, mostly very minute, more or less lenticular in form, and indistinctly, concentrically striated." *U. S.* When exposed to a moist air, it absorbs a considerable quantity of water, which may be driven off by a gentle heat. It is insoluble in alcohol, ether, and cold water; but unites with boiling water, which, on cooling, forms with it a soft semi-transparent paste, or a gelatinous opaline solution, according to the proportion of starch employed. The paste placed on folds of blotting-paper, renewed as they become wet, abandons its water, contracts, and assumes the appearance of horn. If the proportion of starch be very small, the solution, after slowly depositing a very minute quantity of insoluble matter, continues permanent, and upon being evaporated yields a semi-transparent mass, which is partially soluble in cold water. The starch has, therefore, been modified by the combined agency of water and heat; nor can it be restored to its original condition. Exposed, in the dry state, to a temperature somewhat above 100° C. (212° F.), it undergoes, according to Caventou, a similar modification. "Triturated with cold water it gives neither an acid nor an alkaline reaction with test-paper. When boiled with water, it yields a white jelly having a bluish tinge, which, when cool, acquires a deep blue color on the addition of test-solution of iodine." *U. S.* At a temperature of 160° C. (320° F.) for air-dried starch, and 200° C. (392° F.) for starch previously dried at 100° C., it is changed into *dextrin* (British gum), and at 200° C. (392° F.) to 215° C. (419° F.) forms a transparent fused mass, which consists exclusively of dextrin (*Payen*); at 220° C. (428° F.) to 230° C. (446° F.) it undergoes further change and yields chiefly *pyrodextrin*, a brown, tasteless, and odorless compound, readily soluble in water, insoluble in alcohol and ether. (Gelis, *Ann. Chim. Phys.*, (3) lii. 388.)

Composition and Nature. The formula of starch is generally taken as $C_6H_{10}O_5$, or a multiple of this. Some writers consider that $(C_6H_{10}O_5)_2 + 3H_2O$ expresses its composition when air-dried, or simply $C_6H_{10}O_5$ when dried at 100° C. (212° F.). Musculus, in 1861, showed that by the action of dilute acids or *diastase*, starch is resolved into *dextrin*, $C_{12}H_{20}O_{10}$, and *dextrose*, $C_6H_{12}O_6$, so that its formula is most probably $C_{18}H_{30}O_{15}$ or $(C_6H_{10}O_5)_3$. Iodine forms with starch, whether in its original state or in solution, a blue compound; and the tincture of iodine is the most delicate test of its presence. The color varies somewhat according to the proportions employed. When the two substances are about equal, the compound is of a beautiful indigo blue; if the iodine is in excess, it is blackish blue; if the starch, violet blue. A singular property of the iodide of starch is that its solution becomes colorless if heated to about 93·5° C. (200° F.), and afterwards recovers its blue color upon cooling. By boiling, the color is permanently lost, whilst Puchot states that certain nitrogenized organic bodies, as albumen, prevent the reaction of iodine on starch or destroy it. (*N. R.*, Nov. 1876.) Alkalies unite with starch, forming soluble compounds, which are decomposed by acids, the starch being precipitated. It is thrown down from its solution by lime-water and baryta-water, forming insoluble compounds with these earths. The solution of subacetate of lead precipitates it in combination with the oxide of the metal. Starch may be made to unite with tannin by boiling their solutions together; and a compound results, which, though retained by the water while hot, is deposited when it cools. By long boiling with diluted sulphuric, hydrochloric, or oxalic acid, it is converted into *dextrin** and glucose or grape sugar. A similar conversion into dextrin and glucose is effected by means of a principle called *diastase*, discovered by MM. Payen and Persoz in the seeds of barley, oats, and wheat, after germination. (See *Hordeum.*) Strong hydrochloric and nitric acids dissolve it; and the latter, by the aid of heat, converts it into oxalic and malic acids. By the action of strong nitric, sulphuric, or crystallizable acetic acid, used with certain precautions, the starch is rendered soluble, and may be obtained in this state by separating the acid by means of alcohol. (*Chem. Gaz.*, Dec. 1, 1854, p. 450.) By the continued action of concentrated sulphuric acid it is decomposed. When it is dissolved in strong nitric acid, and precipitated by water, a white powder is thrown down, called *xyloidin*, $C_6H_9(NO_2)O_5$ (*Braconnot*), in which one atom of the hydrogen of the starch is replaced by one group, NO_2, furnished by the nitric acid. Mixed with hot water and exposed to a temperature of 27° C. (80° F.), it undergoes chemical changes, which result in the formation of several distinct principles, among which are sugar, a gummy substance (perhaps *dextrin*), and a soluble modification of starch. With yeast, starch undergoes the vinous fermentation, being, however, first converted into sugar. Mixed with cheese and chalk it is said to yield alcohol without the previous saccharine conversion. (Berthelot, *Journ. de Pharm.*, 3e sér., xxxii. 260.) All plants which contain chlorophyll have the power of using the chemical rays of sunlight in producing from inorganic compounds and elements a substance which is organic. There is first formed in the centre of the chlorophyll granule a minute speck, which is believed to be starch; this new starch granule is incapable of solution, but by conversion into sugar or dextrin is rendered soluble, and in this form is carried in the juices of the plant. One of two destinies there awaits it. It may be converted into the permanent compound cellulose which constitutes the woody tissue, or it may be reconverted to its original form and be deposited in some part of the plant. These stores of starch are usually accumulated for future growth, and are especially seen in plants which flower in the spring before the leaves are put forth, or which reproduce the species without seeding. When the potato is planted by the farmer, the starch is converted into a soluble form, passes into the growing "eye" or bud, and, as cellulose, forms the new shoot. Different opinions have been held as to the precise structure of the starch granules. The one first adopted is that they consist of a thin exterior coating, and of an interior substance; the former wholly insoluble, the latter soluble in water. The former constitutes, according to M. Payen, only 4 or 5 thousandths of the weight of starch. In relation to the interior portion, there is not an exact coincidence of opinion. M. Guérin supposed that it consisted of two distinct substances, one soluble in cold water, the other soluble at first in boiling water, but becoming insoluble by evaporation. Thus, when one part of starch is boiled for fifteen minutes in one hundred parts of water, and the liquid is allowed to stand, a small portion, consisting of the broken teguments, is gradually deposited. If the solution be now filtered and evaporated, another portion is deposited which cannot afterwards be dissolved. When wholly deprived of this portion, and evaporated to dryness, the solution yields the part soluble in cold water. According to MM. Payen and Persoz, the interior portion of the globules consists only of a single substance, which is converted into the two just mentioned by the agency of water; and Thenard is

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* *Dextrin* is a substance resembling gum in appearance and properties, but differing from it in not affording mucic acid by the action of nitric acid. It is largely dissolved by water, hot or cold, and forms a mucilaginous solution, from which it is precipitated by alcohol. Large quantities of dextrin are now made both here and abroad, and employed for various purposes in the arts, under the name of *artificial gum*. It is found in the market in the form of mucilage, in that of a white brilliant powder, and in small masses or fragments resembling natural gum. According to M. Emil Thomas, it may be distinguished from gum arabic by the taste and smell of potato oil which it always possesses. It is made by the action either of acids or of diastase on starch. For particulars as to the manufacture, the reader is referred to a paper by M. Thomas, republished in

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A. J. P. (vol. xix. p. 284). Recent researches of Nägili and Musculus seem to show that the change of starch into dextrin takes place in several phases, and they name the several products *amylodextrin, erythrodextrin, achrodextrin α and β.* For a fuller account of these products see Husemann, *Pflanzenstoffe*, 2d ed., 1882.

Dextrin, according to Payen, is converted into glucose, through the action of diastase; but the glucose impedes the action unless removed; as, however, during the alcoholic fermentation the glucose is consumed, no obstacle prevents the influence of diastase. Hence dextrin by conversion into sugar may contribute to the alcoholic product. (*Journ. de Pharm.*, 4e sér., i. 363.)

Adulteration and purification of dextrin.—Commercial dextrin is said to be occasionally very impure. Several parcels, analyzed by Dr. H. Hayes, were found to contain an average of about 45 per cent. of impurities, consisting mainly of insoluble matter with sugar and water. He recommends, as the best method of purifying it, to dissolve 10 parts of the impure dextrin, with agitation, in 18 parts of distilled water, in a cylindrical vessel; to decant the solution when it has become clear on standing, and mix it with 1·5 or 2 per cent. of alcohol of 95. The liquid is then decanted from the doughy precipitate formed, which is dissolved in a little distilled water; and the solution spread on glass or porcelain plates to dry, in a warm place. (*A. J. P.*, 1870, p. 327.)

inclined to the same opinion. An appropriate name for the interior soluble portion of starch is *amidin*, which has been adopted by some chemists. Starch, in its perfect state, is not affected by cold water, because the exterior insoluble teguments prevent the access of the liquid to the interior portion; but, when the pellicle is broken by heat, or by mechanical means, the fluid is admitted, and the starch partially dissolved.

Another view of the structure of the starch granule, founded on microscopic observation, has been advanced by Schleiden. According to this view, it consists of concentric layers, all of which have the same chemical composition; but the outer layers, having been first formed, have more cohesion than the inner, and are consequently more difficult of solubility. The rings observed upon the surface of the granules, in some varieties, are merely the edges of these layers; and the point or hylum about which the rings are concentrically placed, is a minute hole, through which probably the substance of the interior layers was introduced. (*Pharm. Centralb.*, 1844, p. 401.)

Mr. J. J. Field thinks he has demonstrated that the granule consists, as at first supposed, of an interior matter surrounded by a distinct membranous envelope. Having saturated some canna starch with glycerin, and then added a little water, an endosmose of the thinner outer liquid took place into the granules, distending them so as to rupture their investing membrane, which was distinctly visible, under the microscope, in longitudinal wrinkles. The concentric rings he thinks nothing more than folds of the membrane, produced probably by the contraction of the granules. (*P. J. Tr.*, xiv. 253.)

The tegumentary portion of starch, for which the name of *amylin* has been proposed, is, when entirely freed from the interior soluble matter, wholly insoluble in water even by prolonged boiling, insoluble in alcohol, and said to suffer no change by the action of diastase. The acids, however, act upon it as they do upon starch. It is thought to approach nearer in properties to lignin than to any other principle. Musculus (*Comptes-Rendus; Journal Franklin Institute*, June, 1879) believes that starch may exist in an amorphous and crystallizable form. In its amorphous state it is soluble in water, capable of being acted on by diastase, soluble in diluted mineral acids, but easily rendered insoluble by undergoing modifications. In its crystalline condition it can be obtained in isolated crystals, which can be readily dissolved in cold water, but when these crystals are united they become less soluble, and then it largely has the properties of the amorphous variety. Sulkowsky (*Ber. d. Chem. Ges.*, xiii. 1395) states that starch may be rendered soluble by heating with glycerin to 190° C. (374° F.), and pouring whilst hot into water, filtering, and adding alcohol to the filtrate, which causes precipitation of the soluble starch.

Varieties. Starch, as obtained from different substances, is somewhat different in its characters. *Wheat starch*, when examined with a microscope, is found to consist of granules varying from about $\frac{1}{1000}$ of an inch in diameter to a mere point, the smaller being spheroidal, the larger rounded and flattened, with the hylum in the centre of the flattened surface, and surrounded by concentric rings, which often extend to the edge. The granules are mixed with loose integuments, resulting from the process of grinding. This variety of starch has a certain degree of hardness and adhesiveness, owing, according to Guibourt, to the escape of a portion of the interior substance of the broken granules, which attracts some moisture from the air, and, thus becoming glutinous, acts as a bond between those which remain unbroken. Another opinion attributes this peculiar consistence to the retention of a portion of the gluten of the wheat flour, which causes the granules to cohere. Under the name of *corn starch*, a variety of fecula obtained from the meal of maize or Indian corn is much used for nutritive purposes in the United States. It is an excellent preparation. The granules of maize starch are very small, with a diameter not exceeding, according to Payen, one-sixth of that of the potato, and little more than one-half that of the wheat granules. (*Gmelin*, xv. 79.) *Potato starch* is employed in various forms, being prepared so as to imitate more costly amylaceous substances, such as arrow-root and sago. In its ordinary state, it is more pulverulent than wheat starch, has a somewhat glistening appearance, and may be distinguished, with the aid of the microscope, by the size of its granules, which are larger than those of any other known fecula, except canna or *tous les mois.*[*] They are exceedingly diversified in size and shape, though their regular form is thought to be ovate. The characters of other kinds of fecula will be given under the heads of the several officinal substances of which they constitute the whole or a part.

According to Chevallier, starch is sometimes adulterated with carbonate and sulphate of calcium; and the fraud is also practised of saturating it with moisture, of which it will absorb 12 per cent. without any obvious change.

Medical Properties, etc. Starch is nutritive and demulcent, but in its ordinary form is seldom administered internally. Powdered and dusted upon the skin, it is sometimes used to absorb irritating secretions, and prevent excoriation. Dissolved in hot water and allowed to cool, it is often employed in enemata, either as a vehicle, or as a demulcent application in irritated states of the rectum. It may be used as an antidote to iodine taken in poisonous quantities.

Off. Prep. Amylum Iodatum, *U. S.;* Glyceritum Amyli, *U. S.;* Glycerinum Amyli, *Br.;* Mucilago Amyli, *Br.;* Pulvis Tragacanthæ Compositus, *Br.*

AMYLUM IODATUM. *U. S.* *Iodized Starch.*

(ĂM′Y̨-LŬM Ī-O̧-DĀ′TŬM.)

Amyli Iodidum, Iodide of Starch; Iodure d'Amidon, *Fr.;* Jodstärke, *G.*

"Starch, *ninety-five parts* [or four hundred and eighteen grains]; Iodine, *five parts* [or twenty-two grains]; Distilled Water, *a sufficient quantity,* To make *one hundred parts* [or one ounce av.]. Triturate the Iodine with a little distilled water, add the starch gradually, and continue triturating until the compound assumes a uniform blue color, approaching black. Dry it at a temperature not exceeding 40° C. (104° F.), and rub it to a fine powder. Iodide of Starch should be preserved in glass-stoppered vials." *U. S.*

This is a new officinal. The view taken by our Pharmacopœia is that of Liebig and Duclaux, that iodized starch is not a definite chemical compound, hence the name *iodized.* Bondonneau, on the other hand, assigns to it the formula $(C_6H_{10}O_5)_5I$, whilst Payen and Fritzsche give it $(C_6H_{10}O_5)_{10}I$. If it is a definite compound, it is one of the most feeble known; sunlight, boiling water, alcohol, potash, and hydrosulphuric acid decomposing it easily. The officinal formula is substantially that of Dr. Andrew Buchanan, of Glasgow, who proposed iodized starch as a means of administering iodine in large doses without causing irritation of the stomach. He prepares it by triturating twenty-four grains of iodine with a little water, adding gradually an ounce of very finely powdered starch, and continuing the trituration until the compound assumes a uniform blue color. The iodide is then dried by a gentle heat, and kept in a well-stopped bottle.

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[*] CANNA was dropped at the last U. S. revision. Although not used as much as formerly, it merits a notice. (*Amylum Cannæ; Tous les Mois, Amidon de Canne, Fécule de Tolomane,* Fr.; *Cannastärke,* G.) It is yet somewhat uncertain from what species of Canna the fecula is derived, though it is generally believed to be *C. edulis.* The tubers of *Canna Achiras* (Gillies), growing in Central and South America, are said to be used as food in Peru and Chili (Lindley, *Med. and Econom. Bot.* p. 50); and a root or rhizome, closely resembling turmeric, and used by the native Africans at Sierra Leone for dyeing yellow, was found by Dr. Wm. F. Daniell to be the product of a species of Canna, believed to be the *C. speciosa* of Roscoe. (*P. J. Tr.,* Nov. 1859, p. 258.)

Canna edulis. Lindley, *Flor. Med.* p. 569, figured in *Fl. Med. and Econ.* of the same author, p. 49, also *B. and T.* 266. This is a tuberous plant, with erect, smooth, purplish stems, from four to six feet high, and invested with sheathing leaves, which are ovate-oblong, tapering towards each end, smooth, and of a deep glaucous green, with purplish edges. The flowers are few, and in compact racemes, of a red and yellow color. The plant is a native of the West Indies, and is cultivated in the islands of St. Kitts and Trinidad, and perhaps others. The tubers are first rasped, by means of a machine, into a pulp, from which the starch is extracted in the usual manner, by washing and straining, and, after the washings have been allowed to stand, so as to deposit the fecula, decanting the clear liquid. (Pereira, *Mat. Med.*)

Properties. Canna starch is in the form of a light, beautifully white powder, of a shining appearance, very unlike the ordinary forms of fecula. Its granules are said to be larger than those of any other variety of starch in use, being from the 300th to the 200th of an inch in length. Under the microscope they appear ovate or oblong, with numerous regular unequally distant rings; and the circular hilum, which is sometimes double, is usually situated at the smaller extremity. (*Pereira.*) This fecula has the ordinary chemical properties of starch, and forms, when prepared with boiling water, a nutritious and wholesome food for infants and invalids. It may be prepared in the same manner as *arrow-root,* and is said to form even a stiffer jelly with boiling water. (See *Maranta.*)

M. Magnes-Lahens, of Toulouse, first employed torrefied starch, but subsequently abandoned its use, and now contents himself with making an intimate mixture of iodine and starch, slightly moistened, which he subjects to the heat of a water-bath, until it is converted into the iodide of starch, forming a solution with water of a magnificent blue color. The heat, thus regulated, disaggregates the starch, without completely transforming it into dextrin, and gives a preparation in the form of a black powder. M. Seput, of Constantinople, has also given a formula for this soluble iodide, and for a *syrup* to be made from it. (See *Journ. de Pharm.*, Mars, 1852, p. 202.) M. Soubeiran reported upon these preparations to the Paris Society of Pharmacy, and deemed them ineligible on account of their variable strength in iodine, arising from the greater or less loss of this element during the necessary exposure to heat. Nevertheless, as the syrup is called for, he recommended the following process for making it, availing himself of the observations of his predecessors, which he had occasion to cite in his report. Triturate thoroughly, in a porcelain mortar, 36 grammes of nitric starch with 4½ grammes of iodine, dissolved in three times its weight of ether, and added in successive portions, until, after the evaporation of the greater part of the ether, a blue powder remains. Introduce this into a weighed, stoppered flask, and, having added 520 grammes of water, expose the whole to the heat of a water-bath, with the stopper at first removed, in order to complete the dissipation of the ether. Afterwards the stopper is replaced, being loosely tied with a packthread, so as to permit of its being raised without being driven out; and the heat is continued for about an hour and a half, when the iodide of starch will be completely formed. The flask is then weighed, and a quantity of water added to it, equal to that lost by evaporation. Lastly, 1040 grammes of sugar are added to the liquid, and dissolved by a gentle heat. By this formula a syrup is prepared, containing a quarter of one per cent. of iodine, a small part of which is in the state of hydriodic acid. The *nitric starch* is used by M. Soubeiran, because it unites with the iodine in much less time than the ordinary starch. It is made by mixing ordinary starch, in the cold, with 150 parts of water, to which 1 part of nitric acid has been added, and allowing the whole to dry in the open air. Three grains of this syrup, diluted with a pint of water, communicate to the liquid a sensible blue tint. This test may serve to determine whether the preparation is of full strength. (*Journ. de Pharm.*, Mai, 1852, p. 329.) The dose of the syrup is from one to four tablespoonfuls a day.

M. Quesneville, for whom it is claimed that he first introduced iodide of starch into therapeutics, recommends the following method of preparing it. Take of the finest starch, unmixed with that from the potato, 1050 grammes; iodine, in very fine powder passed twice through a sieve of silk, 100 grammes. Carefully mix the powders, and, when the mixture is complete, sprinkle into it gradually, agitating constantly, a mixture of 400 grammes of water and 100 of alcohol. The powder becomes gradually more and more deeply colored, and soon of a beautiful black. It is to be allowed to stand 15 or 20 days, and is then dried, first by a current of air and then in a stove. When well dried, the powder has no smell of iodine, of which it contains exactly one-tenth of its weight. It is quite insoluble in cold water; but to render it soluble, it is sufficient to heat it in an enamelled pan over a very gentle fire with constant agitation; the heat must be removed when a pungent odor is emitted. The powder thus procured is sufficient for pharmaceutical use. If it be desired to obtain it purer and extremely soluble in cold water, and always of a fine violet-blue, it will be necessary to make with heat a concentrated solution, so as to mark 7 or 8 degrees on the areometer for saline solutions, allow it to stand and settle for several days, then decant the liquor, add a quantity of alcohol just sufficient to precipitate the iodide of starch, put the magma which forms upon a linen cloth, press it as strongly as possible, and dry it by a stove-heat upon shallow dishes. (*Journ. de Pharm.*, Juillet, 1868, p. 30.)

Medical Properties. This preparation has been highly recommended by Drs. A. Buchanan, J. C. Dalton, and others, as affording a means of introducing iodine very largely into the general system without causing local irritation. Dr. Buchanan thinks that, by means of the starch, the iodine is converted into hydriodic acid, and in this state enters the circulation. Prof. Dalton, of New York, found that nearly all the animal fluids decompose iodide of starch, and destroy its blue color. (*Am. Journ. of Med. Sci.*, April, 1856, p. 327.) This result is owing, no doubt, to the alkaline nature of most of the animal fluids, especially those of the duodenum, alkaline iodides being formed at the expense of the starch. The dose is a heaped teaspoonful, given in water-gruel, three times a day, and afterwards increased to a tablespoonful. No nicety is necessary in apportioning the dose. In some cases Dr. Buchanan has given half ounce (15·6 Gm.) doses of the iodide three times a day, immediately increased to an ounce (31·1 Gm.).

ANETHI FRUCTUS. *Br.* *Dill Fruit.*

(Ạ-NĒ′THĪ FRŬC′TŬS.)

"The fruit of Anethum graveolens." *Br.*

Aneth, Fenouil puant, *Fr.;* Dill, *G.*

OLEUM ANETHI. *Br.* *Oil of Dill.*

(Ō′LẸ-ŬM Ạ-NĒ′THĪ.)

"The oil distilled in Britain from dill fruit." *Br.*

Essence d'Aneth, Aneth à odeur forte, *Fr.;* Dill, Dillöl, *G.;* Aneto, *It.;* Eneldo, *Sp.*

Gen. Ch. Fruit nearly ovate, compressed, striated. *Petals* involuted, entire. *Willd.*

Anethum graveolens. Willd. *Sp. Plant.* i. 1469; Woodv. *Med. Bot.* p. 125, t. 48. Dill is an annual plant, three or four feet high, with a long spindle-shaped root; an erect, striated, jointed branching stem; and bipinnate or tripinnate, glaucous leaves, which stand on sheathing footstalks, and have linear and pointed leaflets. The flowers are yellow, and in large, flat, terminal umbels, destitute of involucre. The plant is a native of Spain, Portugal, and the south of France; and is found growing wild in various parts of Africa and Asia. It is cultivated in all the countries of Europe, and has been introduced into our gardens. The seeds, as the fruit is commonly called, are the only part used. They are usually rather more than a line in length, and less than a line in breadth, of an oval shape, thin, concave on one side, convex and striated on the other, of a brown color, and surrounded by a yellowish membranous expansion. Each mericarp has three sharply keeled dorsal ridges, besides two marginal thin membranous projections or ridges. The vittæ or oil tubes are six in number, two upon the face and one in each furrow between the ridges. The odor is strong and aromatic, but less agreeable than that of fennel seed; their taste, moderately warm and pungent. These properties depend on a volatile oil, which may be obtained separate by distillation. The bruised seeds impart their virtues to alcohol and to boiling water.

Oil of dill is of a pale yellow color, with the odor of the fruit, and a hot, sweetish, acrid taste. The fruit yields about 3·5 per cent. of it. The chief constituent of this oil was found by Gladstone (*Chem. Soc. Jour.*, [2] 2, p. 2 and 10, p. 3) to be a hydrocarbon, $C_{10}H_{16}$, to which he gave the name of *anethene.* This substance has a lemon-like odor, sp. gr. 0·846, and boils at 172° C. (341·6° F.). It deviates a ray of polarized light strongly to the right. Nietzki (*Arch. Phar.*, (3) 4, p. 317) ascertained that there is present, moreover, another hydrocarbon, $C_{10}H_{16}$, in very small proportion, which boils at 155°–160° C. (311°–320° F.). A third constituent is in all probability identical with *carvol*, $C_{10}H_{14}O$, inasmuch as Flückiger prepared from the oil of dill direct the crystals $(C_{10}H_{14}O)_2H_2S$. (*Pharmacographia*, 2d ed., p. 329.) The oil is sometimes used for preparing dill-water.

Medical Properties. Dill seeds have the properties common to the aromatics, but are very seldom used in this country. They may be given in powder or infusion. The dose of the fruit is from fifteen grains to a drachm (1–3·9 Gm.), of the oil three or four drops (0·18–0·24 C.c.).

Off. Prep. of Dill. Aqua Anethi, *Br.*

ANISUM. *U.S.* *Anise.*

(Ạ-NĪ'SŬM.)

"The fruit of Pimpinella Anisum. Linné. (*Nat. Ord.* Umbelliferæ, Orthospermæ.)" *U.S.*

Fructus (Semen) Anisi, s. Anisi vulgaris; Aniseed, *E.;* Anis, Anisvert, Graines d'Anis, *Fr.;* Anissame, Anis, *G.;* Semi d'Aniso, *It.;* Simiente de Anis, *Sp.;* Anison, *Ar.*

Gen. Ch. Fruit ovate-oblong. *Petals* inferior. *Stigma* nearly globular. *Willd.*

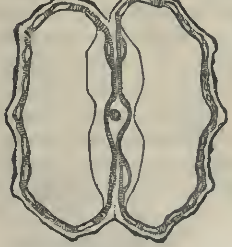
Pimpinella Anisum. Willd. *Sp. Plant.* i. 1473; *B. and T.* 122. This is an annual plant, about a foot in height, with an erect, smooth, and branching stem. The leaves are petiolate, the lower roundish-cordate, lobed, incised-serrate, the middle pinnate-lobed with cuneate or lanceolate lobes, the upper trifid, undivided, linear. The flowers are white, and in terminal compound umbels, destitute of involucres.

The anise plant is a native of Egypt and the Levant, but has been introduced into the south of Europe, and is cultivated in various parts of that continent. It is also cultivated occasionally in the gardens of this country. The fruit is abundantly produced in Malta and Spain, and especially so in Romagna, in Italy, whence it is largely exported through Leghorn. The Spanish is smaller than the German or French, and is usually preferred. It is said also to be extensively cultivated in India and South America, although we are not aware that the product ever comes into American commerce.

It is one of the oldest aromatics, having been spoken of by Theophrastus and cultivated in the imperial German farms of Charlemagne. In 1305, Edward I. granted a patent giving the right to levy tolls upon it at the Bridge of London for the purpose of repairing the bridge itself.

Anise seeds (botanically, fruit) are about a line in length, oval, striated, somewhat downy, attached to their footstalks, and of a light greenish brown color, with a shade of yellow. "About one-sixth of an inch (4 mm.) long, ovate, compressed at the sides, grayish, finely hairy, and consisting of two mericarps, each with a flat face, and five light brownish filiform ridges, and about fifteen thin oil tubes." *U. S.* Their odor is fragrant, and increased by friction; their taste, warm, sweet, and aromatic. These properties, which depend upon a peculiar volatile oil, are imparted sparingly to boiling water, freely to alcohol. The volatile oil exists in the envelope of the seeds, and is obtained separate by distillation. (See *Oleum Anisi.*) Their internal substance contains a bland fixed oil. By expression, a greenish oil is obtained, which is a mixture of the two. The seeds are sometimes adulterated with small fragments of argillaceous earth, which resembles them in color; and their aromatic qualities are occasionally impaired by a slight fermentation, which they are apt to undergo in the mass, when collected before maturity.

When examined by the microscope, anise is seen to contain a very great but variable number of small oil tubes, which are well represented in the accompanying figure,—from fifteen to thirty to each mericarp. The epidermis is supplied with short, simple hairs, easily detached in making a section, and not represented in the cut.



A case of poisoning is on record from the accidental admixture of the fruits of *Conium maculatum*, which bear some resemblance to those of anise, but may be distinguished by their crenate or notched ridges and the absence of oil tubes. They are, moreover, broader in proportion to their length, and are generally separated into half fruits, while those of anise are whole.

Star aniseed, the *Cardamomum Siberiense* or *Annis de Sibérie* of the seventeenth century and the *badiane* of the French writers, is the product of the *Illicium anisatum*, a small evergreen tree, which belongs to the Magnoliaceæ, and is a native of China and Japan. The drug is said to be collected solely in Southwestern China. The fruit consists of from five to ten brownish ligneous capsules, opening by their upper edge, four or five lines long, united together in the form of a star, each containing a brown shining elliptical seed. They contain about 4 per cent. of a volatile oil, closely resembling that of anise, or suggesting to some persons that of fennel. There are no known chemical differences between these oils, although dealers distinguish them by their smell and taste. Star anise is not used in medicine, but is very largely employed, especially upon the continent of Europe, for flavoring liquors. Cases of poisoning have occurred through the use of the fruit of *Illicium religiosum* (*Shikimi*), which closely resembles star anise. This false star anise is devoid of the anise odor, but has an odor resembling laurel, clove, and nutmeg. The poisonous principle has been called *Sikimine* by Eykman. (*P. J. Tr.*, June 18 and 25, 1881.)

Dr. Ruschenberger, U.S.N., has shown that oil of anise has a remarkable power of deodorizing sulphide of potassium; a drop of the oil having entirely deprived of offensive odor a drachm of lard with which five grains of the sulphide had been incorporated. (*Am. Journ. of Med. Sci.*, N.S., xlviii. 419.)

Medical Properties and Uses. Anise is a grateful aromatic carminative; and is supposed to have the property of increasing the secretion of milk. It has been in use from the earliest times. In Europe it is much employed in flatulent colic, and as a corrigent of griping or unpleasant medicines; but in this country fennel seed is preferred. Anise may be given bruised, or in powder, in the dose of twenty or thirty grains (1·3–1·95 Gm.) or more. The infusion is less efficient. The volatile oil may be substituted for the seeds in substance. Much use is made of this aromatic for imparting flavors to liquors.

Off. Prep. Oleum Anisi, *U. S.*

ANTHEMIS. *U. S., Br.* *Anthemis.* [*Chamomile.*]

(ĂN'THẸ-MĬS.)

Anthemidis Flores, *Br.;* Flores Chamomillæ Romanæ, *P. G.;* Roman or English Chamomile, *E.;* Camomille Romaine, *Fr.;* Romische Kamille, *G.;* Camomilla Romana, *It.;* Manzanilla Romana, *Sp.*

"The flower heads of Anthemis nobilis. Linné. (*Nat. Ord.* Compositæ.) Collected from cultivated plants." *U. S.* "The dried single and double flower heads of the common chamomile, Anthemis nobilis; wild and cultivated." *Br.*

Gen. Ch. Receptacle chaffy. *Seed-down* none or a membranaceous margin. *Calyx* hemispherical, nearly equal. *Florets of the ray* more than five. *Willd.*

Several species of Anthemis have been employed in medicine. *A. nobilis,* which is the subject of the present article, is by far the most important. *A. Cotula,* or mayweed, was formerly recognized by the U.S. Pharmacopœia. *A. Pyrethrum,* which affords the pellitory root, is among the officinal plants. (See *Pyrethrum.*) *A. arvensis,* a native of this country and of Europe, bears flowers which have an acrid bitter taste, and possess medical properties analogous though much inferior to those of common chamomile. They may be distinguished by their want of smell. *A. tinctoria* is occasionally employed as a tonic and vermifuge in Europe. *Matricaria suaveolens* is said to yield the chamomile of the Indian bazaars.

Anthemis nobilis. Willd. *Sp. Plant.* iii. 2180; *B. and T.* 154. This is an herbaceous plant with a perennial root. The stems are from six inches to a foot long, round, slender, downy, trailing, and divided into branches, which turn upwards at their extremities. The leaves are bipinnate, the leaflets small, threadlike, somewhat pubescent, acute, and generally divided into three segments. The flowers are solitary, with a yellow convex disk, and white rays. The calyx is common to all the florets, of a hemispherical form, and composed of several small imbricated hairy scales. The receptacle is convex, prominent, and furnished with rigid bristle-like paleæ. The florets of the ray are numerous, narrow, and terminated with three small teeth. The whole herb has a peculiar fragrant odor, and a bitter aromatic taste. The flowers only are officinal.

This plant is a native of Europe, and grows wild in all the temperate parts of that continent. It is also largely cultivated for medicinal purposes.* In France,

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* Mr. Jacob Bell, of Mitcham, in Surrey, England, stated that the plant is usually propagated by dividing the root, though the seeds are employed when it is desired to introduce new varieties. Each root will serve as the source of thirty or forty plants. They are set in rows a yard apart, at

Germany, and Italy, it is generally known by the name of *Roman chamomile.* By cultivation the yellow disk florets are often converted into the white ray florets. Thus altered, the flowers are said to be *double,* while those which remain unchanged are called *single;* but, as the conversion may be more or less complete, it generally happens that with each of the varieties there are intermingled some flowers of the other kind, or in different stages of the change. The double flowers are generally preferred; though, as the sensible properties are found in the greatest degree in the disk, the single are the most powerful. It is rather, however, in aromatic flavor than in bitterness that the radical florets are surpassed by those of the disk. If not well and quickly dried, the flowers lose their beautiful white color, and are less efficient. The flowers which are largest, most double, and whitest should be preferred. They are thus described officinally. "Subglobular, about three-quarters of an inch (2 c.m.) broad, consisting of an imbricated involucre, and numerous white, strap-shaped, three-toothed florets, inserted upon a chaffy, conical, solid receptacle. It has a strong, agreeable odor, and an aromatic bitter taste." *U. S.* The seeds yield by expression a fixed oil, which is said to be applied in Europe to various economical uses.

Though not a native of America, chamomile grows wild in some parts of this country, and is occasionally cultivated in our gardens for family use; the whole herb being employed. The medicine, as found in our shops, consists chiefly of the double flowers, and is imported from Germany and England. From the former country the flowers of *Matricaria Chamomilla* are also occasionally imported, under the name of chamomile. (See *Matricaria.*) In France, the flowers of two other plants are sold in the shops, indiscriminately with those of *Anthemis nobilis;* viz., those of *Pyrethrum Parthenium* (the *Chrysanthemum Parthenium* of Persoon) or *feverfew,* and those of *Anthemis parthenoides,* De Cand., or the *Matricaria parthenoides,* Desf. (*Journ. de Pharm.,* Mai, 1859, p. 347.) For the peculiar character by which these two flowers may be distinguished from the chamomile, see *Pyrethrum Parthenium* in Part II.

Properties. Chamomile flowers, as usually found in the shops, are large, almost spherical, of a dull white color, a fragrant odor, and a warmish, bitter, aromatic taste. When fresh, their smell is much stronger, and was fancied by the ancients to resemble that of the apple. Hence the name *chamæmelum* (*χαμαι*, on the ground, and *μηλόν*, an apple); and it is somewhat singular that the Spanish name *manzanilla* (a little apple) has a similar signification. The flowers impart their odor and taste to water and alcohol, the former of which, at the boiling temperature, extracts nearly one-fourth of their weight. The investigations of several chemists performed in 1878–1879, in Fittig's laboratory at Strassburg, have shown the oil of chamomile to contain the following constituents:—a fraction distilling at 147°–148° C. (296°–298° F.) consisting of *isobutylic ethers* and hydrocarbons; *angelicate of isobutyl* at 177° C. (350·5° F.); *angelicate of isoamyl* at 200°–201° C. (392°–394° F.); *tiglinate of isoamyl* at 204°–205° C. (399°–401° F.) (both these compound ethers answering to the formula $C_5H_{11},C_5H_7O_2$). In the residual portion, hexylic alcohol, C_6H_{13},OH, and an alcohol of the formula $C_{10}H_{16}O$ are met with, both probably occurring in the form of compound ethers. By decomposing the angelicates and the tiglinate above mentioned with potash, *angelic acid,* $C_5H_8O_2$, and *tiglinic acid* (or *methyl-crotonic*) isomeric with the former are obtained to the extent of about 30 or more per cent. of the crude oil. In the oil examined by Fittig, angelic acid prevailed; from another specimen E. Schmitt (1879) obtained but very little of it, tiglinic acid prevailing. Flückiger performed some experiments in order to isolate the *bitter principle,* but did not succeed in obtaining it in a satisfactory state

intervals of about eighteen inches. The proper period for planting is March; and the flowers are in perfection in July, but continue to appear throughout the season. Extremely wet or extremely dry weather is injurious to the crop. It is more productive in a rather heavy loam, than either in light sandy soil, or in stiff clay. It requires little manure, but attention to weeding is necessary. Over-manuring increases the leaves at the expense of the flowers. When gathered, the flowers are dried upon canvas trays in a drying-room, artificially warmed, where they remain about a day. The crop varies from three to ten hundredweight per acre. The single flowers are more productive than the double by weight; but, as they command a less price, the value of the crop is about the same. (*P. J. T.,* x. 118.)

of purity; it formed a brown extract, apparently a glucoside. He also confirms the statement that no alkaloid is present.

Medical Properties and Uses. Chamomile is a mild tonic, in small doses acceptable and corroborant to the stomach, in large doses capable of acting as an emetic. In cold infusion it is often advantageously used in cases of enfeebled digestion, whether occurring as an original affection, or consequent upon some acute disease. It is especially applicable to that condition of general debility, with languid appetite, which often attends convalescence from idiopathic fevers. As a febrifuge it formerly enjoyed much reputation, and was employed in intermittents and remittents; but we have remedies so much more efficient, that it is now seldom used in this capacity. The tepid infusion is very often given to promote the operation of emetics, or to assist the stomach in relieving itself when oppressed by its contents. The flowers are sometimes applied externally in the form of fomentation, in cases of irritation or inflammation of the abdominal viscera, and as a gentle incitant in flabby, ill-conditioned ulcers. The dose of the powder as a tonic is from half a drachm to a drachm (1·95–3·9 Gm.) three or four times a day, or more frequently. The infusion is usually preferred. The decoction and extract cannot exert the full influence of the medicine; as the volatile oil is driven off at the boiling temperature.

Off. Prep. Extractum Anthemidis, *Br.;* Infusum Anthemidis.

ANTIMONIUM. *Antimony.*

Sb; 122. (ĂN-TỊ-MŌ'NỊ-ŬM.) **Sb; 122.**

Stibium, *Lat.;* Antimoine, *Fr.;* Antimon, Spiessglanz Metall, *G.;* Antimonio, *Sp., It.*

Metallic antimony, sometimes called *regulus of antimony*, is not officinal in the British or United States Pharmacopœias; but, as it enters into the composition of a number of important pharmaceutical preparations, we have thought it proper to notice it under a distinct head.

Antimony exists in nature—1, uncombined; 2, as an oxide; 3, as antimonous sulphide (tersulphide) and 4, as an oxysulphide. It is found principally in France and Germany; but has been discovered also in the British province of New Brunswick.

Extraction. All the antimony of commerce is extracted from the native sulphide. The ore is first separated from its gangue by fusion. It is then reduced to powder, and placed on the floor of a reverberatory furnace, where it is subjected to a gentle heat, being constantly stirred with an iron rake. This process of roasting is known to be completed, when the matter is brought to the state of a dull grayish white powder, called *antimony ash.* By this treatment the antimony is partly teroxidized, and partly converted into antimonious acid; while nearly all the sulphur is dissipated in the form of sulphurous acid gas; a portion of tersulphide, however, remains undecomposed. The matter is then mixed with charcoal impregnated with a concentrated solution of carbonate of sodium, and the mixture heated in crucibles, in a melting furnace. The charcoal reduces the teroxide of antimony, while the alkali unites with the undecomposed tersulphide, and forms melted scoriæ, which cover the reduced metal, and diminish its loss by volatilization. Antimony is more generally obtained by the reduction of the native sulphide by iron. The reduction of the antimony sulphide by iron takes place at a red heat, but as sulphide of iron needs a higher temperature for its fusion, and its specific gravity is not much less than that of the metallic antimony, the mass must be heated to a white heat to effect a perfect separation, and this occasions a loss of the antimony. In order to avoid this, sodium sulphide is added in practice, which unites with the sulphide of iron to form a more fusible and lighter slag of double sodium and iron sulphide. To 100 parts of antimony sulphide is taken 42 parts of iron, 10 parts of anhydrous sulphate of sodium, and 2½ to 3½ parts of carbon.

The purest commercial antimony is not entirely free from foreign metals, chiefly iron, lead, and arsenic. M. Lefort purifies it for the purposes of pharmacy, by gradually adding twenty-five parts of the metal, in fine powder, to fifty parts of nitric acid, by the action of which the antimony is precipitated as antimonious acid, while the foreign metals remain in solution. The precipitate is then thoroughly washed with water, containing a hundredth part of nitric acid, drained completely, mixed with three or four parts of powdered sugar, and reduced to the metallic state by being heated to redness in a Hessian crucible. (*Journ. de Pharm.*, Août, 1855, p. 93.)

Antimony is imported into the United States principally from France, packed in casks. A portion is also shipped from Trieste, from Holland, and occasionally from Cadiz. The Spanish antimony is generally in the form of pigs; the French, in circular cakes of about ten inches in diameter, flat on one side and convex on the other; the English, in cones. The French is most esteemed.

Properties, etc. The time of the discovery of antimony is not known; but Basil Valentine was the first to describe the method of obtaining it, in his work entitled *Currus Triumphalis Antimonii*, published towards the end of the fifteenth century. It is a brittle, brilliant metal, ordinarily of a lamellated texture, of a silver-white color when pure, but bluish white as it occurs in commerce. When rubbed between the fingers, it imparts a sensible odor. Its atomic weight is 122, symbol Sb, sp. gr. 6·7, and fusing point 425° C. (797° F.), or about a red heat. On cooling after fusion, antimony assumes an appearance on the surface bearing some resemblance to a fern leaf. When strongly heated, it burns with the emission of white vapors, consisting of teroxide, formerly called *argentine flowers of antimony*. A small portion, being fused, and then thrown upon a flat surface, divides into numerous globules, which burn rapidly as they move along. It forms three combinations with oxygen, *antimony trioxide* (antimonous oxide), Sb_2O_3, *antimony tetroxide*, Sb_2O_4 (by some considered to be an antimonate of the teroxide of antimony, Sb_4O_8), and *antimony pentoxide* (antimonic oxide), Sb_2O_5. The first of these unites with water to form antimonous acid, the salts of which are called *antimonites*, the third unites with water to form antimonic acid, the salts of which are called *antimonates*. The trioxide will be noticed under the head of *Antimonii Oxidum*. The tetroxide is a white powder, yellowish when hot, and difficultly soluble in acids. It forms when either of the other two oxides is strongly heated in air. *Antimony ash* described above is also an impure tetroxide. *Antimonic acid* is a lemon-colored powder, which may be prepared by oxidizing the metal by digestion in nitric acid, and then driving off the excess of the acid by a heat not exceeding 315·5° C. (600° F.). When exposed to a red heat, it parts with oxygen, and is converted into the *antimony tetroxide* just described. This, though medicinally inert, frequently forms a large proportion of the preparation called antimonial powder. (See *Pulvis Antimonialis.*)

Antimony is officinal in the following states of combination.

I. SULPHURETTED.
  Antimonii Sulphidum, *U. S.;* Antimonium Nigrum, *Br.—Sulphide of Antimony; Black Antimony.* (*Prepared Sulphide of Antimony, Br.* 1864.)
  Antimonium Sulphuratum, *U. S.*, *Br.—Sulphurated Antimony.*
  Antimonii Sulphidum Purificatum, *U. S.—Purified Sulphide of Antimony.*
II. OXIDIZED.
  Teroxide. Antimonii Oxidum, *U. S.*, *Br.— Oxide of Antimony.*
  Teroxide mixed with phosphate of calcium. Pulvis Antimonialis, *Br.—Antimonial Powder.*
III. COMBINED WITH CHLORINE.
  Liquor Antimonii Chloridi, *Br.—Solution of Chloride of Antimony.*
IV. IN SALINE COMBINATION.
  Antimonii et Potassii Tartras, *U. S.;* Antimonium Tartaratum, *Br.— Tartrate of Antimony and Potassium. Tartarated Antimony. Tartar Emetic.*
    Unguentum Antimonii Tartarati, *Br.—Ointment of Tartarated Antimony.*
    Vinum Antimonii, *U. S.;* Vinum Antimoniale, *Br.— Wine of Antimony. Antimonial Wine.*

The antimonial preparations are active in proportion to their solubility in the gastric juice. According to Mialhe, those antimonials which contain the hydrated teroxide, or are easily converted into it, are most active. Hence metallic antimony in fine powder, and tartar emetic, act with energy. The teroxide is much more active when prepared in the moist than in the dry way. According to Serullas, all the antimonial preparations, except tartar emetic and butter (or terchloride) of antimony, contain a minute proportion of arsenic. Tartar emetic is an exception, because it separates entirely, in the act of crystallizing, from any minute portion of arsenic in the materials from which it is prepared; the poisonous metal being left behind in the mother-water of the process.

ANTIMONII ET POTASSII TARTRAS. *U.S.* *Tartrate of Antimony and Potassium.* [*Tartar Emetic.*]

(ĂN-TI̤-MŌ′NI̤-Ī ĔT PO̤-TĂS′SI̤-Ī TÄR′TRĂS.)

$2KSbO\ C_4\ H_4\ O_6 . H_2\ O$; 664. $KO, SbO_3, C_8\ H_4\ O_{10} . HO$; 332.

Antimonium Tartaratum, *Br.;* Antimonium Tartarizatum, Tartarized Antimony, Tartrated Antimony; Antimonii Potassio-Tartras, Tartarus Stibiatus, *P. G.;* Tartarus Emeticus, Stibio-Kali Tartaricum; Tartrate de Potasse et d'Antimoine, Emétique, Tartre stibié, *Fr.;* Brechweinstein, *G.*

"Take of Oxide of Antimony *five ounces* [avoirdupois]; Acid Tartrate of Potash, in fine powder, *six ounces* [avoird.]; Distilled Water *two pints* [Imperial measure]. Mix the Oxide of Antimony and Acid Tartrate of Potash with sufficient Distilled Water to form a paste, and set aside for twenty-four hours. Then add the remainder of the Water and boil for a quarter of an hour, stirring frequently. Filter, and set aside the clear filtrate to crystallize. Pour off the mother-liquor, evaporate to one-third, and set aside that more crystals may form. Dry the crystals on filtering paper at the temperature of the air." *Br.*

A process for Tartar Emetic not being given in the new U. S. Pharmacopœia, that of 1870 is inserted below.* This compound is a normal tartrate. Tartaric acid is dibasic. In acid potassium tartrate (cream of tartar) one of the two replaceable hydrogen atoms is replaced by potassium, while the other is unreplaced; in neutral potassium tartrate (soluble tartar) both are replaced by potassium; in tartar emetic, one is replaced by potassium, while the other is replaced by the group (SbO) antimonyl, which is a univalent group, exactly replacing one hydrogen atom.

In the preparation of tartar emetic several circumstances should be taken into view. The cream of tartar should not be in excess; as in that case it is apt to crystallize, upon cooling, with the tartar emetic. To avoid such a result it is better to have a slight excess of antimonial oxide. No rule is applicable to the determination of the proper proportion of water, except that it should be sufficient to dissolve the tartar emetic formed. The hot filtration, directed in the U. S. Pharmacopœia of 1870, may be conveniently performed by a jacketed funnel filled with hot water. In all cases the salt should be obtained in well-defined crystals, unmixed with those of cream of tartar, as the best index of its purity. The practice of some manufacturing chemists of boiling the filtered liquor to dryness, whereby an impure mass is obtained, consisting in part only of the antimonial salt, is very reprehensible.

It is not easy to decide as to the relative eligibility of the different forms of antimonial oxide, used for preparing tartar emetic. The preference, however, was given to the oxychloride (*powder of Algaroth*) by Berzelius; and M. Henry, an eminent pharmaceutist of Paris, after a careful comparison of the different processes, declared also in its favor.

M. Henry has given a process for preparing tartar emetic with the oxychloride on a large scale; and, as his formula may be useful to the manufacturing chemist, we subjoin it, converting French weights into the nearest *apothecaries'* weights and measures. Take of prepared sulphide of antimony, in very fine powder, three pounds four ounces; hydrochloric acid, marking 22° (sp. gr. 1·178), eighteen pounds and a half; nitric acid, two ounces and a half. Introduce the sulphide into a glass matrass, of a capacity double the volume of the mixture to be formed; and add to it from three to five pounds of the acids previously mixed; so that the sulphide may be thoroughly penetrated by them; then add the remainder of the acids. Place the matrass on a sand-bath, and heat the mixture gradually to ebullition, avoiding the

* "Take of Oxide of Antimony, in very fine powder, *two troyounces;* Bitartrate of Potassium, in very fine powder, *two troyounces and a half;* Distilled Water *eighteen fluidounces.* To the Water, heated to the boiling point in a glass vessel, add the powders, previously mixed, and boil for an hour; then filter the liquid while hot, and set it aside that crystals may form. Lastly, dry the crystals, and keep them in a well-stopped bottle. By further evaporation the mother-water may be made to yield more crystals, which should be purified by a second crystallization." *U. S.* 1870.

vapors, which are disengaged in large quantity. Continue the heat until the vapors given off are so far deprived of sulphuretted hydrogen as not to blacken white paper moistened with solution of acetate of lead; after which allow the liquor to cool, and to remain at rest until it has become clear. Decant the clear liquor, and, in order to procure the portion of liquid which may be retained by the moist residue, add to this a small portion of hydrochloric acid, and again decant. Mix the decanted liquids, which consist of a solution of terchloride of antimony, and add them to a large quantity of water, in order that the oxychloride may be precipitated; taking care, during their addition, to stir constantly in order that the precipitated powder may be more minutely divided, to facilitate its subsequent washing. To determine whether the water has been sufficient to decompose the whole of the terchloride, a part of the supernatant liquid, after the subsidence of the powder, is to be added to a fresh portion of water; and, if a precipitate take place, more water must be added to the mixture, so as to obtain the largest possible product of oxychloride. The precipitation being completely effected, wash the powder repeatedly with water, until this no longer affects litmus, and place it on linen to drain for twenty-four hours. The quantity of oxychloride thus obtained will be about three pounds and a half in the moist state, or two pounds nine ounces when dry. Assuming it to be this quantity, mix it with three pounds eleven ounces of cream of tartar in fine powder, and add the mixture to two gallons and five pints of boiling water, contained in an iron kettle. Concentrate the liquor rapidly until it marks 25° of Baumé's hydrometer for salts, and then filter. By repose the liquor furnishes a crop of very pure crystals, which require only to be dried. The mother-waters are treated in the following manner. Saturate the excess of acid with chalk, filter, and concentrate to 25°. By cooling, a second crop of crystals will be obtained; and by proceeding in a similar manner, even a third crop. But these crystals are somewhat colored, and must be purified by recrystallization.*

In relation to the above process, it may be observed that the proportion of oxychloride and cream of tartar must be adjusted according to the numbers given, on the assumption that the former is dry; but it by no means follows that the whole of the oxide should be dried. To proceed thus would be a waste of time. The mode of proceeding is to weigh the whole of the moist oxide, and afterwards to weigh a small part of it, and ascertain how much this loses in drying. Then, by a calculation, it is easy to determine how much the whole of the moist oxide would weigh if dry.

Tartar emetic is not usually prepared by the apothecary, but made on a large scale by the manufacturing chemist. Different processes are pursued in different manufactories; and it is not material what plan is adopted, provided the crystals of the antimonial salt are carefully purified. In an extensive manufactory in London, antimony ash is employed for boiling with the cream of tartar, and it is stated to form the cheapest material for making tartar emetic. (*Pereira's Mat. Med.*) Mohr prefers the use of a *moist* oxide, prepared by adding gradually an intimate mixture of one part, each, of tersulphide of antimony and nitrate of potassium, to a boiling mixture of one part of sulphuric acid and two of water. The liquid is boiled down nearly to dryness and allowed to cool. The grayish white mass, thus formed, is then washed thoroughly with water. The details of this process are given by Soubeiran, by whom it is praised, in the *Journ. de Pharm.*, 3e sér., iii. 327.

Properties, etc. It is in the form of "small, transparent crystals, of the rhombic system, becoming opaque and white on exposure to air, or a white, granular powder, having a sweet, and afterwards disagreeable metallic taste, and a feebly acid reaction. Soluble in 17 parts of water at 15° C. (59° F.) and in 3 parts of boiling water. Insoluble in alcohol, which precipitates it from its aqueous solution in the form of a crystalline powder. When heated to redness, the salt chars, emits the odor of burnt sugar, and leaves a blackened residue of an alkaline reaction. The aqueous solution of the salt yields with hydrochloric acid, a white precipitate soluble in an excess of the acid; but no precipitate occurs if tartaric acid has been previously added. In a solution of the salt acidulated with hydrochloric acid, hydrosulphuric acid causes an orange-red precipitate. A dilute solution at once becomes permanently turbid on the addition of a little carbonate of potassium." *U. S.* Tartrate of antimony and potassium was discovered in 1631 by Adrian de Mynsicht. When prepared from the oxychloride it crystallizes in tetrahedrons. As it occurs in the shops, it is often in the form of a white powder, resulting from the pulverization of the crystals. They are insoluble in alcohol, but dissolve in proof spirit or wine.* (See *Vinum Antimonii.*) Its aqueous solution slightly reddens litmus, and undergoes decomposition by keeping. If one-fifth of its bulk of alcohol be added to the water, the decomposition is prevented. It is incompatible with acids, alkalies and their carbonates, some of the earths and metals, chloride of calcium, and acetate and subacetate of lead. It is incompatible also with astringent infusions and decoctions, as of rhubarb, cinchona, catechu, galls, etc.; but these substances, unless galls be an exception, do not render it inert, though they lessen its activity to a greater or less extent.

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* For still another method of preparing tartar emetic, which we omit from want of space, see *Journ. de Pharm.*, 4e sér., xi. 404.

Characteristics and Tests of Purity. "A one per cent. aqueous solution of the salt previously acidulated with acetic acid, should not be clouded by the addition of a few drops of test-solution of chloride of barium (sulphate), or of ferrocyanide of potassium (iron and other metals), or of oxalate of ammonium (calcium), or of nitrate of silver (chloride). If 1 Gm. of the salt and some pieces of aluminium wire be added to strong solution of soda (sp. gr. about 1·260), contained in a long test-tube, a gas is given off which should not impart any color to filter paper wet with test-solution of nitrate of silver, and held over the mouth of the test-tube (abs. of more than traces of arsenic)." *U. S.* Tartar emetic, when pure, exhibits its appropriate crystalline form. A crystal or two, dropped into a solution of hydrosulphuric acid, will be covered with an orange-colored deposit of tersulphide of antimony. "Twenty grains dissolve without residue in an [Imperial] fluidounce of distilled water [437·5 grains] at 60°; and the solution gives with sulphuretted hydrogen an orange precipitate, which, when washed and dried at 212°, weighs 9·91 grains." *Br.* Entire solubility in water is not a character belonging exclusively to the pure salt, for, according to the late Mr. Hennell, tartar emetic may contain 10 per cent. of uncombined cream of tartar, and yet be wholly soluble in the proper proportion of water. (*Phillips.*) This being the case, the character, given in the Br. Pharmacopœia, of entire solubility in 21·8 parts of water, is not to be depended upon. Mr. Hennell's method of detecting uncombined bitartrate, is to add a few drops of a solution of carbonate of sodium to a boiling solution of the antimonial salt. If the precipitate formed be not redissolved, no bitartrate is present.

The impurities found in tartar emetic are uncombined cream of tartar from faulty preparation or fraudulent admixture, tartrate of calcium, iron, sulphates, and chlorides. The mode of detecting cream of tartar has been indicated above. Tartrate of calcium is derived from the cream of tartar, which always contains this impurity. It is apt to form on the surface of the crystals of tartar emetic in crystalline tufts, which are easily brushed off. Iron is sometimes present, especially when the antimonial salt has been prepared from glass of antimony. It is detected by a blue color being *immediately* produced by ferrocyanide of potassium, added after a little acetic acid. If the blue color be *slowly* produced, it may arise from reactions on the iron of the ferrocyanide itself. If much iron be present, the solution of the tartar emetic will be yellow instead of colorless. According to Serullas, tartar emetic, except when well crystallized, and all the other antimonial preparations usually contain a minute proportion of arsenic, derived from the native tersulphide of antimony, which almost always contains this dangerous metal. Subsequently, however, Mr. Thos. Williams (*P. J. Tr.*, July, 1874, p. 63) examined a number of samples of various antimonial preparations and found them remarkably free from arsenic. Tartar emetic should always be bought by the apothecary in good crystals, in which state the salt is pure, or very nearly so, and entirely free from arsenic. Its powder is perfectly white; and, when it is yellowish white, iron is probably present.

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* Alcohol precipitates it from its aqueous solution, and Mr. T. S. Wiegand proposes as a method of obtaining it in fine powder, to boil an ounce in four times its weight of water, and to pour the solution into a pint and a half of 95 per cent. alcohol. (*A. J. P.*, 1858, p. 407.)

It has been already stated, in general terms, that tartar emetic in solution is incompatible with acids and alkalies, and with some of the earths; but this salt is so important, that some details in regard to the effects of particular reagents, included under these titles, seem to be necessary. Hydrochloric and sulphuric acids, added to a solution of the antimonial salt, not too dilute, throw down a white precipitate of terchloride or subsulphate of antimony, mixed with cream of tartar, which is redissolved by an excess of the precipitant. Nitric acid throws down a subnitrate, which is taken up by an excess of it. When caustic potassa is added to a tolerably concentrated solution, it produces at first no effect, then a precipitate of teroxide, and afterwards the solution of this precipitate, if the addition of the alkali be continued. Lime-water acts in a weaker solution, and throws down a white precipitate, consisting of the mixed tartrates of calcium and antimony. Carbonate of potassium affects still weaker solutions, throwing down a white precipitate of teroxide; but this test does not act in solutions containing less than a quarter of a grain to the fluidounce. Ammonia, both pure and carbonated, precipitates a solution of tartar emetic, throwing down the pure teroxide. To these reagents may be added infusion of galls, which, when fresh and strong, causes a dirty yellowish white precipitate of tannate of antimony.

Medical Properties and Uses. When tartar emetic is given in minute doses to the healthy man (gr. $\frac{1}{12}$), it produces only a slight lessening of the force of the pulse and a tendency to increased secretion from the skin. After somewhat larger amounts these symptoms are more pronounced and have nausea added to them. If a grain be ingested, the nausea and vomiting are usually severe and persistent, and are accompanied by marked prostration, both of the circulation and of the muscular strength. Symptoms of acute poisoning by the drug are an austere metallic taste; excessive nausea; copious vomiting; frequent hiccough; burning pain in the stomach; colic; frequent stools and tenesmus; fainting; small, contracted, and accelerated pulse; coldness of the skin, and even of the internal organs; difficult and irregular respiration; cutaneous anæsthesia; loss of sense; convulsive movements; very painful cramps in the legs; prostration, and death. Ten grains is the smallest dose reported to have proved fatal. In the lower animals antimony causes symptoms similar to those which it produces in man. It has been experimentally proven that the fall of the arterial pressure is produced, at least in part, by a direct action upon the heart. The loss of muscular power, of reflex activity and of sensibility, are believed to be due to depression of the spinal centres, and the disturbance of respiration to a direct influence upon the nerve centres which preside over that function. The purging and vomiting are connected with an effort at elimination, the poison escaping through the gastro-intestinal mucous membrane, as well as through the kidneys. After death from antimony, fatty degeneration of the liver, kidneys, and other organs has been found, indicating that the poison has a powerful influence upon nutrition.

The above summary shows that in small doses tartar emetic is powerfully depressant to the circulation and stimulant to the secretion of the skin. It has been very largely used as a sedative, antiphlogistic, diaphoretic, and expectorant. It is, however, at present much less frequently administered than formerly; in *small* doses (gr. $\frac{1}{12}$ to $\frac{1}{8}$), mostly associated with saline, alkaline, or diaphoretic remedies, and assisted by copious dilution, it is still resorted to in febrile complaints, for the purpose of producing perspiration, which is often freely induced, especially if the remedy gives rise to nausea. It also proves useful, on many occasions, in the first stages of bronchitis; and with a view to its action in this way, it is conjoined with expectorant remedies. In *full* doses it acts as an emetic, and is characterized by certainty, strength, and permanency of operation. It remains longer in the stomach than ipecacuanha, produces more frequent and longer-continued efforts to vomit, and exerts a more powerful impression on the system. The nausea and attendant prostration are often very considerable. As an emetic its use is indicated where the object is not merely to evacuate the stomach, but to agitate and compress the liver and other abdominal viscera; its employment is contraindicated by debility or gastro-intestinal irritability, and it is very badly borne by children. By the extension of its action to the duodenum, it often causes copious discharges of bile, and may thus prove useful when there is a morbid excess of that secretion.

The so called contra-stimulant use of large doses of antimony originated with Dr. Rasori, professor of clinical medicine at Milan, who published his views in 1800, but has gone entirely out of vogue. The principal diseases in which it was practised were pneumonia, pleurisy, bronchitis, and acute rheumatism. The medicine was directed in doses, varying from a grain to two grains or more, every two hours, dissolved in a small quantity of water; the patient being restricted in the use of drinks whilst under its operation. It is stated that, when the remedy is thus given in diseases of high action, it seldom produces vomiting, an effect which the author of the practice wished to avoid. The power of the system to bear large doses of tartar emetic, during the existence of acute diseases, was considered by Rasori to depend upon the coexisting morbid excitement, and the capability of bearing them was expressed by the term *tolerance.*

Externally, tartar emetic is employed as a counter-irritant, mixed with lard, or cerate, or in the form of a plaster. (See *Unguentum Antimonii* and *Emplastrum Antimonii.*) It causes, after a longer or shorter interval, a burning sensation, accompanied by a peculiar and painful pustular eruption. This mode of producing counter-irritation is serviceable when a very powerful and persistent effect is desirable. Care must be taken, when the salt is applied by means of a plaster, that the pustular inflammation does not proceed too far; as, in that event, it produces deep and very painful ulcerations, difficult to heal. According to M. Guérin, inflamed parts exhibit a condition of tolerance to the local effects of tartar emetic, evinced by the absence of pustulation.

Tartar emetic is generally given in solution, and in an amount which varies with the object in view in its administration. Its dose as an alterative is from the thirty-second to the sixteenth of a grain (0·002–0·004 Gm.); as a diaphoretic or expectorant, from the twelfth to the sixth of a grain (0·005–0·01 Gm.); and as a nauseating sudorific, from a sixth to a quarter of a grain (0·01–0·016 Gm.); repeated, according to circumstances, every hour, two, or four hours; as an emetic, half a grain (0·03–0·065 Gm.), repeated every fifteen or twenty minutes till it vomits; the operation being aided by warm water or chamomile tea.

Poisoning. The general symptoms of acute tartar emetic poisoning have been sufficiently described. In rare cases vomiting and purging do not take place; and, when they are absent, the other symptoms are aggravated. Sometimes a pustular eruption is produced, like that caused by the external application of the antimonial; as in a case reported by Dr. J. T. Gleaves, of Tennessee.

The effects of slow poisoning by tartar emetic on inferior animals have been carefully studied by Dr. B. W. Richardson, of London, and Dr. Nevins, of Liverpool. All the surfaces absorb the solution of the salt, and the metal is found in all the tissues after death, except that of the brain; but most abundantly in that of the liver. The elimination of the poison is effected by all the secreting organs, but especially by the kidneys. The tolerance of antimony is attributed by Dr. Richardson to the eliminating action of these glands. The pathological appearances are general congestion, marked fluidity of the blood, and intense vascularity of the stomach and sometimes of the rectum, but without ulceration. No other pulmonary lesion occurs but simple congestion. (*Am. Journ. of Med. Sci.*, 1857, p. 266.) The general results obtained by Dr. Richardson were confirmed by Dr. Nevins. (*P. J. Tr.*, 1857, p. 415.)

In treating a case of poisoning by tartar emetic, if it be found that the patient has not vomited, immediate recourse must be had to tickling the throat with a feather, and the use of abundance of warm water. Usually, however, the vomiting is excessive and distressing; and here it is necessary to use remedies calculated to decompose the poison, and to allay the pain and irritation. Tannic acid should be freely administered, in order to form the insoluble and inactive, if not absolutely inert, tannate of antimony. A case of poisoning with half an ounce of tartar emetic, successfully treated with copious draughts of green tea and large doses of tannin, is reported by Dr. S. A. McCreery, of the U. S. Navy. (*Am. Journ. of Med. Sci.*, 1853, p. 131.) To stop the vomiting and relieve pain, laudanum should be given, either by the mouth or by injection; and to combat consecutive inflammation, leeches to the epigastrium and other antiphlogistic measures may be resorted to.

After death from suspected poisoning by tartar emetic, it is necessary to search for the poison in the body. The contents of the stomach should be digested in water, acidulated with hydrochloric and tartaric acids. The former acid will serve to coagulate organic matter; the latter to give complete solubility to the antimony. The solution obtained, after having been filtered, should be subjected to a stream of sulphuretted hydrogen, which, if tartar emetic be present, will throw down the orange red tersulphide of antimony, distinguished from tersulphide of arsenic and all other precipitates by forming with hot hydrochloric acid a solution, from which a white curdy precipitate of oxychloride of antimony (powder of Algaroth) is thrown down upon the addition of water. Sulphuretted hydrogen is by far the most delicate test for tartar emetic.

Sometimes the antimony is not in the stomach and bowels, and yet may exist in other parts, especially in the liver and kidneys, and their secretions. The mode of extracting the antimony, recommended by Orfila, is to carbonize the dried viscera with pure concentrated nitric acid in a porcelain capsule, to boil the charred mass obtained for half an hour with hydrochloric acid, assisted with a little nitric acid, to filter the liquor, and introduce it into Marsh's apparatus. Antimoniuretted hydrogen will be formed, which, being inflamed, will deposit the antimony on a cold surface of porcelain as a black stain, distinguishable from the similar stain produced by arsenic by its slighter volatility, by its forming, with hot hydrochloric acid, a solution which affords a white precipitate of oxychloride of antimony when added to water, its insolubility in solution of bleaching powder or chlorinated soda, and its solubility in solution of stannous chloride. (See *Acidum Arseniosum*, p. 41.)

Reinsch's process is a good one for separating antimony from the tissues, and was first used for that purpose by Dr. Alfred Taylor, of London. The tissues are boiled in hydrochloric acid, and a bright slip of copper is immersed in the hot solution. The metallic film, deposited on the copper, must be proved to be antimony. This is done by Dr. Odling by first boiling the coated copper in a solution of permanganate of potassium, with a little excess of potassa, for a few minutes, whereby the antimony becomes oxidized and dissolved, and then passing sulphuretted hydrogen through the filtered and acidulated solution. The characteristic orange red precipitate of tersulphide of antimony is produced, which may be tested for antimony as above mentioned. Mr. H. H. Watson has simplified Dr. Odling's process by dispensing with the use of the permanganate of potassium. He subjects the coated copper slip, in a tube, to a boiling very dilute solution of caustic potassa, the metal being alternately drawn out of and immersed in the solution, by the aid of a copper wire, until the whole of the coating is oxidized and dissolved. The solution is then treated as directed by Dr. Odling. (*Med. Times and Gaz.*, July, 1857, p. 613.) Antimoniuretted hydrogen (evolved either by galvanic processes or from zinc and sulphuric acid), when passed over sulphur, is decomposed, slowly in diffused daylight, very rapidly in sunlight, antimonous sulphide forming, with liberation of hydrogen sulphide. The orange red sulphide can be freed from excess of sulphur by exhaustion with bisulphide of carbon. (Jones, *Journ. Chem. Soc.*, i., 1876.)

Off. Prep. Syrupus Scillæ Compositus, *U. S.;* Unguent. Antimonii Tartarati, *Br.;* Vinum Antimoniale, *Br.;* Vinum Antimonii, *U. S.*

ANTIMONII OXIDUM. *U. S., Br.* *Oxide of Antimony.*

Sb_2O_3; 288. (ĂN-TI-MŌ'NI-Ī ŎX'I-DŬM.) SbO_3; 144.

Stibium Oxydatum, Oxydum Antimonicum s. Stibicum; Oxyde d'Antimoine, *Fr.;* Antimonoxyd, *G.*

A process for this salt is no longer officinal. Below is that of the Pharm. 1870.*

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* "Take of Sulphuret of Antimony, in very fine powder, *four troyounces;* Muriatic Acid *eighteen troyounces;* Nitric Acid *a troyounce and one hundred and twenty grains;* Water of Ammonia *a fluidounce and a half;* Water, Distilled Water, each, *a sufficient quantity.* Introduce the Sulphuret into a flask, of the capacity of two pints, and, having added the Muriatic Acid, digest, by means of a sand-bath, until effervescence ceases. Then, having removed the flask from the sand-bath, add the Nitric Acid gradually; and, when nitrous acid vapors cease to be given off, and the liquid has grown cold, add to it half a pint of Water, and filter. Pour the filtered liquid gradually into twelve pints of Water, constantly stirring, and allow the precipitate to subside. Decant the supernatant liquid, and wash the precipitate twice by decantation, using, each time, eight pints of Water.

"Take of Solution of Chloride of Antimony *sixteen fluidounces;* Carbonate of Soda *six ounces* [avoirdupois]; Water *two gallons* [Imperial measure]; Distilled Water *a sufficiency.* Pour the Antimonial Solution into the Water, mix thoroughly, let the precipitate settle, remove the supernatant liquid by a siphon, add one gallon [Imp. meas.] of Distilled Water, agitate well, let the precipitate subside, again withdraw the fluid, and repeat the process of affusion of Distilled Water, agitation, and subsidence. Add now the Carbonate of Soda previously dissolved in two pints [Imp. meas.] of Distilled Water, leave them in contact for half an hour, stirring frequently, collect the deposit on a calico filter, and wash with boiling distilled water until the washings cease to give a precipitate with a solution of nitrate of silver acidulated by nitric acid. Lastly, dry the product at a heat not exceeding 212°." *Br.*

In the U. S. 1870 formula the solution of terchloride is prepared as the first step of the proceeding; in the British it is taken already formed, as the result of a distinct process. When tersulphide of antimony is digested with hydrochloric acid, a chemical reaction takes place as follows: $Sb_2S_3 + 6HCl = (SbCl_3)_2 + (H_2S)_3$; the hydrogen of the acid uniting with the sulphur of the antimonial, and escaping as sulphuretted hydrogen, while the chlorine and antimony combine to form terchloride of antimony which is held in solution. The effect of the nitric acid is supposed to be to render the oxide whiter, by decomposing any remaining sulphuretted hydrogen, and thus preventing it from contaminating the product. Though the result thus far is an aqueous solution of the terchloride, this cannot be diluted beyond a certain degree without decomposition. Hence, if largely diluted, as when poured into an excess of water, decomposition takes place, and a white powder is precipitated, formerly called *powder of Algaroth,* which is mainly an oxychloride. The composition of the powder, however, is not uniform; as it contains more teroxide, the greater the proportion of water used in the decomposition. The pure oxychloride, $SbOCl$, is formed when the proportion of 4 mols. of water to 1 mol. of antimony chloride exists, but with a relatively larger proportion of water the average composition of the powder is $Sb_4O_5Cl_2$, which may be considered as made up of $(SbOCl)_2 + Sb_3O_2$. The oxychloride is first washed with abundance of water to separate adhering hydrochloric acid, and then acted upon by a solution of alkali (Ammonia, *U. S.*, Carbonate of sodium, *Br.*) to decompose the oxychloride, with the effect of adding to the amount of teroxide; after which the teroxide only requires to be washed with water in order to render it pure. The last washing separates the chloride of ammonium or of sodium resulting from the decomposition of the oxychloride; and the water of this washing is tested, in both formulas, by nitrate of silver, until the presence of chlorine ceases to be indicated.

Properties. Teroxide of antimony is a heavy, grayish white powder, permanent in the air, almost insoluble in water, insoluble in alcohol and nitric acid, readily soluble in hydrochloric or tartaric acid, or in boiling solution of bitartrate of potassium. Heated in close vessels it becomes yellow, fuses at a full red heat, and finally sublimes in crystalline needles. When cooled from a state of fusion it forms a fibrous crystalline mass, of pearl color. Heated in open vessels it suddenly becomes red hot, and, by the absorption of oxygen, changes into Sb_2O_4 (antimony antimonate), which differs from the teroxide in being insoluble in hydrochloric acid, less fusible, and not volatile. This oxide is the active ingredient of all the medicinal preparations of antimony. "By dropping its solution in hydrochloric acid into water, a white precipitate is formed, which is at once changed to orange by hydrosulphuric acid. A solution of Oxide of Antimony in an excess of tartaric acid should yield no precipitate with test-solutions of nitrate of silver (chloride), chloride of barium (sulphate), or ferrocyanide of potassium (iron and other metals)." *U. S.* It is frequently impure from the presence of the before-mentioned antimonate

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Then transfer it to a muslin filter to drain, and, after the draining is completed, wash it with Water until the washings cease to have an acid reaction. Next introduce it into a suitable vessel, and subject it to the action of the Water of Ammonia for two hours; at the end of which time transfer it to a moistened muslin filter, and wash it with Distilled Water as long as the washings produce a precipitate with nitrate of silver. Lastly, dry the precipitate upon bibulous paper with the aid of a gentle heat." *U. S.* 1870.

of antimony, in which case it is not *entirely* soluble in hydrochloric acid. If it contain oxychloride, which it is apt to do from the imperfect action of the alkaline solutions employed in its purification, its solution in tartaric acid will be precipitated by nitrate of silver. When antimonate of antimony is substituted for it, the fraud may be detected by the spurious preparation being entirely insoluble in hydrochloric acid.

Medical Properties. This oxide, which must not be confounded with the powder of Algaroth, has the general therapeutic properties of the antimonials. Like antimonial powder, it is unequal in its effects, sometimes vomiting, at other times being apparently inert. The inequality of action is plausibly explained by the state of the stomach as to acidity, the presence of acids giving the medicine activity; and this explanation is confirmed by the experiments of Dr. Osburn, of Dublin, with the Dublin oxide. As to the French Codex oxide, prepared by boiling the oxychloride with a solution of bicarbonate of potassium, the inequality is attributed by M. Durand, of Caen, to the presence of more or less terchloride, which is separated with difficulty. Objecting to the Codex oxide, M. Durand proposes to prepare the teroxide by precipitating tartar emetic with ammonia in excess. Thus obtained it contains no terchloride, and does not vomit. (*Journ. de Pharm.*, 3e sér., ii. 364.) The dose of teroxide of antimony is set down as three grains (0·20 Gm.), every two or three hours, but the drug should not be employed as a medicine. It was introduced into the U. S. Pharmacopœia, to be used in the preparation of tartar emetic.

Off. Prep. Antimonium Tartaratum, *Br.;* Pulvis Antimonialis, *Br.*

ANTIMONII SULPHIDUM. *U.S.* *Sulphide of Antimony.*

Sb_2S_3; 336. (ĂN-TỊ-MŌ′NỊ-Ī SŬL-PHĪ′DŬM.) Sb, S_3; 168.

[Antimonii Sulphuretum, Pharm. 1870.]

"Native sulphide of antimony, purified by fusion and as nearly free from arsenic as possible." *U.S.* "Native sulphide of antimony, Sb_2S_3, purified from silicious matter by fusion, and afterwards reduced to fine powder." *Br.*

Antimonium Nigrum, *Br.;* Black Antimony. (Prepared Sulphuret of Antimony, *Br.* 1864.) Stibium Sulfuratum Crudum et Lævigatum, *P. G.;* Antimonium Crudum, Stibium Sulfuratum Nigrum, Sulfuretum Stibicum; Artificial Sulphuret of Antimony; Antimoine sulfuré, Sulfure d'Antimoine, Antimoine cru, *Fr.;* Schwefelantimon, Schwefelspiessglanz, *G.;* Solfuro d'Antimonio, *It.;* Antimonio crudo, *Sp.*

Preparation, etc. The sulphide of antimony of the Pharmacopœias is obtained from the native sulphide, called *antimony ore*, by different processes of purification; the following being an outline of that generally pursued. The ore is placed in melting-pots in a circular reverberatory furnace, and these are made to connect, by means of curved earthen tubes, with the receiving pots, situated outside the furnace. This arrangement affords facilities for removing the residue of the operation, and allows of the collection of the melted sulphide without interrupting the fire, and, consequently, without loss of time or fuel. In the U. S. Pharmacopœia it is directed to be melted in order to purify it from infusible substances; in the British, to be reduced to fine powder, to fit it for pharmaceutic use. In order to bring it to this state, it should be submitted to the process of levigation. (See *Creta Præparata.*)

Properties. Sulphide of antimony is mostly prepared in France and Germany. It is called, in commerce, antimony, or *crude antimony*, and occurs in fused conical masses, denominated loaves. "Steel-gray masses of a metallic lustre and a striated crystalline fracture, forming a black or grayish black, lustreless powder, without odor or taste, and insoluble in water or alcohol. When heated, it fuses at a temperature below red heat. One part of the powdered sulphide, when boiled with 10 parts of hydrochloric acid, dissolves without leaving more than a slight residue, hydrosulphuric acid being evolved. The solution when added to water gives a white precipitate, which is soluble in a solution of tartaric acid. After separation of the precipitate by filtration, the filtrate gives an orange red precipitate with hydrosulphuric acid." *U. S.* The quality of the sulphide cannot well be judged of, except in mass; hence it ought never to be bought in powder. Arsenic, which is often present in considerable quantities, may be detected by the usual tests for that metal. (See *Acidum Arseniosum*, p. 41.)

Composition. The officinal sulphide of antimony is a tersulphide consisting of two atoms of antimony 240, and three of sulphur 96 = 336.

When prepared by pulverization and levigation, it is in the form of an insoluble powder, without taste or smell, usually of a dull blackish color, but reddish brown when perfectly pure. By exposure to the air, it absorbs, according to Buchner, a portion of oxygen, and becomes partially converted into teroxide.

Medical Properties and Uses. This preparation is very uncertain in its operation; being sometimes without effect, at other times, if it meet with acid in the stomach, acting with violence by vomiting and purging. The effects attributed to it are those of a diaphoretic and alterative; and the principal diseases in which it has been used are scrofula, glandular obstructions, cutaneous diseases, and chronic rheumatism. It is employed in the United States solely in veterinary practice. The dose is from ten to thirty grains (0·65–1·95 Gm.), given in powder or bolus.

Off. Prep. Antimonii Sulphidum Purificatum, *U. S.;* Antimonium Sulphuratum; Liquor Antimonii Chloridi, *Br.*

ANTIMONII SULPHIDUM PURIFICATUM. *U. S.* *Purified Sulphide of Antimony.*

Sb_2S_3; 336. (ĂN-TỊ-MŌ′NỊ-Ī SŬL-PHĪ′DŬM PŬ-RỊ-FỊ-CĀ′TŬM.) SbS_3; 168.

"Sulphide of Antimony, *ten parts;* Water of Ammonia, *five parts.* Reduce the Sulphide of Antimony to a very fine powder. Separate the coarser particles by elutriation, and, when the finely divided sulphide has been deposited, pour off the water, add the Water of Ammonia, and macerate for five days, agitating the mixture frequently. Then let the powder settle, pour off the Water of Ammonia, and wash the residue by repeated affusion and decantation of water. Finally dry the product by the aid of heat." *U. S.*

This is a new officinal process, which is intended to furnish a black sulphide of antimony better fitted for the manufacture of the officinal preparations of antimony and for internal administration. Copper, a common impurity in the crude sulphide, is rendered soluble by the water of ammonia, whilst the subsequent washing and decantation effectually remove all soluble impurities.

Properties. "A dark gray powder, odorless and tasteless, and insoluble in water or alcohol. It fuses at a temperature below red heat. When boiled with 10 parts of hydrochloric acid it is nearly all dissolved, hydrosulphuric acid being evolved. The solution when added to water yields a white precipitate, which is soluble in a solution of tartaric acid. After separation of the precipitate by filtration, the filtrate gives an orange red precipitate with hydrosulphuric acid." *U. S.*

Tests. "If 2 Gm. of the salt be mixed and cautiously ignited, in a porcelain crucible, with 8 Gm. of pure nitrate of sodium, and the fused mass boiled with 25 Gm. of water, there will remain a residue which should be white or nearly so, and not yellowish or brownish (abs. of other metallic sulphides). On boiling the filtrate with an excess of nitric acid, until no more nitrous vapors are evolved, then dissolving in it 0·1 Gm. of nitrate of silver, filtering again if necessary, and cautiously pouring a few drops of Water of Ammonia on top, not more than a white cloud, but no red or reddish precipitate should appear at the line of contact of the two liquids (abs. of more than traces of arsenic)." *U. S.*

ANTIMONIUM SULPHURATUM. *U. S., Br.* *Sulphurated Antimony.*

(ĂN-TỊ-MŌ′NỊ-ŬM SŬL-PHŪ-RĀ′TŬM.)

Antimonii Oxysulphuretum, *Lond.;* Antimonii Sulphuretum Aureum, *Ed.;* Precipitated Sulphide of Antimony; Stibium Sulfuratum Aurantiacum, *P. G.;* Sulphur Stibiatum Aurantiacum, Sulphur Auratum Antimonii; Golden Sulphuret of Antimony, Golden Sulphur; Soufre doré d'Antimoine, *Fr.;* Goldschwefel, *G.*

"Chiefly Antimonious Sulphide [**Sb_2S_3; 336**—SbS_3; 168] with a very small amount of Antimonious Oxide." *U. S.*

"Purified Sulphide of Antimony, *one part* [or four ounces av.]; Solution of Soda, *twelve parts* [or two pints and thirteen fluidounces]; Distilled Water, Diluted Sulphuric Acid, each, *a sufficient quantity.* Mix the Purified Sulphide of Antimony with the Solution of Soda and *thirty parts* [or eight pints] of Distilled Water, and boil the mixture over a gentle fire, for two hours, constantly stirring, and occasionally adding distilled water so as to preserve the same volume. Strain the liquid immediately through a double muslin strainer, and drop into it, while yet hot, Diluted Sulphuric Acid so long as it produces a precipitate. Wash the precipitate with hot Distilled Water until the washings are at most but very slightly clouded by test-solution of chloride of barium; then dry the precipitate and rub it to a fine powder." *U. S.*

"Take of Black Antimony *ten ounces* [avoirdupois]; Solution of Soda *four pints and a half* [Imperial measure]; Diluted Sulphuric Acid, Distilled Water, of each, *a sufficiency*. Mix the Black Antimony with the Solution of Soda, and boil for two hours with frequent stirring, adding Distilled Water occasionally to maintain the same volume. Strain the liquor through calico, and, before it cools, add to it by degrees the Diluted Sulphuric Acid till the latter is in slight excess. Collect the precipitate on a calico filter, wash with Distilled Water till the washings no longer precipitate with chloride of barium, and dry at a temperature not exceeding 212°." *Br.*

There are three preparations containing antimony and sulphur, viz.: the *amorphous precipitated antimonious sulphide*, Sb_2S_3, which while orange red in color corresponds to the black native sulphide; a reddish brown mixture known as "*kermes mineral*," which contains both antimonious sulphide and oxide, and has an average composition $(Sb_2S_3)_2 + Sb_2O_3$;[*] and the *golden sulphide*, which is antimonic sulphide, Sb_2S_5, and is obtained by decomposing sulph-antimoniates like *Schlippe's salt* (SbS_4Na_3) by the addition of a strong mineral acid.

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[*] ANTIMONII OXYSULPHURETUM. *U. S.* 1870. *Oxysulphuret of Antimony. Kermes Mineral. Kermes mineral* was officinal in 1870. The following is the process. "Take of Sulphuret of Antimony, in very fine powder, *a troyounce;* Carbonate of Sodium *twenty-three troyounces;* Water *sixteen pints.* Dissolve the Carbonate of Sodium in the Water previously heated to the boiling point, and, having added the Sulphuret of Antimony, boil for an hour. Then filter rapidly into a warm earthen vessel, cover this closely, and allow the liquid to cool slowly. At the end of twenty-four hours, decant the supernatant liquid, drain the precipitate on a filter, wash it with boiled water previously allowed to become cold, and dry it without heat. Lastly, preserve the powder in a well-stopped bottle, protected from the light." *U. S.*

Though very long in use as a medicine, and much employed on the continent of Europe, it was only recently that this preparation was admitted into the U. S. Pharmacopœia, having been superseded by the precipitated sulphide, which was supposed to have very similar if not identical properties.

Kermes mineral, according to Thenard, may be obtained by treating the tersulphide of antimony in three ways; 1st with a boiling solution of the carbonated alkalies, 2d with a boiling solution of the caustic alkalies, and 3d with the carbonated alkalies at a red heat. These several processes give brown powders, which vary in their shade of color, and which, though usually considered as identical, differ in composition. The kermes obtained by means of the carbonated alkalies in solution is an oxysulphide, that is, a compound of hydrated tersulphide of antimony with the teroxide; while the product, when either the caustic alkalies in solution or the carbonated alkalies at a red heat are used, is essentially a hydrated tersulphide, though containing occasionally a little oxysulphide. It is the first of these methods that was adopted in the U. S. process of 1870. It is in fact the formula of Cluzel (see U. S. D., 11th ed., p. 926), and is substantially that of the French Codex of 1837.

The rationale of the formation of kermes by this process is as follows. A portion of the carbonate of sodium is converted, by a transfer of carbonic acid, into caustic soda and sesquicarbonate. By a double decomposition taking place between a part of the tersulphide of antimony and the caustic soda, sulphide of sodium and teroxide of antimony are formed. The undecomposed portion of the tersulphide then dissolves in the solution of sulphide of sodium, and the teroxide in that of the remaining carbonate of sodium. The tersulphide and teroxide, being both more soluble in these menstrua hot than cold, precipitate together as the liquid cools, and constitute this variety of kermes. Thus obtained it is light, velvety, of a dark reddish purple color, brilliant in the sun, and of a crystalline appearance. It consists, according to M. Henry, jun., of tersulphide of antimony 62·5, teroxide 27·4, water 10, and soda a trace; proportions which correspond most nearly with two mols. of tersulphide, one of teroxide, and six of water. From the presence of so large a proportion of teroxide of antimony in this variety of kermes, it must be far more active than the other kinds, and ought, therefore, to be preferred for medical use.

Kermes, when obtained by means of the caustic alkalies, may be formed by the use of either potassa or soda. When the former alkali is selected, it may be prepared by boiling, for a quarter of an hour, two parts of the tersulphide of antimony with one part of caustic potassa dissolved in twenty-five or thirty parts of water, filtering the liquor, and allowing it to cool; whereupon the kermes precipitates. In this process one portion of the tersulphide, by reacting with a part of the potassa, gives rise to teroxide of antimony and sulphide of potassium. A second portion dissolves in the solution of sulphide of potassium formed, and a third forms an insoluble compound with a part of the teroxide. The remainder of the teroxide unites with the undecomposed potassa, forming a compound, which, being but sparingly soluble, is only in part dissolved. The hot filtered

The first of these is obtained by dissolving the powdered native sulphide in caustic potash solution with the aid of heat and then adding to this solution, which contains the antimony combined as potassium antimonite and sulph-antimonite, sulphuric acid, when a reddish precipitate is formed which dries to a reddish brown powder.

The second is obtained by boiling the native sulphide or the red amorphous sulphide just described with sodium carbonate, and then allowing the compound to settle out from the hot filtered liquid as it cools.

The third is obtained by first forming a sulph-antimoniate by boiling finely powdered antimonious sulphide and caustic soda with sulphur (or carbonate of sodium and chalk instead of the caustic soda), and then adding the solution of this to dilute hydrochloric or sulphuric acid, when yellow Sb_2S_5 separates according to the reaction—

$$2(SbS_4Na_3 + 9H_2O) + 3H_2SO_4 = 3Na_2SO_4 + Sb_2S_5 + 3H_2S + 18H_2O.$$

Properties of the Precipitated Sulphide of Antimony. (*Sulphurated Antimony, U. S., Br.*) "A reddish brown, amorphous powder, odorless and tasteless, and insoluble in water and in alcohol. When heated with 12 parts of hydrochloric acid, it is nearly all dissolved with evolution of hydrosulphuric acid. The residue, after having been washed and dried, burns, on the application of a flame, with the characteristic odor of sulphur, and should leave not more than a scanty ash. On dropping a solution of Sulphurated Antimony in hydrochloric acid into water, a white precipitate is produced, which, after washing and drying, should weigh not less than 85 per cent. of the sulphide. The liquid filtered from this precipitate yields an orange red precipitate with hydrosulphuric acid. Distilled Water boiled with Sulphurated Antimony, filtered and acidulated with hydrochloric acid, should be rendered not more than slightly opalescent by test-solution of chloride of barium (limit of sulphate)." *U. S.* Water in which this preparation has been boiled, should not yield a white precipitate with oxalate of ammonium. The non-action of this test shows the absence of lime. When pure, precipitated sulphide of antimony is completely soluble in a hot solution of potassa; but, as it is found in commerce, a white matter is usually left undissolved. When boiled with a solution of cream of tartar, about 12 per cent. of teroxide is dissolved; but, according to H. Rose, this method of determining the proportion of the teroxide cannot be relied on. Exposed to heat it takes fire, and burns with a greenish blue flame, giving off sulphurous acid; while the metal remains behind in the state of a grayish oxide.

The London precipitated sulphide of antimony, as analyzed by Mr. Phillips, consisted, in the 100 parts, of tersulphide 76·5, teroxide 12, and water 11·5; propor-

liquor, therefore, contains this compound dissolved in water, and tersulphide of antimony dissolved in the solution of sulphide of potassium. By refrigeration, the tersulphide in a hydrated state falls down, free or nearly free from teroxide, this latter being still held in solution by means of the caustic alkali.

Kermes may be obtained by the third method, that is, in the dry way, by the use of the carbonated alkalies at a red heat. If carbonate of potassium* be selected, the process is as follows. Rub together two parts of tersulphide of antimony and one of carbonate of potassium, fuse the mixture in a crucible by a red heat, reduce the fused mass to powder, boil it with water, and strain. As the strained liquor cools the kermes is deposited. The rationale of its formation is nearly the same with that of the formation of the second variety of kermes. An inferior kermes, prepared in the dry way, and intended for use in veterinary medicine, is directed in the French Codex of 1837 to be prepared by fusing together, well mixed, 500 parts of tersulphide of antimony, 1000 of carbonate of potassium, and 30 of washed sulphur, reducing the fused mass to powder, and boiling it with 10,000 parts of water. The liquor, upon cooling, lets fall the kermes, which must be washed with care and dried.

Kermes mineral is an insipid, inodorous powder, of a purplish brown color, and soft and velvety to the touch. By the action of air and light it gradually becomes lighter colored, and at last yellowish white. It is readily and wholly dissolved by hydrochloric acid, with escape of hydrosulphuric acid gas, and is partly soluble in a hot solution of potassa, leaving a residue soluble in tartaric acid. It is sometimes adulterated with ferric oxide. In Paris, in 1849, a number of the shops contained a spurious kermes of very handsome appearance, which was little else than this oxide. Kermes mineral first came into use as a remedy in France about the beginning of the last century. Its mode of preparation was possessed as a secret by a French surgeon named La Ligerie. In 1720, the recipe was purchased by the French government and made public. Its remedial properties are considered above.

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* According to the researches of M. A. Terreil (*Journ. de Pharm.*, 4e sér., xix. 131), carbonate of potassium if absolutely pure will not yield kermes by the moist way, but by the dry way will give a larger yield than will carbonate of sodium.

tions corresponding nearly with five mols. of tersulphide, one of teroxide, and fifteen of water. It usually contained a portion of pentasulphide, as shown by the action of hydrochloric acid, which, when heated with this antimonial, forms the terchloride with disengagement of sulphur. (*Gmelin's Handbook*, iv. 989.) Its active ingredient is the teroxide; and, in reference to its presence, the London College called the preparation *oxysulphuret of antimony.* The Edinburgh College named it incorrectly *golden sulphuret of antimony;* this name being properly applicable to the precipitate produced by the sole action of acids, and not to that obtained by the action of acids and refrigeration conjointly.

Sulphurated Antimony, in the British Pharmacopœia, is defined to be "sulphide of antimony, Sb_2S_3, with a small and variable amount of oxide of antimony, Sb_2O_3," and is described as "an orange red powder, readily dissolved by caustic soda, also by hydrochloric acid with the evolution of sulphuretted hydrogen and the separation of a little sulphur. Boiled in water with acid tartrate of potassium, the resulting solution is precipitated orange red with sulphuretted hydrogen. Sixty grains of this preparation, dissolved in hydrochloric acid and dropped into water, give a white precipitate, which, when washed and dried, weighs about fifty-three grains." *Br.* Mr. Wm. Tilden (*P. J. Tr.*, Dec. 1870, p. 443) asserts that the officinal (Br.) test is not satisfactory, because, if a little too much hydrochloric acid be present, a portion of the antimony will remain in solution as the chloride; and proposes the following substitute. "Fifty grains, moistened with nitric acid, then dried and heated to redness, give a white residue weighing about forty-five grains." Mr. John Moss asserted, before the London Pharmaceutical Society, that the British process always yields a dark reddish or reddish brown powder; but that the kermes mineral, in English commerce, is golden yellow or yellowish red, and must be prepared by some other method. He was confirmed in both statements by Profs. Redwood and Attfield; the latter explaining that the officinal kermes contains the tersulphide, the commercial the pentasulphide of antimony.

Medical Properties. *Precipitated sulphide of antimony* (*sulphurated antimony*) is alterative, diaphoretic, and emetic. It is, however, an uncertain medicine, and is very little used. In combination with calomel and guaiac (*Plummer's pill*), it was formerly employed in secondary syphilis and cutaneous eruptions. (See *Pilulæ Antimonii Compositæ.*) During its use the patient should abstain from acidulous drinks. Its dose as an alterative is from one to two grains given twice a day, in the form of pill; as an emetic, from five grains to a scruple.

Kermes mineral, when prepared by means of the carbonated alkalies in the moist way, contains between two and three times as much teroxide as the precipitated sulphide, and is a more active preparation, to be used in a smaller dose.

Golden sulphide acts like kermes mineral, but is much weaker, and must be given in a larger dose.

Off. Prep. Pilulæ Antimonii Compositæ, *U. S.;* Pilula Hydrargyri Subchloridi Composita, *Br.*

APOCYNUM. *U. S.* *Apocynum.* [*Canadian Hemp.*]

(Ạ-PŎÇ′Ỵ-NŬM.)

"The root of Apocynum cannabinum. Linné. (*Nat. Ord.* Apocynaceæ.)" *U. S.*

Chanvre du Canada, *Fr.;* Canadische Haufwurzel, *G.*

Gen. Ch. Calyx five-parted, the lobes acute. *Corolla* bell-shaped, five-cleft, bearing five triangular appendages in the throat opposite the lobes. *Stamens* five, inserted on the very base of the corolla. *Filaments* flat, shorter than the arrow-shaped anthers, which converge round the ovoid, obscurely two-lobed stigma, and are slightly adherent to it by their inner face. *Style* none. *Stigma* large, ovoid, slightly two-lobed. *Fruit* of two long slender follicles. *Gray's Manual.*

There are two indigenous species of this genus, *A. cannabinum*, L., and *A. androsæmifolium*, L., of very similar general aspect. Both plants abound in a milky juice, and have a tough fibrous bark, which, by maceration, affords a substitute for hemp. From this circumstance the common name has been derived.

In the officinal species the stem and branches are upright or ascending, terminated by erect and close, many-flowered cymes, which are usually shorter than the leaves, and the corolla has nearly erect lobes, with the tube not longer than the lanceolate divisions of the calyx. In *A. androsæmifolium* the branches are divergently forked, the cymes loose and spreading, the open bell-shaped corolla with revolute lobes and a tube much longer than the ovate-pointed divisions of the calyx. The two plants grow together, although *A. cannabinum* seems to be proportionately more common in the West, and frequently they are gathered indiscriminately by the herbalists. *A. androsæmifolium* was formerly included in the U. S. secondary list.

The root of *A. cannabinum* is horizontal, five or six feet in length, about one-third of an inch thick, dividing near the end into branches which terminate abruptly, of a yellowish brown color when young, but dark chestnut when old, of a strong odor, and a nauseous, somewhat acrid, permanently bitter taste. The internal or ligneous portion is yellowish white, and less bitter than the exterior or cortical part. "Long, cylindrical, somewhat branched, one-fourth to one-third of an inch (6 to 8 m.m.) thick, pale brown, longitudinally wrinkled and transversely fissured; brittle; fracture short, white; the bark rather thick; the wood porous, spongy, with delicate, medullary rays and a thin pith; inodorous; taste bitter, disagreeable." *U. S.* The fresh root, when wounded, emits a milky juice, which concretes into a substance resembling caoutchouc. In the dried state, it is brittle and readily pulverized, affording a powder like that of ipecacuanha. Dr. Knapp found it to contain a bitter principle, extractive, tannin, gallic acid, resin, wax, caoutchouc, fecula, lignin, and a peculiar active principle which he proposed to call *apocynin*. (*Am. Med. Review*, iii. 197.) Dr. Griscom, by a subsequent analysis, obtained similar results, with the addition of gum. The root yields its virtues to water and alcohol, but, according to Dr. Griscom, most readily to the former. Prof. J. U. Lloyd noticed a white, tasteless, crystalline, waxy precipitate, formed in a fluid extract of *A. cannabinum*.

Medical Properties and Uses. Apocynum (or, as it is frequently improperly called, *Indian Hemp*) is powerfully emetic and cathartic, sometimes diuretic, and, like other emetic substances, promotes diaphoresis and expectoration. It produces much nausea, diminishes the frequency of the pulse, and appears to induce drowsiness independently of the exhaustion consequent upon vomiting. The disease in which it has been found most beneficial is dropsy. From fifteen to thirty grains (1–1·95 Gm.) of the powdered root will generally produce copious vomiting and purging. The decoction is a more convenient form for administration. It may be prepared by boiling half an ounce of the dried root in a pint and a half of water to a pint, of which from one to two fluidounces (30–60 C.c.) may be given twice or thrice daily, or more frequently. The watery extract, in doses of three or four grains (0·20–0·26 Gm.), three times a day, will generally act on the bowels.

APOMORPHINÆ HYDROCHLORAS. *U. S.* *Hydrochlorate of Apomorphine.*

(ĂP-Q̣-MÖR-PHĪ′NÆ HȲ-DRQ̣-CHLŌ′RĂS.)

$C_{17}H_{17}NO_2$, HCl; 303·4. $C_{34}H_{17}NO_4$, HCl; 303·4.

Apomorphine, *Fr.*; Apomorphin, *G.*

"The hydrochlorate of an artificial alkaloid prepared from morphine. It should be kept in small well-stopped vials, in a dark place." *U. S.*

Apomorphine was discovered by Dr. Matthiessen and Mr. C. A. Wright. It is prepared by heating morphine in a closed tube with a great excess of hydrochloric acid for two or three hours to the temperature of 140° and 150° C. The contents of the tube are then dissolved in water, an excess of the bicarbonate of sodium added, and the precipitate exhausted with ether or chloroform. On the addition to the solution of a very small quantity of hydrochloric acid, crystals of the chloride of apomorphine form. The process is one of dehydration; the morphine parting with one molecule of water, the formula of apomorphine being $C_{17}H_{17}NO_2$. Apomorphine may also be made by the action of hydrochloric acid upon codeine, and it is affirmed that the best method in practice is that of E. Mayer, in which morphine is treated with a solution of chloride of zinc, at 120° C. (*Berichte Deutsch. Chem. Gesell.*, Berlin, 1871, iv. 121.) According to Prof. Gubler (*Ann. de Thérap.*, 1874), it is very closely allied to the alkaloid of Sanguinaria Canadensis.

Properties. Hydrochlorate of apomorphine is usually in "minute, colorless, or grayish white, shining crystals, turning greenish on exposure to light and air, odorless, having a bitter taste, and a neutral or faintly acid reaction. Soluble in 6·8 parts of water and in 50 parts of alcohol at 15° C. (59° F.); slowly decomposed by boiling water or boiling alcohol; almost insoluble in ether or chloroform, and should it impart color to either of these liquids, it should be rejected, or it may be purified by thoroughly agitating it with either liquid, filtering, and then rapidly drying the salt on bibulous paper, in a dark place. The aqueous solution, on gentle warming, rapidly turns green, but retains a neutral reaction. Solution of bicarbonate of sodium, added to an aqueous solution of the salt, throws down the white, amorphous alkaloid, which soon turns green on exposure to air, and forms a bluish green solution with alcohol, a purple one with ether or pure benzol, and a violet or blue one with chloroform. Addition of test-solution of nitrate of silver to an aqueous solution of the salt produces a white precipitate insoluble in nitric acid, but instantly reduced to metallic silver by water of ammonia." *U. S.* The alkaloid is colored dark red by nitric acid and rose-red by ferric chloride, changing to violet, and finally black on exposure. The aqueous and alcoholic solutions are at first colorless, but change rapidly to greenish, finally becoming deep emerald-green in color. This change in color is probably due to oxidation, and it has been noticed that the solution on standing loses its power: for this reason it is best not to keep the solution, but to make it as wanted. According to Max Quehl and H. Koehler, apomorphine is precipitated from its solutions greenish by tannic acid, lemon-yellow by picric acid, bluish white, and turning to sap-green on boiling, by sulphate of copper, purplish by chloride of gold, white, turning to blackish violet on boiling, by ferridcyanide of potassium, blood-red by iodine in solution of iodide of potassium, the precipitate disappearing on boiling, white and curdy by sulphocyanate of potassium. (*A. J. P.*, 1873, p. 166.) With bichromate of potassium and concentrated sulphuric acid it turns a dark red; with the potassium salt alone, a deep yellow orange; with neutral chloride of iron, an amethyst color.

Medical Properties and Uses. Apomorphine was first brought forward as a prompt and safe emetic by Dr. Gee. It has the great advantages of smallness of dose and freedom from irritating properties, so that it can be used hypodermically. When from $\frac{1}{15}$ to $\frac{1}{10}$ of a grain (0·004–0·006 Gm.) of it is injected under the skin of a man, in from 5 to 20 minutes free emesis usually occurs; the dose may be repeated at intervals if necessary. The effects upon the general system are usually not marked; but in some cases very alarming syncopal symptoms have been produced, and death is said to have resulted from $\frac{1}{15}$ of a grain (0·004 Gm.) in a feeble adult, worn out with chronic bronchitis and emphysema. (*Med. Rec.*, 1877, p. 664.) According to Harnack, young children bear the remedy very badly. Apomorphine has also been used to some extent as a sedative expectorant in the earlier stages of acute bronchitis. As an emetic, it has been employed in narcotic poisoning, to dislodge foreign bodies from the œsophagus, in suffocative catarrh, etc. Very alarming symptoms have followed the use of a solution which has undergone change, and fresh solution only should be administered. Under no circumstances should more than $\frac{1}{4}$ grain (0·016 Gm.) be given at a dose, indeed, except in the strongest adults and in narcotic poisoning, not more than $\frac{1}{10}$ of a grain (0·006 Gm.).

AQUÆ. *U. S.* *Medicated Waters.*

(Ā'QUÆ—ā'kwē.)

Aquæ Destillatæ; Distilled Waters, *E.;* Eaux distillées, Hydrolats, *Fr.;* Destillirte Wässer, *G.*

Under this head are included, in the U. S. Pharmacopœia, all preparations consisting of water holding volatile or gaseous substances in solution, many of which were formerly obtained by distillation, and some of which still continue to be so. They include the preparations formerly specially designated as "Distilled Waters," having been made by distilling water from plants or parts of plants containing volatile oil.

The Distilled Waters, as thus defined, hold a much more prominent position in the pharmacy of Europe, particularly of continental Europe, than in that of the United States; and a great deal of thought and elaborate investigation has been bestowed there upon the various conditions calculated to furnish the best products in the most convenient method. It would be doing injustice to the subject not to give it a distinct consideration in a work like the present, though its relative want of importance with us will render our remarks comparatively brief.

Many vegetables impart to water distilled from them their peculiar flavor, and more or less of their medical properties. The Distilled Waters chiefly used are those prepared from aromatic plants, the volatile oils of which rise with the aqueous vapor, and are condensed with it in the receiver. But, as water is capable of holding but a small proportion of the oil in solution, these preparations are generally feeble, and are employed chiefly as pleasant vehicles or corrigents of other medicines.

In the preparation of the Distilled Waters, dried plants are sometimes used, because the fresh are not to be had at all seasons; but the latter, at least in the instance of herbs and flowers, should be preferred if attainable. Flowers which lose their odor by desiccation may be preserved by incorporating them intimately with one-third of their weight of common salt, and in this state afford Distilled Waters of delicate flavor. Some pharmacists prefer to employ the salted flowers in certain instances, believing that the waters distilled from them keep better than when prepared from the fresh flowers. Mr. C. R. Tichborne has discovered a method of preserving flowers, which is said to answer even better than the use of salt. It consists simply in immersing the fresh flowers in glycerin, which preserves them with all their aromatic properties wholly unimpaired. The flowers, as of the elder, rose, and orange, should be gathered after full expansion, and packed firmly in wide-mouthed bottles or jars, but without crushing them. The glycerin is then to be poured on until it covers them, and the vessel closed. Mr. Tichborne has kept flowers in this way for two years, and at the end of that time procured from them distilled waters, of which the perfume has equalled that of the waters prepared from recent flowers. It is not necessary that the glycerin should be perfectly pure; but it should be without smell. (*P. J. Tr.*, 2d ser., vii. 135.)

The idea at one time prevailed, to a considerable extent, that Waters kept better distilled from dried herbs than from fresh; and the opinion was true in regard to those prepared with the defective alembics of former times, and by a naked fire; but experiment has sufficiently established the fact, that, with a suitable apparatus, and a regular heat, the fresh herbs yield products which, while they have a more agreeable odor of the plant, keep quite as well as those from dried herbs. (*Journ. de Pharm.*, Mai, 1861, p. 359.)

It is necessary to observe certain practical rules in conducting the process of distillation. When the substance employed is dry, hard, and fibrous, it should be mechanically divided, and macerated in water for a short time previous to the operation. The quantity of materials should not bear too large a proportion to the capacity of the alembic, as the water might otherwise boil over into the receiver. The water should be brought quickly to the state of ebullition, and continued in that state till the end of the process. Care should be taken to leave sufficient water undistilled to cover the whole of the vegetable matter; lest a portion of the latter, coming in contact with the sides of the vessel, might be decomposed by the heat, and yield empyreumatic products. Besides, when the operation is urged too vigorously, or carried too far, a slimy matter is apt to form, which adheres to the sides of the still above the water, and is thus exposed to igneous decomposition. To obviate these disadvantages, the heat may be applied by means of an oil-bath, regulated by a thermometer, or of a bath of solution of chloride of calcium, by which any temperature may be obtained between 100° C. (212° F.) and 132·2° C. (270° F.), according to the strength of the solution; or, when the process is conducted upon a large scale, by means of steam introduced under pressure into a space around the still. To prevent the disagreeable effects of charring, and the excessive empyreumatic odor frequently noticed in distilled waters, caused by the solid contents of the still coming into direct contact with the heated bottom, we have devised an expedient which prevents the herb from touching the bottom, and yet permits the water and steam to have free access to all parts of it. (See Pharmaceutical Still under *Extracta.*) A hemispherical No. 12 sieve of copper with a loosely-fitting lid and handle is filled with the herb and placed in the water in the still. If the bottom of the still be flat or nearly so, the rounded bottom of the cage must have a very slight point of contact, and thus charring will be prevented. A convenient mode of applying heat by steam, is by means of a coil of leaden tube placed in the bottom of the still, having one end connected with a boiler, and the other passing out beneath or at the side, and furnished with a stop-cock, by which the pressure may be increased, or the condensed water drawn off at will. If any volatile oil float upon the surface of the Distilled Water, it may be separated.*

From a series of experiments made in Paris in reference to the best mode of applying heat, it was concluded that, as regards the great majority of aromatics, the direct application of steam was preferable, because the Distilled Waters prepared by means of it have a freshness of aroma that is wanting in the others, are always free from the odor of the still, are much more limpid, are less apt to deposit mucilaginous matter, and keep better; but that exceptions to the general rule are afforded by bitter almonds, cherry-laurel leaves, mustard, and horse-radish, in all of which the oil does not pre-exist in the plant, but is formed upon contact with water; by woods, barks, and roots, the tissue of which cannot be sufficiently penetrated by steam; and by roses. (*Journ. de Pharm.*, Mai, 1861, p. 364.) Later experiments have led to the conclusion that even these substances are most advantageously treated by distillation with steam; and that, in fact, there is no exception to the general rule.

But, however carefully the process may be conducted, the Distilled Waters prepared from plants always have at first an unpleasant smoky odor. They may be freed from this by exposure for a short time to the air, before being enclosed in well-stopped bottles, in which they should be preserved. When long kept, a viscid ropy matter is apt to form in them, and they become sour. This result has been ascribed to other principles, which rise with the oil in distillation, and promote its decomposition. To prevent this decomposition, rectified spirit is sometimes added to the water employed in the distillation. But this addition is inadequate, and is in fact injurious, as the alcohol by long exposure to the air undergoes the acetous fermentation. A better plan is to redistil the Waters. When thus purified, it is said that they may be kept for several years unchanged.

Robiquet considered the mucosity which forms in Distilled Waters to be the result of a vegetative process, for which the presence of air is essential. He has found that, so long as the water is covered with a layer of essential oil, it undergoes no change; but that the oil is gradually altered by exposure to the air, and, as soon as it disappears, the water begins to be decomposed. He states that camphor exercises the same preservative influence over the Distilled Waters by resisting the vegetation, and that those in which the odor of camphor is developed keep better on that account. Finally, he has observed that the more Distilled Water is charged with volatile oil, the more abundant is the mucosity when it has begun to form. Robiquet unites with Henry and Guibourt, and with Virey, in recommending that all these Waters, when intended to be kept for a considerable time, should be introduced, immediately after distillation, into bottles of a size proportionate to the probable consumption of the water when brought into use; and that the bottles should be quite filled, and then sealed or otherwise well stopped, so as entirely to exclude the air. It is best that they should be small, and be closed with well-fitting glass stoppers. Thus treated, the Waters may be preserved without change for many years. (*Journ. de Pharm.*, xxi. 402.) We have frequently noticed microscopic plants belonging to the *Confervoideæ* in the Distilled Waters contained in shop bottles standing on the shelves in the dispensing room, and if it be desired to keep Distilled Waters, the only sure way is to destroy the spores and prevent the admission of fresh ones by placing the bottles filled to the lip with the Distilled Water into a bath of boiling water, and when thoroughly heated, corking and sealing.[*]

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* This direction is generally given; but, in a communication to the Pharmaceutical Society of England, Mr. Haselden recommends the excess of oil to be well shaken with the water, and the whole to be transferred to the stock vessel, where it may be allowed to rest, and the oil to separate. He thinks the water keeps better when thus treated; and the full strength is always insured. The stock vessel he prefers made of stoneware, and furnished with a tap placed two inches from the bottom, whereby the water may be drawn off clear when wanted for the ordinary shop bottles; the oil rising to the top, or sinking to the bottom, according to its sp. gr. (*P. J. Tr.*, xvi. 14, 15.)

Another mode of preparing the Distilled Waters is to substitute the volatile oil, previously separated from the plant, for the plant itself in the process. This mode is directed in the British Pharmacopœia, in several instances. It is said to afford a more permanent product than the preceding, but does not always preserve the flavor of the plant.

In relation to most of the aromatic waters, the U. S. Pharm. formerly directed that water should be impregnated with the volatile oil by trituration with carbonate of magnesium, and subsequently filtered. This was by far the most simple and easy process. The resulting solution is nearly pure and permanent, and is perfectly transparent, the carbonate of magnesium being separated by the filtration. Carbonate of magnesium is preferable to the pure earth; as the latter sometimes gives a brownish color to the liquid, and requires to be used in larger proportion. But both these substances are dissolved in minute quantities, and are apt to occasion a slight flocculent precipitate. They may also possibly prove injurious by decomposing certain substances given in very small doses, as salts of the alkaloids, bichloride of mercury, and nitrate of silver. The object of the magnesia or its carbonate is simply to enable the oil to be brought to a state of minute division, and thus presented with a larger surface to the action of the solvent. Precipitated phosphate of calcium has been used as a substitute for carbonate of magnesium, but this has been shown to be slightly soluble in water and also objectionable. W. S. Thompson, of Washington, D.C., suggests the use of absorbent cotton as being free from all of these objections, and his views have been substantially adopted by the Committee of Revision of the present Pharmacopœia. A very good way to make medicated waters when a volatile oil is directed, is that proposed by Percival, which is to heat the water required, pour it in a bottle and add the oil, cork tightly, shake occasionally until cool, then pour off and filter; this secures a medicated water free from foreign substances, and a saturated solution; most oils being more soluble in hot than in cold water. According to Mr. Robert Warington, this object may be better accomplished by porcelain clay, finely powdered glass, or pumice stone, which are wholly insoluble (*Chem. Gaz.*, March, 1845, p. 113); and the London College employed finely powdered silica for the purpose. Chalk and sugar answer the same end; but the latter, by being dissolved with the oil, renders the preparation impure. The *Dublin College* prepared its Waters by agitating an alcoholic solution of the oil with distilled water, and filtering. They consequently contained alcohol, and were liable to the objection, already mentioned, against the medicated waters thus impregnated. They were, besides, feeble in the properties of their respective oils. In the preparation of the aromatic waters by these processes, it is very important that the water should be pure. The presence of a sulphate causes a decomposition of the oil, resulting in the production of sulphuretted hydrogen and a carbonate; and the aromatic properties are quite lost. (See *A. J. P.*, xix. 303.) Hence the propriety of the officinal direction to employ distilled water.[†]

The Distilled Waters are liable to contain various metallic impurities, derived from the vessels in which they are prepared or preserved. The metallic salts which have been found in them are those of iron, zinc, copper, and lead. With ferrocyanide of potassium, iron will give a blue color, zinc and lead white precipitates, and copper a rose color followed by chestnut brown. Sulphide of sodium causes with the salts of iron, copper, and lead, a brown discoloration more or less deep, followed by precipitates varying from brown to black; with those of zinc, a white precipitate. The Distilled Waters may be freed from these impurities by animal charcoal, previously well purified. The charcoal should be strongly shaken, eight or ten times in the course of a day, with the impure Water, which should then be allowed to rest, and the next day be filtered. Five grains of the charcoal will be sufficient for a gallon of the Distilled Water. (*Journ. de Pharm.*, Nov. 1862, p. 416.) The volatile oils may be recovered from the Waters containing them, or at least may be transferred to a spirituous menstruum, by mixing olive oil with the water, adding a little solution of potassa so as to form a soap, and a consequent emulsion with the liquid, and then neutralizing by an acid. The fixed oil will rise to the surface, bringing the volatile oil along with it. The latter may then be separated from the former by agitation with alcohol. (T. B. Groves, *P. J. Tr.*, Feb. 1864.)

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[*] It is of some importance to know the proportion which the aromatic submitted to distillation ought to bear to the amount of Distilled Water obtained. The following statement upon this point, based upon experiments, is contained in the *Journ. de Pharm.* (Mai, 1861, p. 367). Fresh aromatic plants requiring one part of the plant for one of product, wormwood, black cherry, scurvy-grass, hyssop, cherry-laurel, lavender, balm, mint, peach-leaves, roses, and sage;—fresh and dry aromatics requiring one part of the plant to two of product, bitter almonds, orange-flowers, melilot, horseradish, elder, and tansy;—dry and very aromatic plants requiring one part to four of product, angelica, green anise, juniper berries, chamomile, canella, cascarilla, fennel, sassafras, linden flowers, and valerian.

[†] Mr. Haselden prefers the process of distillation from the aromatic itself in the instances of dill, caraway, fennel, cinnamon, and pimento, which are not apt to afford to the distilled water such matter as may cause it to become sour; but he prefers trituration for peppermint, spearmint, and pennyroyal waters. He advises, however, that these waters should not be filtered, but prepared in quantity, allowed to settle, and drawn off as wanted. (*P. J. Tr.*, xvi. 14, 15.)

AQUA. *U. S.*, *Br.* *Water.*

H_2O; 18. (Ā-QUẠ—ā'kwạ.) HO; 9.

"Natural water in its purest attainable state." *U. S.* "Natural water, the purest that can be obtained, cleared, if necessary, by filtration." *Br.*

Aqua communis, *P.G.;* Ὕδωρ, *Gr.;* Eau, *Fr.;* Wasser, *G.;* Acqua, *It.;* Agua, *Sp.*

Water has always been included in the U. S. Pharmacopœia, on account of its great importance as a medical and pharmaceutical agent. It was not admitted into the officinal lists of the British Pharmacopœias until 1839, when it was first recognized by the Edinburgh College. It is more or less concerned in almost all the changes which take place in inorganic matter, and is essential to the growth and existence of living beings, whether animal or vegetable. In treating of a substance of such diversified agency, our limits will allow of a sketch only of its properties and modifications. We shall speak of it under the several heads of *pure water*, *common water*, and *mineral waters.*

PURE WATER. Water, in a pure state, is a transparent liquid, without color, taste, or smell. Its sp. gr. is assumed to be unity, and forms the term of comparison for that of solids and liquids. A cubic inch of it, at the temp. of 15·5° C. (60° F.), weighs very nearly 252·5 grains. In the metric system the weight of 1 C.c. of distilled water taken at 4° C. (39·2° F.) is made equal to 1 gramme, the unit of weight in this system. It is compressible to a small extent, as was proved first by Canton, and afterwards, in an incontestable manner, by Perkins. Reduced in temp. to 0° C. (32° F.), it becomes a solid or ice, with the sp. gr. 0·9175 (Dufour, *Comptes-Rendus*, Juin, 1860); and raised to 100° C. (212° F.), an elastic fluid called steam. In the latter state its bulk is increased nearly 1700 fold, and its sp. gr. so far lessened as not to be much more than half that of atmospheric air. At the temp. of 4° C., or 39·2° F., its density is at the maximum; and consequently, setting out from that point, it is increased in bulk by being either heated or cooled. It has the power of dissolving more or less of all gases, including common air, the constituents of which are always present in natural water. It uniformly exists in the atmosphere, in the form of invisible vapor, even in the driest weather.

Water consists of two atoms of hydrogen 2, and one of oxygen 16 = 18; or, in volumes, of two volumes of hydrogen and one volume of oxygen condensed into two volumes of aqueous vapor or steam. On these data, it is easy to calculate the sp. gr. of steam; which will be 0·0693 (sp. gr. of hydrogen) + 0·5528 (half the sp. gr. of oxygen) = 0·6221.

COMMON WATER. By reason of its extensive solvent powers, water, in its natural state, must be more or less contaminated with foreign matter. Thus, it becomes variously impregnated, according to the nature of the strata through which it percolates. When the foreign substances present are in so small an amount as not materially to alter its taste and other sensible qualities, it constitutes the different varieties of *common water.*

There are almost innumerable shades of difference in common water, as obtained from different localities and sources; but all its varieties may be conveniently arranged under the two heads of soft and hard. A *soft water* is one which contains but inconsiderable impurities, and which, when used in washing, forms a lather with soap. By a *hard water* is understood a variety of water which contains calcareous or magnesian salts, or other impurities, through which it curdles soap, and is unfit for domestic purposes. Tincture of soap is a convenient test for ascertaining the quality of water. In distilled water it produces no effect; in soft water, only a slight opalescence; but in hard water, a milky appearance. The milkiness is due to the formation of an insoluble compound between the fatty acids of the soap and the lime or magnesia of the foreign salt.

The most usual foreign substances in common water, besides oxygen and nitrogen, and matters held in a state of mechanical suspension, are carbonic acid, sulphate and carbonate of calcium, and chloride of sodium (common salt). Carbonic acid is detected by lime-water, which produces a precipitate before the water is boiled, but not afterwards, as ebullition drives off this acid. The presence of sulphate of calcium is shown by precipitates being produced by nitrate of barium, and, after ebullition, by oxalate of ammonium. The former test shows the presence of sulphuric acid, and the latter, after boiling the water, indicates lime not held in solution by carbonic acid. Carbonate of calcium, when held in solution by an excess of carbonic acid, may be detected by boiling the water, which causes it to precipitate; but, even after ebullition and filtration, the water will retain enough carbonate of calcium to give a precipitate with acetate of lead; carbonate of calcium being itself to a minute extent soluble in water. Nitrate of silver will produce a precipitate, if any soluble chloride be present; and, ordinarily, the one present may be assumed to be common salt. Arsenic in minute quantity has been found in water used as drink. At Whitbeck, in Cumberland, England, the inhabitants employ, both as drink and for culinary purposes, a water holding enough arsenic in solution to be quite sensible to tests, without any known injurious consequence. (*Chem. News*, 1860, p. 128.)

Dr. Clark has proposed to purify hard water, when the hardness arises from bicarbonate of calcium, by a process which he calls *liming.* This consists in adding to the water sufficient lime-water to convert the bicarbonate into the very sparingly soluble carbonate. This procedure renders the water soft, and gets rid of all the lime, except that in the minute portion of carbonate dissolved. The merit of this process consists chiefly, not in the removal of lime, but in preventing the formation of organic matters, principally confervæ, the decomposition of which renders the water offensive and unwholesome. Dr. Clark's process has been for some time in successful operation on the water obtained by boring, at the Plumstead water-works, near Woolwich. (*P. J. Tr.*, June, 1856.) River water containing the usual amount of calcareous matter, if allowed to stagnate in open reservoirs, in the summer, will become contaminated with myriads of microscopic plants and animals. This change is prevented, according to Dr. Clark, by his peculiar treatment, which deprives the living organism of the nutriment, derived from loosely combined carbonic acid.

The oxygen and nitrogen present in natural waters are not usually in the same proportion as in atmospheric air; the oxygen in atmospheric air amounting to about 20 per cent. in volume, while the usual gaseous mixture, expelled from fresh water by boiling, contains 32 per cent. (See table on page 219.)

Common water is also divided into varieties according to its source. Thus, we have rain, snow, spring, river, well, lake, and marsh water.

Rain and *snow water* are the purest kinds of natural water. Rain water, to be obtained as pure as possible, must be collected in large vessels in the open fields, at a distance from houses, and some time after the rain has commenced falling; otherwise it will be contaminated with the dust which floats in the atmosphere, and with other impurities derived from roofs. The rain water of large cities contains nitrogenized organic matter, as shown by the odor produced by burning the residue left after the water has been evaporated.

Rain water ordinarily contains atmospheric air, and, according to Liebig, a little nitric acid, the amount of which is increased when the rain descends during a storm. M. Chabrier states as the result of his observations, that rain water contains either nitrous or nitric acid, the one or the other predominating according to the condition of the weather; the nitrous acid being relatively in excess in mild weather, but the nitric when the rain is attended with tempestuous winds. (*Journ. de Pharm.*, Janv. 1872, p. 42.) According to an analysis, made by M. Martin, of rain water which fell at Marseilles during a violent storm, 1000 parts by weight contained 0·004 of chlorine and 0·003 of ammonia. Not a trace of iodine or of nitric acid was discovered. Boussingault has ascertained that the rain which falls in towns contains considerably more ammonia than that which falls in the country. Thus the rain of Paris was found by him to contain three or four parts of ammonia per million; while that collected in a mountainous region, contained about four-fifths of one part only in a million. The average results of Mr. J. B. Lawes and Dr. J. H. Gilbert give one part of ammonia to the million of rain water. Snow water has a peculiar taste, which was supposed to depend on the presence of air more oxygenated than that of the atmosphere; but in point of fact it contains no air, and this accounts for its vapid taste. Rain and snow water is sufficiently pure for most chemical operations.

Spring water (*aqua fontana*) depends entirely for its quality on the strata through which it flows; being purest when it passes through sand or gravel, or where the prevailing rock formation is granitic. On the contrary, where the formation is limestone, the water will, because of the carbonic acid gas dissolved in it, take up the carbonate of lime and become what is called a *hard water.* It almost always contains a trace of common salt, and generally other impurities, which vary according to the locality of the spring.

River water (*aqua fluvialis*) is, generally speaking, less impregnated with saline matter than spring water, because made up in considerable part of rains; while its volume bears a larger proportion to the surface of its bed. It is, however, much more apt to have mechanically suspended in it insoluble matters, of an earthy nature, like clay and silt, which impair its transparency. It is frequently rendered more sightly by being run through porous stone, carbon, or sand filter. The coarse particles are by this filtration removed; but any sewage or other very finely divided organic material is not removed, so that such clean filtered water may be a very deadly poison.

Well water, like that from springs, is liable to contain various impurities. As a general rule, the purity of the water of a well will be in proportion to its depth and the constancy with which it is used. Well water in large cities always contains a large amount of impurity, both organic and inorganic, the result of sewage contamination. Dr. R. D. Thomson found 147·6 grs., per Imperial gallon, of impurity in a well in London. (*P. J. Tr.*, 1856, p. 27.) The presence of nitrates in water prevents the formation of organic beings, even after it has been long kept. *Artesian* or *overflowing wells*, from their great depth, generally afford a pure water.

Lake water cannot be characterized as having any invariable qualities. The water of most of the lakes in the United States is pure and wholesome.

Marsh water is generally stagnant, and contains vegetable remains undergoing decomposition. It is unwholesome, and ought never to be used internally.

All water which is exposed to the air dissolves a quantity of oxygen and nitrogen, which is determined by the laws of gaseous absorption. It is indeed upon this dissolved oxygen that the life of water-breathing animals depends. In every pure water the proportion between the dissolved nitrogen and oxygen is found to be constant, and it is represented by the following numbers:—oxygen 34·91, and nitrogen 65·09 per cent.: 1000 C.c. of pure water, such as rain water, when saturated dissolves 17·95 C.c. of air. If the water be rendered impure by the introduction of organic matter undergoing oxidation, the proportion between the dissolved oxygen and nitrogen becomes different, owing to the oxygen having been partly or wholly used for the oxidation of this material. This is clearly shown in the following analysis made by Miller of the dissolved gases contained in Thames water collected at various points above and below London.

	Thames water taken at					
	Kingston.	Hammer-smith.	Somerset House.	Green-wich.	Wool-wich.	Erith.
	C.c.	C.c.	C.c.	C.c.	C.c.	C.c.
Total volume of gas per litre..........	52·7	......	62·9	71·25	63·05	74·3
Carbon dioxide..............................	30·3	......	45·2	55·6	48·3	57·
Oxygen..	7·4	4·1	1·5	0·25	0·25	1·8
Nitrogen	15·0	15·1	16·2	15·4	14·5	15·5
Ratio of oxygen to nitrogen............	1 : 2	1 : 3·7	1 : 10·5	1 : 60	1 : 52	1 : 8·1

This table shows that whereas the pure water at Kingston contains the normal quantity of dissolved oxygen, the ratio of nitrogen to oxygen increases in a very rapid rate as the river water becomes contaminated with London sewage, but that this ratio again shows signs of a return to the normal at Erith.

Hence it is clear that an analysis of the gases dissolved in water may prove of much help in ascertaining whether the water is pure or whether it has been contaminated with putrescent organic matter. Indeed, Miller concludes that whenever the proportion between dissolved oxygen and nitrogen rises to more than 1 to 2 the water is unfit for drinking purposes. (Roscoe and Schorlemmer, *Treatise on Chem.*, i. 245.)

The second class of dissolved impurities are inorganic salts, even rain water washing some of these out of the atmosphere. It invariably contains ammoniacal salts, chloride of sodium, and various organic germs. In towns the rain water also contains a larger proportion of nitrates than that falling in the country. It is, however, the spring waters especially which contain the largest amount of mineral matter in solution. The salts which most commonly occur in solution in spring water are: (1) The carbonates of calcium, magnesium, iron, and manganese, dissolved in an excess of carbonic acid. (2) The sulphates of calcium and magnesium. (3) Alkaline carbonates, chlorides, sulphates, nitrates, or silicates.

Spring waters which issue from considerable depths, or which originate in volcanic districts, are always hotter than the mean annual temperature of the locality where they come to the surface.

The term *Aqua*, in the U. S. and Br. Pharmacopœias, may be considered as designating any natural water of good quality which answers well for cooking, and does not curdle soap. Upon the addition of nitrate of barium, nitrate of silver, or oxalate of ammonium, its transparency is but slightly affected; and, upon being evaporated to dryness, it leaves but an inconsiderable residue.

"A colorless, limpid liquid, without odor and taste at ordinary temperatures, and remaining odorless while being heated to boiling, of a perfectly neutral reaction, and containing not more than 1 part of fixed impurities in 10,000 parts.

"The transparency or color of Water should not be affected by hydrosulphuric acid or sulphide of ammonium (abs. of metallic impurities). On heating 100 C.c. of Water, acidulated with 10 C.c. of diluted sulphuric acid, to boiling, and adding enough of a dilute solution of permanganate of potassium (1 in 1000) to impart to the liquid a decided rose-red tint, this tint should not be entirely destroyed by boiling for five minutes (abs. of more than traces of organic or other oxidizable matters)." *U. S.*

Water should never be kept in leaden cisterns, on account of the risk of its dissolving a small portion of lead. This risk is greater in proportion to the softness and purity of the water; for it is found that the presence of a minute proportion of saline matter, as for example of sulphate of calcium, protects the water from the slightest metallic impregnation. The chlorides are not protective; as they give rise to chloride of lead, which is slightly soluble. The protection has been ascribed to an insoluble film on the surface of the lead, formed by the decomposition of the saline matter. Upon this principle is based a plan of protection by Dr. Schwartz, of Breslau, who proposes to fill leaden pipes through which water is conducted with a strong solution of an alkaline sulphide, which forms a perfectly insoluble coating of sulphide (sulphuret) of lead, said to be quite impermeable by the water afterwards introduced. (*Chem. News*, Sept. 26, 1863, p. 157.) A coating of zinc has been employed for protecting the surface of iron pipes and reservoirs against the action of water, but has failed. Experiment has shown that the water becomes impregnated with the salts of both metals. (*Ibid.*, April 5, 1862, p. 188.)*

A very important class of dissolved impurities is made up of organic compounds. This organic matter may be derived from a vegetable source, such as leaf-mould and the decomposition products of wood, in which case it is practically harmless, or it may be derived from animal sources, in which case it almost always proves a serious impurity.

The careful observations of students of public health leave no doubt that a number of epidemic diseases, especially cholera and typhoid fever, are often contracted and spread by means of drinking water, contaminated with germs of disease from excreta and general sewage. This impure water may be clear and may have filtered through considerable distances of soil, and yet may contain these poisonous germs. Now nitrogen is one of the characteristic constituents of animal matter as contrasted with vegetable matter, relatively few forms of which contain it, and those are of a character not likely to be found in natural waters. Hence, if water should be impregnated with animal matter, this would be indicated by the presence of nitrogen in solution, either in the form of albumen or albuminous matter, if the animal matter in the water is still unchanged, or, if the animal matter has undergone oxidation, in the form of ammonia or nitrous or nitric acid.

There is, therefore, to be determined in the examination of a water with reference to this presence of organic nitrogenous matter, (1) the ammonia, (2) the unchanged albuminous matter, which, as it is changed into and determined as ammonia, is called "albuminoid ammonia," (3) the nitrates and nitrites present.

The ammonia is first determined by distilling the water made alkaline with carbonate of sodium as long as the distillate carries enough ammonia to be recognized by Nessler's solution.† For this purpose the distillate is collected successively in volumes of 50 C.c. and the amount of ammonia in each of these separate distillates determined. The smallest quantity of ammonia will produce a yellow color, the tint of which is to be compared with that obtained from the Nessler solution treated with a standard sal ammoniac solution.

After the free ammonia has been distilled off, a solution of caustic soda and permanganate of potash is added and the distillation is continued. Another portion of ammonia now comes off, owing to the action of the permanganate on the nitrogenous organic matter. The amount of ammonia thus obtained is determined and is tabulated as "albuminoid ammonia," because albumen is one of the bodies which is decomposed in this way.

Instead of this method proposed by Wanklyn and Chapman, another process described by Frankland and Armstrong is often used. In this case, the water having been evaporated, the dry residue is submitted to an organic combustion analysis, which gives the "organic nitrogen" and the "organic carbon," and the ratio of these gives an indication as to the presence of albuminous matter rich in nitrogen. If the amount of albuminoid nitrogen indicated by either of these processes exceed 0·15 parts for one million of water, the latter should be rejected as a drinking water. In some large towns, however, the surface well waters have shown albuminoid nitrogen to the amount of 0·3 to 0·8 parts per million. Such waters are little better than sewage. The free ammonia, moreover, should not exceed 0·08 parts per million, or the water must be considered as containing sewage contamination.

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* Experiments by M. Roux, pharmaceutist of the marine at Rochefort, made by order of the naval authorities, have satisfactorily shown that reservoirs of iron coated with zinc are attacked with great facility by water contained in them, which becomes more or less impregnated with both metals in the state of oxides and salts, and especially with those of zinc, to such a degree as to render such vessels improper as recipients of water for drinking. Of the different kinds of water tried, distilled water deprived as far as possible of atmospheric air produced least effect; next in degree of action was spring water; still more energetic was distilled water containing carbonic acid furnished by the earthy bicarbonates of the water submitted to distillation; and more powerful than all was river water containing common salt. (*Journ. de Pharm. et Chim.*, 4e sér., i. 99.)

† This solution is prepared as follows. 35 Gm. of potassium iodide and 13 Gm. of mercuric chloride (corrosive sublimate) are dissolved in about 800 C.c. of hot water, and then a saturated solution of mercuric chloride is gradually added until the precipitate formed ceases to redissolve. 100 Gm. of caustic potash are then dissolved in the liquid, and the cold solution is diluted to one litre and is allowed to deposit any undissolved matter.

The nitrates and nitrites present can be estimated in another portion of the water by reducing these acids to ammonia by means of the hydrogen evolved from aluminium or zinc-dust in presence of caustic alkalies.

The determination of chlorine is also frequently of great importance, for although mineral waters may be rich in chlorides, ordinary well waters or river waters, which are the chief sources of supply, will not contain much chlorine unless they have been contaminated. Both urine and sewage may contribute this chlorine, as they are highly charged with common salt. As a rule it may be said that water containing more than two grains of chlorine per gallon must be looked upon with suspicion, unless some good reason for the presence of common salt can be assigned.

MINERAL WATERS. When natural spring waters are so far impregnated with foreign substances as to have a decided taste, and a peculiar operation on the economy, they are called *mineral waters.* These are conveniently arranged under the heads of *carbonated*, *alkaline*, *sulphuretted*, *saline* (including *magnesian*, *chalybeate*, and *chlorinated*), and *silicious.*

1. *Carbonated waters* are cold, and are characterized by containing an excess of carbonic acid, which gives them a sparkling appearance, and the power of reddening litmus paper. These waters frequently contain the carbonates of calcium, magnesium, and iron, which are held in solution by the excess of carbonic acid. The waters of Seltzer, Spa, Apollinaris, and Pyrmont in Europe, and of the sweet springs in Virginia, belong to this class. For Artificial Carbonic Acid Water, see page 224.)

2. *Alkaline waters* contain a larger quantity of bicarbonate of sodium, as well as common salt and Glauber's salt. These are sometimes warm, such as the springs at Ems and Vichy, but generally cold. The Gettysburg spring water is of this class.

3. *Sulphuretted waters* are such as contain sulphuretted hydrogen, and are distinguished by the peculiar fetid smell of that gas, and by yielding a brown precipitate with the salts of lead or silver. Examples of this kind are the waters of Aix la Chapelle and Harrogate in Europe, and those of the white, red, and salt sulphur springs in Virginia.

4. *Saline waters* are those, the predominant properties of which depend upon saline impregnation. The salts most usually present are the sulphates and carbonates of sodium, calcium, and magnesium, in which latter case the name *magnesian* is given to them; the presence of the chlorides of these alkalies giving the class *chlorinated* waters, which reach their maximum concentration in sea waters; whilst the presence of ferrous salts makes another class, the *chalybeate.* Among magnesian waters may be mentioned those of Friedrichshall, Hunyádi Janos, and Epsom; among chalybeate waters, those of Tunbridge and Brighton in England, of Pyrmont, Wiesbaden, and Spa on the continent, and of Bedford, Pittsburg, and Brandywine in the United States. Potassa is occasionally present, and lithia has been detected by Berzelius in Carlsbad, and other salt springs of Germany, and is also found in some American spring waters. Cæsia and rubidia have also been detected in certain mineral waters, such as the Dürkheim and Baden-Baden waters, in the former of which these elements were first discovered by Bunsen. Bromine is found in the saline at Theodorshalle, in Germany, as also in the salt wells of Western Pennsylvania, Ohio, and West Virginia. The mineral springs at Saratoga contain a small proportion of iodine and bromine. The principal saline waters are those of Seidlitz in Bohemia, Cheltenham and Bath in England, and Harrodsburg and Saratoga in the United States.

5. *Silicious waters* are those in which the saline contents consist chiefly of alkaline silicates, such as the hot spring waters of Iceland and the geysers of Fire-hole Basin and Gardiner's River, Yellowstone National Park, U. S.

In the Appendix will be found a list of analyses of noted mineral spring waters, classified as far as possible under the above heads.

The following analyses serve to show the differences between a good potable water and one which is totally unfit for drinking. (Roscoe & Schorlemmer, *Chemistry.*

i., p. 254.) No. 1, the water supplied by the Manchester corporation from the Derbyshire hills; No. 2 is a surface-well water recently used for drinking purposes in a manufacturing town, although little better than effluent sewage:

	No. 1. Good Water.		No. 2. Bad Water.	
	Parts per million.	Grains per gallon.	Parts per million.	Grains per gallon.
Total solids	63·0	4·4	530·	37·1
Nitrogen, as nitrites and nitrates	0·25	0·017	7·8	0·546
Free ammonia	0·03	0·002	4·32	0·303
Albuminoid ammonia	0·07	0·005	0·9	0·063
Chlorine	11·4	0·8	69·	4·8
Temporary hardness	....	0·1	....	7·2
Permanent hardness	....	2·4	....	14·4
Total hardness	....	2·5	....	21·6

Sea Water. English Channel. In a thousand grains. Water 964·744 grs.; chloride of sodium 27·059; chloride of potassium 0·765; chloride of magnesium 3·667; bromide of magnesium 0·029; sulphate of magnesium 2·296; sulphate of calcium 1·407; carbonate of calcium 0·033. Total 1000 grs. (*Schweitzer.*) The proportion of chloride of sodium is from 36 to 37 parts in 1000 in the ocean, at a distance from land. Its amount is small in the interior of the Baltic. It is perceived that bromine is present in very minute amount; 100 pounds of sea water yielding only 3½ grs. of this element. According to Balard, iodine exists in the water of the Mediterranean; but it has not been detected in the water of the ocean, the bromine being supposed to mask its presence. Beside these ingredients, others are alleged to exist in minute proportion in sea water; as fluorine by Dr. G. Wilson; lead, copper, and silver by MM. Malaguti, Durocher, and Sarzeau; and iron and manganese by M. Uziglio. Anterior to Wilson's researches, Mr. Middleton and Prof. Silliman, jun., had inferred the existence of fluorine in sea water, from its presence in marine animals. The lead and copper above mentioned were found in certain fuci only; the silver in the sea water itself. The presence of silver in sea water has been rendered probable by Mr. F. Field, by a comparative analysis of the same copper sheathing, when new, and after having been on a vessel for many years. The old sheathing was always found to contain more silver than the new (*Chem. Gaz.*, March 2, 1857); and the observations of Mr. Field have been subsequently confirmed by others. Schweitzer's analysis gives a small proportion of carbonate of calcium; but Bibra could not detect any. Dr. John Davy's examinations of sea water show that carbonate of calcium does not exist at a great distance from land, except in very minute proportion, but becomes quite evident at a distance of from fifty to a hundred miles from coasts. Boric acid has been found by Mr. Veatch in the sea water on the coast of California. (See *A. J. P.*, 1860, p. 330.)*

Sea water, filtered, and charged with five times its volume of carbonic acid, forms,

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* The following analysis of sea water, taken at 2 leagues from Fécamp, on the coast of France, merits special notice from the care with which it was made, and the large quantity operated on. The sp. gr. was 1·026, at 57° F.

Gaseous Contents.	*In one kilog.* litres.	*In one litre.* litres.
Atmospheric air	0·0120	0·0123
Free carbonic acid	traces	traces
" sulphydric acid	traces	traces
Solid Contents.	grs.	grs.
Chloride of potassium	0·09763	0·10019
" sodium	26·09300	26·78913
" lithium	0·00042	0·00043
" ammonium	0·00178	0·00183
" magnesium	3·19300	3·27700
Iodide of sodium	0·00920	0·00944
Bromide of sodium	0·10605	0·10882
" magnesium	0·03084	0·03163
Sulphate of calcium	0·90170	0·92540
" potassium	0·00919	0·00943

Solid Contents.	*In one kilog.* grs.	*In one litre.* grs.
Sulphate of sodium	2·57250	2·64012
" magnesium	0·32736	0·33597
Phosphate of magnesium	0·00046	0·00047
" (ammoniaco-magnesian)	signs	signs
Carbonate of calcium	0·13600	0·13959
" magnesium	traces	traces
" iron	0·00021	0·00021
" manganese	signs	signs
Silicic acid	0·01420	0·01457
Organic matter	signs	signs.
Pure water	966·50646	991·91577
Total	1000·00000	1026·30000

(*Journ. de Pharm. et de Chim.*, 4e sér., i. 381, 1865.)

according to Pasquier, a gentle purgative, which keeps very well, and is not disagreeable to take. The dose is from half a pint to a pint.

By freezing, sea water is almost entirely freed from saline matter, the ice being nearly pure water. It is obvious that the unfrozen water contains much more than its ordinary proportion of salts; and this is one of the methods of concentrating this and other saline solutions.

Medical Properties of Water. Water is a remedy of great importance. When taken into the stomach, it acts by its temperature, by its bulk, and by being absorbed. When of the temperature of about 15·5° C. (60° F.), it gives no positive sensation either of heat or cold; between 15·5° C. (60° F.) and 7·2° C. (45° F.), it creates a cool sensation; and below 7·2° C. (45° F.), a decidedly cold one. Between 15·5° C. (60° F.) and 37·7° C. (100° F.), it relaxes the fibres of the stomach, and is apt to produce nausea, particularly if the effect of bulk be added to that of temperature. By its bulk and solvent powers, it allays irritation by diluting the acrid contents of the stomach and bowels, and favoring their final expulsion; and by its absorption, it promotes the secretion of urine and cutaneous transpiration.

Water, externally applied as a bath, is also an important remedy. It may act by its own specific effect as a liquid, or as a means of modifying the heat of the body. It acts in the latter way differently, according to the temperature at which it may be applied. When this is above 36·1° C. (97° F.), it constitutes the vapor or hot bath; when between 36·1° C. (97° F.) and 29·4° C. (85° F.), the warm bath; between 29·4° C. (85° F.) and 18·3° C. (65° F.), the tepid bath; and between 18·3° C. (65° F.) and 0° C. (32° F.), the cold bath.

The general action of the *vapor bath* is to accelerate the circulation, and produce profuse sweating. It acts locally on the skin, by softening and relaxing its texture. In stiffness of the joints, and in various diseases of the skin, it has often proved beneficial.

The *hot bath*, like the vapor bath, is decidedly stimulant. By its use the pulse becomes full and frequent, the veins turgid, the face flushed, the skin red, and the respiration quickened. If the temperature be high, and the constitution peculiar, its use is not without danger; as it is apt to produce a feeling of suffocation, violent throbbing in the temples, and vertigo with tendency to apoplexy. When it acts favorably, it produces profuse perspiration.

The *warm bath*, though below the animal heat, nevertheless produces a sensation of warmth; as its temperature is above that of the surface. It diminishes the frequency of the pulse, renders the respiration slower, lessens the heat of the body, and relaxes the skin. It cannot, therefore, be deemed a stimulant. By relieving certain diseased actions and states, accompanied by morbid irritability, it often acts as a soothing remedy, producing a disposition to sleep. It is proper in febrile exanthematous diseases, in which the pulse is frequent, the skin hot and dry, and the general condition characterized by restlessness. It is contraindicated in diseases of the head and chest.

The *tepid bath* is not calculated to have much modifying influence on the heat of the body. Its peculiar effects are to soften and cleanse the skin, and to promote insensible perspiration.

The *cold bath* acts differently according to its temperature and manner of application, and the condition of the system to which it is applied. When of low temperature and suddenly applied, it acts primarily as a stimulant, by the sudden and rapid manner in which the heat is abstracted; next as a tonic, by condensing the living fibres; and finally as a sedative. It is often useful in diseases of relaxation and debility, when practised by affusion or plunging. But it is essential to its efficacy and safety, that the stock of vitality should be sufficient to create, immediately after its use, those feelings of warmth and invigoration, included under the term reaction. In febrile diseases the use of the cold bath, as advocated by Currie, has been recently viewed with much success. For a discussion of this practice the reader is referred to the last edition of H. C. Wood's Treatise on Therapeutics.

Cold water is frequently applied as a sedative in local inflammations, and as a means of restraining hemorrhage. Its use, however, is scarcely admissible in inflammations of the chest.

Pharm. Uses. Water is used in a vast number of preparations, either as a menstruum, or as a means for promoting chemical action by its solvent power.

Off. Prep. Aqua Destillata.

CARBONIC ACID WATER, or *Soda Water* (so called), (*Aqua acidula simplicior*, F. P.; *Eau gazeuse simple*, Fr.; *Kohlensäure-Wasser*, G.), which was formerly officinal in the U. S. Pharmacopœia, consists of water highly charged with carbonic acid. Water is found to take up its volume of this gas under the pressure of the atmosphere; and Dr. Henry ascertained that precisely the same *volume* of the compressed gas is absorbed under a higher pressure. From this law, the bulk taken up is constant, the quantity being different in proportion as there is more or less driven into a given space. As the space occupied by a gas is inversely as the compressing force, it follows that the quantity of the acid forced into the water will be directly as the pressure. A double pressure will force a double quantity into a given space, and, therefore, cause a double quantity to be absorbed; a treble pressure will drive a treble quantity into the same space, and cause its absorption; and so on for higher pressures, the *bulk* of the *compressed* gas absorbed always remaining the same. From the principles above laid down it follows that, to saturate water with five times its volume of carbonic acid, as directed in the formula, it must be subjected to a pressure of five atmospheres.

Carbonic acid water is familiarly called in this country "*mineral water*," and "*soda water;*" the latter name, originally applied to the preparation when it contained carbonate of sodium, being from habit continued since the alkali has been omitted.

Carbonic acid water is dispensed in most of the pharmacies in this country. The fountain is usually placed in the cellar, and the tube proceeding from the fountain is made to pass through the floor and counter of the store, and to terminate in a draught tube, by means of which the carbonic acid water may be drawn off at pleasure. In order to have the liquid cool, the tube from the cellar generally terminates in a strong metallic vessel of convenient shape, or a series of block tin pipes called coolers, placed inside the counter apparatus, and surrounded with ice. For some practical suggestions upon the making of carbonic acid water and use of apparatus, see *N. R.*, June, July, August, 1877.

Properties. Carbonic acid water is a sparkling liquid, possessing an agreeable pungent, acidulous taste. It reddens litmus deeply from its state of concentration, and is precipitated by lime-water. Being impregnated with a large quantity of the acid gas under the influence of pressure, it effervesces strongly when freed from restraint. Hence, to preserve its briskness, it should be kept in strong well-corked bottles, placed inverted in a cool place. Several natural waters are of a similar nature; such as those of Seltzer, Spa, Pyrmont, Apollinaris, etc.; but the artificial water has the advantage of a stronger impregnation with the acid gas. Carbonic acid water should be made with every precaution to avoid metallic impurity. Hence the necessity of having the fountain well tinned on the inner surface. Even with this precaution, a slight metallic impregnation is not always avoided, especially in the winter season, when the water is less consumed as a drink, and, therefore, allowed to remain longer in the tubes and stop-cocks. Iron fountains lined with a hard enamel are greatly to be preferred, but the best fountains are now made of cast steel, lined with block tin. When leaden tubes are employed to convey the water, it is liable to be contaminated with this metal, which renders it deleterious. A case of colica pictonum was treated by Dr. Geo. B. Wood, arising from the daily use of the first draught of carbonic acid water from a fountain furnished with tubes of lead. Tubes of pure tin are free from objection, and should be exclusively used.

Copper fountains, well tinned, are liable to the objections that the tin lining wears away by use, and that there is no convenient means of inspecting the interior, owing to the solder joint, which permanently unites the two sections of the fountain. To remove the latter objection, the improvement has been proposed by Dr. R. O. Doremus, of New York, of having the two sections with flanges, securely bolted together, with intervening gutta-percha packing, in order to furnish facilities for examining the interior, to determine whether re-tinning is necessary. Sometimes drops of solder and chips of copper are carelessly left in the fountain, and form an additional source of danger. There can be no doubt that carbonic acid water is not unfrequently rendered poisonous by metallic impregnation. Dr. Doremus has proved, by a chemical examination, that lead and copper are sometimes present. (*A. J. P.*, 1854, p. 422; from the *Am. Med. Monthly.*) Dr. John T. Plummer, of Richmond, Ind., has found lead. The latter metal is detected by sulphuretted hydrogen, which gives with it a black precipitate, and copper by ferrocyanide of potassium, which causes a brown precipitate. In testing for copper, a few drops of the reagent should be added to a glass of the suspected water, placed on a sheet of white paper, when, if even a minute proportion of copper be present, a brownish discoloration will be seen, upon looking down through the liquid.

Medical Properties and Uses. Carbonic acid water is a grateful drink to febrile patients, allaying thirst, lessening nausea and gastric distress, and promoting the secretion of urine. The quantity taken need only be regulated by the reasonable wishes of the patient. It also forms a very convenient vehicle for the administration of magnesia, the carbonated alkalies, sulphate of magnesium, and the saline cathartics generally; rendering these medicines less unpleasant to the palate, and, in irritable states of the stomach, increasing the chances of their being retained. When used for this purpose, six or eight fluidounces (178–236 C.c.) will be sufficient.

AMMONIA. *Ammonia.*

NH_3; 17. (A̤M-MŌ′NI̤-A̤.) NH_3; 17.

All the ammoniacal compounds owe their distinctive properties to the presence of a peculiar gaseous substance, composed of nitrogen and hydrogen, called *ammonia.* This is most easily obtained by the action of lime on chloride of ammonium or sal ammoniac: when the lime unites with the hydrochloric acid, so as to form chloride of calcium and water, and expels the ammonia. It is transparent and colorless, like common air, but possesses an acrid taste, and exceedingly pungent smell. It has a powerful alkaline reaction, and, from this property and its gaseous nature, was called the *volatile alkali* by the earlier chemists. Its sp. gr. is 0·59. It is irrespirable, the glottis closing spasmodically when the attempt is made to breathe it. It consists of one atom of nitrogen 14, and 3 of hydrogen $3 = 17$; or, in volumes, of one volume of nitrogen and three volumes of hydrogen, condensed into two. Its formula is NH_3.

As the gas ammonia exists in the free state, the molecule NH_3 is a definite saturated compound under ordinary conditions. When, however, ammonia gas is mixed with hydrochloric acid gas or its aqueous solution with hydrochloric acid in solution, the two unite to form a new compound, NH_4Cl, which proves to be a definite compound, analogous to potassium or sodium chlorides. Berzelius, therefore, proposed to call this the chloride of *ammonium*, assuming that the monad group $(NH_4)^I$ acted like the monad metal K^I—in forming compounds. And in fact we find that when sulphuric, nitric, carbonic, and other acids are neutralized by *ammonia* gas or solution we get crystallizable salts like $(NH_4)_2SO_4$, NH_4NO_3 and $(NH_4)_2CO_3$, which we therefore call *ammonium* sulphate, nitrate, and carbonate respectively. These are very similar to the corresponding potassium and sodium salts.

The atmosphere contains a minute proportion of ammonia, probably in the state of carbonate. The alkali is sometimes also found in snow. (A. Vogel, *Neues Repert. für Pharm.*, 1872, p. 327.)

Ozonized oxygen oxidizes the elements of ammonia, producing water and nitric acid, which latter, by uniting with undecomposed ammonia, generates nitrate of ammonium. Ordinary oxygen, under the influence of platinum-black, or finely divided copper, likewise oxidizes the elements of ammonia, the nitrogen to the extent only of forming nitrous acid, with the result of producing nitrite of ammonium. (Schönbein, *Chem. Gaz.*, March 16, 1857.)

The following table contains a list of the principal officinal preparations of ammonia, with their synonyms.

I. IN AQUEOUS SOLUTION.

Aqua Ammoniæ Fortior, *U. S.;* Liquor Ammoniæ Fortior, *Br.*—*Stronger Water of Ammonia. Stronger Solution of Ammonia.*

Linimentum Camphoræ Compositum, *Br.*— *Compound Liniment of Camphor.*

Aqua Ammoniæ, *U.S.;* Liquor Ammoniæ, *Br.*— *Water of Ammonia. Solution of Ammonia.*

Hydrargyrum Ammoniatum, *U. S., Br.*— *Ammoniated Mercury. White Precipitate.*

AQUA AMMONIÆ. *U.S.* *Water of Ammonia.*

(Ā'QUẠ ẠM-MŌ'NỊ-Æ.)

"An aqueous solution of Ammonia [**NH_3; 17**—NH_3; 17], containing 10 per cent., by weight, of the gas." *U.S.*

Liquor Ammoniæ, *Br.;* Solution of Ammonia; Liquor Ammonii Caustici, *P.G.;* Spiritus Salis Ammoniaci Causticus, Ammonia Aqua Soluta; Ammoniaque liquide, Eau (Solution, Liqueur) d'Ammoniaque, *Fr.;* Salmiakgeist, Aetzammoniak, Ammoniak-Flüssigkeit, *G.*

The U. S. Pharmacopœia of 1880 omits a process for preparing Water of Ammonia, as it is rarely made by the pharmacist. The U. S. P. 1870 contained an excellent process, which is appended.*

"Take of Strong Solution of Ammonia *one pint* [Imperial measure]; Distilled Water *two pints* [Imp. meas.]. Mix, and preserve in a stoppered bottle. Sp. gr. 0·959." *Br.*

The title of this preparation was changed, at the revision of the U. S. Pharmacopœia in 1860, from Liquor Ammoniæ to Aqua Ammoniæ, that it might conform in name as well as character with the Waters, among which all the officinal preparations consisting of aqueous solutions of gaseous bodies are included.

The object of the process is to obtain a weak aqueous solution of the alkaline gas ammonia. In the U. S. P. 1870 process, the chloride of ammonium is decomposed by the superior affinity of the lime for its acid, ammonia is disengaged, and the lime, combining with the acid, forms chloride of calcium and water, $2NH_4Cl + Ca2HO = CaCl_2 + 2H_2O + 2NH_3$. The process differs from that of 1850 in introducing the materials into the retort with a large quantity of water, instead of in the dry state. In both cases the gas is driven over by heat, but in the moist plan is accompanied with more watery vapor than in the dry. If the object were to obtain the water of ammonia in the highest possible state of concentration, there might be some advantage in the dry method; but, as a weak solution is contemplated, the wet method is equally efficient, while in all respects it is more convenient, and productive of better results; for, according to Dr. Squibb, the water of ammonia made by the former officinal process has invariably an empyreumatic odor, from which that made by the present process is free. (*Proc. A. P. A.*, 1858, p. 407.) The receiver is intended to retain any water holding in solution undecomposed chloride, or the oily matter sometimes contained in the salt, as well as other impurities, which may be driven over by the heat while the pure gas passes forward into the bottle containing the distilled water, which should not fill it, on account of the increase in the bulk of the water during the absorption of the gas. The tube should extend to near the bottom of the bottle, and pass through a cork, loosely fitting its mouth. To prevent the regurgitation of the water from the bottle into the intermediate vessel, the latter should be furnished with a Welter's safety tube. Very large bottles are improper for keeping the water of ammonia; as, when they are partially empty, the atmospheric air within them may furnish a little carbonic acid to the ammonia.

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* "Take of Chloride of Ammonium, in small pieces, Lime, each, *twelve troyounces;* Water *six pints;* Distilled Water *a sufficient quantity.* Pour a pint of the Water upon the Lime, in a convenient vessel; and, after it has slaked, stir the mixture so as to bring it to the consistence of a smooth paste. Then add the remainder of the Water, and mix the whole thoroughly together. Decant the milky liquid from the gritty sediment into a glass retort, of the capacity of sixteen pints, and add the Chloride of Ammonium. Place the retort on a sand-bath, and adapt to it a receiver, previously connected with a two-pint bottle, by means of a glass tube, reaching nearly to the bottom of the bottle, and containing a pint of Distilled Water. Surround the bottle with ice-cold water; and apply heat, gradually increased, until ammonia ceases to come over. Remove the liquid from the bottle, and add to it sufficient Distilled Water to raise its specific gravity to 0·960. Lastly, keep the liquid in small bottles, well stopped." *U.S.*

In preparing solution of ammonia, equal weights of chloride of ammonium and lime are used for generating the gaseous ammonia. This proportion gives a great excess of lime, compared with the quantity required if determined by the molecular weights; but in practice it is found advantageous to have an excess, as well to insure the full decomposition of the chloride of ammonium, as to make up for accidental impurities in the lime.

The British Pharmacopœia gives directions for diluting *Liquor Ammoniæ Fortior*, so as to reduce it to the strength of *Liquor Ammoniæ.* This is effected by mixing one measure of their stronger preparation with two measures of distilled water.

Properties. Water of ammonia is "a colorless, transparent liquid, of a very pungent odor, and acrid alkaline taste, and a strongly alkaline reaction. Sp. gr. is 0·959 at 15° C. (59° F.). It is completely volatilized by the heat of a water-bath. On bringing a glass rod dipped into hydrochloric acid near the liquid, dense, white fumes are evolved. On supersaturating Water of Ammonia with diluted sulphuric acid, no empyreumatic odor should be developed. Water of Ammonia should remain clear, or be at most only faintly clouded, when mixed with five times its volume of lime-water (only minute traces of carbonic acid). When supersaturated with nitric acid, the liquid should remain clear on the addition of test-solution of chloride of barium (sulphate) or of nitrate of silver (chloride). Either before or after neutralization with nitric acid, it should not be affected by hydrosulphuric acid (metallic impurities). Test-solution of oxalate of ammonia should produce no cloudiness (calcium). To neutralize 8·5 grammes (or 8·9 C.c.) of Water of Ammonia should require 50 C.c. of the volumetric solution of oxalic acid. Water of Ammonia should be kept in glass-stoppered bottles, in a cool place." *U. S.* Of the British preparation, "85 grains by weight require for neutralization 500 grain-measures of the volumetric solution of oxalic acid, corresponding to 10 per cent. by weight of ammonia, NH_3. One fluidrachm contains 5·2 grains of ammonia." *Br.*

Water of Ammonia is incompatible with acids, and with acidulous and many earthy and metallic salts; but it does not decompose the salts of lime, baryta, or strontia, and only partially decomposes those of magnesia. Commercial solution of ammonia sometimes contains *pyrrol*, *naphthalene*, and other soluble impurities. These may be detected by the solution being reddened by nitric acid, and, after having been supersaturated with hydrochloric acid, by its tingeing a slip of fir wood of a rich purple color, characteristic of pyrrol. (*Maclagan.*) The source of these impurities is coal-gas liquor, from which the ammoniacal compounds are largely obtained. Donath (*Dingler's Polytechnisches Journal*, vol. iv. p. 229) tested some ammonia prepared from gas liquor by neutralizing with diluted sulphuric acid, when the liquid assumed a rose color, and a solution of the sulphate emitted the characteristic odor of naphthalene.

Composition. Water is capable of absorbing 670 times its volume of ammoniacal gas at 10° C. (50° F.), and increases in bulk about two-thirds. But the officinal solution of ammonia is by no means a saturated one. Thus, the ammonia contained in the U. S. preparation is about 10 per cent. The following table gives the percentage of ammoniacal gas in aqueous solutions of different densities at the temperature of 14° C. (57·2° F.). (Carius, *Annal. Ch. Pharm.*, xcix. 164.)

Ammonia per cent.	Specific Gravity.	Ammonia per cent.	Specific Gravity.	Ammonia per cent.	Specific Gravity.	Ammonia per cent.	Specific Gravity.
1	0·9959	10	0·9593	19	0·9283	28	0·9026
2	0·9915	11	0·9556	20	0·9251	29	0·9001
3	0·9873	12	0·9520	21	0·9221	30	0·8976
4	0·9831	13	0·9484	22	0·9191	31	0·8953
5	0·9790	14	0·9449	23	0·9162	32	0·8929
6	0·9749	15	0·9414	24	0·9133	33	0·8907
7	0·9709	16	0·9380	25	0·9106	34	0·8885
8	0·9670	17	0·9347	26	0·9078	35	0·8864
9	0·9631	18	0·9314	27	0·9052	36	0·8844

Medical Properties and Uses. When brought into contact with living tissue, ammonia acts as a stimulant, irritant, or caustic, according to the strength of its solution. When applied to the skin it may excite simply burning pain and redness, but in the form even of the present preparation, if the contact be sufficiently maintained, it is capable of destroying the whole dermal tissue; taken internally in a concentrated form it acts as a violent corrosive poison, and may cause rapidly fatal gastro-enteritis, with the destruction of the visceral coats. In some cases it has produced death in a few minutes by entering the larynx and causing œdema, with consequent suffocation. When taken internally in therapeutic doses its action is immediate, and continues but for a few moments. In the stomach it acts as a stimulant antacid, and is often useful in heartburn, sick headache, etc. After absorption it stimulates most powerfully the circulation and respiration, affecting especially the heart and respiratory centres. By full doses the respiratory rate and the arterial pressure are for a few moments enormously increased. Toxic doses are directly paralyzant to the heart muscle, and may cause, if injected into a vein, immediate diastolic arrest of the heart. According to the researches of Bence Jones, ammonia is oxidized in the system with the formation of nitric acid, which is eliminated by the kidneys.

Water of ammonia is a valuable remedy in all forms of sudden syncope. The injection of ammonia into a vein was brought forward by Prof. G. B. Halford, of Melbourne, as a specific against the poison of serpents, and some evidence has been adduced as to its value. As long ago, however, as 1782, Fontana published at Florence a series of experiments showing the uselessness of such injections as a remedy for snake-bite, and recently the subject has been investigated in India by Sir Joseph Fayrer (*Indian Annals Med. Sci.*, 1872), and by a Royal Commission (*Lancet*, Sept. 1874), with the result of completely establishing the truth of the experiments and conclusions of Fontana. In collapse following severe accident, or in sudden cardiac failure from other acute cause, the intravenous injection of aqua ammoniæ has been of the greatest service in arousing the action of the heart. Half a drachm to a drachm diluted in half an ounce to an ounce of water may be slowly thrown directly into a vein. In some cases the drug has been simply used hypodermically, but is almost certain to cause severe local symptoms. On account of its cheapness it is much used as an ingredient in liniments, especially combined with olive or other oil. The internal dose is from ten to thirty drops (0·6–1·9 C.c.), largely diluted.

Pharm. Uses. To prepare Aconitia, *Br.;* Ammonii Chloridum Purificatum, *U. S.;* Antimonii Oxidum, *U. S.;* Beberiæ Sulphas, *Br.;* Calcis Phosphas, *Br.;* Digitalinum, *U. S.*, *Br.;* Ferri et Quiniæ Citras; Ferri Oxidum Hydratum, *U. S.;* Ferri Pyrophosphas, *U. S.;* Liquor Bismuthi et Ammoniæ Citratis, *Br.;* Liquor Ferri Citratis, *U. S.;* Morphiæ Acetas, *Br.;* Morphiæ Hydrochloras, *Br.;* Santoninum, *Br.*

Off. Prep. Ammoniæ Benzoas, *Br.;* Ammonii Benzoas, *U. S.;* Ammonii Bromidum, *U. S.;* Ferri et Ammonii Citras, *U.S.;* Ferri et Ammoniæ Citras, *Br.;* Hydrargyrum Ammoniatum; Linimentum Ammoniæ; Linimentum Hydrargyri, *Br.;* Spiritus Ammoniæ Aromaticus, *U. S.*

AQUA AMMONIÆ FORTIOR. *U. S.* *Stronger Water of Ammonia.*

(Ā′QUẠ ẠM-MŌ′NỊ-Æ FÖR′TỊ-ỌR.)

"An aqueous solution of ammonia [$\mathbf{\dot{N}H_3}$; **17**—$\dot{N}H_3$; 17], containing 28 per cent., by weight, of the gas." *U. S.* "Ammoniacal gas, NH_3, dissolved in water, and constituting 32·5 per cent. of the solution." *Br.*

Liquor Ammoniæ Fortior, *Br.* Strong Solution of Ammonia. Eau d'Ammoniaque forte, *Fr.;* Starker Salmiakgeist, *G.*

This preparation is too strong for internal exhibition, but forms a convenient ammoniacal solution for reduction, by dilution with one and a half measures of distilled water (two measures British preparation), to the strength of ordinary officinal Water of Ammonia (Aqua Ammoniæ), or for preparing strong rubefacient and vesicating lotions and liniments.

The U. S. Pharmacopœia does not give a process; but in the British, the following formula is given for its preparation.

"Take of Chloride of Ammonium, in coarse powder, *three pounds* [avoirdupois]; Slaked Lime *four pounds* [av.]; Distilled Water *thirty-two fluidounces.* Mix the Lime with the Chloride of Ammonium, and introduce the mixture into an iron bottle, placed in a metal pot surrounded by sand. Connect the iron tube, which screws air-tight into the bottle, in the usual manner, by corks, glass tubes, and caoutchouc collars, with a Woulf's bottle capable of holding a pint [Imperial measure]; connect this with a second Woulf's bottle of the same size, the second bottle with a matrass of the capacity of three pints [Imp. meas.], in which twenty-two [fluid]ounces of the Distilled Water are placed, and the matrass, by means of a tube bent twice at right angles, with an ordinary bottle containing the remaining ten [fluid]ounces of Distilled Water. Bottles 1 and 2 are empty, and the latter and the matrass which contains the twenty-two ounces of distilled water are furnished each with a siphon safety tube, charged with a very short column of mercury. The heat of a fire, which should be very gradually raised, is now to be applied to the metal pot, and continued until bubbles of condensible gas cease to escape from the extremity of the glass tube which dips into the water of the matrass. The process being terminated, the matrass will contain about forty-three fluidounces of the Strong Solution of Ammonia.

"Bottles 1 and 2 will now include, the first about sixteen, the second about ten fluidounces of a colored ammoniacal liquid. Place this in a flask closed by a cork, which should be perforated by a siphon safety tube containing a little mercury, and also by a second tube bent twice at right angles, and made to pass to the bottom of the terminal bottle used in the preceding process. Apply heat to the flask until the colored liquid it contains is reduced to three-fourths of its original bulk. The product now contained in the terminal bottle will be nearly of the strength of Solution of Ammonia, and may be made exactly so by the addition of the proper quantity of Distilled Water, or of Strong Solution of Ammonia." *Br.*

In this process the ammonia is disengaged in the usual manner from chloride of ammonium by the action of lime, as explained under the head of *Aqua Ammoniæ.* But it is perceived, by the details of the process, that the purpose is to obtain both the *stronger* and *ordinary* solution of ammonia at one operation. This is done by connecting the iron bottle containing the materials with a series of four receivers, the first two being empty Woulf's bottles, the third a matrass containing twenty-two fluidounces of distilled water, and the fourth an ordinary bottle containing the remainder of the distilled water. In the first two bottles, impurities are condensed with a considerable portion of ammonia; in the matrass, the officinal Strong Solution of Ammonia (*Br.*) has been formed by the absorption of the gas; and, in the fourth, a weaker ammoniacal liquid is formed by the absorption of a portion of the gas which has passed through the matrass unabsorbed. This last liquid is raised to the strength of the officinal Solution of Ammonia (*Br.*) by forcing into it a portion of ammoniacal gas from the impure contents of the first two bottles. We presume that the receivers are to be kept cool by means of cold water or ice, though no such direction is given in the process. If the solution in the fourth bottle be not of the required officinal strength (sp. gr. 0·959), it may be made so by the addition of stronger solution from the matrass, if too weak, or of distilled water, if too strong.

Water of Ammonia is seldom made by the formula of the Pharmacopœia, but is prepared on a large scale, from one of the products of the coal-gas manufacture, by the following more economical process. *Gas liquor* is distilled, and the distillate, which is principally sulphide of ammonium, is converted into sulphate of ammonium by sulphuric acid. The rough sulphate is then gently distilled with milk of lime, the still being connected with a series of glass carboys, arranged like Woulf's bottles, and three-fourths filled with distilled water. In this way solution of ammonia may be obtained of maximum strength. (See *A. J. P.*, 1855, p. 362.)

Properties of Aqueous Ammonia of Maximum Strength. This is a colorless liquid, of an acrid taste, and very pungent smell. It is strongly alkaline, and immediately changes turmeric, when held over its fumes, to reddish brown. Cooled to 40° F. below zero, it concretes into a gelatinous mass, and at 54° C. (130° F.) boils, owing to the rapid disengagement of the gas. Its sp. gr. is 0·875 at 10° C.

(50° F.). Anhydrous ammonia is said to dissolve metallic sodium, and the solution is intensely blue. (*Chem. News*, Nov. 4, 1870, p. 217.)

Properties of the Officinal Stronger Water of Ammonia. This has similar properties to those above mentioned. Its sp. gr. is 0·900, *U. S.*, 0·891, *Br.* When of the former density, it contains 28 per cent. of the gas, when of the latter 32·5 per cent. "To neutralize 3·4 Gm. (or 3·9 C.c.) of Stronger Water of Ammonia should require 56 C.c. of the volumetric solution of oxalic acid." *U. S.* "By weight, 52·3 grains require for neutralization 1000 grain-measures of the volumetric solution of oxalic acid. One fluidrachm contains 15·83 grains of Ammonia, NH_3." *Br.* The stronger water of ammonia of commerce usually ranges in density from 0·900 to 0·920. Even when of proper officinal strength at first, it generally becomes weaker by the escape of ammonia. To prevent its deteriorating, it should be kept in closely-stopped bottles in a cool place. If precipitated by lime-water, it contains carbonic acid. After having been saturated with nitric acid, a precipitate by carbonate of ammonium indicates earthy impurity, by nitrate of silver, a chloride, and by chloride of barium, a sulphate. "When diluted with four times its volume of distilled water, it does not give precipitates with solution of lime, oxalate of ammonia, sulphide of ammonium, or ammonio-sulphate of copper" (*Br.*); indicating the absence of carbonates, lime, metals, and sulphides.

When purchasing the Stronger Solution of Ammonia, the apothecary should not trust to its being of the officinal strength; but should ascertain the point by taking its density, either by the specific gravity bottle or the hydrometer. Another method of ascertaining its density is by the *ammonia-meter* of Mr. J. J. Griffin, of London, described and figured in *P. J. Tr.* (x. 413). In reducing it to make Aqua Ammoniæ, the same precaution should be taken; and, if the mixture should not have the sp. gr. 0·959, it should be brought to that density by the addition either of the stronger solution or of distilled water, as the case may require. "Stronger Water of Ammonia should be kept in strong glass-stoppered bottles, not completely filled, in a cool place." *U. S.*

Medical Properties and Uses. This solution is too strong for medical use in its unmixed state. Sufficiently diluted with spirit of camphor and rosemary, it has been much employed as a prompt and powerful rubefacient, vesicatory, or escharotic, in various neuralgic, gouty, rheumatic, spasmodic, and inflammatory affections, in which strong and speedy counter-irritation is indicated. When mere rubefaction is desired, a mixture may be used composed of five fluidounces of the ammoniacal liquid and eight of the diluent liquid; and this will answer even for blistering or cauterizing, unless a very prompt effect is necessary. In the latter case, a lotion may be resorted to consisting of five measures of the ammoniacal to three of the diluent liquid. These mixtures are applied by means of linen folded several times, or a thick piece of flannel saturated with the liniment. A convenient mode is to fill the wooden cover of a large pill or ointment box, an inch or two in diameter, with patent lint, saturate this with the liquid, and press it upon the part. The ammonia is thus prevented from escaping, and a definite boundary given to the inflammation. The application will generally produce rubefaction in from one to eight minutes, vesication in from three to ten minutes, and a caustic effect in a somewhat longer time.

When a solution of ammonia of 25° (sp. gr. 0·905) is mixed with fatty matter, the mixture forms the *vesicating ammoniacal ointment* of Dr. Gondret. The revised formula of this ointment is as follows. Take of lard 32 parts, oil of sweet almonds 2 parts. Melt them together by the *gentle* heat of a candle or lamp, and pour the melted mixture into a bottle with a wide mouth. Then add 17 parts of solution of ammonia of 25°, and mix, with continued agitation, until the whole is cold. The ointment must be preserved in a bottle with a ground stopper, and kept in a cool place. When well prepared, it vesicates in ten minutes. There may be danger of excessive irritation and inflammation of the nostrils, mouth, and air-passages, from the inadvertent inhalation of the gas escaping from a bottle of the stronger water of ammonia, when freshly opened; and serious consequences have occurred from this cause, or the accidental breaking of the bottle. The best antidote, under these circumstances, would be the inhalation of the vapors of vinegar or acetic acid.

Off. Prep. Ammoniæ Phosphas, *Br.;* Linimentum Camphoræ Compositum, *Br.;* Liquor Ammoniæ, *Br.;* Liquor Ammoniæ Citratis, *Br.;* Liquor Bismuthi et Ammoniæ Citratis, *Br.;* Spiritus Ammoniæ Aromaticus, *Br.;* Spiritus Ammoniæ Fœtidus, *Br.;* Tinctura Opii Ammoniata, *Br.*

AQUA AMYGDALÆ AMARÆ. *U.S.* *Bitter Almond Water.*

(Ā'QUA̤ A̤-MY̆G'DA̤-LÆ A̤-MĀ'RÆ.)

Aqua Amygdalarum Amararum, *P.G.;* Eau d'Amandes amères, *Fr.;* Bittermandelwasser, *G.*

"Oil of Bitter Almonds, *one part* [or fifteen minims]; Distilled Water, *nine hundred and ninety-nine parts* [or two pints], To make *one thousand parts* [or two pints]. Dissolve the Oil in the Distilled Water, and filter through a well-wetted filter." *U. S.*

This preparation has the effects of hydrocyanic acid on the system, and may be used as a vehicle for other medicines in nervous coughs, and various spasmodic affections. It is, however, liable to spontaneous change, and is consequently more or less uncertain. A drop of sulphuric acid added to a pint of it will contribute to its preservation; as will also complete exclusion from the light and air. But the better plan is to prepare it in small quantities, as wanted for use. The dose of it, to begin with, when of full strength, should not be more than two teaspoonfuls (7·5 C.c.). Its principal use in this country is as a vehicle, many physicians prescribing it not for its medicinal virtues, but on account of its agreeable taste and powers of masking the taste of saline substances; in using it care must be exercised not to exceed the proper dose. Under the same name, a preparation has been much used on the continent of Europe, prepared by distilling bitter almonds with water.* This when fresh is much stronger than the preparation of the U. S. Pharmacopœia, containing, according to an analysis of Geiger, in 1000 parts, 1·2 parts of anhydrous hydrocyanic acid. But, in consequence either of circumstances in the manner of its preparation, or of changes upon being kept, it is of variable and uncertain strength, and cannot be relied on.† It has been prescribed with fatal effects; and the greatest caution, therefore, should be observed by the apothecary not to put up the distilled water instead of the officinal.

AQUA ANETHI. *Br.* *Dill Water.*

(Ā'QUA̤ A̤-NĒ'THĪ.)

Eau d'Aneth, *Fr.;* Dillwasser, *G.*

"Take of Dill Fruit, bruised, *one pound* [avoirdupois]; Water *two gallons* [Imperial measure]. Distil *one gallon* [Imp. meas.]." *Br.*

This water, which is frequently prescribed in Great Britain, is occasionally used here; it closely resembles caraway water, over which it has no advantages.

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* *Preparation of Bitter Almond Water* (Distilled). H. C. Vielhaber powders ten pounds bitter almonds as finely as possible, separates the fatty oil, which usually amounts to 36 to 38 per cent., by strong pressure, and reduces the almond press-cake to a very fine powder; a quantity of this corresponding to two pounds of almonds is then distilled with water (without alcohol) until about 500 grammes of distillate have been obtained, when the receiver is disconnected, another receiver attached, and the distillation continued as long as the presence of hydrocyanic acid can be recognized by its odor and taste in the distillate; this second distillate is then used in the place of distilled water for distilling another two-pound lot of the almonds, and the operation continued thus, always collecting the first and second distillates separately and utilizing the latter for distilling the next lot, until all the press-cake has been subjected to distillation; the first distillates are mixed, and also the second. The author thus obtained from 10 pounds of almonds about 5 pounds of first and 9 to 10 pounds of second distillate, the former containing a large percentage of volatile almond oil, which is dissolved by adding the officinal (Ph. Germ.) percentage of alcohol (about $\frac{1}{4}$ of its weight) to the distillate. The percentage of hydrocyanic acid is then determined in the first and second distillates, and sufficient of the latter added to the former to reduce it to the officinal strength (one-tenth of one per cent.). (*Archiv d. Pharm.*, May, 1879, p. 409; *A. J. P.*, July, 1879.) G. A. Zwick prepares distilled bitter almond water by breaking up 12 pounds peach kernels in a mill, then powdering finely, expressing 25 per cent. of fixed oil, powdering the press-cake, introducing this into a still, with water, reserving the first forty fluidounces of distillate, this having been shown by assay to contain the proper amount of hydrocyanic acid, one per mille. (*A. J. P.*, 1881.)

† For a method of determining the amount of hydrocyanic acid in bitter almond water, see *Archiv d. Pharm.*, Nov. 1878, p. 408; *A. J. P.*, Feb. 1879.

AQUA ANISI. *U. S.* *Anise Water.*

(Ā′QUẠ Ạ-NĪ′SĪ.)

Eau d'Anis, *Fr.;* Aniswasser, *G.*

"Oil of Anise, *two parts* [or thirty minims]; Cotton, *four parts* [or sixty grains]; Distilled Water, *a sufficient quantity*, To make *one thousand parts* [or two pints]. Add the Oil to the Cotton, in small portions at a time, distributing it thoroughly by picking the Cotton apart after each addition; then pack it firmly in a conical percolator, and gradually pour on Distilled Water, until *one thousand parts* [or two pints] of percolate are obtained." *U. S.*

Anise water is rarely made by distillation, although the product thus secured has a more delicate flavor than the officinal preparation. The U. S. P. 1870, in one of its processes, directed ten troyounces of anise seed in coarse powder to be mixed with sixteen pints of water, and eight pints of distillate to be collected.

This water is used solely as a vehicle.

AQUA AURANTII FLORUM. *U. S.* *Orange Flower Water.*

(Ā′QUẠ ÂU-RĂN′TỊ-Ī FLŌ′RŬM—âu-răn′shẹ-ī.)

Aqua Aurantii Floris, *Br.;* Orange Flower Water; Aqua Florum Naphæ; Eau (Hydrolat) distillée de Fleurs d'Oranger, Eau de Naphe, *Fr.;* Orangenblüthenwasser, *G.*

"Recent Orange Flowers, *forty parts* [or fifty-four ounces av.]; Water, *two hundred parts* [or sixteen pints], To make *one hundred parts.* Mix them, and, by means of steam, distil *one hundred parts* [or eight pints]. Keep the product in well-stopped bottles, excluded from light." *U. S.*

This preparation is considered by the British Pharmacopœia as an object of importation. According to this authority, it is obtained indiscriminately from the flowers of the bitter and those of the sweet orange tree; and the same is the case with our own officinal standard; though, in Italy and France, where it is largely made, the flowers of the bitter orange are preferred, as yielding the most fragrant product. It may be prepared in the most southern districts of our country from the fresh flowers; and these might be brought to the North for the same purpose, if previously incorporated with one-third or one-quarter of their weight of common salt. The proper method is to arrange the flowers and salt in successive layers in jars of stoneware or glass. They may also be preserved by means of glycerin. Notwithstanding, however, the facility of preparing this Water here, it is generally imported from the south of France, whence it usually comes in cans of tinned copper.

Orange flower water is nearly colorless, though often of a pale yellowish tint. "Orange Flower Water should remain unaffected by hydrosulphuric acid or sulphide of ammonium (metallic impurities), and should not be mucilaginous." *U. S.* From being kept in tinned copper cans, it sometimes contains metallic impurity, which is said to be chiefly carbonate of lead, derived from the lead used as a solder in making the cans. The means of detecting metallic impurity are mentioned under the general observations on distilled waters. Much color, offensive odor, or mouldiness indicates impurity derived from the flowers in distillation.

L. Malenfant observed that fresh orange flowers, mixed with cold water, yield, on distillation over the naked fire, a milky water, possessing a somewhat empyreumatic odor and a strong, somewhat acrid taste. Kept for twelve or eighteen months in glass vessels covered with parchment, it loses its empyreuma, and after filtering has an agreeable odor and taste. If the flowers be mixed with boiling water and immediately distilled, the water is limpid, and gradually separates some thick oil of a brownish color; the water has the odor and taste of the flowers, but complicated with a still smell (*goût de feu*), which it loses after long keeping; it seems to alter less rapidly than that obtained by the former process. Distilled by steam a limpid water of a pure odor and taste is at once obtained, free from empyreuma; it may be at once used, and keeps better in the light than when obtained by the two former processes. (*A. J. P.*, June, 1874.) A distilled water of the leaves is also prepared; and sometimes a mixture of the leaves and flowers is employed. But this is a fraud, as the distilled water of the leaves never has the sweet perfume of that of the flowers. (*Journ. de Pharm.*, 4e sér., iii. 249.) Orange flower water is used exclusively on account of its agreeable odor; though it may possess slight powers as a nervous stimulant.

Nitric, sulphuric, or hydrochloric acid produces a red coloration with orange flower water: particularly if the water be shaken with ether to take up the oil and the acid added to the ethereal solution. (*P. J. Tr.*, 1878, p. 248.)

Off. Prep. Syrupus Aurantii Florum, *U. S.;* Syrupus Aurantii Floris, *Br.;* Trochisci Santonini, *Br.*

AQUA CAMPHORÆ. *U.S., Br.* *Camphor Water.*

(Ā'QUA̤ CĂM'PHO̤-RÆ.)

Aqua Camphorata; Eau camphrée, *Fr.;* Kampferwasser, *G.*

"Camphor, *eight parts* [or one hundred and sixteen grains]; Alcohol, *sixteen parts* [half a fluidounce]; Cotton, *sixteen parts* [half an ounce av.]; Distilled Water, *a sufficient quantity,* To make *one thousand parts* [two pints]. Dissolve the Camphor in the Alcohol, and add the solution to the Cotton, in small portions at a time, distributing it thoroughly by picking the Cotton apart after each addition. Expose the Cotton to the air until the Alcohol has nearly evaporated; then pack it firmly in a conical percolator, and gradually pour on Distilled Water, until *one thousand parts* [or two pints] of percolate are obtained." *U. S.*

"Take of Camphor, broken into pieces, *half an ounce* [avoirdupois]; Distilled Water *one gallon* [Imperial measure]. Enclose the camphor in a muslin bag, and attach this to one end of a glass rod, by means of which it may be kept at the bottom of a bottle containing the Distilled Water, the other end of the rod terminating just below the stopper of the bottle. Having thus put the Camphor into the Water, close the mouth of the bottle for at least two days, and then pour off the solution when it is required." *Br.*

In these processes the object is to effect a solution of the camphor. Water is capable of dissolving but a small proportion of this principle; but the quantity varies with the method employed. The present officinal process is an improvement on former methods, for it undoubtedly secures a saturated solution. The process of U. S. Pharm. 1870, notwithstanding an ordinary amount of care, usually left considerable camphor on the filter not in a finely divided state, and the water passed through not fully saturated. This defect could have been largely overcome by allowing the milky mixture to stand twenty-four hours with occasional agitation before filtering; the present process, however, makes sure of the fine division of the camphor by forming an alcoholic solution, and then securing the distribution of the camphor through the cotton. The present British process is still more inefficient than the old formulas of the different Colleges for their *Mistura Camphoræ,* which has received in the late revision a much more appropriate name. In the present British process no trouble is taken even to comminute the camphor, or to shake it with the water, which is thus allowed to take up what it may be disposed to do by contact with the camphor contained in a bag; though some ingenuity is exhibited in retaining the latter, which is lighter than water, beneath the surface of the liquid by means of a glass rod. The solution thus effected must be extremely feeble, containing probably less than one part in a thousand, which, according to Berzelius, is taken up by water when triturated with camphor. It is besides of uncertain strength, varying with the size of the fragments of camphor. Mr. J. C. Pooley found that 120 grains of camphor, treated according to the officinal directions, gave, when cut into 4 pieces, 6 grains to half a gallon of water, but in 20 pieces gave 20 grains, or about one part to 1750 of water. (*P. J. Tr.*, 2d ser., vii. 162.) The U. S. process is much preferable to the British, as it affords a permanent solution, of sufficient strength to be employed with a view to the influence of the camphor on the system; while the other has little more than the flavor of the narcotic, and is fit only for a vehicle of other medicines. Mr. Wm. B. Addington proposed to add to the camphor just enough alcohol to dissolve it, and triturate the liquor with magnesia, during which process he affirmed that the alcohol evaporated (*A. J. P.*, xlv. 209); and Mr. F. T. Hartzell substituted for alcohol, ether, a few drops of which enabled him to bring the camphor to an impalpable powder. (*Ibid.*, xlvi. 233.) The camphor is separated from its aqueous solution by a solution of pure potassa, and, according to Dr. Paris, by sulphate of magnesium and several other salts. Sir J. Murray proposes a solution of camphor and bicarbonate of magnesium, which contains three grains of the former and six grains of the latter in each fluidounce.

Camphor water has this advantage over camphor in substance, that the latter is with difficulty dissolved by the liquors of the stomach; but it is too feeble a preparation for use when a decided effect is desired. It is usually given in the dose of one or two tablespoonfuls (15–30 C.c.), repeated every hour or two hours.

AQUA CARUI. *Br.* *Caraway Water.*

(Ā′QUẠ CĂR′Ú-Ī.)

Aqua Carvi; Eau distillée de Carvi, *Fr.;* Kümmelwasser, *G.*

"Take of Caraway Fruit, bruised, *one pound* [avoirdupois]; Water, *two gallons* [Imp. meas.]. Distil one gallon [Imp. meas.]." *Br.*

Distilled Caraway Water has the flavor of the fruit or seeds, but is seldom used in the United States. It is usually made from the volatile oil (15 minims in a pint), in the same manner as is cinnamon water.

AQUA CHLORI. *U.S.* *Chlorine Water.*

(Ā′QUẠ ȻHLŌ′RĪ.)

"An aqueous solution of Chlorine [**Cl; 35·4**—Cl; 35·4], containing at least 0·4 per cent. of the gas." *U.S.*

Liquor Chlori, *Br.;* Solution of Chlorine; Aqua Chlorata, *P. G.;* Aqua Chlori, Chlorum Solutum, Aqua Oxymuriatica; Eau chlorée, Chlore liquide, *Fr.;* Chlorwasser, *G.;* Aqua Chlorini, *Phar.* 1870.

"Black Oxide of Manganese, *ten parts* [or eighty grains]; Hydrochloric Acid, *forty parts* [or five fluidrachms]; Water, *seventy-five parts* [or ten fluidrachms]; Distilled Water, *four hundred parts* [or seven fluidounces]. Place the Oxide in a flask, add the Acid previously diluted with *twenty-five parts* [or three and a half fluidrachms] of Water, and apply a gentle heat. Conduct the generated Chlorine, by suitable tubes, through the remainder of the Water contained in a small wash-bottle, to the bottom of a bottle having the capacity of *one thousand parts* [or one pint], into which the Distilled Water has been introduced, the neck of which is loosely stopped with cotton, and which is to be kept, during the operation, at a temperature of about 10° C. (50° F.). When the air has been entirely displaced by the gas, disconnect the bottle from the apparatus, and, having inserted the stopper, shake the bottle, loosening the stopper from time to time, until the gas ceases to be absorbed. If necessary, reconnect the bottle with the apparatus, and continue passing the gas and agitating, until the Distilled Water is saturated. Finally, pour the Chlorine Water into dark amber-colored, glass-stoppered bottles, which must be completely filled therewith, and keep them in a dark and cool place." *U. S.*

"Take of Hydrochloric Acid *six fluidounces* [Imperial measure]; Black Oxide of Manganese, in fine powder, *one ounce* [avoirdupois]; Distilled Water *thirty-four fluidounces* [Imp. meas.]. Put the Oxide of Manganese into a gas-bottle, and, having poured upon it the Hydrochloric Acid diluted with two [fluid]ounces of the Water, apply a gentle heat, and, by suitable tubes, cause the gas, as it is developed, to pass through two [fluid]ounces of the Water placed in an intermediate small phial, and thence to the bottom of a three-pint bottle containing the remainder of the water, the mouth of which is loosely plugged with tow. As soon as the chlorine ceases to be developed, let the bottle be disconnected from the apparatus in which the gas has been generated, corked loosely, and shaken until the chlorine is absorbed. Lastly, introduce the solution into a green glass bottle furnished with a well-fitting stopper, and keep it in a cool and dark place." *Br.*

The U. S. and Br. processes are essentially the same. Both are intended to make saturated solutions of chlorine in water. The only material variation in the British formula is the larger proportion of the black oxide of manganese and hydrochloric acid, to the distilled water. The British process differs in directing the disconnection of the apparatus for generating the gas, as soon as it ceases to be produced, instead of after the air in the receiving bottle has been displaced by it. This is a practical improvement which should have been adopted in the U. S. process. Should there be any danger of deficiency of chlorine in the resulting chlorine water, the British process would have the advantage, as it uses not only a larger proportion of the materials for making the gas, but exhausts them.

In both processes, the chlorine gas is extricated from the hydrochloric acid by the black oxide of manganese,* whilst the chloride of manganese and water produced remain in the flask, and the chlorine is passed, through an intermediate vessel containing a little water for purifying it, into the bottle containing the distilled water, loosely stopped, until the vacant part of the bottle is filled with it to the exclusion of the atmospheric air. $MnO_2 + 4HCl = MnCl_2 + Cl_2 + 2H_2O$. The bottle being then corked, is shaken so as to cause the absorption of the gas by the water. Of course the stopper must be from time to time loosened, in order to allow the entrance of air to supply the partial vacuum created by the absorption of the chlorine. The chlorine water is directed to be kept secluded from the light, because otherwise it would be apt to be converted partially into hydrochloric acid, through the union of the chlorine with the hydrogen of the water. In the Br. Pharmacopœia it is ordered to be kept in a green glass bottle, for the purpose, probably, of protecting it from the light; but experiments have shown that it is an orange, and not a green color, which appears to prevent the passage of the chemical rays.†

An extemporaneous chlorine water, containing chloride of potassium and free hydrochloric acid, not more than twenty-four and twelve grains respectively to the pint, may be made as follows. Put in a bottle forty grains of chlorate of potassium, add one-half troyounce of hydrochloric acid. When the bottle begins to be filled with chlorine vapors, add one fluidounce of distilled water. Stopper the bottle, and, when the crystals have dissolved, add distilled water to a pint. (*A. J. P.*, xlii. 208.) The reaction liberates, however, at the same time, the somewhat explosive gas, Cl_2O_4, and may be dangerous at times.

Properties. "A greenish yellow, clear liquid, having the suffocating odor and disagreeable taste of Chlorine, and leaving no residue on evaporation. It instantly decolorizes dilute solutions of litmus and indigo. When shaken with an excess of mercury until the odor of Chlorine has disappeared, the remaining liquid should be at most but faintly acid (limit of hydrochloric acid). On mixing 35·4 Gm. of Chlorine Water with a solution of 0·9 Gm. of iodide of potassium in 20 Gm. of water, the resulting deep red liquid should require for complete decoloration at least 40 C.c. of the volumetric solution of hyposulphite of sodium (corresponding to at least 0·4 per cent. of Chlorine)." *U. S.* Like gaseous chlorine, it destroys vegetable colors. When cooled to about the freezing point, it forms deep yellow crystalline plates, consisting of hydrate of chlorine. It is intended to contain at least twice its volume of the gas. According to MM. Riegel and Walz, chlorine water containing two and a half volumes of the gas at 12·2° C. (54° F.) keeps best. The British solution "immediately discharges the blue color of a dilute solution of indigo. Its sp. gr. is 1·003, and when evaporated it leaves no residue. When 20 grains of iodide of potassium, dissolved in a [fluid]ounce of distilled water, are added to 439 grains by weight (one fluidounce) of this preparation, the mixed solution acquires a deep red color, which requires for its discharge 750 grain-measures of the volumetric solution of the hyposulphite of soda, corresponding to 2·66 grains of chlorine." *Br.* This indicates the quantity of chlorine in the solution, by the amount of the hyposulphite required to decolorize an equivalent quantity of iodine, liberated from the iodide of potassium.

Chlorine is an elementary gaseous fluid of a greenish yellow color, and characteristic smell and taste. It is a supporter of combustion. Its specific gravity is 2·47, and its atomic weight 35·4. When the attempt is made to breathe it, even much diluted, it excites cough and a sense of suffocation, and causes a discharge from the mucous membrane of the nostrils and bronchial tubes. Breathed in considerable quantities, it produces spitting of blood, violent pains, and sometimes death.

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* The oxide of manganese is of course deoxidized. In manufacturing chlorine on the large scale, it is of great importance to reoxidize the manganese, so that it can be used over again. For methods of doing this, and for other improvements in the manufacture of chlorine, see *Chem. News*, Sept. 1867; also March, 1870, p. 121, Sept. 1870, p. 145, and May, 1872, p. 210; *A. J. P.*, 1869, p. 538; *Journ. de Pharm.*, Nov. 1875, p. 91.

† *Deacon's process.* Mr. Henry Deacon, Jr., has discovered that chlorine may be made by passing hydrochloric acid vapor and oxygen over sulphate of copper at a temperature from 400° to 700° F., the copper salt coming out unchanged. For details of this process the reader is referred to *Chem. News*, xxii., p. 157, and *Journ. de Pharm.*, Feb. 1875.

Medical Properties and Uses. Chlorine water is stimulant and antiseptic. Internally it has been used in typhus, and in chronic affections of the liver; but the diseases in which it has been most extolled are scarlatina, malignant sore throat, and diphtheria. Mr. Wm. M. Dobie found it more effectual in an epidemic of that disease which appeared in Chester, England, in the autumn of 1866, than any other remedy. (*Edin. Med. Journ.*, March, 1867, p. 829.) It is said, also, by Dr. Althaus, to have been used in a late epidemic of the same disease in Germany with highly satisfactory results. (*Med. Times and Gaz.*, July, 1868, p. 56.) Externally it is employed, duly diluted, as a gargle in smallpox, scarlatina, and putrid sore throat, as a wash for ill-conditioned ulcers and cancerous sores, and as a local bath in diseases of the liver. It has been used with advantage as an application to buboes and large abscesses, to promote the absorption of the matter. As it depends upon chlorine for its activity, its medical properties coincide with those of chlorinated lime and chlorinated soda, under which heads they are more particularly given. The dose of chlorine water is from one to four fluidrachms (3·75–15 C.c.), properly diluted. It should not be prescribed in mixtures, almost all organic substances causing a rapid disappearance of the chlorine. Even sugar has this action, and glycerin still more markedly. (*A. J. P.*, xliv. 163.)

Gaseous chlorine has been recommended by Gannal in chronic bronchitis and pulmonary consumption, exhibited by inhalation, in minute quantities, four or six times a day. Its first effect is to produce some dryness of the fauces, with increased expectoration for a time, followed ultimately by diminution of the sputa and amendment. Dr. Christison states that he has repeatedly observed these results in chronic catarrh; and both he and Dr. Elliotson have obtained, in consumption, a more decided improvement of the symptoms from the use of chlorine inhalations than from any other means. The liquid in the inhaler may be formed either of water containing from ten to thirty drops (0·6–1·9 C.c.) of chlorine water, or of chlorinated lime dissolved in forty parts of water, to which a drop or two of sulphuric acid must be added, each time the inhalation is practised. The inhaler should be placed in water heated to about 37·7° C. (100° F.).

AQUA CHLOROFORMI. *Br.* *Chloroform Water.*

(Ā'QUA̦ C̸HLŌ-RO̦-FÖR'MĪ.)

Eau de Chloroforme, *Fr.;* Chloroformwasser, *G.*

"Take of Chloroform *one fluidrachm* [Imp. meas.]; Distilled Water *twenty-five fluidounces* [Imp. meas.]. Put them into a two-pint stoppered bottle, and shake them together until the Chloroform is entirely dissolved in the water." *Br.*

This water contains one-half per cent. of chloroform, and is probably fully saturated. The dose is one-half to two fluidounces (15–60 C.c.).

AQUA CINNAMOMI. *U. S., Br.* *Cinnamon Water.*

(Ā'QUA̦ CĬN-NA̦-MŌ'MĪ.)

Eau de Cannelle, *Fr.;* Einfaches Zimmtwasser, *G.*

"Oil of Cinnamon, *two parts* [or thirty minims]; Cotton, *four parts* [or sixty grains]; Distilled Water, *a sufficient quantity*, To make *one thousand parts* [or two pints]. Add the Oil to the Cotton, in small portions at a time, distributing it thoroughly by picking the Cotton apart after each addition; then pack it firmly in a conical percolator, and gradually pour on Distilled Water until *one thousand parts* [or two pints] of percolate are obtained." *U. S.*

"Take of Cinnamon Bark, bruised, *twenty ounces* [avoirdupois]; Water *two gallons* [Imperial measure]. Distil a gallon [Imp. meas.]." *Br.*

Of these processes, that of the U. S. Pharmacopœia is the easier, though the second, the British, may yield a sweeter product. On standing, cinnamon water is apt to precipitate, owing to the gradual oxidation and formation of cinnamic acid, which is comparatively insoluble in water; this can be prevented by passing a stream of carbonic acid through the fresh water for a few minutes. (E. Backhaus.) Cinnamon water is much used as a vehicle for other less agreeable medicines, but should be given cautiously in inflammatory affections. For ordinary purposes the U. S. preparation is sufficiently strong when diluted with an equal measure of water. Dr. E. Holmes recommends glycerin as an excellent intermedium between the oil of cinnamon and water. Ten drops of glycerin will effect the solution of a drop of the oil in a fluidounce of water.

Off. Prep. Mistura Cretæ; Mistura Guaiaci, *Br.;* Mistura Spiritus Vini Gallici, *Br.*

AQUA CREASOTI. *U. S.* *Creasote Water.*

(Ā′QUẠ CRĒ-Ạ-SŌ′TĪ.)

Eau créosotée, *Fr.;* Kreosotwasser, *G.*

Creasote, *one part* [or seventy minims]; Distilled Water, *ninety-nine parts* [or a sufficient quantity], To make *one hundred parts* [or one pint]. Agitate the Creasote with the Distilled Water until dissolved, and filter through a well-wetted filter." *U. S.*

This preparation contains 4·38 minims of creasote in each fluidounce, and affords a convenient method of administering that medicine. It is about twenty-five per cent. stronger than that formerly officinal. The dose is from one to four fluidrachms (3·75–15 C.c.). It may also be used with advantage as a gargle, lotion, or mixed with cataplasms, to correct fetor, and gently stimulate indolent surfaces.

AQUA DESTILLATA. *U. S., Br.* *Distilled Water.*

H_2O; 18. (Ā′QUẠ DĔS-TỊL-LĀ′TẠ.) HO; 9.

Eau distillée, Hydrolat simple, *Fr.;* Destillirtes Wasser, *G.*

"Water, *one thousand parts* [or twenty-five pints], To make *eight hundred parts* [or twenty pints]. Distil the Water from a suitable apparatus provided with a block-tin or glass condenser. Collect the first *fifty parts* [or one and a quarter pints] and throw this portion away. Then collect *eight hundred parts* [or twenty pints] and keep the Distilled Water in glass-stoppered bottles." *U. S.*

"Take of Water *ten gallons* [Imperial measure]. Distil from a copper still, connected with a block-tin worm; reject the first half gallon, and preserve the next eight gallons." *Br.*

No natural water is sufficiently pure for certain pharmaceutical purposes; and hence the necessity of the above processes for its distillation. It is best to reject the first portion which comes over, as this may contain carbonic acid and other volatile impurities; and the last portion of the water ought not to be distilled, lest it should pass over with an empyreumatic taste. The distillation is usually performed with the ordinary still and worm; but, to avoid any impurity from the worm or the receiver, the condenser is directed in the U. S. Pharmacopœia to be of block-tin or glass. In the British formula the worm is ordered to be of block-tin; and the same is undoubtedly contemplated in our officinal process; as the ordinary tin-coated sheet-iron, commonly called tin, would be wholly unfit for the purpose. Mr. Brande states that distilled water often derives from the still a foreign flavor, which it is difficult to avoid. He, therefore, recommends that a still and condenser be kept exclusively for distilling water; or, where this cannot be done, that steam be driven through the worm for half an hour, for the purpose of washing it out before it is used, the worm-tub having been previously emptied. Mr. Mackay, of Edinburgh, cautions against distilling water in a still with a leaden head or leaden worm, for fear of contaminating the water with lead. Even the use of pure tin, which is generally considered unexceptionable, does not give perfect security against impurity; as water distilled from metallic alembics, with the head and worm of this metal, has a peculiar odor which it retains for some time. A portion of distilled water thus prepared, after having been kept for four months in a well-stopped bottle, was found by M. Flech, an apothecary of Kevelaer, to have deposited white flocculi, which proved on examination to consist of oxidized tin; and the water, besides, contained tin in solution and a little ammonia. M. Flech supposes that a part of the water was decomposed; its oxygen uniting with the tin, and its hydrogen in the nascent state with the nitrogen of the air to form ammonia; and he is disposed, moreover, to ascribe to this cause the peculiar odor referred to, which is never perceived when the distillation is performed in glass vessels. (*Journ. de Pharm.*, Fév. 1860, p. 125.)

Properties, etc. Distilled water, as usually obtained, has a vapid and disagreeable taste, and is not perfectly pure; water, to be rendered so, requiring to be distilled in silver vessels. The properties of pure water have already been given under the head of *Aqua*. Distilled water should undergo no change by sulphuretted hydrogen, or on the addition of tincture of soap, subacetate of lead, chloride of barium, oxalate of ammonium, nitrate of silver, or lime-water. "On evaporating 1 litre of Distilled Water, no fixed residue should remain. The transparency or color of Distilled Water should not be affected by hydrosulphuric acid or sulphide of ammonium (abs. of metals), by test-solutions of chloride of barium (sulphate), nitrate of silver (chloride), oxalate of ammonium (calcium), or mercuric chloride, with or without the subsequent addition of carbonate of potassium (ammonium salts or free ammonia). On heating 100 C.c. of Distilled Water acidulated with 10 C.c. of diluted sulphuric acid, to boiling, and adding enough of a dilute solution of permanganate of potassium (1 in 1000) to impart to the liquid a decided rose-red tint, this tint should not be entirely destroyed by boiling for five minutes, nor by subsequently setting the vessel aside, well covered, for ten hours (abs. of organic or other oxidizable matters)." *U. S.* It is uselessly employed in some formulas, but is essential in others. As a general rule, when small quantities of active medicines are to be given in solution, and in the preparation of collyria, distilled water should be directed. The following list contains the chief substances which require distilled water as a solvent: tartar emetic, corrosive sublimate, nitrate of silver, the chlorides of barium and calcium, acetate and subacetate of lead, permanganate of potassium, the sulphates of iron and zinc, sulphate of quinine, sulphate, hydrochlorate, and acetate of morphine, and, in general terms, all the alkaloids and their salts. Distilled water is used in preparing the officinal diluted acids, for absorbing gaseous ammonia, and for forming nearly all the officinal aqueous solutions.

AQUA FŒNICULI. *U.S.*, *Br.* *Fennel Water.*

(Ā′QUẠ FŒ-NĬC′Ụ̇-LĪ.)

Eau de Fenouil, *Fr.;* Fenchelwasser, *G.*

"Oil of Fennel, *two parts* [or thirty minims]; Cotton, *four parts* [or sixty grains]; Distilled Water, *a sufficient quantity*, To *make one thousand parts* [or two pints]. Add the Oil to the Cotton, in small portions at a time, distributing it thoroughly by picking the Cotton apart after each addition; then pack it firmly in a conical percolator, and gradually pour on Distilled Water, until *one thousand parts* [or two pints] of percolate are obtained." *U. S.*

"Take of Fennel Fruit, bruised, *one pound* [avoirdupois]; Water *two gallons* [Imperial measure]. Distil one gallon [Imp. meas.]." *Br.*

Fennel water is a pleasant vehicle for other medicines, and useful when a mild aromatic is indicated. The process of the British Pharmacopœia, although more troublesome, furnishes a more delicate and agreeable water.

AQUA LAURO-CERASI. *Br.* *Laurel Water.*

(Ā′QUẠ LÂU′RŌ ÇĔR′Ạ-SĪ.)

Eau distillée de Laurier-cerise, *Fr.;* Kirschlorbeerwasser. *G.;* Cherry-laurel Water.

"Take of Fresh Leaves of Common Laurel [cherry-laurel] *one pound* [avoirdupois]; Water *two pints and a half* [Imperial measure]. Chop the leaves, crush them in a mortar, and macerate them in the Water for twenty-four hours; then distil one pint [Imp. meas.] of liquid. Shake the product, filter through paper, and preserve it in a stoppered bottle." *Br.*

As the cherry-laurel is little cultivated in the United States, the Water is not officinal; but from experiments by the late Prof. Procter, there is little or no room to doubt that a preparation, identical in its effects, might be made from the leaves of our common wild cherry, *Cerasus serotina*. The imported cherry-laurel water, as found in commerce, is generally impaired by age, and not to be relied on.

A. Ripping, of Rotterdam, proposes to make an artificial cherry-laurel water by adding 6 grammes of oil of cherry-laurel and 4·5 grammes of cyanide of potassium to a half-litre of water, and distilling the mixture in a tubulated retort, a current of carbonic acid gas being passed through it at the same time. The distillate is afterwards diluted with distilled water so as to contain one-tenth per cent. of hydrocyanic acid. (*Archiv d. Pharm.*, 1876, pp. 526–531.)

In a former edition of the Dispensatory it was stated that the best plan of preparing this water is "to thoroughly bruise the leaves, and, having mixed them with at least three times their weight of water, to allow the mixture to stand at a temperature of about 86° F. for at least twelve hours, so that opportunity may be given for those reactions by which the hydrocyanic acid is produced, and then to distil them by means of a current of steam. Without the preliminary maceration the distillation by steam does not afford a satisfactory result; but properly performed, it yields the largest possible product. (*Journ. de Pharm.*, Juillet, 1861, p. 15; and Juin, 1864, p. 523.)" More recent investigations have, however, thrown great doubt upon this statement. Cherry-laurel leaves contain 65 per cent. of water, sufficient to provoke the reactions which result in the formation of a volatile oil and hydrocyanic acid. Water is very prone to hasten the conversion of the volatile oil into benzoic acid by oxidation, and it has been found by Mr. C. Umney (*P. J. Tr.*, x. 467) and by Dr. Moore (*Ibid.*, 604) that the water distilled without previous maceration is somewhat stronger in hydrocyanic acid and decidedly stronger in oil (Umney) than the officinal product. The strength of officinal cherry-laurel water is so uncertain as to render it ineligible. It ought to be a powerful preparation, about one-twentieth the strength of the officinal hydrocyanic acid (Br. Ph.), and yet in commerce it varies as 53 to 100 (Umney). The difference depends upon the age of the preparation, the mode of preparing, and the time of year at which the leaves are gathered. M. Garot (*Annuaire de Thérap.*, 1843, p. 45) has found that the leaves yield only half as much in July as in April. Mr. C. Umney obtained 1·26 grains of acid in 1000 grains in March, in July 1·08 grains, and in November 0·64 gr. (*P. J. Tr.*, x. 468.) Dr. Moore, in an elaborate series of experiments, obtained the largest product in July of one year and in October of the next. Mr. Leger (*Ibid.*, June, 1873) has found the maximum percentage in July, and also that different leaves taken from the same bush on the same day vary enormously; young leaves being much richer than old ones. It is evidently impossible to get a uniform cherry-laurel water, except by following the plan of the French Codex* of testing the product and bringing it to a definite uniform strength; in the French

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* The following conclusions, in reference to Cherry-laurel water, were arrived at by a committee of pharmaceutists in Paris, appointed to examine the subject of the distilled waters with a view to the revision of the Codex. 1. The whole of the volatile oil and hydrocyanic acid furnished by cherry-laurel leaves, results from a reaction between two substances analogous to the emulsin and amygdalin of bitter almonds, which can take place only in the presence of water. 2. The quantity of volatile oil furnished by the leaves is always in direct relation to that of hydrocyanic acid. 3. The leaves furnish, by mere contact for twenty-four hours with cold water, only one-third of the quantity which they can be made to yield. 4. The fermentable matter of the leaves is liable to change, so that the leaves, after being picked, afford less and less of the acid the longer they are kept; and a moist heat favors change; so that complete decomposition takes place in a few hours. 5. Difference in climate, soil, exposure to the sun, and age of the tree, have but a secondary influence on the productiveness of the leaves. 6. The season of the year, however, has a great influence. The younger the leaf, the greater is its yield; so that, while 0·150 per cent. of the acid was obtained from the forming leaves in spring, those of the autumn yielded only 0·132, those of the winter 0·120, and leaves two years old gave only 0·112. 7. Different plants, under apparently the same circumstances, differ greatly in productiveness, so that 0·176 per cent. was obtained from the most productive, and only 0·092 from the least so. 8. The distillation by steam yields the greatest possible product. The committee, therefore, propose the adoption of this method; the bruised leaves having been previously mixed with at least three times their weight of water, and exposed to a gradually increasing heat, not to exceed 140° F., when all reaction ceases. 9. Bruising is the best method of comminuting the leaves. 10. As it is impossible to obtain a Water always identical from the leaves, the committee propose to fix a definite strength, and state that the proportion generally adopted is from 0·040 per cent. of acid as the minimum, to 0·050, or one-twentieth of one per cent. as the maximum, which is only one-half the strength proposed for bitter-almond water. 11. Though a change rapidly takes place in this and bitter-almond water exposed to the air, yet in bottles full, and perfectly closed by glass stoppers, the change at the end of a year is scarcely perceptible; and this observation applies to the distilled waters in general. (*Journ. de Pharm.*, 1864, p. 520.)

Codex this is 50 milligrammes of acid to a cubic centimetre. The proportion of hydrocyanic acid in the Water diminishes with time. It has been ascertained by M. Deschamps that, if a drop of sulphuric acid be added to a pint of the preparation, it will keep unchanged for at least a year. It is best preserved by the entire exclusion of air and light. M. Lepage found that, preserved in full and perfectly air-tight bottles, both this and bitter-almond water remained unchanged at the end of a year; while if freely exposed to the air, they lost all their hydrocyanic acid and essential oil in two or three months. (*Journ. de Pharm.*, xvi. 346.) In view of the uncertain strength of the Water as obtained from the leaves, it was proposed in France, in reference to the Codex then in preparation, to fix upon a definite proportion of hydrocyanic acid; and the percentage generally adopted was from 0·04 to 0·05. Dr. W. H. Pile proposed an easy volumetric method for estimating the hydrocyanic acid strength of cherry-laurel and bitter-almond waters, as well as of other liquids containing this acid. (See *A. J. P.*, 1862, p. 130.)

Medical Properties. Cherry-laurel water is employed in Europe as a sedative narcotic, identical in its properties with a dilute solution of hydrocyanic acid; but it is of uncertain strength, and should not be allowed to supersede the more definite preparation of the acid now in use. Its fraudulent use in Paris in the preparation of a cordial, in imitation of the genuine cherry cordial, made by fermentation and distillation, and like it called "*kirsch*," has been the subject of no little reprobation. (*Journ. de Pharm. et de Chim.*, 4e sér., i. 33, 1865.) The dose is from thirty minims to a fluidrachm (1·9–3·75 C.c.).

AQUA MENTHÆ PIPERITÆ. *U. S., Br.* *Peppermint Water.*

(Ā′QUA̦ MĔN′THÆ PĬP-E̦R-Ī′TÆ.)

Eau de Menthe poivrée, *Fr.;* Pfeffermünzwasser, *G.*

"Oil of Peppermint, *two parts* [or thirty minims]; Cotton, *four parts* [or sixty grains]; Distilled Water, *a sufficient quantity*, To make *one thousand parts* [or two pints]. Add the Oil to the Cotton, in small portions at a time, distributing it thoroughly by picking the Cotton apart after each addition; then pack it firmly in a conical percolator, and gradually pour on Distilled Water, until *one thousand parts* [or two pints] of percolate are obtained." *U. S.*

"Take of Oil of Peppermint *one fluidrachm and a half;* Water *one gallon and a half* [Imperial measure]. Distil one gallon [Imp. meas.]." *Br.*

Off. Prep. Mistura Ferri Aromatica, *Br.*

AQUA MENTHÆ VIRIDIS. *U. S., Br.* *Spearmint Water.*

(Ā′QUA̦ MĔN′THÆ VĬR′I̦-DĬS.)

Eau de Menthe verte, *Fr.*

"Oil of Spearmint, *two parts* [or thirty minims]; Cotton, *four parts* [or sixty grains]; Distilled Water, *a sufficient quantity*, To make *one thousand parts* [or two pints]. Add the Oil to the Cotton, in small portions at a time, distributing it thoroughly by picking the Cotton apart after each addition; then pack it firmly in a conical percolator, and gradually pour on Distilled Water, until *one thousand parts* [or two pints] of percolate are obtained." *U. S.*

"Take of Oil of Spearmint *one fluidrachm and a half;* Water *one gallon and a half* [Imperial measure]. Distil one gallon [Imp. meas.]." *Br.*

The two mint waters are among the most grateful and most employed of this class of preparations. Together with cinnamon water, they are used in this country, almost to the exclusion of all others, as the vehicle of medicines given in the form of mixture. They serve not only to conceal or qualify the taste of other medicines, but also to counteract their nauseating properties. Peppermint water is generally thought to have a more agreeable flavor than that of spearmint, but some prefer the latter. Their effects are the same.

AQUA ROSÆ. *U. S., Br.* *Rose Water.*

(Ā′QUA̦ RŌ′ȘÆ.)

Eau distillée de Rose, *Fr.;* Rosenwasser, *G.*

"Recent, Pale Rose, *forty parts* [or forty-eight ounces av.]; Water, *two hundred* *parts* [or fourteen pints], To make *one hundred parts* [or seven pints]. Mix them, and, by means of steam, distil *one hundred parts* [or seven pints]." *U. S.*

"Take of Fresh Petals of the Hundred-leaved Rose *ten pounds* [avoirdupois] (or an equivalent quantity of the petals preserved while fresh with common salt); Water *two gallons* [Imperial measure]. Distil one gallon [Imp. meas.]." *Br.*

An improvement has been made in this preparation by doubling its strength, experience having shown that the stronger rose water keeps better.

It should be observed that, in the nomenclature of the U. S. Pharmacopœia, the term "Rose" implies only the petals of the flower. These are usually preferred in the recent state; but it is said that, when preserved by being incorporated with one-third of their weight of common salt, they retain their odor, and afford a water equally fragrant with that prepared from the fresh flower. Indeed, Mr. Haselden prefers the salted roses, believing that the water prepared from them is less mucilaginous, less apt to become sour, and keeps its odor better than that prepared from the fresh flowers. (*P. J. Tr.*, xvi. 15.) It is not uncommon to employ the whole flower, including the calyx; but the product is less fragrant than when the petals only are used, as officinally directed.* Rose water is sometimes made by distilling together water and the oil of roses. This is best performed by dropping 10 drops of oil of rose on a sponge and adjusting it in the upper part of a still in the body of which a gallon of water is placed: the steam from the boiling water will carry over portions of the oil, and the distillate will thus be impregnated.

When properly prepared, it has the delightful perfume of the rose in great perfection. It is most successfully made on a large scale. Like the other distilled waters, it is liable to spoil when kept; and the alcohol which is sometimes added to preserve it is incompatible with some of the purposes to which the water is applied, and is even said to render it sour through acetous fermentation. It is best, therefore, to avoid this addition, and to substitute a second distillation. This distilled water is chiefly employed, on account of its agreeable odor, in collyria and other lotions. It is wholly destitute of irritating properties, unless when it contains alcohol.

Off. Prep. Confectio Rosæ, *U. S.;* Mistura Ferri Composita; Trochisci Bismuthi, *Br.;* Unguentum Aquæ Rosæ, *U. S.*

AQUA SAMBUCI. *Br.* *Elder-flower Water.*

(Ā'QUẠ SĂM-BŪ'CĪ.)

"Take of fresh Elder Flowers, separated from the stalks, *ten pounds* [avoirdupois]

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* A. Monthus states that the petals of the hundred-leaved rose are more odorous the nearer they are to the centre of the flower, and, contrary to what is said in the text, thinks that the calyx should not be rejected in preparing the distilled water. He maintains that so far from injuring the product, it in fact contributes to its preservation, and that the water obtained from the whole flower is less liable to that mucosity, which is the commencement of decomposition. This effect he ascribes to the astringent matter of the calyx, coagulating the mucilaginous matter of the petals, and preventing it from passing over in the distillation. (*Journ. de Pharm.*, 1863, p. 497.)

Milk of Roses. In making this cosmetic it is essential to produce an emulsion which, if it separates after long repose, may be restored by slight agitation. Although other perfumes may be, and are, commonly added to it, the scent of roses should predominate and form its characteristic odor. There are three varieties, the English, French, and German. The latter variety should never be employed as a cosmetic, on account of containing lead.

English. Almonds (blanched) 1½ ounce; Oil of Almonds and White Windsor Soap, of each, 1 drachm; Rose Water ¾ pint. Make an emulsion; to the strained emulsion add a mixture of Essence or Spirit of Roses ½ fluidrachm; Alcohol 2½ fluidounces; and subsequently of Rose Water q. s. to make the whole measure one pint; more alcohol is apt to cause the separation of the ingredients. Some makers add a few drops of oil of bergamot, with two or three drops each of oil of lavender and otto of roses, dissolved in the alcohol.

Or, Oil of Almonds and White Windsor Soap, of each, 1 ounce; Salts of Tartar ½ drachm; Boiling Water ¼ pint. Triturate, and subsequently agitate until perfectly united. When cold, further add Alcohol 2 fluidounces; Spirit of Roses a few drops; Rose Water q. s. to make the whole measure a pint.

French. Tincture of Benzoin (simple) ½ fluidounce; Tincture of Styrax ¼ fluidounce; Spirit of Roses 1 to 2 fluidrachms; Alcohol 2½ fluidounces. Mix, and add gradually, with agitation, Rose Water 16½ fluidounces. Augustin recommends the addition of a little carbonate of potassium (say 1 drachm to the pint) when it is intended to be used as a lotion in acne.

Or, Tincture of Benzoin (simple) 1 fluidrachm; Tincture of Balsam of Peru 20 drops; Rose Water ½ pint. The addition of an ounce of alcohol, in lieu of a like quantity of rose water, improves it.

German. Dilute solution of Diacetate of Lead, ½ fluidounce; Lavender Water 2 fluidrachms; Alcohol 2½ fluidounces; Rose Water ¾ of a pint. Mix and agitate.

(or an equivalent quantity of the flowers preserved while fresh with common salt); Water *two gallons* [Imperial measure]. Distil one gallon [Imp. meas.]." *Br.*

Elder flowers yield very little oil upon distillation; and, if the water be needed, it may be best prepared from the flowers. Mr. Haselden prefers the salted flowers to the fresh, for the reason stated under Rose Water. The preparation is little used in this country.

ARECA. *Br.* *Areca Nut.*

(A-RĒ'CA.)

Semen Arecæ, Betel Nut, *E.;* Noix d'Arec, *Fr.;* Arekanüsse, Betelnüsse, *G.*

This drug is rarely used in this country, although officinal in the British Pharmacopœia. For an account of its physical and medical properties, see Part II.

ARGENTUM. *Silver.*

Ag; 108. (ĂR-ĢĔN'TUM.) Ag; 108.

"ARGENTUM PURIFICATUM. *Refined Silver.* Pure metallic silver." *Br.*

Argent raffiné, Argent, *Fr.;* Silber, Raffinirtes Silber, *G.;* Argento, *It.;* Plata, *Sp.*

Silver is occasionally found in the metallic state, sometimes crystallized, at other times combined with gold, antimony, arsenic, or mercury; but usually it occurs in the state of sulphide, either pure or mixed with other sulphides, as those of copper, lead, and antimony. It is sometimes found as a chloride.

The most productive mines of silver are found on this continent, being those of Mexico and Peru, and our own Rocky Mountain territories; the richest in Europe are those of Norway, Hungary, and Transylvania. Mines have been opened and profitably worked in California and Nevada, but at present it is chiefly Colorado and Idaho which furnish the great bulk of the American silver production. Arizona and New Mexico are said also to contain very rich silver deposits which are now being developed. The principal ore is the sulphide. The mineral containing silver, which is most disseminated, is argentiferous galena, which is sulphide of lead, containing a little sulphide of silver. Argentiferous galena exists in several localities in the United States. A mine of silver was opened, about the year 1841, in Davidson County, N. C. The ore is an argentiferous carbonate of lead, yielding about one-third of its weight of lead, from which from 100 to 400 ounces of silver are extracted per ton. (Eckfeldt and Du Bois, *Manual of Coins.*) Native silver is associated, in small quantities, with the native copper of the Lake Superior region; and a little of it has come into the market. The two metals, though more or less mixed, are yet quite distinct, never being alloyed to any considerable extent, showing conclusively that the deposits have not undergone igneous fusion at any time, but that the metals have deposited from solution.

Extraction. Silver is extracted from its ores by two principal processes, *amalgamation* and *cupellation.* At Freiberg, in Saxony, the ore, which is principally the sulphide, is mixed with a tenth of chloride of sodium, and roasted in a reverberatory furnace. As fast as the sulphide is oxidized to sulphate, this reacts with the sodium chloride, forming silver chloride and sodium sulphate. The roasted mass is then reduced to very fine powder, mixed with half its weight of mercury, one-third of its weight of water, and about a seventeenth of iron in flat pieces, and subjected, for sixteen or eighteen hours, to constant agitation in barrels turned by machinery. The chlorine combines with the iron, and remains in solution as chloride of iron; while the reduced silver forms an amalgam with the mercury. The amalgam is then subjected to pressure in leathern bags, through the pores of which the excess of mercury passes, a solid amalgam being left behind. This is then subjected to heat in a distillatory apparatus, by means of which the mercury is separated from the silver, which is left in a porous mass. In Peru and Mexico the process is similar to that above given, common salt and mercury being used; but slacked lime and sulphide of iron are also employed, with an effect which is not very obvious.

When argentiferous galenas are worked for the silver they contain, they are first reduced, and the argentiferous lead obtained is fused on a large, oval, shallow vessel called a *test*, and exposed to the blast of a bellows, whereby the lead is oxidized, half vitrified, and driven off the test in scales, in the form of *litharge.* The operation being continued on successive portions of argentiferous lead, the whole of the lead is separated, and the silver, not being oxidizable, accumulates on the test as a brilliant fused mass, until its amount is sufficient to be removed. The time required for the separation is much abridged by the process of Mr. Pattinson, of Newcastle, England. This consists in allowing the melted alloy to cool slowly, and separating the crystals which first form, consisting mainly of lead, by means of a perforated ladle. The residue is a very fusible alloy of lead and silver, in which the latter metal is in large proportion, and from which it can be easily separated by cupellation or other means. (*Brande and Taylor.*)

Properties. Silver is a white metal, very brilliant, tenacious, malleable, and ductile. In malleability and ductility, it is inferior only to gold. It is harder than gold, but softer than copper. Its atomic weight is 108, symbol Ag, and sp. gr. from 10·4 to 10·5. It forms but one well-characterized oxide. Exposed to a full red heat, it enters into fusion, and exhibits a brilliant appearance. It is not oxidized in the air, but contracts a superficial tarnish of sulphide of silver by the action of sulphuretted hydrogen in the atmosphere; from which it may be freed by washing it with a strong solution of cyanide of potassium, and, as soon as it becomes bright, washing it with water and drying it. (*Chem. News*, 1866, p. 12.) It is entirely soluble in diluted nitric acid. If any gold be present, it will remain undissolved as a dark-colored powder. From the nitric solution, the whole of the silver may be thrown down by chloride of sodium, as a white precipitate of chloride of silver, characterized by being completely soluble in ammonia. If the remaining solution contain copper or lead, it will be precipitated or discolored by sulphuretted hydrogen. "The solution, deprived of silver by means of chloride of sodium, and filtered, is not colored, *or but slightly so*, and is not precipitated by hydrosulphuric acid." *U. S.* 1870. "If ammonia be added in excess to a solution of the metal in nitric acid, the resulting fluid exhibits neither color nor turbidity" (*Br.*); proving the absence of copper, lead, and other metals.

Off. Prep. Argenti Nitras, Argenti Nitras Dilutus, Argenti Nitras Fusus; Argenti Cyanidum, Argenti Iodidum, Argenti Oxidum. *U. S.*

ARGENTI CYANIDUM. *U.S.* *Cyanide of Silver.*

$AgCN$; 133·7. (ĂR-ĢĔN'TĪ CȲ-ĂN'Ị-DŬM.) AgC_2N; 133·7.

Cyanuret of Silver; Argentum Cyanatum; Cyanure d'Argent, *Fr.;* Cyansilber, *G.*

A process for preparing this salt is no longer officinal. Below will be found that of the U. S. P. 1870.*

In the process of 1870 all the silver contained in a given weight of nitrate of silver, placed in a receiver in solution, is converted into cyanide by hydrocyanic acid, produced from ferrocyanide of potassium by the action of sulphuric acid, $AgNO_3 + HCN = HNO_3 + Ag,CN$. The materials in the retort are sufficient to produce a little more hydrocyanic acid than is necessary to convert the whole of the silver in the receiver into cyanide; so that the complete decomposition of the nitrate of silver is insured. Cyanide of silver should be kept in dark amber-colored vials, protected from light.

According to Messrs. Glassford and Napier, the best way of obtaining cyanide of silver is to add cyanide of potassium to a solution of nitrate of silver so long as a precipitate is formed.

Properties. Cyanide of silver is "a white powder, permanent in dry air, but gradually turning brown by exposure to light, odorless and tasteless, and insoluble in water and in alcohol. Insoluble in cold, but soluble in boiling nitric acid, with evolution of hydrocyanic acid; also soluble in water of ammonia and in solution of hyposulphite of sodium. When strongly heated, the salt fuses, gives off cyanogen gas, and, on ignition, metallic silver is left behind." *U. S.*

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* "Take of Nitrate of Silver, Ferrocyanide of Potassium, each, *two troyounces;* Sulphuric Acid *a troyounce and a half;* Distilled Water *a sufficient quantity.* Dissolve the Nitrate of Silver in a pint of Distilled Water, and pour the solution into a tubulated glass receiver. Dissolve the Ferrocyanide of Potassium in ten fluidounces of Distilled Water, and pour the solution into a tubulated retort, previously adapted to the receiver. Having mixed the Sulphuric Acid with four fluidounces of Distilled Water, add the mixture to the solution in the retort, and distil, by means of a sand-bath, with a moderate heat, until six fluidounces have passed over, or until the distillate no longer produces a precipitate in the receiver. Lastly, wash the precipitate with Distilled Water, and dry it." *U. S.* 1870.

Its best solvent is cyanide of potassium. It has no medical uses.

Off. Prep. Acidum Hydrocyanicum Dilutum, *U. S.*

ARGENTI IODIDUM. *U. S.* *Iodide of Silver.*

Ag I; 234·3. (ĂR-ÇĔN'TĪ Ī-ŎD'Ị-DŬM.) Ag I; 234·3.

This is a new officinal salt, which may be readily prepared by adding a solution of iodide of potassium to one of nitrate of silver, and washing and drying the precipitate, which should be kept in dark amber-colored vials, protected from light.

According to the experiments of M. Fizeau, it has the remarkable property of contracting with heat and expanding with cold, differing in this respect from the chlorides and bromides of the same metal, and the iodides of other metals. (*Journ. de Pharm.*, 1867, p. 435.) This appears, however, to be only a partial truth, the iodide having three allotropic forms and a point of maximum density at about 116° C. (240·8° F.). See paper by G. F. Rodwell, in *Chem. News*, xx. 288; xxi. 14. The Pharmacopœia describes it as "a heavy, amorphous, light yellowish powder, unaltered by light if pure, but generally becoming somewhat greenish yellow, without odor and taste, and insoluble in water, alcohol, diluted acids, or in solution of carbonate of ammonium. Soluble in about 2500 parts of stronger water of ammonia. When heated to about 400° C. (752° F.), it melts to a dark red liquid, which, on cooling, congeals to a soft, yellow, slightly translucent mass. When mixed with water of ammonia, it turns white, but regains its yellowish color by washing with water. It is dissolved by an aqueous solution of cyanide of potassium, and the resulting solution yields a black precipitate with hydrosulphuric acid or sulphide of ammonium. If a small quantity of chlorine water be agitated with an excess of the salt, the filtrate acquires a dark blue color on the addition of gelatinized starch. If the salt be boiled with test-solution of carbonate of ammonium previously diluted with an equal volume of water, the resulting filtrate, on being supersaturated with nitric acid, should not be rendered more than faintly opalescent (abs. of chloride)." *U. S.*

Medical Properties. It possesses the general medical properties of nitrate of silver, and Dr. Charles Patterson, of Dublin, states that it may be used without any danger of producing discoloration of the skin, but in this he is probably incorrect. Dr. Patterson found it generally successful in curing the stomach affections of the Irish peasantry, in the treatment of which nitrate of silver had previously proved useful. He succeeded with it in curing several cases of hooping-cough in a short time, and in greatly relieving a case of dysmenorrhœa of three years' standing. Its effects in epilepsy were least satisfactory. The dose is one or two grains (·065–·13 Gm.), three times a day, given in the form of pill; for children, from the eighth to the fourth of a grain (·008–·016 Gm.), according to the age.

ARGENTI NITRAS. *U. S., Br.* *Nitrate of Silver.*

Ag NO_3; 169·7. (ĂR-ÇĔN'TĪ NĪ'TRĂS.) Ag O, NO_5; 169·7.

Argentum Nitricum Crystallisatum, *P.G.;* Azotas (Nitras) Argenticus; Azotate d'Argent, Nitre lunaire, *Fr.;* Salpetersaures Silberoxyd, Silbersalpeter, *G.*

The U. S. Pharmacopœia does not give a process for making this salt.* The British process is as follows. "Take of Refined Silver *three ounces* [avoirdupois];

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* The U. S. Pharmacopœia, 1870, gave the following. "Take of Silver, in small pieces, *two troyounces;* Nitric Acid *two troyounces and a half;* Distilled Water *a sufficient quantity.* Mix the Acid with a fluidounce of Distilled Water in a porcelain capsule, add the Silver to the mixture, cover it with an inverted glass funnel, resting within the edge of the capsule, and apply a gentle heat until the metal is dissolved, and red vapors cease to be produced; then remove the funnel, and, increasing the heat, evaporate the solution to dryness. Melt the dry mass, and continue the heat, stirring constantly with a glass rod, until free nitric acid is entirely dissipated. Dissolve the melted salt, when cold, in six fluidounces of Distilled Water, allow the insoluble matter to subside, and decant the clear solution. Mix the residue with a fluidounce of Distilled Water, filter through paper, and, having added the filtrate to the decanted solution, evaporate the liquid until a pellicle begins to form, and set it aside in a warm place to crystallize. Lastly, drain the crystals in a glass funnel until dry, and preserve them in a well-stopped bottle. By evaporating the mother-water, more crystals may be obtained." *U. S.*

Nitric Acid *two and a half fluidounces* [Imperial measure]; Distilled Water *five fluidounces* [Imp. meas.]. Add the Nitric Acid and the Water to the Silver in a flask, and apply a gentle heat till the metal is dissolved. Decant the clear liquor from any black powder which may be present, into a porcelain dish, evaporate, and set aside to crystallize; pour off the clear liquor, and again evaporate and crystallize. Let the crystals drain in a glass funnel, and dry them by exposure to the air, carefully avoiding the contact of all organic substances. Nitrate of Silver must be preserved in bottles furnished with accurately ground stoppers." *Br.*

The two formulas are essentially the same; but that of the U. S. Pharmacopœia, 1870, is more detailed and precise, with two peculiarities which deserve notice. One of these is the direction to cover the materials in the capsule, during the continuance of the reaction, with a glass funnel. This is in order to economize the nitric acid, a portion of which rises in vapor, and, being condensed on the inner surface of the funnel, falls again into the capsule. The second peculiarity is the fusion of the salt before being dissolved. This would, from the phraseology of the directions, appear to have been intended to get rid of any uncombined nitric acid which might remain in the dry salt. But the effect is to decompose any nitrate of copper that might have been derived from the silver, which, if coin be employed, always contains copper. The heat decomposes the nitrate of copper, and the comparatively insoluble oxide is formed, which remains on the filter when the mass is subsequently dissolved in water and filtered, the nitrate of silver not being decomposed by the heat used.

During the solution of silver in nitric acid, part of the acid is decomposed and nitric oxide is given off, which becomes red by contact with the atmosphere, and the oxygen oxidizes the silver. This is taken up by the remainder of the acid, and produces nitrate of silver in solution, which, by due evaporation, furnishes crystals of the salt. The silver should be pure, and the acid diluted for the purpose of promoting its action. If the silver contain copper, the solution will have a greenish tint, not disappearing on the application of heat; and if a minute portion of gold be present, it will be left undissolved as a black powder. The acid also should be pure. The commercial nitric acid, as it frequently contains both hydrochloric and sulphuric acids, should never be used. The hydrochloric acid gives rise to an insoluble chloride, and the sulphuric, to the sparingly soluble sulphate of silver.*

Properties. Nitrate of silver is in "colorless, transparent, tabular, rhombic crystals, becoming gray or grayish black on exposure to light in presence of organic matter, odorless, having a bitter, caustic and strongly metallic taste and a neutral reaction. Soluble in 0·8 part of water and in 26 parts of alcohol at 15° C. (59° F.), in 0·1 part of boiling water and in 5 parts of boiling alcohol. When heated to about 200° C. (392° F.), the salt fuses to a faintly yellow liquid, which, on cooling, congeals to a purely white, crystalline mass. At a higher temperature the salt is gradually decomposed, with evolution of nitrous vapors. It should be kept in dark amber-colored vials protected from the light." *U. S.* The solution stains the skin of an indelible black color, and is itself discolored by the most minute portion of organic matter, for which it forms a delicate test. The affinity of this salt for animal matter is evinced by its forming definite compounds with albumen and fibrin. The solution also stains linen and muslin in a similar manner; and hence its use in making the so-called indelible ink. To remove these stains, Mr. W. B. Herapath advises to let fall on the moistened spots a few drops of tincture of iodine, which converts the silver into iodide of silver. The iodide is then dissolved by a solution of hyposulphite of sodium, made with half a drachm to a fluidounce of water, or by a moderately dilute solution of caustic potassa, and the spots are washed out with warm water. They are taken out also by a solution of two and a half drachms of cyanide of potassium, and fifteen grains of iodine, in three fluidounces of water.

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* It is desirable that pure silver, free from copper, should be used in this process. As silver coin always contains copper, it should be purified before being employed. For this purpose, according to the method of M. Lienau, it should be dissolved in nitric acid, and the solution precipitated by chlorine water, which throws down the silver only in the form of chloride. The precipitate is to be well washed with chlorine water, then dissolved in solution of ammonia, and precipitated by clean copper wire. The silver is deposited as a black powder, which, when washed with solution of ammonia, is perfectly pure. (See *A. J. P.*, 1862, p. 368.)

Stains on the skin may be removed by the same reagents. Dr. H. Kraetzer recommends instead of potassium cyanide, a solution of 10 parts sal ammoniac and 10 parts corrosive sublimate in 100 parts of water, with which the stains are said to be removed readily from the hands, and from linen, wool, and cotton without injuring the fabric. (*Archiv d. Pharm.*, 1880, p. 52.) Nitrate of silver is incompatible with almost all spring and river water, on account of a little common salt usually contained in it; with soluble chlorides; with sulphuric, hydrosulphuric, hydrochloric, and tartaric acids, and their salts; with the alkalies and their carbonates; with lime-water; and with astringent infusions. It is sometimes improperly prescribed in pill with tannic acid, by which it is decomposed. Nitrate of silver is an anhydrous salt, consisting of one atom of silver, 108, combined with the monatomic group NO_3, 62, characteristic of nitric acid, $=170$.

Impurities and Tests. Hydrochloric acid or a solution of chloride of sodium, added in excess to one of nitrate of silver, should throw down the whole of the silver as a white curdy precipitate darkening on exposure to light, and nothing besides. This precipitate should be entirely soluble in ammonia. If not so, the insoluble part is probably chloride of lead. If the supernatant liquid, after the removal of the precipitate, be discolored or precipitated by sulphuretted hydrogen, the fact shows the presence of metallic matter, which is probably copper or some remains of lead, or both. The solution, after precipitation by hydrochloric acid and filtration, should leave no residue when evaporated. A piece of the salt, heated on charcoal by the blowpipe, melts, deflagrates, and leaves behind a whitish metallic coating. After all, the best sign of the purity of nitrate of silver is the characteristic appearance of the crystals. An aqueous solution of the salt yields with hydrochloric acid a white precipitate of silver chloride, soluble in ammonia. "If all the silver has been precipitated with hydrochloric acid, and the filtrate is evaporated to dryness, no fixed residue should be left (abs. of foreign metallic impurities). 1 Gm. Nitrate of Silver, when completely precipitated by hydrochloric acid, should yield 0·84 Gm. of dry chloride of silver." *U. S.*

Medical Properties and Uses. When nitrate of silver in a pure state is brought in contact with a living tissue, it acts as an escharotic. Owing to the formation of a dense film of coagulated albumen, the depth of its action is very limited; the albuminous coating is at first white, but soon becomes blackish owing to the reduction of the silver. The solution of the salt is, if not too strong, a local stimulant and astringent, and is very largely employed (grs. xx to f℥i) in ordinary angina, or more concentrated (grs. xxx to f℥i) in diphtheria, and is also used in inflammations of the urethral and conjunctival mucous membranes; for the latter purpose the strength should usually not exceed one or two grains to the ounce. As a counter-irritant, stimulant, and alterative, or an escharotic in various external ulcerations, morbid growths, etc., nitrate of silver finds a very wide use. It is largely employed, also, internally in inflammations and ulcerations of the alimentary tract, such as subacute gastritis, pyrosis, ulcer of the stomach, chronic diarrhœa, catarrh of the gall ducts, etc. In all stomachic diseases it should be given half an hour before eating, so as to reach as thoroughly as possible the gastric mucous membrane. Dr. Boudin, of Marseilles, employed it in typhoid fever, and Prof. Wm. Pepper has followed the practice with asserted brilliant results. As it has been found in all the tissues of the body, it is undoubtedly absorbed. It is soluble in peptones, and is probably so taken up, although some believe that it is converted in the stomach into a soluble double chloride with sodium or potassium. It is never used in practical medicine to produce an acute impression on the general system, but for general effects solely as a slowly acting alterative in certain nervous affections, especially epilepsy and chronic spinal inflammation, such as locomotor ataxia, spasmodic tabes, tabes dorsalis, etc. The occasional production of a slate-colored discoloration of the skin is a great drawback to the long-continued use of the nitrate, but it probably never occurs under a course of the remedy of less than two months. It affects also the mucous membrane, and, according to Dr. Branson (confirmed by Dr. Wm. Pepper), an indication of the approach of discoloration is furnished by the occurrence of a dark blue line on the edges of the gums, very similar to that produced by lead, but somewhat darker. When once produced, the discoloration seems to be permanent, although Dr. L. P. Yandell has reported two cases in which the discoloration of the skin disappeared during a course of iodide of potassium for syphilitic disease. (*N. R.*, July, 1873.)

The dose of nitrate of silver (crystals) is the fourth of a grain (0·016 Gm.), gradually increased to half a grain (0·03 Gm.), three times a day. For internal exhibition, the physician should always prescribe the crystals, and never direct the fused nitrate, which may not be pure. Nitrate of silver should always be given in pill, as the solution is decomposed by the liquids of the mouth. In the treatment of epilepsy, Dr. Powell recommends the exhibition at first of grain (0·065 Gm.) doses, to be gradually increased to six grains (0·4 Gm.), three times a day. Its effects vary very much, owing no doubt to the salt being more or less decomposed by the substances used in preparing it in pill, or with which it comes in contact in the stomach. It should not be made up into pill with crumb of bread, as this contains common salt, but with some vegetable powder and mucilage, preferably powdered sugar of milk with an excipient of glucose. But, as all organic substances decompose it more or less, M. Vée proposes the use of inorganic matter, such as nitre, or preferably pure silica obtained by precipitating one of the silicates by an acid, and washing it. The least possible proportion of tragacanth may be used to give adhesiveness to the mass. (*Journ. de Pharm.*, Mai, 1864, p. 408.) In view of the fact that chloride of sodium is used with food, and exists, together with phosphates, in the secretions, and that free hydrochloric acid and albuminous fluids are present in the stomach, it is almost certain that, sooner or later, the whole of the nitrate of silver will be converted into the chloride, phosphate, and albuminate, compounds far less active than the original salt. The experiments of Keller, who analyzed the fæces of patients under the use of this salt, confirm this view. Such being the inevitable result when the nitrate is given, the question arises how far it would be expedient to anticipate the change, and give the silver as a chloride ready formed. Dr. Geo. B. Wood tried the chloride in large doses, in two cases of epilepsy, but without advantage. According to Mialhe, nitrate of silver upon entering the stomach is converted into a soluble and readily absorbable double chloride, by combining with chloride of sodium or of potassium.

When ingested in sufficient dose, nitrate of silver is a violent poison, and has several times caused death. The symptoms are those of toxic gastro-enteritis, with marked constitutional disturbance, especially coma, convulsions, paralysis, and profound alteration of the respiration. The treatment of the poisoning resolves itself into the use of the antidotes (common salt, soap, alkalies), and the meeting of symptoms as they arise.

Off. Prep. Argenti Cyanidum, *U. S.;* Argenti Nitras Dilutus; Argenti Nitras Fusus, *U. S.*

ARGENTI NITRAS DILUTUS. *U. S.* *Diluted Nitrate of Silver.*

(ÄR-ÇĔN'TĪ NĪ'TRĂS DỊ-LŪ'TŬS.)

"Nitrate of Silver, *fifty parts;* Nitrate of Potassium, *fifty parts,* To make *one hundred parts.* Melt the salts together in a porcelain crucible, at as low a temperature as possible, stirring the melted mass well until it flows smoothly. Then cast it in suitable moulds. Keep the product in dark amber-colored vials, protected from light." *U. S.*

This is a new officinal preparation. Its introduction grew out of the frequent demand for a fused nitrate of silver, which would not be so severe in its action as the pure article. The manufacturers have been in the way of furnishing for many years a "*No.* 2 *Lunar Caustic,*" which contains 67 per cent. of pure nitrate of silver; the officinal diluted nitrate contains 50 per cent. of lunar caustic.

Properties. Diluted nitrate of silver is officinally described as "a white, hard solid, generally in form of pencils or cones of a finely granular fracture, becoming gray or grayish black on exposure to light in presence of organic matter, odorless, having a caustic, metallic taste, and a neutral reaction. Each of its constituents retains the solubility in water and in alcohol mentioned respectively under *Argenti Nitras* and *Potassii Nitras.* An aqueous solution of 2 Gm. of Diluted Nitrate of

Silver, acidulated with nitric acid, when completely precipitated by hydrochloric acid, should yield not less than 0·84 Gm. of dry chloride of silver. The filtrate, separated from the precipitate, when evaporated to dryness, leaves a residue which is completely soluble in water, and which yields a white, crystalline precipitate with a concentrated solution of bitartrate of sodium." *U. S.*

Medical Properties. This preparation is only used externally. It is similar in its action to the fused nitrate, but less energetic.

ARGENTI NITRAS FUSUS. *U.S.* *Moulded Nitrate of Silver.*

(ĂR-ÇĔN'TĪ NĪ'TRĂS FŪ'SŬS.)

Argenti Nitras, *Br.;* Lunar Caustic; Lapis Infernalis, Argentum Nitricum Fusum, *P.G.;* Azotas (Nitras) Argenticus Fusus; Azotate d'Argent fondu, Pierre infernale, *Fr.;* Höllenstein, Geschmolzenes Salpetersaures Silberoxyd, *G.;* Fused Nitrate of Silver.

"Nitrate of Silver, *one hundred parts* [or one ounce av.]; Hydrochloric Acid, *four parts* [or sixteen minims]. Melt the Nitrate of Silver in a porcelain capsule, at as low a temperature as possible; then add to it, gradually, the Hydrochloric Acid, stir well, and, when nitrous vapors cease to be evolved, pour the melted mass in suitable moulds. Keep the product in dark amber-colored vials, protected from light." *U. S.*

"To obtain the Nitrate in rods, fuse the crystals in a capsule of platinum or thin porcelain, and pour the melted salt into proper moulds." *Br.*

For most purposes it is desirable to have the nitrate of silver less brittle than in its pure state. Prof. J. L. Smith, of Louisville, Ky., found that this could be effected by adding a little chloride of silver, which rendered the stick tough, without materially impairing its efficiency. Dr. Squibb proposed to accomplish the object by adding 40 grains of hydrochloric acid, with half a fluidounce of distilled water, to two ounces of nitrate of silver, heating the mixture by means of a sand-bath to dryness, and then melting and casting into moulds. (*Proc. A. P. A.*, 1858.) This process has been adopted in the present U. S. Pharmacopœia. In order to keep the sticks from becoming discolored during the casting process, it is advisable to add a diluted nitric acid (1 in 5) occasionally to the melted nitrate, and carefully prevent the mass from becoming overheated. The British process is merely the continuation of that by which the nitrate is obtained in crystals. As the salt while melting sinks into a common crucible, the fusion is performed in one of porcelain or platinum, the size of which should be sufficient to hold five or six times the quantity of the salt operated on, in order to prevent its overflowing in consequence of the ebullition. Sometimes small portions of the liquid are spirted out, and the operator should be on his guard against this occurrence. When the mass flows like oil, it is completely fused, and ready to be poured into the moulds. These should be warmed, but not greased, as organic matter would thus be furnished, which would partially decompose the fused salt.

Properties. Fused nitrate of silver, as prepared by the above process, is in the form of hard brittle sticks of the size of a goose-quill, at first translucent, but quickly becoming gray or more or less dark under the influence of light, owing to the reduction of the silver, effected probably by organic matter or sulphuretted hydrogen contained in the atmosphere. That the change does not depend on the sole action of light has been proved by Mr. Scanlan, who finds that nitrate of silver in a clean glass tube hermetically sealed undergoes no change by exposure to light. The sticks often become dark-colored and nearly black on the surface, and when broken across, exhibit a crystalline fracture with a radiated surface. Fused nitrate of silver, when pure, is wholly soluble in distilled water; but even fair samples of the fused salt will not totally dissolve, a very scanty black powder being left of reduced silver, arising probably from the salt having been exposed to too high a heat in fusion. Stein (*Schweiz. Wochenschrift für Pharmacie*, 6, 10, 1877) recommends a plan for obtaining sticks of lunar caustic of special diameter or length by taking a glass tube or rod of required outside diameter, and wrapping around it moistened parchment paper, pasting the edges, tying the lower end, and drying. The melted lunar caustic is poured into the paper mould, held upright in a test-tube, and allowed to cool by standing. *Elastic crayons* of nitrate of silver may be made by taking a laminaria tent $\frac{1}{10}$th of an inch (·002 mm.) in diameter, dipping it into thick mucilage, rolling in finely powdered lunar caustic, and drying it. (*Pajot.*) Entirely black lunar caustic is sometimes seen in France, which contains about 2 per cent. of nitrate of potassium and the same quantity of black oxide of manganese. Heller's caustic pencils look like ordinary lead-pencils, and consist of long, thin sticks of lunar caustic, encased in wood; they may be sharpened like lead-pencils, and the point protected by a cap to prevent injury when not in use. "Soluble, with the exception of about 5 per cent. of chloride of silver, in 0·6 part of water and in 25 parts of alcohol at 15° C. (59° F.), in 0·5 part of boiling water, and in 5 parts of boiling alcohol. It is insoluble in ether. Whatever is left undissolved by water is completely soluble in water of ammonia." *U. S.*

Impurities and Tests. Fused nitrate of silver is liable to contain free silver from having been exposed to too high a heat, the nitrates of lead and copper from the impurity of the silver dissolved in the acid, and nitrate of potassium from fraudulent admixture or otherwise. Free silver will be left undissolved as a black powder, after the action of distilled water. A very slight residue of this kind is hardly avoidable; but, if there be much free silver, it will be shown by the surface of a fresh fracture of one of the sticks presenting an unusually dark gray color. (*Christison.*) The mode of detecting lead and copper is explained under nitrate of silver. (See *Argenti Nitras.*) In order to detect nitrate of potassium, a solution of the suspected salt should be treated with hydrochloric acid in excess, to remove silver, and with sulphuretted hydrogen, to throw down other metals if they happen to be present. The filtered liquid, if the salt be pure, will entirely evaporate by heat; if it contain nitrate of potassium, this will be left, easily known by its properties as a nitrate. This impurity sometimes exists in fused nitrate of silver in large amount, varying, according to different statements, from 10 to 75 per cent. According to Dr. Christison, it may be suspected if the sticks present a colorless fracture. Prof. Pollacci (*Journ. de Pharm.*, 4e sér., xvii. 160) states that if nitrate of silver, after having been heated in a porcelain capsule to redness and cooled, imparts an alkaline reaction to water, it contains nitre. The U. S. Pharmacopœia gives the following quantitative test. "A filtered aqueous solution of 2 Gm. of the salt, acidulated with nitric acid, when completely precipitated by hydrochloric acid, should yield 1·6 Gm. of dry chloride of silver." *U. S.* In the Br. Pharmacopœia the following method is given for testing fused nitrate of silver for impurity, without determining its nature. "Ten grains dissolved in two fluidrachms of distilled water give with hydrochloric acid a precipitate, which, when washed and thoroughly dried, weighs 8·44 grains. The filtrate when evaporated by a water-bath leaves no residue." If the weight of the precipitate be greater or less than here stated, there must be some impurity in the nitrate; and any non-precipitable matter, if solid at the temperature of the water-bath, will be left behind when the filtrate is evaporated.

Medical Properties. Fused nitrate of silver should be restricted to external use. Externally applied, the fused nitrate acts variously as a stimulant, vesicant, and escharotic, and may be employed either dissolved in water, or in the solid state. A drachm of the fused salt, dissolved in a fluidounce of water, forms an escharotic solution, which may often be resorted to with advantage. But fused nitrate of silver is most frequently employed in the solid state; and, as it is not deliquescent nor apt to spread, it forms the most manageable caustic that can be used. When thus employed, it is useful to coat the caustic, as recommended by M. Dumeril, by dipping it into melted engravers' sealing-wax, which strengthens the stick, protects it from change, prevents it from staining the fingers, and affords facilities for limiting the action of the caustic to particular spots. If it is desired, for example, to touch a part of the throat with the caustic, it is prepared by scraping off the sealing-wax with a penknife, to a suitable extent, from one end. Another way to strengthen the stick is to cast it around a platinum wire, as recommended by M. Chassaignac; or around a wick of cotton, according to the plan of M. Blatin. By the latter plan, when the stick is broken, the fragments remain attached. If the fused nitrate be rubbed gently over the moistened skin until this becomes gray, it generally vesicates, causing usually less pain than is produced by cantharides. The fused nitrate is also employed to destroy strictures of the urethra, warts and excrescences, fungous flesh, incipient chancres, and the surface of other ulcers. Mr. Higginbottom considers its free application to ulcers, so as to cover them with an eschar, as an excellent means of expediting their cicatrization. He alleges that, if an adherent eschar be formed, the parts underneath heal before it falls off. It has also been used with good effect in the solid state by Dr. Jewell in leucorrhœa, and by Ricord, Hannay, and others in the gonorrhœa of women. In these cases the pain produced is much less than would be expected. Lunar caustic is frequently used in aqueous solution as a topical remedy in various low forms of inflammation, but particularly in erysipelas, applied both to the inflamed and to the surrounding healthy parts. In some cases it is sufficient to blacken the cuticle; in others it is best to produce vesication. In the treatment of these inflammations, Mr. Ward, of London, finds an ethereal solution, formed by dissolving eight grains of the salt in a fluidounce of common nitric ether, much more convenient and manageable than an aqueous solution. The ethereal solution is readily applied, and quickly dries. In cases of prolapsus ani, Mr. Lloyd, of London, smears the protruded bowel with the solid caustic, and then returns it. Three or four applications, at intervals of a week or a fortnight, are generally sufficient to effect a cure. Mr. Lloyd never knew this practice to be attended with bad consequences. Prof. Parker, of New York, uses nitrate of silver for the radical cure of hydrocele. After drawing off the liquid, he introduces, through the canula, a common probe, the end of which is coated, for half an inch or more, with the caustic. The probe is then carried lightly over the serous surface of the tunica vaginalis, and withdrawn. In smallpox it has been proposed by Bretonneau and Serres to cauterize each pustule, after its top has been removed, on the first or second day of the eruption, in order to arrest its development, and prevent pitting. The fused nitrate also forms an efficacious application to certain ulcerations of the throat, to different forms of porrigo of the scalp, and other skin diseases, to punctured and poisoned wounds, and to chilblains, slowly rubbed over the moistened part. If, unexpectedly, the pain produced by its external use should be excessive, it may be allayed by washing the parts with a solution of common salt, which acts by decomposing the caustic. In the form of ointment, made by mixing one part of the caustic, in powder, with thirty of lard, it has been used in ozæna; a piece of lint, smeared with the ointment, being introduced into the nasal fossa. Dr. Richardson, of New Orleans, obtains the most signal success by the injection of a strong solution (20 to 60 grains to the ounce) in chronic cystitis. First washing out the bladder, he injects about two ounces of the liquid, and, except in the case of very strong solutions, allows it to remain; in eight days he repeats the operation. (*Phila. Med. Times*, v. 735.)

Nitrate of silver, in impalpable powder, mixed with an equal weight of lycopodium, and used by inhalation, has been found beneficial in ulcerated sore throat, laryngitis, bronchitis, and incipient phthisis, by Dr. W. M. Cornell, of Boston. (*Boston Med. and Surg. Journ.*, Sept. 25, 1850.) The salt, used in this way, has since been successfully employed in the treatment of chronic laryngitis by M. Trousseau, of Paris, and others. The mixture employed consisted of three grains of the nitrate and a drachm of sugar of milk, intimately mixed in fine powder, of which as much as would fill the barrel of a steel pen was inhaled daily. The steel pen, charged with the powder, and attached to the barrel of a quill, is placed on the root of the tongue, and the patient compresses his lips around the quill. Then, holding his nose, he makes a deep inspiration, which draws the powder into the larynx. (See *Am. Journ. of Med. Sci.*, Oct. 1855, p. 515.) It is, however, much better and safer to apply the nitrate in solution to the affected part by means of laryngoscopy. Dr. Guillon, of France, strongly recommends the insufflation of the powder in pseudo-membranous croup.

ARGENTI OXIDUM. *U.S., Br.* *Oxide of Silver.*

Ag_2O; 231·4. (ĂR-ÇĔN′TĪ ŎX′Ị-DŬM.) AgO; 115·7.

Argentum Oxydatum, Argentic Oxide; Oxyde d'Argent, *Fr.*; Silberoxyd, *G.*

"Take of Nitrate of Silver, in crystals, *half an ounce* [avoirdupois]; Solution of Lime *three pints and a half* [Imperial measure]; Distilled Water *ten fluidounces*.

Dissolve the Nitrate of Silver in four [fluid]ounces of the Distilled Water, and, having poured the solution into a bottle containing the Solution of Lime, shake the mixture well, and set it aside to allow the deposit to settle. Draw off the supernatant liquid, collect the deposit on a filter, wash it with the remainder of the Distilled Water, and dry it at a heat not exceeding 212°. Keep it in a stoppered bottle." *Br.*

A process for preparing oxide of silver has not been adopted in the present Pharmacopœia: that of the U. S. Pharmacopœia of 1870 is given below.*

Oxide of silver was introduced into the U. S. Pharmacopœia of 1850, and was adopted in the Br. Pharmacopœia from the Dublin. In the processes for making it, nitrate of silver is decomposed by potassa or lime, the oxide being precipitated, and nitrate of potassium or nitrate of calcium, as the case may be, remaining in solution. When thus obtained, the oxide is an olive-brown powder. If the potassa used be not wholly free from carbonic acid, the precipitated oxide will be contaminated with some carbonate of silver. According to Mr. Borland, of London, the carbonate is sometimes sold for the oxide. A third process for obtaining this oxide is that of Gregory, which consists in boiling the moist, recently prepared chloride of silver with a very strong solution of caustic potassa (sp. gr. 1·25 to 1·30), when, by double decomposition, oxide of silver and chloride of potassium are formed. "Oxide of silver should be kept in dark amber-colored vials, protected from the light."

Properties and Tests. "A heavy, dark brownish black powder, liable to reduction by exposure to light, odorless, having a metallic taste and imparting an alkaline reaction to water, in which it is very slightly soluble. It is insoluble in alcohol. When heated, it loses oxygen, and metallic silver is left behind. On adding the Oxide to hydrochloric acid, no effervescence should take place (abs. of carbonate). 1 Gm. of the Oxide, when treated with an excess of hydrochloric acid, should yield 1·236 Gm. of chloride of silver. Oxide of silver should not be triturated with readily oxidizable or combustible substances, and should not be brought in contact with ammonia." *U. S.* When its solution in nitric acid is precipitated by chloride of sodium in excess, the supernatant liquid is not discolored by sulphydrate of ammonium. The non-action of this test shows the absence of most foreign metals, especially copper and lead. It parts with its oxygen with great facility, being decomposed by many organic substances, and even causing sulphur to take fire when the two are rubbed together, quite dry, in a mortar. (*Chem. News*, 1864, p. 217.)

Medical Properties and Uses. This oxide has been proposed as a substitute for nitrate of silver, as having the general therapeutic virtues of the latter, without its escharotic effect, and objectionable property of discoloring the skin. Experience, however, has shown that it will tint the skin. (*New York Med. Journ.*, June, 1869; *Phila. Med. Times*, vi.) It was first tried as a medicine by Van Mons and Sementini. In 1840 it was employed by Dr. Butler Lane, who considered it to act as a sedative. In 1845 the late Sir James Eyre strongly recommended it in his work on exhausting diseases. Dr. Lane used it with more or less success in nausea, cardialgia, pyrosis, various painful affections of the stomach without organic lesion, dysentery, diarrhœa, night-sweats without other obvious affection, dysmenorrhœa, menorrhagia, leucorrhœa, chronic enlargements of the uterus attended with flooding, etc. The oxide appeared to exert a peculiar control over uterine fluxes. Some of the cases treated required the use of tonics, after the curative influence of the oxide had been exerted. The late Dr. Golding Bird also obtained favorable effects from the use of oxide of silver, and confirmed to a certain extent the results of Dr. Lane, especially as to its valuable powers in menorrhagia. In stomach disease characterized by a glairy instead of a watery discharge, Dr. Bird derived not the slightest benefit from the oxide, though he used it in thirty cases. In tænia it has been used successfully in two cases by Mr. Whittel. The dose of oxide of silver is a grain (0·065 Gm.) twice or thrice a day. If pills are ordered, they should not be made with honey, conserve of roses, or other excipient containing glucose; and, indeed, most organic substances, especially in a moist state, deoxidize the oxide, reviving the silver. There would seem to be need of great caution in making these pills. Dr. Jackson has recorded a case in which pills of oxide of silver, muriate of morphia, and extract of gentian exploded violently in the pocket of the patient. (*P. J. Tr.*, xi. 552.) Mr. Ambrose Smith recommends, as among the best excipients, gum arabic, or this with a little syrup. (*Proc. A. P. A.*, 1859, p. 308.) The best method of administering is probably in gelatin capsules, the oxide being introduced in the form of a dry powder. Oxide of silver has been used in an ointment, composed of from five to ten grains to the drachm of lard, as an application to venereal sores, and to the urethral membrane in gonorrhœa, smeared on a bougie.

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* "Take of Nitrate of Silver *four troyounces;* Distilled Water *half a pint;* Solution of Potassa *a pint and a half,* or *a sufficient quantity.* Dissolve the Nitrate of Silver in the Water, and to the solution add Solution of Potassa so long as it produces a precipitate. Wash this repeatedly with water until the washings are nearly tasteless. Lastly, dry the precipitate and keep it in a well-stopped bottle, protected from the light." *U. S.* 1870.

ARMORACIÆ RADIX. *Br.* *Horse-radish Root.*

(ĂR-MỌ-RĀ′CỊ-Æ RĀ′DĬX.)

"The fresh root of Cochlearia Armoracia." *Br.* (*Nat. Ord.* Cruciferæ, Siliquosæ.)

Armoracia, Br. 1864; Raifort sauvage, Moutarde des Moines, Radis de Cheval, *Fr.;* Meerrettig, *G.;* Rafano rusticano, *It.;* Rabano rusticano, *Sp.*

Gen. Ch. Silicula emarginate, turgid, scabrous with gibbous, obtuse valves. *Willd.*

Cochlearia Armoracia. Willd. *Sp. Plant.* ii. 451; Woodv. *Med. Bot.* p. 400, t. 145. The root of this plant is perennial, sending up numerous very large leaves, from the midst of which a round, smooth, erect, branching stem rises two or three feet in height. The radical leaves are lance-shaped, waved, scolloped on the edges, sometimes pinnatifid, and stand upon strong footstalks. Those of the stem are much smaller, without footstalks, sometimes divided at the edges, sometimes almost entire. The flowers are numerous, white, peduncled, and form thick terminal clusters. The calyx has four ovate, deciduous leaves, and the corolla an equal number of obovate petals, twice as long as the calyx, and inserted by narrow claws. The pod is small, elliptical, crowned with the persistent stigma, and divided into two cells, each containing from four to six seeds.

The horse-radish is a native of western Europe, growing wild on the sides of ditches, and in other moist situations. It is cultivated for culinary purposes in most civilized countries, and is said to have become naturalized in some parts of the United States. Its flowers appear in June.

The root, which is officinal in its fresh state, is long, conical at top, then nearly cylindrical for some inches, at last tapering, whitish externally, very white within, fleshy, of a strong pungent odor when scraped or bruised, and of a hot, biting, somewhat sweetish, and sometimes bitterish taste. Its virtues are imparted to water and alcohol. They depend upon a *volatile oil*, which is dissipated by drying; the root becoming at first sweetish, and ultimately insipid and quite inert. Its acrimony is also destroyed by boiling. The oil may be obtained by distillation with water. It is colorless or pale yellow, heavier than water, very volatile, excessively pungent, acrid, and corrosive, exciting inflammation and even vesication when applied to the skin. Hubatka considers it as identical with the volatile oil of mustard. He combined it with ammonia and obtained crystals of *thiosinammine*, the composition of which agreed with that produced from mustard oil. (*Journ. de Pharm.*, 3e sér., v. 42.) According to Gutret, only six parts of it are obtained from 10,000 of the root. Besides this principle, the fresh root contains, according to the same chemist, a bitter resin in minute quantity, sugar, extractive, gum, starch, albumen, acetic acid, acetate and sulphate of calcium, water, and lignin. A. Hilger found in the ashes of the root of horse-radish, lime, magnesia, potassa, a trace of soda and oxide of iron, with sulphuric, hydrochloric, carbonic, phosphoric, and silicic acids in combination. (*Chem. Centralbl.*, p. 597, 1878; *A. J. P.*, 1879, p. 21.) From observations made by F. L. Winckler, it may be inferred that *myronic acid* exists in the root combined with potassa, and that it is from the reaction between this acid, *myrosine*, also existing in the root, and water, that the volatile oil is produced, in the same manner as oil of mustard from mustard seed. (See *Sinapis.*) Horse-radish, when distilled with alcohol, yields none of the oil. (*Journ. für Prakt. Pharm.*, xviii. 89.) The root may be kept for some time without material injury, if buried in sand in a cool place.

It is said that if to the powder of the dried root, which has become apparently inert, the emulsion of white mustard seed containing myrosine be added, it reacquires its original irritant properties; so that it is the myrosine and not the myronate of potassium which is injured by drying. Hence the powdered root may be added with advantage to mustard in preparing cataplasms, pediluvia, etc. (*Journ. de Pharm. et de Chim.*, xxvii. 268.)*

Medical Properties and Uses. Horse-radish is highly stimulant, exciting the stomach when swallowed, and promoting the secretions, especially that of urine. Externally, it is rubefacient. Its chief use is as a condiment to promote appetite and invigorate digestion; but it is also occasionally employed as a medicine, particularly in dropsy attended with enfeebled digestion and general debility. It has, moreover, been recommended in palsy and chronic rheumatism, both as an internal and an external remedy; and in scorbutic affections is highly esteemed. Cullen found advantage in cases of hoarseness, from the use of a syrup prepared from an infusion of horse-radish and sugar, and slowly swallowed in the quantity of one or two teaspoonfuls, repeated occasionally. The root may be given in the dose of half a drachm (1·95 Gm.) or more, grated or cut into small pieces.

Off. Prep. Spiritus Armoraciæ Compositus, *Br.*

ARNICÆ FLORES. *U.S.* *Arnica Flowers.*

(ĂR'NI̦-ÇÆ FLŌ'RĒȘ.)

"The flower heads of Arnica montana. Linné. (*Nat. Ord.* Compositæ.)" *U.S.*

ARNICÆ RADIX. *U.S., Br.* *Arnica Root.*

(ĂR'NI̦-ÇÆ RĀ'DĬX.)

"The rhizome and rootlets of Arnica montana. Linné. (*Nat. Ord.* Compositæ.)" *U.S.* "The dried rhizome and rootlets of Arnica montana." *Br.*

Leopard's Bane, *U.S.* 1850; Flores Arnicæ, *P.G.;* Fleurs d'Arnique, *Fr.;* Wohlverleichblüthen, Arnicablüthen, *G.*

Gen. Ch. Calyx with equal leaflets in a double row. *Seed-down* hairy, sessile. *Seeds* of the disk and ray furnished with seed-down. *Receptacle* hairy. *Hayne.*

Arnica montana. Willd. *Sp. Plant.* iii. 2106; *B. & T.* 158. This is a perennial, herbaceous plant, having a woody, brownish, horizontal root, from one to three inches long, and two or three lines thick, ending abruptly, and sending forth numerous slender fibres of the same color. The stem is about a foot high, cylindrical, striated, hairy, and terminating in one, two, or three peduncles, each bearing a flower. The radical leaves are ovate, entire, ciliated, and obtuse; those of the stem, which usually consist of two opposite pairs, are lance-shaped. Both are of a bright green color, and somewhat pubescent on their upper surface. The flowers are very large, and of a fine orange-yellow color.

This plant is a native of the mountainous districts of Europe and Siberia, and is found, according to Nuttall, in the northern regions of this continent, west of the Mississippi. It has been introduced into England, and might no doubt be cultivated in this country. The flowers, leaves, and root are employed; but the flowers are usually preferred.

Properties. The whole plant, when fresh, has a strong, disagreeable odor, which is apt to excite sneezing, and is diminished by drying. The taste is acrid, bitterish, and durable. The dried root is cylindrical, contorted, and marked by scars from the insertion of the leaves. Water extracts its virtues. The Pharmacopœia thus describes the flowers and the root.

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* The French Codex contains a formula for a compound *Syrup of Horse-radish* (*Sirop Antiscorbutique*), as follows. Scurvy grass, water cress, horse-radish (root), all fresh, of each, 100 parts, buckbean (marsh trèfoil), fresh, 10 parts, bitter orange peel 20 parts, canella 5 parts, white wine 400 parts, sugar 500 parts. Thoroughly contuse and comminute the solid ingredients, macerate for 48 hours with the wine, and distil off 100 parts. Express and strain the residue from the distillation, clarify the liquid with white of egg, and strain; add 300 parts sugar, and make into a syrup of sp. gr. 1·270 whilst boiling; with the rest of the sugar and sufficient water make a thick syrup, mix this with the other syrup, allow to cool, then add the distilled essence. *Iodized Syrup of Horse-radish* may be made by adding one part of tincture of iodine to ninety-nine parts of the compound syrup above.

The flowers are "about one and one-fifth inch (30 cm.) broad, depressed, roundish, consisting of a scaly involucre in two rows, and a small, flat, hairy receptacle, bearing about sixteen yellow, strap-shaped ray-florets, and numerous, yellow, five-toothed, tubular disk-florets; having slender, spindle-shaped achenes, crowned by a hairy pappus. It has a feeble, aromatic odor, and a bitter, acrid taste." *U. S.*

The rhizome is "about two inches (5 cm.) long, and one-eighth or one-sixth of an inch (3 or 4 mm.) thick; externally brown, rough from leaf-scars; internally whitish, with a rather thick bark, containing a circle of resin-cells, surrounding the short wood-wedges, and large, spongy pith. The rootlets numerous, thin, fragile, grayish brown, with a thick bark containing a circle of resin-cells. Odor somewhat aromatic; taste pungently aromatic and bitter." *U. S.*

Bastick (*P. J. Tr.*, x. 389) separated an alkaloid from the flowers, to which he gave the name of *arnicine*. His process in given in the foot-note.*

The *arnicine* of Walz (*N. Jahrb. Pharm.*, 13, p. 175), extracted from both the root and the flowers, is a different substance; it is an amorphous yellow mass of acrid taste, slightly soluble in water, freely in alcohol or ether, and dissolving also in alkaline solutions. It is precipitable from its alcoholic solution by tannic acid or by water. Walz assigns to arnicine the formula $C_{20}H_{30}O_4$; other chemists that of $C_{35}H_{54}O_7$. Arnicine has not yet been proved to be a glucoside, although it is decomposed by dilute acids.

Sigel (1873) obtained from dried arnica root about ½ per cent. of essential oil, and 1 per cent. from the fresh; the oil of the latter had a sp. gr. of 0·999 at 18° C. (64·4° F.). The oil was found to be a mixture of various bodies, the principal being the *dimethyl ether of thymohydroquinone*, $C_{10}H_{12}\left\{\begin{matrix}OCH_3\\OCH_3,\end{matrix}\right.$ boiling at about 235° C. (455° F.). The water from which the oil separates contains *isobutyric acid;* probably also a little *angelic* and *formic acids;* but neither capronic nor caprylic acid, which had been pointed out by Walz. Arnica root contains *inulin*, which Dragendorff extracted from it to the extent of about 10 per cent. (*Pharmacographia*, 2d edition, p. 391.)

Medical Properties and Uses. When taken internally in sufficient dose, arnica acts as an irritant to the stomach and bowels, often producing an emetic and cathartic effect, and is said by Bergius to be diuretic, diaphoretic, and emmenagogue. It is capable of acting as a poison in overdoses, causing burning in the stomach, violent abdominal pains, intense headache, and great nervous disturbance, with, in some cases, marked reduction of the pulse-rate, and finally collapse. A case of tetanic spasm of one side, and ultimate death, under its use, is on record; but there is reason to doubt whether arnica was the real cause of the fatal issue. (*Ann. de Thérap.*, 1854, p. 46.) It is much used by the Germans, who prescribe the flowers and root with advantage in amaurosis, paralysis, and other nervous affections. It is said to prove useful in that disordered condition which succeeds concussion of the brain from falls, blows, etc., and from this circumstance has received the title of *panacea lapsorum.* It has also been recommended in chronic catarrh of the old, intermittent fever and its sequelæ, dysentery, diarrhœa, nephritis, gout, rheumatism, passive hemorrhages, dropsy, chlorosis, amenorrhœa, and various other complaints, in most of which it seems to have been empirically prescribed, and the exact value of the remedy has not been determined. The powdered flowers and leaves are employed as a sternutatory; and the inhabitants of Savoy and the Vosges are said to substitute them for tobacco. They may be given in substance or infusion. The dose of the powder is from five to twenty grains (0·33–1·3 Gm.) frequently repeated. The infusion may be prepared by digesting an ounce of the flowers in a pint of water, of which from half a fluidounce to a fluidounce (15–30 C.c.) may be given every three hours. It should always be strained through linen, in order to separate the fine fibres, which might irritate the throat. A tincture prepared from the flowers is largely used in this country as a domestic remedy in sprains, bruises, etc. It is employed externally. A tincture of the root is now officinal: this would be preferable for internal use. (See *Tinctura Arnicæ Radicis.*)

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* The flowers were macerated with alcohol acidulated with sulphuric acid; the tincture was filtered, and treated with lime until it evinced an alkaline reaction; the liquid was then filtered, and the filtrate treated with sulphuric acid in slight excess; the acid solution was filtered and concentrated by evaporation; to the residue a little water was added, the liquid was evaporated until all the alcohol was driven off, and was then again filtered; the filtered liquor was saturated with carbonate of potassium, and, after filtration, was mixed with a considerable excess of that salt; finally, the liquid was agitated with successive portions of ether until this fluid ceased to dissolve anything, and the ethereal solution obtained was left to spontaneous evaporation. Arnicine remained.

Off. Prep. of the Flowers. Extractum Arnicæ Alcoholicum, *U. S.;* Tinctura Arnicæ Florum, *U. S.*

Off. Prep. of the Root. Extractum Arnicæ Radicis; Extractum Arnicæ Radicis Fluidum; Tinctura Arnicæ Radicis, *U. S.;* Tinctura Arnicæ, *Br.*

ARSENIUM. *Arsenic.*

As; 75. (ĂR-SĒ′NỊ-ŬM.) As; 75.

Arsenum, Arsenium; Arsenic, *Fr.;* Arsenik, *G.;* Arsenico, *It., Sp.*

This metal was introduced into the U. S. and Dublin Pharmacopœias in 1850, for the purpose of being used to form the iodide of arsenic, and the solution of iodide of arsenic and mercury, at that time two new officinals of those works. It has been rejected by the compilers of the U. S. Pharmacopœia and the British. The Dublin College gave the following formula.

"Take of White Oxide of Arsenic of Commerce two drachms [*Dub. weight*]. Place the Oxide at the sealed end of a hard German glass tube, of about half an inch in diameter and eighteen inches long, and, having covered it with about eight inches of dry and coarsely pulverized charcoal, and raised the portion of the tube containing the charcoal to a red heat, let a few ignited coals be placed beneath the Oxide, so as to effect its slow sublimation. When this has been accomplished, the metallic arsenic will be found attached to the interior of the tube at its distant or cool extremity.

"In conducting this process, the furnace used in the performance of an organic analysis should be employed, and the fuel should be ignited charcoal. It will be proper also to connect the open extremity of the tube with a flue, for the purpose of preventing the possible escape into the apartment of arsenical vapors; and, with the view of keeping it from being plugged by the metal, to introduce occasionally into it, as the sublimation proceeds, an iron wire through a cork, fixed (but not air-tight) in its open extremity."

In the above process, the white oxide (arsenious oxide) is reduced by the agency of ignited charcoal, which attracts the oxygen of the oxide, and revives the metal. On the large scale, metallic arsenic is generally obtained by heating arsenical pyrites ($FeAs,FeS_2$) in earthen tubes; when the metal sublimes, and two mols. of ferrous sulphide, FeS, are left.

Properties. Arsenic is a brittle, crystalline metal, of a steel-gray color, and possessing much brilliancy when recently broken or sublimed. Exposed to the air, its surface becomes dull and blackish. Its texture is granular, and sometimes a little scaly. Rubbed on the hands, it communicates a peculiar odor; but it is devoid of taste. Its sp. gr. is about 5·73 (5·88, *U. S.*). When heated to about 180° C. (356° F.) it sublimes, giving rise to white vapors having a garlicky odor.* Its atomic weight is 75. It forms two combinations with oxygen, arsenious and arsenic oxides, As_2O_3 and As_2O_5 respectively, to each of which the corresponding acid is known, and three with sulphur, namely, the disulphide or realgar, As_2S_2; the trisulphide or orpiment, As_2S_3, corresponding in composition to arsenious oxide; and the pentasulphide, As_2S_5, corresponding to arsenic oxide. (See *Acidum Arseniosum;* also *realgar* and *orpiment* in Part II. of this work.) *Arsenic acid* is obtained by distilling off a mixture of twelve parts of nitric and one of hydrochloric acid from four parts of arsenious acid, until the whole acquires the consistence of a thin syrup. The liquid is then poured into a porcelain dish, and evaporated at a moderate heat. Suddenly the arsenic oxide concretes into an opaque white mass, which should be transferred, while warm, to a well-stopped bottle. Arsenic oxide is white, solid, deliquescent, and soluble in six parts of cold and two of boiling water. It forms several acids, corresponding to the several varieties of phosphoric acid, to which it bears a close analogy. With nitrate of silver it gives a brick-red precipitate of arseniate of silver. As a poison it is even more virulent than arsenious oxide. It consists of two atoms of arsenic and five of oxygen (As_2O_5).

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* The statement that arsenic on being heated sufficiently passes at once into the state of vapor without fusing was disproved by experiments of Dunnington and Odger, made under the direction of Prof Mallet, of the University of Virginia. They succeeded in fusing arsenic without great difficulty. (*Chem. News*, Aug. 30, 1872.)

Arsenic is much diffused. Besides being present in a great many minerals, it has been detected, in minute proportion, in the earth of graveyards by Orfila; in certain soils and mineral waters by M. Walchner; in the ashes of various plants by M. Stein; and in various kinds of mineral coal, as also in the incrustation formed in the boiler of a sea-going steamer, by M. Daubrée.

ARSENII IODIDUM. *U. S.* *Iodide of Arsenic.*

As I₃; 454·7. (ĂR′SẸ-NĪ Ī-ŎD′Ị-DŬM.) As I₃; 454·7.

Arsenici Iodidum, *U. S.* 1870; Arsenicum jodatum, Arsenik jodür, *G.;* Iodure d'Arsenic, *Fr.*

"Iodide of Arsenic should be kept in glass-stoppered vials, in a cool place." This iodide was introduced into the U. S. Pharmacopœia for the purpose of being used in preparing the solution of iodide of arsenic and mercury. It is made by the direct combination of its constituents, with the aid of a gentle heat.

For U. S. process of 1870 see foot-note.* J. F. Babcock (*Proc. A. P. A.*, 1875, p. 693) proposes to make it by placing a troyounce of iodine in a suitable vessel with 10 or 12 fluidounces of water, and passing sulphuretted hydrogen through until the iodine color is entirely gone; then filtering, heating the filtrate until the odor of sulphuretted hydrogen has been dissipated; then adding a quarter of a troyounce of arsenious acid, heating until dissolved, filtering, and evaporating to dryness. $As_2O_3 + 6HI = 2AsI_3 + 3H_2O$. Nickle's process enables the operator to obtain the salt in a crystalline condition. Arsenic and iodine in equivalent proportions are heated together with carbon disulphide in a flask, to which an upright condenser is attached, until the iodine color disappears. The solution is then evaporated to the crystallizing point.

In the *Berichte d. Deutsch. Chem. Ges.*, 2643, 1881, may be found a process for obtaining this salt chemically pure, by making a hot solution of arsenious acid in hydrochloric acid, and mixing it with a concentrated solution of iodide of potassium, whereupon the teriodide separates as a crystalline powder; this may be washed with hydrochloric acid, sp. gr. 1·120, until a portion of the washings on evaporation ceases to leave a residue of chloride of potassium.

Properties, etc. Iodide of arsenic is an orange red, crystalline solid, soluble in 3·5 parts of water, wholly volatilized by heat, officinally described as in "glossy, orange red, crystalline masses, or shining, orange red, crystalline scales, gradually losing iodine when exposed to the air, having an iodine-like odor and taste, and a neutral reaction. Soluble in 3·5 parts of water and in 10 parts of alcohol at 15° C. (59° F.); also soluble in ether and in disulphide of carbon. It is gradually decomposed by boiling water and by boiling alcohol. By heat the salt is completely volatilized. The aqueous solution has a yellow color, and, on standing, gradually decomposes into arsenious and hydriodic acids. On passing hydrosulphuric acid through the solution, a lemon-yellow precipitate is thrown down. If the salt be heated with diluted nitric acid, vapor of iodine will be given off." *U. S.* It has a great tendency to decompose even at ordinary temperatures, iodine separating and volatilizing, oxygen being absorbed and arsenious acid formed. It has been used by Biett as an external application in corroding tubercular skin diseases. By the late Dr. A. T. Thomson it was given internally with advantage in lepra, impetigo, and diseases resembling cancer. Dr. F. C. Crane cured a case of what he considered cancer of the breast by its use for nearly eight months. The ointment used by Biett was composed of three grains of the iodide to an ounce of lard. The dose is an eighth of a grain (0·008 Gm.) three times a day, in pill or solution.

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* "Take of Arsenic *sixty grains;* Iodine *three hundred grains.* Rub the Arsenic in a mortar until reduced to a fine powder; then add the Iodine, and rub them together until they are thoroughly mixed. Put the mixture into a small flask or a test-tube, loosely stopped, and heat it very gently until liquefaction occurs. Then incline the vessel in different directions, in order that any portion of the iodine, which may have condensed on its surface, may be returned into the melted mass. Lastly, pour the melted iodide on a porcelain slab, and, when it is cold, break it into pieces, and keep it in a well-stopped bottle." *U. S.* 1870.

Off. Prep. Liquor Arsenii et Hydrargyri Iodidi, *U. S.*

ASAFŒTIDA. *U. S., Br.* *Asafetida.*

(ĂS-Ạ-FŒT′Ị-DẠ—ăs-ạ-fĕt′ị-dạ.)

"A gum-resin obtained from the root of Ferula Narthex, Boissier, and of Ferula Scorodosma, Bentham et Hooker. (*Nat. Ord.* Umbelliferæ, Orthospermæ.)" *U. S.* "A gum-resin obtained by incision from the living root of Narthex Assafœtida." *Br.*

Assafœtida, *Br.;* Asafœtida, *P.G.;* Gummi-resina Asafœtida; Asefétide, Assafœtida, *Fr.;* Stinkasant, Teufelsdreck, *G.;* Assafetida, *It.;* Asafetida, *Sp.;* Ungoozeh, *Pers.;* Hilteet, *Arab.*

Concerning the genus Ferula there has been much dispute by botanists, but at present a much wider range is given to it than formerly. H. Falconer (*Trans. Linn. Soc.*, xx. 285) separated from it the genus *Narthex*, relying chiefly upon the distinctness of the vittæ as characteristic, whilst Bunge separated the genus *Scorodosma* on account of the absence of vittæ. According, however, to Bentham and Hooker, the vittæ in Bunge's type specimens are no more inconspicuous than in various other species of the genus; and, further, the vittæ vary so much that no generic characters can be drawn from them. The genus Ferula is a very difficult one to characterize briefly, and for its description the reader is referred to that of Bentham and Hooker, *Genera Plantarum*, i. 917.

Ferula Narthex. Bois. *Narthex Assafœtida.* Falconer. *Ferula Assafœtida.* Willd. *Sp. Plant.* i. 1413. *B. & T.* This plant was first described from actual observation by H. Falconer, who found it near Kashmir. It has flowered twice in the Edinburgh Botanical Gardens. The root is perennial, fleshy, tapering, simple or divided, a foot or more in length, about three inches thick at top, where it is invested above the soil with numerous small fibres, dark gray and transversely corrugated on the outside, internally white, and abounding in an excessively fetid, opaque, milky juice. The leaves, which spring from the root, are numerous, large and spreading, nearly two feet long, light green above, paler beneath, and of a leathery texture. They are three-parted, with bipinnatifid segments and oblong-lanceolate, obtuse, entire or variously sinuate, decurrent lobes, forming a narrow winged channel on the divisions of the petiole. From the midst of the leaves rises a luxuriant, herbaceous stem, from six to ten feet high, two inches in diameter at the base, simple, erect, round, smooth, striated, solid, and terminating in a large head of compound umbels, with from ten to twenty rays, each surmounted by a roundish partial umbel. It is furnished with numerous branches, springing from the axils of dilated sheathing petioles. The flowers are pale yellow, and the fruit oval, thin, flat, foliaceous, and reddish brown. The plant is said to differ in its leaves and product, in different situations.

It is a native of Persia, Afghanistan, and other neighboring regions; and flourishes abundantly in the mountainous provinces of Laar and Chorassan, where its juice is collected. Burns, in his travels into Bokhara, states that the young plant is eaten with relish by the people, and that sheep crop it greedily.

Ferula Scorodosma. Bentham and Hooker. *Scorodosma fœtidum.* Bunge. *Ferula Assafœtida*, L., of Boissier. *Flora Orientalis*, ii. 994, resembles in its general characters *F. Narthex*, but is not quite so large; has its stem nearly naked with the numerous umbels only at the top, and the few stem leaves lacking the wide sheathing petioles. This plant was first discovered by Lehman in 1844, growing in sandy deserts near the Sea of Aral. About twenty years later it was found by Bunge in Persia.

Notwithstanding the authority of the Pharmacopœia, the source of the asafetida of commerce must still be considered doubtful. The plants mentioned may yield the gum-resin, but neither of them agrees with the figures given by Engelbert Kaempfer of the plant which he observed in 1687, and to which he gave the name of *Assafœtida Disgunensis*, although Falconer considers the latter plant as identical with his *Narthex assafœtida*, and Borszczon, who studied *F. Scorodosma*, growing wild in the neighborhood of the Caspian Sea, believes this plant the same as that of Kaempfer. *F. Persica* is said also to produce an asafetida-like gum-resin, and was formerly recognized by the Edinburgh Pharmacopœia.

The oldest plants are most productive, and those under four years old are not considered worth cutting, according to the statement of Kaempfer in 1687. At the season when the leaves begin to fade, the earth is removed from about the top of the root, and the leaves and stem, being twisted off near their base, are thrown with other vegetable matters over the root, in order to protect it from the sun. After some time the summit of the root is cut off transversely, and, the juice which exudes having been scraped off, another thin slice is removed, in order to obtain a fresh surface for exudation. This process is repeated at intervals till the root ceases to afford juice, and perishes. During the whole period of collection, which occupies nearly six weeks, the solar heat is as much as possible excluded. The juice collected from numerous plants is put together, and allowed to harden in the sun. Dr. H. W. Bellew visited Kandahar in 1872, and witnessed the collection of the drug; he describes the process essentially as did Kaempfer. The roots varied in size from that of a carrot to the thickness of a man's leg, and their yield from half an ounce to two pounds. The drug, he states, is very much adulterated. The fruit is said to be sent to India, where it is highly esteemed as a medicine.

Asafetida is brought to this country either from India, whither it is conveyed from Bushire, and down the Indus, or by the route of Great Britain. It sometimes comes in mats, but more frequently in cases, the former containing eighty or ninety, the latter from two hundred to four hundred pounds. It is sometimes also imported in casks.

Properties. As found in the shops, asafetida is in irregular masses, softish when not long exposed, of a yellowish or reddish brown color externally, exhibiting when broken an irregular, whitish, somewhat shining surface, which soon becomes red on exposure, and ultimately passes into a dull yellowish brown. This change of color is characteristic of asafetida, and is ascribed to the influence of air and light upon its resinous ingredient. The masses appear as if composed of distinct portions agglutinated together, sometimes of white, almost pearly tears, embedded in a darker, softer, and more fetid paste. Occasionally the *tears* are separate, though rarely in the commerce of this country. They are roundish, oval, or irregular, and generally flattened, from the size of a pea to that of a large almond, sometimes larger, yellowish or brownish externally and white within, and not unlike ammoniac tears, for which they might be mistaken except for their odor, which, however, is weaker than that of the masses. A very fine variety of asafetida is spoken of by Bellew as being procured from the leaf-bud in the centre of the root. It does not come into European commerce, but is the *Kandaharee Hing* of the Indian bazaars. (*P. J. Tr.*, viii. 103.) It occurs in moist flaky pieces and tears, yielding a reddish yellow oil on pressure, and mostly mixed with the remains of leaf-buds.

The odor of asafetida is alliaceous, extremely fetid, and tenacious; the taste, bitter, acrid, and durable. The effect of time and exposure is to render it more hard and brittle, and to diminish the intensity of its smell and taste, particularly the former. Kaempfer assures us that one drachm of the fresh juice diffuses a more powerful odor, through a close room, than one hundred pounds of the drug as usually kept in the stores. The color, which is at first white, becomes pink, and finally the well-known brown, on exposure. Asafetida softens by heat without melting, and is of difficult pulverization. Its sp. gr. is 1·327. (*Berzelius.*) It is inflammable, burning with a clear, lively flame. It yields all its virtues to alcohol, and forms a clear tincture, which becomes milky on the addition of water. "At least 60 per cent. of it should dissolve in alcohol." *U. S.* Macerated in water it produces a turbid red solution, and, triturated with that fluid, gives a white or pink-colored milky emulsion of considerable permanence. Touched with nitric acid (sp. gr. 1·2) the tear becomes of an evanescent green color. When asafetida is dissolved by means of sulphuric acid or ammonia, it exhibits a bluish fluorescence. In 100 parts, Pelletier found 65 parts of resin, 19·44 of gum, 11·66 of bassorin, 3·60 of volatile oil, with traces of acid malate of calcium. Brandes obtained 4·6 parts of volatile oil, 47·25 of a bitter resin soluble in ether, 1·6 of a tasteless resin insoluble in ether, 1·0 of extractive, 19·4 of gum containing traces of potassa and lime united with sulphuric, phosphoric, acetic, and malic acids, 6·4 of bassorin, 6·2 of sulphate of calcium, 3·5 of carbonate of calcium, 0·4 of oxide of iron and alumina, 0·4 of malate of calcium with resin, 6·0 of water, and 4·6 of impurities consisting chiefly of sand and woody fibre. The odor of the gum-resin depends on the *volatile oil*, which may be procured by distillation with water or alcohol. It is lighter than water, colorless when first distilled, but becoming yellow with age, of an exceedingly offensive odor, and of a taste at first flat, but afterwards bitter and acrid. It contains, according to Stenhouse, from 15·75 to 23 per cent., or, according to Flückiger, may contain as much as 25 per cent., of sulphur. Hlasiwetz (*Ann. Chem. und Pharm.*, 71, p. 23) considers it a mixture, in variable proportions, of the sulphide and bisulphide of a compound radical, consisting of carbon and hydrogen ($C_{12}H_{22}$). A persulphide of allyl, which is sublimed when oil of mustard is heated with persulphide of potassium, is said by Wertheim to have an extremely intense odor of asafetida; a fact which justifies the supposition that it may be identical with the oil of that gum-resin. (*Gmelin*, ix. 377.) The oil boils at about 138° C. (280° F.), but suffers decomposition, yielding sulphuretted hydrogen. When long exposed to the air it becomes slightly acid, and acquires a somewhat different odor. (*Chem. Gaz.*, No. 178, p. 108.)

The resin is, according to Hlasiwetz and Barth (*Ann. Chem. und Pharm.*, 138, p. 61), a mixture containing *ferulaic acid*, $C_{10}H_{10}O_4$, crystallizing in iridescent needles, and obtained by precipitating the alcoholic solution with lead acetate, washing the precipitate, and decomposing it with diluted sulphuric acid. Fused with caustic potash, ferulaic acid yields oxalic acid and carbonic acids, several acids of the fatty series, and proto-catechuic acid. The resin itself treated in like manner, after it has been previously freed from gum, yields resorcin.

Impurities and Adulterations. Asafetida is probably often purposely adulterated; it frequently comes of inferior quality, and mixed with various impurities, such as sand and stones. Portions which are very soft, dark brown, or blackish, with few or no tears, and indisposed to assume a red color when freshly broken, should be rejected. We have been informed that a case seldom comes without more or less of this inferior asafetida, and of many it forms the larger portion. It is sold chiefly for horses. A factitious substance, made of garlic juice and white pitch with a little asafetida, has occurred in commerce. Asafetida is said to be usually mixed with wheat or barley flour, or with earthy matters at the place of its production; the impurities sometimes exceeding 30 per cent. *Hingra* of the Bombay bazaars is a very stony variety, composed largely of earthy matter.

Asafetida is sometimes kept in the powdered state; but this is objectionable, as the drug is thus necessarily weakened by the loss of volatile oil, and is besides rendered more liable to adulteration.

Medical Properties and Uses. The effects of asafetida on the system are those of a moderate stimulant, antispasmodic, efficient expectorant, and feeble laxative. Some consider it also emmenagogue and anthelmintic. Its volatile oil is undoutedly absorbed; as its peculiar odor may be detected in the breath and the secretions. As an antispasmodic simply, it is employed in the treatment of hysteria, hypochondriasis, convulsions of various kinds, spasm of the stomach and bowels unconnected with inflammation, and in numerous other nervous disorders of a merely functional character. From the union of expectorant with antispasmodic powers, it is highly useful in spasmodic pectoral affections, such as hooping-cough and asthma, and in certain infantile coughs and catarrhs, complicated with nervous disorder, or with a disposition of the system to sink. In catarrhal senilis; in the secondary stages of peripneumonia notha, croup, measles, and catarrh; in pulmonary consumption; in fact, in all cases of subacute or chronic disease of the chest in which there is want of due nervous energy, asafetida may be occasionally prescribed with advantage. In the form of enema, it is useful in cases of inordinate accumulation of air in the bowels, and also in the hysteric paroxysm, and other functional convulsions.

Its laxative tendency is generally advantageous, but must sometimes be counteracted by opium. It may often be usefully combined with cathartics in flatulent constipation.

It appears to have been known in the East from very early ages, and, notwithstanding its repulsive odor, is at present much used in India and Persia as a condiment. Persons soon habituate themselves to its smell, which they even learn to associate pleasantly with the agreeable effects experienced from its internal use. Children with hooping-cough sometimes become fond of it.

The medium dose is ten grains (0·65 Gm.), which may be given in pill or emulsion. (See *Mistura Asafœtidæ.*) The tincture is officinal, and is much used. When given by injection, the gum-resin should be triturated with warm water. From half a drachm to two drachms (1·95–7·8 Gm.) may be administered at once in this way. It may also sometimes be conveniently given in the form of a suppository. A syrup has been recommended, in which the fetid odor of the drug is obviated by the use of the infusion of wild cherry bark. (See *A. J. P.*, 1871, p. 397.)*

Off. Prep. Emplastrum Asafœtidæ, *U. S.;* Enema Assafœtidæ, *Br.;* Mistura Asafœtidæ; Pilulæ Aloës et Asafœtidæ; Pilulæ Asafœtidæ, *U. S.;* Pilula Assafœtidæ Composita, *Br.;* Pilulæ Galbani Compositæ, *U. S.;* Spiritus Ammoniæ Fœtidus, *Br.;* Tinctura Asafœtidæ, *U. S.*

ASCLEPIAS. *U. S.* *Asclepias.* [*Pleurisy Root.*]

(AS-CLĒ'PI-AS.)

"The root of Asclepias tuberosa. Linné. (*Nat. Ord.* Asclepiadaceæ.)" *U. S.*

Butterfly-Weed; Racine d'Asclépiade tubereuse, *Fr.;* Knollige Schwalbenwurzel, *G.*

Gen. Ch. Calyx small, five-parted. *Corolla* rotate, five-parted, mostly reflexed. *Staminal crown* (or nectary) simple, five-leaved; leaflets opposite the anthers, with a subulate averted process at the base. *Stigmas* with the five angles (corpuscles) opening by longitudinal chinks. *Pollinia* five distinct pairs. *Torrey.*

Several species of Asclepias, besides *A. tuberosa*, have been employed medicinally; and two of these, *A. Syriaca* and *A. incarnata*, were recognized in the Secondary Catalogue of the U. S. Pharm. 1870.

Asclepias tuberosa. Willd. *Sp. Plant.* i. 1273; Bigelow, *Am. Med. Bot.* ii. 59; Barton, *Med. Bot.* i. 239. The root of the butterfly-weed, or *pleurisy root*, is perennial, and gives origin to numerous stems, which are erect, ascending, or procumbent, round, hairy, of a green or reddish color, branching at the top, and about three feet in height. The leaves are scattered, oblong-lanceolate, very hairy, of a rich, deep green color on their upper surface, paler beneath, and supported usually on short footstalks. They differ, however, somewhat in shape according to the variety of the plant. In the variety with decumbent stems they are almost linear, and in another variety cordate. The flowers are of a beautiful reddish orange color, and disposed in terminal or lateral corymbose umbels. The fruit is an erect lanceolate follicle, with flat ovate seeds connected to a longitudinal receptacle by long silky hairs.

This plant differs from other species of Asclepias in not emitting a milky juice when wounded. It is indigenous, growing throughout the United States from Massachusetts to Georgia, and as far west as Texas, and, when in full bloom, in June and July, having a splendid appearance. It is most abundant in the Southern States. The root is the only part used in medicine. It is "large and fusiform, dried in longitudinal or transverse sections; from one to six inches (25 to 150 mm.) long, and about three-quarters of an inch (2 cm.) or more in thickness; the head knotty, and slightly but distinctly annulate, the remainder longitudinally wrinkled; externally orange brown, internally whitish; tough, and having an uneven fracture; bark thin, and in two distinct layers, the inner one whitish; wood yellowish, with large, white, medullary rays; it is inodorous, and has a bitterish, somewhat acrid taste; when long kept it acquires a gray color." *U. S.*

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* J. W. Wood prepares syrup of asafetida by dissolving 256 grains of asafetida in two fluidounces of glycerin by the aid of a gentle heat, and straining. He then dissolves 15 drops oil of wintergreen, 5 drops oil of cinnamon, and 1 drop oil of bitter almond, in three fluidrachms of 95 per cent. alcohol, and adds it to the above, together with enough simple syrup to make the whole measure one pint. Each fluidrachm represents two grains of asafetida. (*A. J. P.*, Sept. 1874.)

When dried, it is easily pulverized; and its taste is bitter, but not otherwise unpleasant. Mr. E. Rhoads discovered in it a peculiar principle, which he obtained by treating the cold infusion with tannic acid, mixing the precipitate, previously washed and expressed, with litharge, drying the mixture and exhausting it with hot alcohol, and finally decolorizing and evaporating the alcoholic liquor. The product was a yellowish white powder, having the taste of the root, soluble in ether, and much less readily so in water, from which it was precipitated by tannic acid. Mr. Rhoads also found evidence of the existence in the root of tannic and gallic acids, albumen, pectin, gum, starch, a resin soluble and another insoluble in ether, fixed oil, a volatile odorous fatty matter, and various salts, besides from 30 to 35 per cent. of lignin. (*A. J. P.*, xxxiii. 492.)

Medical Properties and Uses. The root of *Asclepias tuberosa* is diaphoretic and expectorant, without being stimulant. In large doses it is often also cathartic. Dr. Pawling, of Norristown, Pa., found it always, when freely given, to diminish the volume and activity of the pulse, while it produced copious diaphoresis (*A. J. P.*, xxxiii. 496); and Dr. Goodbrake, of Clinton, Ill., considers it, from his experience, slightly sedative and astringent. (*Trans. of Illinois State Med. Soc.*, 1857.) In the Southern States it has long been employed by regular practitioners in catarrh, pneumonia, pleurisy, consumption, and other pectoral affections. Its popular name of *pleurisy root* expresses the estimation in which it is held as a remedy in that disease. It has also been useful in diarrhœa, dysentery, and acute and chronic rheumatism. Dr. Lockwood speaks highly of its efficacy in promoting the eruption in exanthematous fevers. (*Buffalo Med. Journ.*, March, 1848.) Much testimony might be advanced in proof of its possessing considerable diaphoretic powers. It is said to be gently tonic, and has been popularly used in pains of the stomach from flatulence and indigestion.

From twenty grains to a drachm (1·3–3·9 Gm.) of the root in powder may be given several times a day; but as a diaphoretic it is best administered in decoction or infusion, made in the proportion of an ounce to a quart of water, and given in the dose of a teacupful every two or three hours till it operates.*

ASPIDIUM. *U. S.* *Aspidium.* [*Male Fern.*]

(A̤S-PĬD′I̤-ŬM.)

"The rhizome of Aspidium Filix mas, Swartz, and of Aspidium marginale, Willdenow. (*Nat. Ord.* Filices.)" *U. S.* The dried rhizome with the bases of the footstalks, and portions of the root fibres, of Aspidium Filix mas. *Br.*

Filix Mas, *Br.* and *U. S.* 1870; Rhizoma Filicis, *P.G.;* Radix Filicis maris, Male Shield Fern; Fougère male, *Fr.;* Wurmfarnwurzel, Woldfarnwurzel, Johanniswurzel, *G.;* Félce maschio, *It.;* Helecho, *Sp.*

Gen. Ch. Fruit dots roundish or round, borne on the backs or extremities of free pinnate veins; indusium flat, scarious, orbicular, or round kidney-shaped, covering the sporangia, attached to the receptacle at the centre, or at the sinus opening all round the margin.

Aspidium Filix mas. Willd. *Sp. Plant.* v. 259; Smith, *Flor. Britan.*—*Nephrodium Filix mas.* Lindley, *Flor. Med.* 619.—*Polypodium Filix mas.* Linn.; Woodv. *Med. Bot.* p. 795, t. 267. The male fern has a perennial, horizontal root or rhizome, from which numerous annual fronds or leaves arise, forming tufts from a foot to four feet in height. The stipe, or footstalk, and midrib are thickly beset with brown, tough, transparent scales; the frond itself is oval-lanceolate, acute, pinnate, and of a bright green color. The pinnæ or leaflets are remote below, approach more nearly as they ascend, and run together at the summit of the leaf. They are deeply divided into lobes, which are of an oval shape, crenate at the edges, and gradually diminish from the base of the pinna to the apex. The fructification is in small dots on the back of each lobe, placed in two rows near the base, and distant from the edges. The plant is a native of Europe, Asia, and the north of Africa. It is also said to have been found in some of the Polynesian islands, and grows in Canada, following the Rocky Mountain chain through Mexico, Venezuela, etc., as far south as Peru. In the Eastern United States it is replaced by *A. marginale*, Sw., and *A. Goldianum*, Hook.

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* *Fluid Extract of Asclepias.* Mr. E. Rhoads prepares a *fluid extract* by moistening sixteen ounces of the powdered root with four fluidounces of a menstruum consisting of three pints of alcohol and a pint and a half of water, packing the mixture into a conical glass percolator, pouring on it the remainder of the menstruum, reserving the twelve fluidounces which first pass, evaporating the residue of the filtered liquor by means of a water-bath to four fluidounces, mixing this with the reserved liquor, and filtering at the end of twenty-four hours. This preparation was found effective by Dr. Pawling, in the dose of a fluidrachm (3·75 C.c.) every four hours.

A. marginale. Swartz. (*Gray's Manual.*) Frond ovate-oblong in outline (one to two feet long), pale green; pinnæ lanceolate, from a broad almost sessile base; pinnules oblong, obtuse, crowded. This species differs from *A. Filix mas* chiefly in having its fruit dots upon the margins of its evergreen fronds.

The revisers of our Pharmacopœia have perhaps acted prematurely in admitting *Aspidium marginale*, but it is probable that most species of the genus, if not of the natural order, are medicinally active. Mr. J. L. Patterson (*A. J. P.*, 1875) found that the newly recognized *A. marginale* contained all of the active principle of *A. Filix mas*, and Mr. Chas. H. Cressler has demonstrated the activity of its oleoresin. (*Ibid.*, 1878.) On the Pacific slope the indigenous *A. rigida* is locally used against the tape-worm, and Mr. J. G. Bowman has found in it filicic acid and resin. Popular belief has long ascribed tænicidal virtues to our native *Asplenium Filix fœmina;* and the Kaffirs of South Africa use the rhizome of *Aspidium Athamanticum* under the name of *inkomankomo*, or *uncomocomo.* It is the *pannum* of European commerce. (*P. J. Tr.*, xvi. 447.)

The proper period for collecting the rhizome is during the summer, when, according to M. Peschier, of Geneva, it abounds more in the active principle than at any other season. The same writer informs us that it deteriorates rapidly when kept, and in about two years becomes entirely inert. The rhizomes of other species of fern are frequently substituted for the officinal; and in the dried state it is difficult to distinguish them. The chaff, together with the dead portions of the rhizome and stipes, should be removed, and only such portions as have retained their green color should be used.

Properties, etc. As taken from the ground, the rhizome consists of a long cylindrical caudex, around which are closely arranged, overlapping each other like the shingles of a roof, the remains of the leafstalks or stipes, which are an inch or two in length, from two to four lines thick, somewhat curved and directed upwards, angular, brown, shining, and surrounded near their origin from the rhizome with thin silky scales, of a light brown color. From between these remains of the footstalks emerge numerous small radical fibres. The whole rhizome, thus constituted, presents a somewhat flexible, cylindrical mass, one or two inches thick, and from three inches to a foot or more in length. In this form, however, it is not usually found in our shops. The whole is ordinarily broken up into fragments, consisting of the separated remains of the leafstalks before described, with a small portion of the substance of the rhizome attached to their base, where they are surrounded by the silky scales. These fragments, as seen in the shops, often appear as if long kept, and are probably, in general, much deteriorated by time. The following observations are made by Geiger in relation to the collection and preservation of the rhizome. The inner parts of the fresh rhizome, and of the portions of stalk attached to it, are fleshy and of a light yellowish green color. In collecting them, all the black discolored portions should be cut away, the fibres and scales separated, and only the sound green parts preserved. These should be immediately but carefully dried, and then pulverized; and the powder should be kept in small well-stopped glass bottles. The powder thus prepared has a pale yellowish color with a greenish tinge.

The dried rhizome is externally of a brown color, internally yellowish white or reddish, with a peculiar but feeble odor which is most obvious in the powder and decoction, and a sweetish, bitter, astringent, nauseous taste. Microscopic examination shows that it is composed of polyhedral, porous-walled cells and vascular bundles containing scalariform ducts: in *A. Filix mas*, ten of these bundles are larger than the others, and are arranged in a circle near to the surface; whilst in *A. marginale* there are only six bundles in the circle. It has been analyzed by H. Bock, who gives, as its constituents, volatile oil, fixed oil, resin, starch, vegetable jelly, albumen, gum, sugar, tannic and gallic acids, pectin, lignin, and various salts. (See *A. J. P.*, xxiv. 64.) Peschier ascertained that its active properties reside in the ethereal extract, which is the fixed oil in an impure state, containing volatile oil, resin, coloring matter, etc. It is a thick dark liquid, with the odor of the fern, and a nauseous, bitterish, somewhat acrid taste. Dr. E. Luck has found in it a peculiar acid, which he denominates *filicic acid*, and has extracted from the root two others named *tannaspidic* and *pteritannic acids.* (*Chem. Gaz.*, ix. 407 and 452.) The *aspidin* of Pavesi is not entitled to the name, as, though it may contain, it does not itself constitute the active principle, and is probably little if at all superior to the ethereal extract.

Medical Properties and Uses. Male fern produces, when taken internally, no very obvious effects upon the system. It was used by the ancients, and is mentioned as a vermifuge in the works of Dioscorides, Theophrastus, Galen, and Pliny, and was also noticed by some of the earlier modern writers, among whom was Hoffman. But it does not appear to have been generally known till about the year 1775. Madame Nouffer, the widow of a surgeon in Switzerland, had gradually acquired great celebrity in the cure of tape-worm by a secret remedy. Her success was such as to attract the attention of the medical profession at Paris; and some of the most eminent physicians of that city, who were deputed to examine into the subject, having reported favorably of the remedy, the secret was purchased by the King of France, and published by his order. The outlines of her plan were to give a dose of the powdered root of the male fern, and two hours afterwards a powerful cathartic, to be followed, if it should not operate in due time, by some purging salt; and this process was to be repeated, at proper intervals, till the worm should be evacuated. A German physician, named Herrenschwand, had used the male fern in a manner somewhat similar, before Madame Nouffer's secret was known. The oleoresin of Male Fern is certainly a very efficient tænicide. It is said (with doubtful accuracy) to prove more effectual against the tape-worm of the Swiss (*Bothriocephalus latus*) than against the *Tænia solium*, which is more frequent in France and England. (*Bremser.*) The ethereal extract should alone be used. (See *Oleoresina Filicis.*) It should always be followed by a brisk cathartic.

Off. Prep. Extractum Filicis Liquidum, *Br.;* Oleoresina Aspidii, *U. S.*

ATROPINA. *U. S.* *Atropine.*

$C_{17}H_{23}NO_3$; 289. (ĂT-RỌ-PĪ′NẠ.) $C_{34}H_{23}NO_6$; 289.

"An alkaloid prepared from Belladonna." *U. S.*

Atropia, *Br.*, also *U. S.* 1870; **Atropinum**, *P.G.;* **Atropine**, *Fr.;* **Atropin**, *G.*

The U. S. Pharmacopœia has very properly omitted the process for preparing atropine; for process of 1870 see foot-note.[*] The British process is as follows: "Take of Belladonna Root, recently dried and in coarse powder, *two pounds* [avoirdupois]; Rectified Spirit *ten pints* [Imperial measure]; Slaked Lime *one ounce* [av.]; Diluted Sulphuric Acid, Carbonate of Potash, of each, *a sufficiency;* Chloroform *three fluidounces;* Purified Animal Charcoal *a sufficiency;* Distilled Water *ten fluidounces.* Macerate the Root in four pints [Imp. meas.] of the Spirit, for twenty-four hours, with frequent stirring. Transfer to a displacement apparatus, and exhaust the root with the remainder of the Spirit by slow percolation. Add the Lime to the tincture placed in a bottle, and shake them occasionally several times.

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[*] "Take of Belladonna Root, in fine powder, *forty-eight troyounces;* Purified Chloroform *four troyounces and a half;* Diluted Sulphuric Acid, Solution of Potassa, Alcohol, Water, each, *a sufficient quantity.* Mix the powder with a pint of Alcohol, and, having introduced the mixture into a cylindrical percolator, pour alcohol gradually upon it until sixteen pints have passed. From the liquid, thus obtained, distil off twelve pints of Alcohol. To the residue add sufficient Diluted Sulphuric Acid to give it an acid reaction, and, having evaporated the liquid to half a pint, add an equal bulk of Water, and filter through paper. To the filtered liquid add, first a troyounce and a half of the Chloroform, and then Solution of Potassa in slight excess, and shake the whole together at intervals, for half an hour. When the heavier liquid has subsided, separate it, and, having added a troyounce and a half of the Chloroform to the lighter liquid, again shake them together, and separate the heavier from the lighter liquid as before. Add to this lighter liquid the remainder of the Chloroform, and, after agitation, separate the heavier liquid for the third time. Mix the heavier liquids in a capsule, and set the mixture aside until, by spontaneous evaporation, the Atropia is left dry." *U. S.* 1870.

Filter, add the Dilute Sulphuric Acid in very feeble excess to the filtrate, and filter again. Distil off three-fourths of the Spirit, add to the residue the Distilled Water, evaporate at a gentle heat, but as rapidly as possible, until the liquor is reduced to one-third of its volume and no longer smells of alcohol; then let it cool. Add very cautiously, with constant stirring, a solution of the Carbonate of Potash so as nearly to neutralize the acid, care, however, being taken that an excess is not used. Set to rest for six hours, then filter, and add Carbonate of Potash in such quantity that the liquid shall acquire a decided alkaline reaction. Place it in a bottle with the Chloroform; mix well by frequently repeated brisk agitation, and pour the mixed liquids into a funnel furnished with a glass stop-cock. When the Chloroform has subsided, draw it off by the stop-cock, and distil it on a water-bath from a retort connected with a condenser. Dissolve the residue in warm Rectified Spirit; digest the solution with a little Animal Charcoal; filter, evaporate, and cool until colorless crystals are obtained." *Br.*

The U. S. process of 1870 is a modification of that of Prof. Procter. (*Proc. A. P. A.*, 1860.) For discussion of this and other processes, see U. S. D., 14th ed.

The British process is a combination of the processes of Mein and Rabourdin (see 14th ed. U. S. Dispensatory), the former being followed until after the addition of carbonate of potassium, and the alkaloid thus liberated being taken up by chloroform as in the latter. The use of lime in the earlier stage of the proceedings is to cause a precipitation of various substances which would otherwise embarrass the subsequent operations. This alkaloid cannot be prepared profitably on the small scale by the pharmacist, and for this reason the Pharmacopœia furnishes several good tests for recognizing its quality, and refrains from giving a process.

Properties and Tests. Atropine is in "colorless, or white, acicular crystals, permanent in the air, odorless, having a bitter and acrid taste, and an alkaline reaction. Soluble in 600 parts of water at 15° C. (59° F.), and in 35 parts of boiling water; very soluble in alcohol; also soluble in 3 parts of chloroform and in 60 parts of ether. When heated to 114° C. (237·2° F.), the crystals melt, and, on ignition, are completely dissipated, emitting acrid vapors. Atropine and its salts are decomposed and rendered inert by prolonged contact with potassa or soda, and, if heated with either of them, evolve vapor of ammonia. A solution of Atropine, or of any of its salts, when applied to the eye, strongly dilates the pupil.

"With sulphuric acid Atropine yields a colorless solution, which is neither colored by nitric acid (abs. of and difference from morphine), nor at once by solution of bichromate of potassium (abs. of and difference from strychnine), though the latter reagent, by prolonged contact, causes the solution to turn green. On heating this green solution, diluted with a little water, to boiling, a pleasant odor, recalling that of roses and orange flowers, is developed. The aqueous solution of Atropine, or of any of its salts, is not precipitated by test-solution of platinic chloride (difference from most other alkaloids). With chloride of gold it yields a precipitate which, when recrystallized from boiling water acidulated with hydrochloric acid, is deposited on cooling (rendering the liquid turbid), in minute crystals, forming a dull, lustreless powder on drying (difference from hyoscyamine)." *U. S.*

It is inflammable, giving off an odor like that of benzoic acid, and, when burned in the open air, leaving no residue. By distilling it with bichromate of potassium and sulphuric acid, Dr. E. Pfeiffer succeeded in obtaining crystals of benzoic acid and propylamine. (*A. J. P.*, 1864, p. 226.) Dr. Kraut, by heating it with baryta water, succeeded in obtaining an uncrystallizable salt, consisting of a peculiar acid and peculiar base, the former of which he calls *tropic acid*, $C_9H_{10}O_3$, and the latter *tropine*, $C_8H_{15}NO$. (*Ibid.*, p. 232.) Ladenburg (*Ber. Chem. Ges.* 12, 942, and 13, 104) has succeeded in effecting the synthesis of atropine from these two constituents, which when heated over a water bath in the presence of dilute hydrochloric acid, unite to form the alkaloid. It is said, moreover, that when a little of it, dissolved in a few drops of sulphuric acid, is heated, an odor is given out resembling that of orange flowers. (*Ibid.*, March, 1864, p. 112.) Hinterberger states that an alcoholic solution of atropine, when cyanogen is passed through it, assumes a blood-red color, and, on spontaneous evaporation, deposits a red syrupy liquid insoluble in water. (*Gmelin.*) The detection of atropine, in small quantity, is a matter of great difficulty; the best test is the physiological, which consists in placing the suspected liquid in the eye of a cat, or other animal, when, if the alkaloid be present, dilatation of the pupil will occur. According to Brunner, the best chemical test is the aromatic smell, which is produced by adding this alkaloid and a little water to a hot mixture of sulphuric acid and bichromate of potassium or molybdate of ammonium. (*P. J. Tr.*, iv. 385.) For further information see *Belladonna.**

Medical Properties and Uses. The local and general effects of atropine on the system are precisely those of belladonna. It is, however, more speedy in its operation, probably in consequence of its easier absorption. Thus, the poisonous action of belladonna is seldom experienced in less than half an hour, while that of atropine shows itself violently in fifteen or twenty minutes. The most prominent effects from small remedial doses are dryness and stricture of the throat, and slight uneasiness of the head, with confusion or giddiness; from somewhat larger doses, dilatation of the pupil, some dimness of vision, frontal headache, hurried respiration, slight delirium, flushed face, and sometimes a scarlet rash. After poisonous doses, the above symptoms occur in a more aggravated form. Two distinct stages of the poisoning can usually be noted. At first there is great dimness or total temporary loss of vision, excessive dilatation of the pupil, headache, delirium, which is always talkative and may be violent, an enormous increase in the frequency of the pulse, which is also small and hard, and an elevation of the bodily temperature, and decided increase of the rate of respiration. Subsequently the second stage develops, and paralytic symptoms set in: the delirium gives way to stupor, restlessness to paralytic weakness, the pulse becomes very feeble, the surface cold, the respirations grow more and more shallow, and death from failure of both respiration and circulation occurs.

In some instances violent convulsions have occurred; nausea and vomiting, and even diarrhœa, are occasionally produced. The atropine is eliminated by the kidneys, and may produce increased diuresis, but usually there is, in cases of poisoning, retention of urine from vesical paralysis. The increase of the heart's action by atropine is chiefly due to its paralyzing the peripheral vagi, the inhibitory nerves of the heart; the final cardiac failure which takes place when poisonous doses have been taken is apparently the result of a direct depressant action on the heart-muscle. Upon the vaso-motor centres atropine in a moderate dose acts as a stimulant, thereby causing a great rise of the arterial pressure. After poisonous doses the primary vaso-motor spasm is followed by dilatation of the vessels, and great fall of the arterial pressure. Upon the spinal cord it acts as a powerful stimulant. Hence the violent convulsions which are sometimes seen in belladonna poisoning. Usually this effect is more or less completely masked by the paralysis of the motor nerves, which is one of the most marked effects of the poison; upon the afferent nerves the poison seems to have but little influence. On all non-striated muscle atropine exerts a very powerful influence, and it is probable, although not certain, that whilst in poisonous amount it lessens and finally paralyzes intestinal movements by a direct action upon the muscular coats, in small doses it increases peristalsis by paralyzing the inhibitory nerves which control this intestinal function. The action of the drug upon the respiratory centres is a very important one, atropine being in moderate doses the most powerful persistent stimulant to the respiratory centre known. The asphyxia of belladonna poisoning is certainly in large measure due to the paralysis of the nerve-trunks, which the poison produces, although it is also probable that the first period of excitation of the respiratory centres is followed by one of depression.

Atropine chiefly depends for its therapeutic powers upon—1st, its sedative action upon the peripheral nerves; 2d, its stimulant action on the respiratory centres; 3d, its influence upon the heart and vaso-motor centres. By virtue of its first-mentioned power it is useful in spasmodic diseases, such as hooping-cough, dysmenorrhœa, local spasms, etc. As the action is upon the nerve-trunks, the remedy is much more effective when it can be applied locally, as by atomization in hooping-cough and asthma, or by hypodermic injection in wry neck. As atropine has some influence upon the afferent nerve, it has some power of relieving pain; but for this action to be marked, direct application is necessary. On account of its influence upon respiration, it is invaluable in narcotic poisonings and other bodily conditions with failure of the function. In shock and other similar states in which vaso-motor paralysis is an important part of the morbid condition, it is a very useful stimulant. On account of the paralyzing influence which it has upon the inhibitory intestinal nerves, atropine may be used as an adjuvant to more decided laxatives.

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* For the behavior of atropine under the influence of an electric current, see *P. J. Tr.*, 1870, i. 244.

It is stated by H. Bullot that if to an aqueous solution of atropine acidulated with sulphuric acid an aqueous solution of picric acid be added, a precipitate will not form with good English atropine; with that obtained by the method of Simon, there will be a very slight precipitate; with the German alkaloid, an abundant yellow precipitate.

On the glandular system atropine exerts a decided influence; its effect upon the salivary and perspiratory glands being at present best understood. The remarkable action which it has in checking the functional activity of these glands is probably exerted through the nervous system, for in Keuchel's experiments it was distinctly proved that the chorda tympani nerve, excitation of which normally provokes salivation in atropine poisoning, is paralyzed. In a case recorded by Dr. James Andrew two-thirds of a grain of atropine occasioned the most alarming symptoms, which continued for several days (*Ed. Month. Journ. of Med. Sci*, xiv. 34); and a lady, under the care of M. Roux, of Brignolles, took somewhat more than a grain, with the same alarming symptoms (*Ann. de Thérap.*, 1861, p. 14); though, in both cases, recovery took place under treatment. In a child three years old less than half a grain was followed by similar dangerous symptoms, and the same favorable result. (*Med. Times and Gaz.*, Dec. 1850, p. 601.) A solution of atropia dropped into the eye produces dilatation of the pupil after ten or fifteen minutes, without causing congestion or inflammation; and the dilatation will usually continue for three or four days. Sometimes it is said that the dilatation is followed by contraction of the pupil, especially when the dose is large. The alkaloid also produces its characteristic constitutional effects when applied to the skin denuded of the epidermis, or to a mucous membrane, as of the rectum, vagina, etc., and especially when injected into the subcutaneous areolar tissue. The remedies for its poisonous operation are the same as those for belladonna; the most prominent being evacuation of the stomach, cold applications to the head, the preparations of opium internally, and stimulants when the strength is failing. As the value of atropine in opium poisoning, which seems unquestionable, is due to its influence on the respiratory centres, it is far from certain that opium is of at all proportionate advantage in poisoning by belladonna, etc. The officinal compound solution of iodine has been given as a chemical antidote to atropine, and with asserted advantage. It acts by forming an insoluble compound with the alkaloid. (See *Belladonna.*)

Atropine may be used internally for all the purposes for which belladonna is given; and it is very largely used as a local remedy, for application to the eye, or to the surface of the body, or for subcutaneous injection; and for these purposes it has the advantage over the ordinary preparations of belladonna, of greater precision of dose, quicker action, and greater neatness and cleanness. In ptyalism and in colliquative sweats the most prompt effects can be obtained from the hypodermic use of atropine. The dose to begin with, for internal use, is about one-sixtieth of a grain (0·0011 Gm.), which may be gradually increased till some effect is experienced; but it is almost too powerful for prudent employment in this way, especially as all the effects of belladonna may be readily obtained from the extract, which should be preferred when immediate effects are not required. In susceptible persons $\frac{1}{100}$th of a grain (0·0006 Gm.) will produce decided dryness of the throat. As the atropine itself is insoluble, the sulphate should always be preferred. For application to the sound skin, the form of ointment is most convenient. This may be made by rubbing a grain of the alkaloid first with four minims of alcohol, and then with a drachm of lard. Glycerin and olein also have been recommended as vehicles of atropine for external use, and may be incorporated with it in the same proportion.

When solution of sulphate of atropine is used for dilating the pupil, it may be either dropped into the eye within the lower lid, or may be introduced on small slips of paper previously saturated with the solution and dried, or, what is still more convenient, by means of minute circular disks of gelatin, made by mixing the solution with gelatin and evaporating so as to procure a thin film, which is to be cut into circular pieces. These have the advantage over paper that they do not require to be subsequently removed from the eye.

The external use of atropine is not without danger, unless great caution be observed. A case is on record in which an ointment composed of three grains of the sulphate and two drachms of lard, applied upon a vesicated surface on the neck, produced in a few minutes the most violent symptoms of belladonna poisoning, ending in death in two hours. (*Ann. de Thérap.*, 1867, p. 9.) The solution of atropine or its salts is very apt to have developed in it a fungous growth with consequent decomposition of the alkaloid.

Off. Prep. Atropinæ Sulphas; Liquor Atropiæ, *Br.;* Unguentum Atropiæ, *Br.*

ATROPINÆ SULPHAS. *U.S.* *Sulphate of Atropine.*

(ĂT-RO̤-PĪ'NÆ SŬL'PHĂS.)

$(C_{17}H_{23}NO_3)_2, H_2SO_4$; 676. $C_{34}H_{23}N_2O_6, HOSO_3$; 338.

Atropiæ Sulphas, *Br.*, also *U.S.* 1870; Sulphate of Atropia; Atropinum Sulfuricum, *P.G.;* Sulfate d'Atropine, *Fr.;* Schwefelsaures Atropin. *G.*

"Take of Atropia *one hundred and twenty grains;* Distilled Water *four fluiddrachms;* Diluted Sulphuric Acid *a sufficiency.* Mix the Atropia with the Water and add the Acid gradually, stirring them together until the alkaloid is dissolved, and the solution is neutral. Evaporate it to dryness at a temperature not exceeding 100°." *Br.*

The U. S. Pharmacopœia gives no process for preparing this salt. The officinal formula of 1870 is essentially the process of M. Ch. Maitre.* Atropine being soluble in ether while its sulphate is insoluble in that fluid, a convenient method is afforded for preparing the sulphate with little evaporation. By adding the mixed acid and alcohol to the ethereal solution, the sulphate is formed, and, being insoluble in the ether, is deposited; while the little left dissolved in the alcohol is obtained by spontaneous evaporation. The quantity of acid added, is intended to saturate the alkaloid; but if the saturation should not be exact, it would be easy to render it so by the addition of a little more alkaloid or a little more acid, as the case might be.

From the great facility with which atropine undergoes change, much caution is necessary in preparing its salts; and the process was arranged in reference to this caution. Upon the addition of the mixed acid and alcohol to the ethereal solution, the liquid becomes milky, and deposits on the sides of the vessel a copious precipitate, of a viscid appearance, which soon dries upon the decantation of the ether, and the placing of the vessel in a drying room. To succeed with this process, it is necessary that the liquids employed should be carefully freed from water, the sulphuric acid being monohydrated, and that the temperature should be kept as low as possible. There should be no excess of acid; and, if such an excess should be found upon applying the test of litmus paper, the solution should be neutralized by a portion of reserved solution of atropine. (*A. J. P.*, xxviii. 361; from *Répert. de Pharm.*) In the British process the same object of avoiding decomposition by heat is attained by the low temperature at which the evaporation is effected.

Properties. "A white, indistinctly crystalline powder, permanent in the air, odorless, having a very bitter, nauseating taste, and a neutral reaction. Soluble in 0·4 part of water and 6·5 parts of alcohol at 15° C. (59° F.), very soluble in boiling water and in boiling alcohol; also soluble in 0·3 part of absolute alcohol. When heated on platinum foil, the salt is decomposed and wholly dissipated, emitting acrid vapors. On adding test-solution of carbonate of sodium to a concentrated aqueous solution of the salt, a white precipitate is obtained, which answers to the reactions of atropine. (See *Atropina.*) The salt, or its solution, when applied to the eye strongly dilates the pupil. An aqueous solution of the salt yields, with test-solution of chloride of barium, a white precipitate insoluble in hydrochloric acid." *U. S.*

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* "Take of Atropia *sixty grains;* Stronger Ether *four fluidounces and a half;* Sulphuric Acid *six grains;* Stronger Alcohol *a fluidrachm.* Dissolve the Atropia in the Ether; then mix the Acid and Alcohol, and add the mixture, drop by drop, to the ethereal solution until the Atropia is saturated. Allow the liquid to stand until the precipitate formed is deposited. Then decant the ether, and expose the residue to spontaneous evaporation until the salt is dry." *U. S.* 1870.

If it be required to procure the sulphate in the form of crystals, which may sometimes be desirable, to avoid adulteration, the process of M. Laneau may be employed. A solution of crystallized atropine in absolute alcohol, in the proportion of 2·89 parts of the former to 4 parts of the latter by weight, having been made with the assistance of a gentle heat, 0·4 part of sulphuric acid of the sp. gr. 1·85, diluted with 3 parts of absolute alcohol, is to be gradually added, and stirred with a glass rod, until saturation, as shown by test-paper, is effected. The solution is then allowed to evaporate spontaneously, and the thinner the stratum the sooner will the process be completed. The crystals are in colorless needles more or less interlaced. (See *A. J. P.*, 1863, p. 315.)

The effects of the salt on the system are precisely the same as those of atropine, and it may be used in the same dose. Its great advantage over the alkaloid is its solubility in water. A solution of the salt in the proportion of one part to one hundred of the solvent has been found instantaneously efficacious in the relief of toothache, applied in the quantity of a drop or two (0·06–0·12 C.c.) to the denuded dental pulp; and it is said, in the same quantity, to produce complete insensibility of the dental nerves, in cases in which an artificial tooth is inserted in a living root. (*Ann. de Thérap.*, 1861, p. 19.)

AURANTII AMARI CORTEX. *U. S.* *Bitter Orange Peel.*

(ÂU-RĂN′TỊ-Ī Ạ-MĀ′RĪ CÖR′TĔX—âu-răn′shẹ-ī.)

"The rind of the fruit of Citrus vulgaris. Risso. (*Nat. Ord.* Aurantiaceæ.)" *U. S.*

Aurantii Cortex. *Bitter Orange Peel.* "The dried outer part of the rind of the bitter orange, Citrus Bigaradia." *Br.*

Cortex Fructus Aurantii, *P.G.;* Cortex Aurantiorum, Cortex Pomorum Aurantii; Écorce (Zestes) d'Oranges amères, Écorce de Bigarade, *Fr.;* Pomeranzenschale, *G.*

AURANTII DULCIS CORTEX. *U.S.* *Sweet Orange Peel.*

(ÂU-RĂN′TỊ-Ī DŬL′CỊS CÖR′TĔX—âu-răn′shẹ-ī.)

"The rind of the fruit of Citrus Aurantium. Risso. (*Nat. Ord.* Aurantiaceæ.)" *U. S.*

Cortex Aurantiorum Dulcium; Écorce (Zestes) d'Oranges douces, *Fr.;* Apfelsinenschalen, *G.*

AURANTII FLORES. *U. S.* *Orange Flowers.*

(ÂU-RĂN′TỊ-Ī FLŌ′RĒŞ—âu-răn′shẹ-ī.)

"The partly expanded, fresh flowers of Citrus vulgaris and Citrus Aurantium. Risso. (*Nat. Ord.* Aurantiaceæ.)" *U. S.*

Flores Naphæ; Fleurs d'Oranger, Écorce d'Orange, *Fr.;* Pomeranzenschale, Orangenblüthen, Pomeranzenblüthen, *G.;* Scorze del Frutto dell' Arancio, *It.;* Corteza de Naranja, *Sp.*

Gen. Ch. Calyx five-cleft. *Petals* five, oblong. *Anthers* twenty, the filaments united into different parcels. *Berry* nine-celled. *Willd.*

This very interesting genus is composed of small evergreen trees, with ovate or oval-lanceolate and shining leaves, odoriferous flowers, and fruits which usually combine beauty of color with a fragrant odor and grateful taste. They are all natives of warm climates. Though the species are not numerous, great diversity exists in the character of the fruit; and many varieties, founded upon this circumstance, are noticed by writers. In the splendid work on the natural history of the *Citrus* by Risso and Poiteau, 169 varieties are described under the eight following heads:—1, sweet oranges, 2, bitter and sour oranges, 3, bergamots, 4, limes, 5, shaddocks, 6, lumes, 7, lemons, and 8, citrons. Of these it is difficult to decide which have just claims to the rank of distinct species, and which must be considered merely as varieties. Those employed in medicine may be arranged in two sets, of which the orange, *C. Aurantium*, and the lemon, *C. medica*, are respectively the types; the former characterized by a winged, the latter by a naked or nearly naked petiole. The form and character of the fruit, though not entirely constant, serve as the basis of subdivisions. *C. decumana*, which yields the *shaddock*, agrees with *C. Aurantium* in the form of its petiole.

Citrus Aurantium. Willd. *Sp. Plant.* iii. 1427; *B. & T.* 51. The orange-tree grows to the height of about fifteen feet. Its stem is rounded, much branched, and covered with a smooth, shining, greenish brown bark. In the wild state, and before inoculation, it is often furnished with axillary spines. The leaves are ovate, pointed, entire, smooth, and of a shining pale green color. When held between the eye and the light, they exhibit numerous small transparent vesicles, filled with volatile oil; and, when rubbed between the fingers, are highly fragrant. Their footstalks are about an inch long, and have wings or lateral appendages. The flowers, which have a delightful odor, are large, white, and attached by short peduncles, singly, or in clusters, to the smallest branches. The calyx is saucer-shaped, with pointed teeth. The petals are oblong, concave, white, and beset with numerous small glands. The filaments are united at their base in three or more distinct portions, and support yellow anthers. The germen is roundish, and bears a cylindrical style, terminated by a globular stigma. The fruit is a spherical berry, often somewhat flattened at its base and apex, rough, of a yellow or orange color, and divided internally into nine vertical cells, each containing from two to four seeds, surrounded by a pulpy matter. The rind of the fruit consists of a thin exterior layer, abounding in vesicles filled with a fragrant volatile oil, and of an interior one, which is thick, white, fungous, insipid, and inodorous. There are two varieties of *C. Aurantium*, considered by some as distinct species. They differ chiefly in the fruit, which in one is sweet, in the other sour and bitterish. The first retains the original title, the second is called *Citrus vulgaris* by De Candolle, and *C. Bigaradia* by Risso. The Seville orange is the product of the latter.*

This beautiful evergreen, in which the fruit is mingled, in every stage of its growth, with the blossoms and foliage, has been applied to numerous purposes of utility and ornament. A native of China and India, it was introduced into Europe at a very early period, was transplanted to America soon after its first settlement, and is now found in every civilized country where the climate is favorable. The fruit is brought to us chiefly from Florida, the south of Europe, and the West Indies. The Florida and Havana oranges have the sweetest and most agreeable flavor.

Various parts of the plant are used in medicine. The leaves, which are bitter and aromatic, are employed in some places in the form of infusion as a gently stimulant diaphoretic. They yield by distillation with water a volatile oil, which is said to be often mixed by the distillers with the oils obtained from the flowers and unripe fruit. In regard to polarized light, it has a rotatory power to the left, which is considerably weakened by the prolonged action of heat. (Chautard, *Journ. de Pharm.*, 3e sér., xliv. 28.) The fresh flowers may be kept for some time by mixing them well with half their weight of chloride of sodium, pressing the mixture in a suitable jar, and keeping it well closed in a cool place. They are officinally described as follows. "About half an inch (12 mm. long; calyx small, cup-shaped, five-toothed; petals five, oblong, obtuse, rather fleshy, white and glandular-punctate; stamens numerous, in about three sets; ovary globular, upon a small disk, with a cylindrical style, and a globular stigma; odor very fragrant; taste aromatic and somewhat bitter." *U. S.* The dried flowers are used on the continent of Europe as a gentle nervous stimulant, in the form of infusion, which may be made in the proportion of two drachms to the pint of boiling water, and taken in the dose of a teacupful. The flowers should be dried in the shade, at a temperature between 24° C. (75° F.) and 35° C. (95° F.). (*Annuaire de Thérap.*, 1861, p. 59.)

An oil is obtained also from the flowers by distillation, which is called *neroli* in France, and is much used in perfumery, and in the composition of *liqueurs.* (See *Oleum Aurantii Florum.*) It is an ingredient of the famous Cologne water. That obtained from the flowers of the Seville or bitter orange (*C. vulgaris*) is deemed the sweetest. It was introduced into the Edinburgh Pharmacopœia, with the title of *Aurantii Oleum*, to serve for the preparation of orange-flower water. Soubeiran considers this oil rather as a product of the distillation than as pre-existing in the flowers. The fact may thus be explained, that orange-flower water, made by dissolving even the finest neroli in water, has not the precise odor of that procured by distillation from the flowers. Pure neroli has a rotating power to the right, in this respect differing from the oil of the leaves. (*Chautard.*)

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* A variety of the orange, called the *Mandarin Orange* (*Citrus Bigaradia Sinensis* or *C. Bigaradia myrtifolia*), which is probably a native of China, but cultivated in Sicily, the south of Italy, and Florida, bears a fruit much smaller than the common orange, round but flattened above and below, with a smooth, thin, delicate rind, and a very sweet delicious pulp. A volatile oil is obtained from the rind by expression, of a yellow color, a very bland agreeable odor, different from that of the orange or lemon, and a not unpleasant taste, like that of the rind. When freed from coloring matter by distillation, it was found by M. S. de Luca to be a pure hydrocarbon, with the formula $C_{10}H_{16}$. (*Journ. de Pharm.*, 3e sér., xxxiii. 52.)

The fruit is applied to several purposes. Small unripe oranges, about the size of a cherry or less, previously dried, and rendered smooth by a turning-lathe, are sometimes employed to maintain the discharge from issues. They are preferred to peas on account of their agreeable odor, and by some are thought to swell less with the moisture; but this is denied by others, and it is asserted that they require to be renewed at the end of twenty-four hours. These fruits are sometimes found in commerce under the name of *orange berries.* They are of a grayish or greenish brown color, fragrant odor, and bitter taste, and are said to be used for flavoring cordials. A volatile oil is obtained from them by distillation, known to the French by the name of *essence de petit grain*, and employed for similar purposes with that of the flowers. The oil, however, which now goes by this name, is said to be distilled from the leaves, and those of the bitter orange yield the best. The oils from the unripe and the ripe fruit have a rotating power to the right, the latter much greater than the former; and this property might serve to distinguish them from the oil of the leaves. Several of the oils from the Aurantiaceæ deposit a crystalline substance, differing from camphor. (*Chautard.*) The juice of the Seville orange is sour and bitterish, and forms with water a refreshing and grateful drink in febrile diseases. It is employed in the same manner as lemon-juice, which it resembles in containing citric acid, though in much smaller proportion. The sweet orange is more pleasant to the taste, and is extensively used as a light refrigerant article of diet in inflammatory diseases, care being taken to reject the membranous portion. The rind both of the sweet and bitter varieties is directed by the U. S. Pharmacopœia, the bitter only by the British. With the latter the outer portion is that considered officinal; as the inner is destitute of activity, and by its affinity for moisture renders the peel liable to become mouldy. The best mode of separating the outer rind when its desiccation and preservation are desired, is to pare it from the orange in narrow strips with a sharp knife, as we pare an apple. When the object is to use the fresh rind for certain pharmaceutical purposes, as for the preparation of the *confection of orange peel*, it is best separated by a grater. The dried peel, sold in the shops, is usually that of the Seville orange, and is brought chiefly from the Mediterranean.

Properties. Orange peel has a grateful aromatic odor, and a warm bitter taste, which depend upon the volatile oil contained in its vesicles. "Bitter orange peel is in narrow, thin bands or in quarters; epidermis of a dark brownish green color, glandular, and with very little of the spongy, white, inner layer adhering to it." *U. S.* The sweet peel is orange yellow and less bitter. Both yield their sensible properties to water and alcohol. The bitter principle, *hesperidin*, was discovered by Lebreton in 1828. It is crystalline, and may be prepared by Paterno and Briosi's process, as follows. The cut and bruised oranges are covered with diluted alcohol, potassa solution added in excess, the liquor filtered after two days, and impure hesperidin precipitated by hydrochloric acid; the precipitate is boiled with acetic acid for 10 minutes, and, after cooling, filtered from the resinous mass left. The hesperidin gradually separates from the filtrate upon standing, in white fine needles. From 4000 oranges about 6 ounces av. of the principle were obtained. (*Berichte d. Chem. Ges.*, 1876, pp. 250–252.) The oil may be obtained by expression from the fresh grated rind, or by distillation with water. It is imported into the United States in tinned copper cans. It has properties resembling those of the oil of lemons, but spoils more rapidly on exposure to the air, acquiring a terebinthinate odor. The perfumers use it in the preparation of Cologne water, and for other purposes; and it is also employed by the confectioners. According to Dr. Imbert-Gourbeyre, they who are much exposed to the inhalation of the oil of bitter oranges are apt to be affected with cutaneous eruptions, and various nervous disorders; as headache, tinnitus aurium, oppression of the chest, gastralgia, want of sleep, and even muscular spasm. He thinks that the oils of the Aurantiaceæ have much resemblance to camphor in their effects. (*Pharm. Centralblatt*, Feb. 1854, p. 128.)

Medical Properties and Uses. Bitter orange peel is a mild tonic, carminative, and stomachic; the sweet is simply aromatic; but neither is much used alone. They are chiefly employed to communicate a pleasant flavor to other medicines, to correct their nauseating properties, and to assist their stimulant impression upon the stomach. They are a frequent and useful addition to bitter infusions and decoctions, as those of gentian, quassia, columbo, and especially Peruvian bark. It is obviously improper to subject orange peel to long boiling; as the volatile oil, on which its virtues chiefly depend, is thus driven off. The dose in substance is from half a drachm to a drachm (1·95–3·9 Gm.) three times a day. Large quantities are sometimes productive of mischief, especially in children, in whom violent colic and even convulsions are sometimes induced by it. We have known the case of a child, in which death resulted from eating the rind of an orange.

When orange peel is used simply for its agreeable flavor, the rind of the sweet orange is preferable; as a tonic, that of the Seville orange.

Off. Prep. of Bitter Orange Peel. Infusum Aurantii, *Br.;* Infusum Aurantii Compositum, *Br.;* Infusum Gentianæ Comp.; Mistura Gentianæ, *Br.;* Spiritus Armoraciæ Comp., *Br.;* Tinctura Aurantii Amari; Tinct. Cinchonæ Comp.; Tinct. Gentianæ Comp.; Extractum Aurantii Amari Fluidum, *U. S.*

Off. Prep. of Sweet Orange Peel. Syrupus Aurantii, *U. S.;* Tinctura Aurantii Dulcis, *U. S.*

Off. Prep. of the Flowers. Aqua Aurantii Florum, *U. S.*

AURI ET SODII CHLORIDUM. *U. S. Chloride of Gold and Sodium.*

(ÂU'RĪ ĔT SŌ'DI̤-Ī C̸HLŌ'RI̤-DŬM.)

"A mixture composed of equal parts of dry Chloride of Gold [**$AuCl_3$; 302·4.**—$AuCl_3$; 302·4], and Chloride of Sodium [**NaCl; 58·4.**—NaCl; 58·4]." *U. S.*

This new officinal is the first preparation of gold to enter the U. S. Pharmacopœia. It may be prepared by dissolving gold in nitro-hydrochloric acid, evaporating the solution to dryness, weighing, and dissolving the dry mass in eight times its weight of distilled water. To this solution a weight of pure decrepitated common salt equalling that of the dry chloride of gold is added, previously dissolved in four parts of water. The mixed solution is then evaporated to dryness, being in the mean time constantly stirred with a glass rod.

Properties. The salt is of a golden yellow color, and, when crystallized, is in the form of long prismatic crystals, unalterable in the air. The Pharmacopœia describes it as "an orange yellow powder, slightly deliquescent in damp air, odorless, having a saline and metallic taste, and a slightly acid reaction. The compound is very soluble in water; at least one-half of it should be soluble in cold alcohol. When exposed to a red heat, it is decomposed and metallic gold is separated. A fragment of the compound imparts an intense, persistent, yellow color to a non-luminous flame. Its aqueous solution yields, with test-solution of nitrate of silver, a white precipitate insoluble in nitric acid, but soluble in ammonia. On bringing a glass rod dipped into water of ammonia close to a portion of the compound, no white fumes should make their appearance (abs. of free acid). If 0·5 Gm. of Chloride of Gold and Sodium be dissolved in 20 C.c. of water, and treated with a clear solution of 2 Gm. of ferrous sulphate in 20 C.c. of water acidulated with a few drops of sulphuric acid, a brown precipitate of metallic gold will be thrown down. If, after at least two hours, this precipitate be separated, well washed, dried and ignited, the residue of metallic gold should weigh not less than 0·162 Gm. (corresponding to 32·4 per cent. of metallic gold)." *U. S.*

Medical Properties. The precise action of this salt upon the system is not known, but there is reason for believing that it exerts some influence upon the general nutrition, and is therefore alterative. By many gynæcologists it is believed to have a specific direction to the genital organs, and it is much used in hysteria, ovarian irritation and neuralgia, chronic ovaritis, and even chronic uterine inflammation. For frictions on the gums and tongue, Chrestien recommends the following formula. Crystallized chloride of gold and sodium, one grain; powdered orris root, deprived of its soluble parts by alcohol and water, and dried, two grains. Mix. At first the fifteenth part of this powder is used daily by frictions; afterwards the fourteenth, the thirteenth, etc., until, increasing gradually, the tenth or eighth part is employed. The use of four grains of the salt in this way is said commonly to cure bad cases of recent syphilis; such, for example, as are characterized by the coexistence of chancres, warts, and buboes. In preparing this powder, lycopodium may be substituted for the orris. MM. Rouault and Debreque have used this preparation of gold with success, in daily frictions for some minutes to the tongue, gums, and inside of the cheeks, for the resolution of chronic glandular tumors, especially those which occur in the neck in the form of a chain. The patient should swallow his saliva while the frictions are practised. (*B. and F. Medico-Chir. Rev.*, Am. ed., July, 1857, p. 172.) It may be given in lozenges, each containing the twelfth of a grain (0·005 Gm.), by mixing immediately five grains of the salt with an ounce of powdered sugar, and making the whole with mucilage of tragacanth into a proper mass, to be divided into sixty lozenges. Pills, containing the same dose, may be formed by dissolving ten grains of the dried salt in a drachm of distilled water, and forming the solution into a pilular mass with a mixture of four drachms of potato starch and one drachm of gum arabic, to be divided into one hundred and twenty pills. (*Journ. de Pharm.*, xx. 648.)

AVENÆ FARINA. *Oatmeal.*

(Ạ-VĒ′NÆ FẠ-RĪ′NẠ.)

"The meal prepared from the seeds of Avena sativa." *U. S.* 1870. (*Nat. Ord.* Gramineæ.)

Farine d'Avoine, *Fr.;* Hafermehl, *G.;* Farina dell' Avena, *It.;* Harina de Avena, *Sp.*

Gen. Ch. Calyx two-valved, many-flowered, with a twisted awn on the back. *Willd.*

Avena sativa. Willd. *Sp. Plant.* i. 446. *B. & T.* 292. The common oat is so well known that a minute description would be superfluous. It is specifically distinguished by its "loose panicle, its two-seeded glumes, and its smooth seeds, one of which is awned." It was known to the ancients, and is now cultivated in all civilized countries; but its original locality has not been satisfactorily ascertained. It grows wild in Sicily, and is said to have been seen by Anson in the island of Juan Fernandez on the coast of Chili. Although it has been dismissed from the U. S. P., its greatly extended use over our country seems to warrant a notice of it here.

This grain, though cultivated chiefly for horses, is very nourishing, and is largely consumed as food by the inhabitants of Scotland, the north of Ireland, Brittany, and some other countries. A decoction is said to possess decided diuretic properties, and to be useful in dropsy. (*Lond. Med. Times and Gaz.*, Sept. 1854, p. 263.) The seeds deprived of their husks are sometimes called *groats;* as a food, coarsely ground oatmeal is usually preferred to the fine meal.

Oatmeal contains, according to Vogel, in 100 parts, 59 of starch, 4·30 of a grayish substance resembling rather coagulated albumen than gluten, 8·25 of sugar and a bitter principle, 2·50 of gum, 2 of fixed oil, and 23·95 of fibrous matter including loss. An elaborate analysis of oats deprived of the husk, made by Professor J. P. Norton, of Yale College, gave as the average of four varieties of the grain, 65·11 per cent. of starch, 2·24 of sugar, 2·23 of gum, 6·55 of oil, 16·51 of a nitrogenous body analogous to casein, though differing from it in some respects, to which he gave the name of *avenin*, 1·42 of albumen, 1·68 of gluten, 2·17 of epidermis, and 2·09 of alkaline salts, with allowance for loss and error. Professor Norton thinks there may have been some error in the proportion of the nitrogenous compounds, in consequence of the difficulty of separating them from starch; and concludes, from the quantity of nitrogen obtained by ultimate analysis, that these compounds must amount to at least 8 per cent. (*Am. Journ. of Sci. and Arts*, 2d ser., iii. 330.) Ritthausen ("*Die Eiweisskörper*," Bonn, 1872, p. 135) considers Norton's avenin to have been a mixture of legumin or vegetable casein and a vegetable gluten containing sulphur, to which he gives the name *gliadin*, the legumin, however, predominating. Oatmeal is very slightly but not unpleasantly bitter, and yields most of its nutritive matter readily to boiling water.

Gruel made with fine oatmeal affords a nutritious, bland, and easily digested aliment, admirably adapted to inflammatory diseases, and, from its somewhat laxative tendency, preferable in certain cases to the purely mucilaginous or amylaceous preparations. It is often administered after brisk cathartics, in order to render them easier and at the same time more efficient in their action. It is sometimes also used in the form of enema; and the meal, boiled with water into a thick paste, forms an excellent emollient cataplasm. *Oatmeal gruel* may be prepared by boiling an ounce of the meal with three pints of water to a quart, straining the decoction, allowing it to stand till it cools, and then pouring off the clear liquor from the sediment. Sugar and lemon-juice may be added to improve its flavor; and raisins are not unfrequently boiled with the meal and water for the same purpose.

AZEDARACH. *U.S.* *Azedarach.*

(Ạ-ZĔD'Ạ-RĂÇH.)

"The bark of the root of Melia Azedarach. Linné. (*Nat. Ord.* Meliaceæ.)" *U. S.*

Pride of India, Pride of China, Common Bead Tree; Écorce d'Azédarach, Écorce de Margousier, *Fr.;* Zedrachrinde, *G.*

Gen. Ch. *Calyx* five-toothed. *Petals* five. *Nectary* cylindrical, toothed, bearing the *anthers* in the throat. *Drupe* with a five-celled nut. *Willd.*

Melia Azedarach. Willd. *Sp. Plant.* ii. 558; Michaux, *N. Am. Sylv.* iii. 4. *M. Azadirachta, B. & T.* 62. This is a beautiful tree, thirty or forty feet high, with a trunk fifteen or twenty inches in diameter. When alone, it attains less elevation, and spreads out into a capacious summit. Its leaves are large and doubly pinnate, consisting of smooth, acuminate, denticulate, dark green leaflets, disposed in pairs with an odd one at the end. The flowers are of a lilac color, delightfully fragrant, and in beautiful axillary clusters near the ends of the branches. The fruit is a round drupe, about as large as a cherry, and yellowish when ripe.

This species of Melia is a native of Syria, Persia, and the north of India, and is cultivated as an ornament in different parts of the world. It is abundant in our Southern States, and has even become naturalized. North of Virginia it does not flourish, though small trees may sometimes be seen in sheltered situations. It flowers early in the spring.

Properties. "The bark is in curved pieces or quills of variable size and thickness; outer surface red-brown, with irregular, blackish, longitudinal ridges; inner surface whitish or brownish, longitudinally striate; fracture more or less fibrous; upon transverse section tangentially striate, with yellowish bast-fibres; inodorous, sweetish, afterward bitter and nauseous. If collected from old roots, the bark should be freed from the thick, rust-brown, nearly tasteless, corky layer." *U. S.*

Jacobs (*A. J. P.*, 1879, p. 444) believes that the active principle is a yellowish white resin, and that the activity of the bark resides in the liber. Hanausek (1878) states that two kinds of oil of azedarach are used in Eastern Asia,—one from the fruit and the other from the seeds; the former is used medicinally, the latter only for burning. The closely related *Azadirachta Indica*, according to Broughton (*P. J. Tr.*, 1873, p. 992), contains a bitter amorphous resin, $C_{36}H_{50}O_{11}$, which fuses at 92° C. (197·6° F.), and a crystallized principle, melting at 175° C. (347° F.). Cornish (*Indian Annals of Med. Sc.*, 4, p. 104) had previously announced the presence of a bitter alkaloid, to which he gave the name *margosine*, from the Portuguese name for the tree, Margosa.

Medical Properties and Uses. The decoction of this bark is cathartic and emetic, and in large doses is said to produce narcotic effects similar to those of spigelia, especially if gathered at the season when the sap is mounting; but in a number of experiments made by Dr. H. C. Wood with extracts from the dried bark and fruit, it was found impossible to produce toxic symptoms in frogs or rabbits. Robins eating of the sweetish fruit, of which they are very fond, are often rendered so far insensible as to be picked up under the tree; though they usually recover in a few hours. It has been suggested that sufficient alcohol is produced by the spontaneous fermentation of the berries to cause intoxication. Children are said to eat the fruit without inconvenience, and possibly the robins simply choke themselves with the large berries. The bark is considered in the Southern States an efficient anthelmintic, and appears to enjoy, in some places, an equal degree of confidence with the pinkroot. The form of decoction is usually preferred. A quart of water is boiled with four ounces of the fresh bark to a pint, of which the dose for a child is a tablespoonful every two or three hours, till it affects the stomach or bowels. Another plan is to give a dose morning and evening for several successive days, and then to administer an active cathartic. The *fresh* bark and the fruit are said to be superior as vermifuges, but are not to be found in our Northern drug stores. A fluid extract and syrup of azedarach are proposed by J. J. Miles (*A. J. P.*, Aug. 1874), the former made in the usual way with diluted alcohol, except that 6 troyounces of white sugar are added. The syrup is made by taking 4 fluidounces of the fluid extract, 8 fluidounces of vanilla syrup, and sufficient simple syrup to make a pint.

BALSAMUM PERUVIANUM. *Balsam of Peru.*

(BĂL′SẠ-MŬM PẸ-RÛ-VỊ-Ā′NŬM.)

"A balsam obtained from Myroxylon Pereiræ. Klotzsch. (*Nat. Ord.* Leguminosæ, Papilionaceæ.)" *U. S.* "A balsam obtained from Myroxylon Pereiræ, *Klotzsch.*" *Br.*

Balsamum Peruvianum Nigrum, Balsamum Indicum; Baume des Indes, Baume de Pérou, *Fr.;* Peruvianischer Balsam, *G.;* Balsamo del Peru, *It.;* Balsamo negro, *Sp.*

Gen. Ch. Calyx subincurved, irregularly dentate. *Vexillum* broadly orbiculate; four inferior *petals* sub-equal, free, narrow. *Stamens* deciduous with the petals, free or at their extreme base very shortly connate. *Ovaries* long, stipitate, near the apex two ovulate. *Styles* short incurved, with a minute terminal stigma. *Legume* stipitate, compressed, indehiscent, with the apex indurated, and one-seeded. *Seed* one, subreniform, with a thin testa. *Cotyledons* plano-convex. *Radicle* very short, incurved. (Bentham and Hooker, *Genera Plantarum*, ii. 559.)

De Candolle and other botanists considered that the genera Myroxylon and Toluifera of Linnæus are not distinct from Myrospermum of Jacquin, but it is now generally recognized that the two Linnean genera are, taken together, entitled to rank as a single genus. To this the title of Myroxylon is now generally applied, although according to the strict rules of botanical nomenclature it should be called Toluifera. In regard to the species now under consideration there has been much discussion, and although the plant is now well known botanically, botanists are not agreed as to its specific distinctness; Ruiz (*Flora Peruviana*), Carson (*A. J. P.*, 1860, p. 297), Baillou, and others believing it to be identical with the tree which yields balsam of Tolu. Flückiger and Hanbury (*Pharmacographia*, 2d ed., 205) give the following points of difference: in *M. Pereiræ* the branches come off near the ground, the calyx is widely cup-shaped, and shallow, the racemes loose, 6 to 8 inches long, and the legume much narrowed at its base; whilst in *M. Toluifera* the trunk does not branch for 30 or 40 feet, the calyx is rather tubular, the racemes dense and 3 to 4½ inches long, the legume scarcely narrowed at the base. Besides the officinal species, there are others of the genus which possess medical virtues, and have been more or less employed.* The pod of *M. frutescens* (Jacq.), growing in Trinidad, is popularly used in that island as a carminative, and externally, in the form of tincture, as a lotion in rheumatic pains; and by incisions in the stem a small quantity of balsamic juice is obtained not distinguishable from balsam of Tolu.† (*P. J. Tr.*, Sept.

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* For an account of the various imperfectly described species related to this plant, see 14th Ed. U. S. D.

† The name *Brazilian Balsam* has been proposed for the product of *M. Peruiferum.* It differs from balsam of Peru in odor, and in having a slightly pungent, but not warm, aromatic taste; in being permanently soluble in 90 per cent. alcohol in all proportions; also in mixing with castor oil in all proportions, forming with bisulphide of carbon a clear light brown solution with residue, and in the deposit, by its chloroform solution, of a powdery precipitate upon standing. At 17° C. its specific gravity is 1·031. Its general constitution is very similar to that of balsam of Peru, containing volatile oil, myroxylin, cinnamic and tannic acids, and resin. (*P. J. Tr.*, 3d ser., xi. 818.)

1862, p. 108.) Another species is known in Paraguay under the name of *quinoquino*, the bark of which is used, in powder and decoction, as a remedy in wounds and ulcers; and from the trunk of which a juice is obtained, which in its concrete state closely resembles dried balsam of Peru. (*Ibid.*, Oct. 1862, p. 183.)

Myroxylon Pereiræ, Klotzsch; *Myrospermum Pereiræ*, Royle et Auctores; "*Myrospermum of Sonsonate*," Pereira; is a handsome tree, with a straight, round, lofty stem, a smooth ash-colored bark, and spreading branches at the top. The leaves are alternate, petiolate, and unequally pinnate. The leaflets are from five to eleven, shortly petiolate, oblong, oval-oblong, or ovate, about three inches long by somewhat less than an inch and a half in breadth, rounded at the base, and contracting abruptly at top into an emarginate point. When held up to the light, they exhibit, in lines parallel with the primary veins, beautiful rounded and linear pellucid spots. The common and partial petioles and midribs are smooth to the naked eye, but, when examined with a microscope, are found to be furnished with short hairs. The fruit, including the winged footstalks, varies from two to four inches in length. At its peduncular extremity it is rounded or slightly tapering; at the top enlarged, rounded, and swollen, with a small point at the side. The mesocarp, or main investment of the fruit, is fibrous, and contains in distinct receptacles a balsamic juice, which is most abundant in two long receptacles or vittæ, one upon each side. A gum-resin exudes in small quantities from the trunk of the tree, which, though containing, besides gum and resin, a small proportion of volatile oil, is distinct from the proper balsam, and yields no cinnamic acid. (Attfield, *P. J. Tr.*, Dec. 1863.)

This tree grows in Central America, in the State of San Salvador, upon the Pacific coast. It is found in the wild forests, singly or in groups, but the trees are owned by individuals. Dr. Charles Dorat states that it is never found at a greater height on the mountains than one thousand feet, that it begins to be productive after five years, and continues to yield for thirty years or more, and that the aroma of its flowers is perceived at the distance of one hundred yards. (*A. J. P.*, xxxii. 303.) In 1861 the tree was introduced in Ceylon with complete success. The balsam is collected from it exclusively by the aborigines, on lands reserved to them, within a small district denominated the Balsam Coast, extending from Acajutla to Port Libertad. Early in November or December the bark is beaten on four sides of the trunk, so as to separate it from the wood without breaking it; intermediate strips being left sound, in order not to destroy the life of the tree. The bruised bark soon splits, or cuts are made in it. Five or six days after the beating the injured surface is set on fire, and about a week later the bark, if it has not fallen off spontaneously, is removed. The juice now begins to exude freely from the exposed wood, which the natives cover with rags. The latter, when saturated, are boiled in water in large jars, and the liquid allowed to stand; whereupon the water rises to the top, and is poured off, leaving the balsam, which is put into calabashes or bladders. It is then taken for sale to the neighboring towns, where it is purified by subsidence and straining, and put into jars or metallic drums for exportation. The destroyed bark is said to renew itself in two years, so that by care a tree can be long worked; two pounds is stated to be the average yearly yield. The export from San Salvador in 1876 was over $78,000 in value.

A substance called *white balsam* (*Balsamo blanco*) is procured from the fruit by expression. This has been confounded with the balsam of Tolu, but is wholly distinct. It is of a semi-fluid or soft-solid consistence, somewhat granular, and, on standing, separates into a white resinous crystalline deposit, and a superior translucent more fluid portion. The smell, though quite distinct from that of the balsam of Tolu and Peru, is not disagreeable. Dr. Stenhouse has obtained from it a peculiar resinous body, readily crystallizable, and remarkably indifferent in its chemical affinities, which he denominates *myroxocarpin*. (*P. J. Tr.*, x. 290.) Dr. Dorat, however, denies that the white balsam is produced by the same tree, or in the same vicinity.

Another substance obtained from the same tree, and much used in Central America, is a tincture of the fruit, made by digesting it in rum. It is called *balsamito* by the inhabitants, and is said to be stimulant, anthelmintic, and diuretic. It is also used as an external application to gangrenous or indolent ulcers, and as a wash to the face to remove freckles. According to Dr. Dorat, the balsamito is not the tincture, but an alcoholic extract of the young fruit. Neither this nor the white balsam reaches the markets of this country.

The balsam of Peru was named from its place of exportation; and it was long thought to be a product of Peru. It is now shipped partly from the Pacific coast, and partly from the Balize or other Atlantic ports, whither it is brought across the country. It was Guibourt who first made known the fact of its exclusive production in Central America. As imported, it is usually in tin canisters, with a whitish scum on its surface, and more or less deposit, which is dissolved with the aid of heat.

Properties. Balsam of Peru is viscid like syrup or honey, of a dark reddish brown color, a fragrant odor, and a warm bitterish taste, leaving when swallowed a burning or prickling sensation in the throat. When exposed to flame it takes fire, diffusing a white smoke and fragrant odor. Containing resin, volatile oil, and both benzoic and cinnamic acids, it is properly considered a balsam, though probably somewhat altered by heat. Alcohol entirely dissolves it, taking up one part in five. (*Br.*) "A thick liquid, brownish black in bulk, reddish brown and transparent in thin layers, having a syrupy consistence, a somewhat smoky, but agreeable and balsamic odor, and a warm, bitter, afterward acrid taste. Sp. gr. 1·135 to 1·150." *U. S.* Boiling water extracts the acid. The oily liquid which separates on agitating Peru balsam with caustic potash or soda, called *Peru balsam oil* by Stolze, *cinnamein* by Frémy, may be separated by fractional distillation into three portions, viz.:—*benzyl alcohol*, C_7H_8O, passing over at about 200° C. (392° F.); *benzylic benzoate*, $C_7H_5O_2,C_7H_7$, the principal portion, boiling at 303°–304° C. (577·5°–579° F.); and *benzylic cinnamate*, $C_9H_7O_2,C_7H_7$, passing over at about the boiling point of mercury. The crude oil likewise contains small quantities of free cinnamic and benzoic acids, resulting from the decomposition of the benzylic ether by the alkali used in separating it, and equivalent to the free benzylic alcohol also contained in it. According to Kraut (*Am. Ch. Pharm.*, 153, p. 129), the benzylic cinnamate constitutes nearly 60 per cent. of the balsam.

Peru balsam appears to contain only a single resin, yielding, by analysis, 66·3 to 67·25 per cent. of carbon, and 6·22 to 6·32 per cent. of hydrogen (Kraut, *loc. cit.*). This resin separated from the alkaline solution of the balsam by hydrochloric acid is brown, has a faint odor of vanilla, and when fused with potash yields protocatechuic acid, together with a little benzoic acid. The resin yielded about two-thirds its weight of protocatechuic acid. (Kachler, *Zeitsch. für Ch.*, [2] 6, 59.) The tree also exudes a gum-resin, which, according to Attfield (*P. J. Tr.*, 1864, p. 248) contains 77·4 per cent. of a resin, non-aromatic, and devoid of cinnamic acid, and therefore entirely distinct from balsam of Peru. The leaves of the tree contain a fragrant oil.

The balsam is said to be adulterated in Europe (especially at Bremen) with castor oil, copaiba, Canada turpentine, etc. (*P. J. Tr.*, xii. 549); and a factitious substance has been sold in this country for the genuine balsam, prepared by dissolving balsam of Tolu in alcohol. This may be distinguished by taking fire readily, and burning with a blue flame. (*N. Y. Journ. of Pharm.*, i. 133.) It would, moreover, undergo diminution in volume when mixed with water, which is not the case with the genuine balsam. (*Br.*) A method of detecting castor oil, proposed by Dr. Wagner, is to expose a small portion of the suspected balsam to distillation until somewhat more than one-half has passed, to shake the distillate with baryta water, to remove by means of a pipette the layer of oil floating on the surface, and to shake this with a concentrated solution of bisulphite of sodium. If castor oil be present, the liquid will immediately become a crystalline mass. (*A. J. P.*, xxx. 570.) The officinal tests of purity are as follows. "It is entirely soluble in 5 parts of alcohol, and should not diminish in volume, when agitated with an equal bulk of benzin, or water (abs. of fixed oils and alcohol). It is readily miscible with absolute alcohol, chloroform, or glacial acetic acid. If 1 volume of the Balsam be triturated with 2 volumes of sulphuric acid, a tough, homogeneous, cherry-red mixture should result. If this be washed, after a few minutes, with cold water, it should be converted into a resinous mass which is brittle, when cold. A mixture of 3 parts of the Balsam with 1 part of disulphide of carbon remains clear; but a mixture of 1 part of the Balsam with 3 parts of disulphide of carbon separates from the Balsam about 40 per cent. of resin. The liquid poured off from the latter should be transparent, should not have a deeper color than light brownish, and should not exhibit more than a faint fluorescence (abs. of gurjun balsam). When distilled with 200 times its weight of water, no volatile oil should pass over." *U. S.* Prof. Flückiger relies upon the specific gravity, which should be between 1·140 and 1·145, and the *lime test*, in which 10 drops of the balsam are shaken with 6 grains (0·4 Gm.) of slaked lime, forming, if there be no adulteration, a soft mixture, which does not harden. *Grote's test* consists in shaking 3 drops of balsam with 2 C.c. of officinal ammonia water; if, after standing, the mixture solidifies, colophony or other adulterant is present: benzoin, storax, and certain other substances cannot be detected by this test. (*A. J. P.*, 1881, pp. 302, 361.)

Medical Properties and Uses. This balsam is a warm stimulating stomachic and expectorant, and has been recommended in chronic catarrhs, certain forms of asthma, phthisis, and other pectoral complaints attended with debility. It has also been used in gonorrhœa, leucorrhœa, amenorrhœa, chronic rheumatism, and palsy. At present, however, it is little employed by American physicians. As an external application it has been found beneficial in chronic indolent ulcers. The dose is half a fluidrachm (1·9 C.c.). It is best administered diffused in water with sugar and the yolk of eggs or gum arabic, or in smaller doses dropped on a lump of sugar.

BALSAMUM TOLUTANUM. *U. S., Br.* *Balsam of Tolu.*

(BĂL'SA̤-MŬM TŌ-LŪ-TĀ'NŬM.)

"A balsam obtained from Myroxylon toluifera. Kunth. (*Nat. Ord.* Leguminosæ, Papilionaceæ.)" *U. S.* "A balsam obtained from Myroxylon Toluifera." *Br.*

Baume de Tolu, Baume de Carthagène, *Fr.;* Tolubalsam, *G.;* Balsamo del Tolu, *It.;* Balsamo de Tolu, *Sp.*

For a long time the tree from which this balsam is derived retained the name of *Toluifera Balsamum*, given to it by Linnæus. Ruiz, one of the authors of the Flora Peruviana, considered it identical with *Myroxylon Peruiferum;* but M. Achille Richard determined that it was a distinct species, and gave it the appropriate specific name of *Toluiferum*, which is now recognized by the Pharmacopœias.

The balsam is procured by making V-shaped incisions in the trunk quite through the bark. The juice is received in small calabash cups, which are inserted in slight excavations beneath the point of the two vertical incisions meeting at the lower end; and Mr. Weir has seen as many as twenty cups at a time on one tree. The collectors go from tree to tree, emptying the cups into flasks of raw hide. In these skin vessels the juice is taken to the different ports on the river, where it is transferred to tin cans. (Weir, *Ibid.*) It is brought from Carthagena in calabashes or baked earthen jars, or in tin or glass vessels.

Properties. As first imported, balsam of Tolu has a soft tenacious consistence, which varies considerably with the temperature. By age it becomes hard and brittle like resin. It is shining, translucent, of a reddish or yellowish brown color, a highly fragrant odor, and a warm, somewhat sweetish and pungent, but not disagreeable taste. Exposed to heat, it melts, inflames, and diffuses an agreeable odor while burning. It is entirely soluble in volatile oils. The officinal description of it is as follows. "A yellowish or brownish yellow, semi-fluid or nearly solid mass, transparent in thin layers, brittle when cold, having an agreeable, balsamic odor, and a mild, aromatic taste. It is entirely soluble in alcohol, and the solution shows an acid reaction with test-paper. It is almost insoluble in water and in benzin. Warm disulphide of carbon removes from the Balsam scarcely anything but cinnamic and benzoic acids. On evaporating the disulphide, no substance having the properties of resin should be left behind." *U. S.* Boiling water extracts its acid. Distilled with water it affords a small proportion of volatile oil; and, if the heat be continued, an acid matter sublimes. Mr. Hatchett states that, when dissolved in the smallest quantity of solution of potassa, it loses its own characteristic odor, and acquires that of the clove pink. G. L. Ulex gives as a test of the purity of the balsam, that, if heated in sulphuric acid, it dissolves without disengagement of sulphurous acid, and yields a cherry-red liquid. (*Archiv der Pharm.*, Jan. 1853.) The balsam is a mixture of volatile oil, free acid, and resin. The volatile oil is obtained by distilling the balsam with water, and may amount to a little over 1 per cent. This oil is chiefly *tolene*, $C_{10}H_{16}$, boiling at 170° C. (338° F.), and rapidly hardening by absorption of oxygen from the air. The free acid, according to Deville and Scharling, consists of benzoic and cinnamic acids, which statement has been recently confirmed by Flückiger. (*Pharmacographia*, 2d ed., p. 204.) Busse (*Ber. Chem. Ges.*, 1876, p. 833) has shown, moreover, that the benzylic ethers of both cinnamic and benzoic acids are present in the balsam, the benzyl cinnamate in larger amount.

According to Kopp, there are two resins in Tolu balsam, one easily soluble in alcohol, $C_{18}H_{18}O_4$, and another sparingly soluble, $C_{18}H_{20}O_5$. According to Deville, however, there is only one resin, that to which the second formula belongs. Trommsdorff obtained 88 per cent. of resin, 12 of acid, and only 0·2 of volatile oil. According to Mr. Heaver, the balsam yields by distillation about one-eighth of its weight of pure cinnamic acid. The acid distils over in the form of a heavy oil, which condenses into a white crystalline mass. It may be freed from empyreumatic oil by pressure in bibulous paper, and subsequent solution in boiling water, which deposits it in minute colorless crystals, upon cooling. (*A. J. P.*, xv. 77.) A factitious balsam of Tolu is described by Dr. R. V. Mattison (*A. J. P.*, 1876, p. 51), which contained 63 per cent. of storax.

Medical Properties and Uses. Balsam of Tolu is a stimulant stomachic, with a peculiar tendency to the pulmonary organs. It is given with some advantage in chronic catarrh and other pectoral complaints, in which a gently stimulating expectorant is demanded; but should not be prescribed until after the reduction of inflammatory action. Independently of its medical virtues, its agreeable flavor renders it a popular ingredient in expectorant mixtures. Old and obstinate coughs are said to be sometimes greatly relieved by the inhalation of the vapor proceeding from an ethereal solution of this balsam. From ten to thirty grains (0·65–1·95 Gm.) may be given at a dose, and frequently repeated. The best form of administration is that of emulsion, made by triturating the balsam with mucilage and loaf sugar, and afterwards with water.

Off. Prep. Syrupus Tolutanus; Tinctura Benzoini Composita; Tinctura Tolutana.

BARIUM. *Barium.*

Ba; 137. (BĀ'RI-ŬM.) Ba; 137.

This is the metal present in the earth baryta. It was first obtained in 1808 by Sir H. Davy, who describes it as a difficultly fusible metal, of a silvery gray color, decomposing water readily, and considerably heavier than sulphuric acid. When exposed to the air, it instantly becomes covered with a crust of baryta, and when gently heated, burns with a deep red light (or greenish light according to Clarke). The compounds of barium formerly officinal are the chloride and the carbonate.

Baryta (or barium oxide) may be obtained from the native carbonate by intense ignition with carbonaceous matter; or from the native sulphate, by ignition with charcoal, which converts it into sulphide of barium, subsequent solution of the sulphide in nitric acid, and strong ignition of the nitrate formed to dissipate the acid. As thus obtained, it is an anhydrous solid, caustic, alkaline, difficultly fusible, and of a grayish white color. Its sp. gr. is about 4. It acts on the animal economy as a poison. When sprinkled with water it slakes like lime, becomes hot, and is reduced to the state of a white pulverulent hydrate. The same hydrate is formed in mass, when the anhydrous earth is made into a paste with water, and exposed to a red heat in a platinum crucible. The excess of water is expelled, and the hydrate, undergoing fusion, may be poured out and allowed to congeal. Barium hydrate dissolves in water, and forms the reagent called *baryta-water*. A boiling saturated solution, as it cools, yields crystals of barium hydrate containing eight molecules of water of crystallization.

An economical process for obtaining barium hydrate in crystals has been published by Dr. Mohr, of Coblentz. It consists in adding to a boiling solution of caustic soda an equivalent quantity of chloride of barium and nitrate of barium. In consequence of the usual impurities in caustic soda, a precipitate is formed of some carbonate and sulphate of barium, which is easily separated by subsidence from the solution of barium hydrate, kept hot. This, when clear, is drawn off by a siphon, and put in a suitable covered vessel to cool and crystallize; when the whole liquid is often converted into a mass of acicular crystals. (*P. J. Tr.*, Dec. 1856.) Baryta consists of one atom of barium 137, and one of oxygen 16 = 153. Its chemical formula is, therefore, BaO. *Carbonate of barium*, $BaCO_3$; mol. wt. 197, is the native carbonate, a rare mineral, discovered in 1783 by Dr. Withering, in honor of whom it is called *Witherite*. It is found in Sweden and Scotland, but most abundantly in the lead mines of the north of England. It occurs usually in grayish, or pale yellowish gray, fibrous masses, but sometimes crystallized. Its sp. gr. varies from 4·2 to 4·4. It is generally translucent, but sometimes opaque. It effervesces with acids, and, before the blowpipe, melts into a white enamel without losing its carbonic acid. It is distinguished from the carbonate of strontium, with which it is most liable to be confounded, by its greater specific gravity, and by its yielding a light greenish rather than a reddish flame upon the burning of alcohol impregnated with its solution in hydrochloric acid. If strontia be present, the reddish flame will show it.

When pure, carbonate of barium is entirely soluble in hydrochloric acid. Any sulphate of barium present is left undissolved. If neither ammonia nor sulphuretted hydrogen produces discoloration or a precipitate in the hydrochloric acid solution, the absence of alumina, iron, copper, and lead is shown. Lime may be detected by adding an excess of sulphuric acid, which will throw down the baryta as a sulphate, and afterwards testing the clear liquid with carbonate of sodium, which, if lime be present, will produce a precipitate of carbonate of calcium.

Carbonate of barium acts as a poison on the animal economy. Its only pharmaceutical use is to prepare chloride of barium. (For *Chloride* and *Sulphate of Barium*, see Part II.)

BEBERIÆ SULPHAS. *Br.* *Sulphate of Beberia.*

(BẸ-BĒ'RỊ-Æ SŬL'PHĂS.)

Sulphate of Bibirine; Sulfate de Bébéerine, *Fr.;* Schwefelsaures Bebirin, *G.*

"Take of Bebeeru Bark [Nectandra, *U. S.*]. in coarse powder, *one pound* [avoirdupois]; Sulphuric Acid *half a fluidounce* [Imperial measure]; Slaked Lime *three-quarters of an ounce*, or *a sufficiency;* Solution of Ammonia *a sufficiency;* Rectified Spirit *sixteen fluidounces*, or *a sufficiency;* Diluted Sulphuric Acid *a sufficiency;* Water *one gallon* [Imp. meas.]; Distilled Water *a sufficiency.* Add the Sulphuric Acid to the Water; pour upon the Bebeeru Bark enough of this mixture to moisten it thoroughly; let it macerate for twenty-four hours, place it in a percolator, and pass through it the remainder of the acidulated water. Concentrate the acid liquor to the bulk of one pint, cool, and add gradually the Lime in the form of milk of lime, agitating well, and taking care that the fluid still retains a distinct acid reaction. Let it rest for two hours; filter through calico; wash the precipitate with a little cold Distilled Water, and to the filtrate add Solution of Ammonia until the fluid has a faint ammoniacal odor. Collect the precipitate on a cloth, wash it twice with ten ounces of cold water, squeeze it gently with the hand, and dry it by the heat of a water-bath. Pulverize the dry precipitate, put it into a flask with six ounces of the Rectified Spirit, boil, let it rest for a few minutes, and pour off the spirit. Treat the undissolved portion in a similar manner with fresh spirit until it is exhausted. Unite the spirituous solutions, add to them four ounces of Distilled Water, and distil so as to recover the greater part of the spirit. To the residue of the distillation add by degrees, and with constant stirring, Diluted Sulphuric Acid till the fluid has a slight acid reaction. Evaporate the whole to complete dryness on the water-bath, pulverize the dry product, pour on it gradually one pint [Imp. meas.] of cold Distilled Water, stirring diligently; filter through paper; evaporate the filtrate to the consistence of syrup, spread it in thin layers on flat porcelain or glass plates, and dry it at a heat not exceeding 140°. Preserve the product in stoppered bottles." *Br.*

In the above process the bark is exhausted by water acidulated with sulphuric acid;

lime is added to separate various inert matters, still leaving the acid in excess, as otherwise it might precipitate the beberine itself; the filtered liquor is treated with ammonia which throws down the beberine; the precipitate is exhausted by alcohol which dissolves the alkaloid; and the solution, having been concentrated, is treated with sulphuric acid so as to form the sulphate, which is obtained by evaporation to dryness. It is obvious that the salt of beberine thus obtained must be very impure, and among other substances probably contains a portion of *sipeerine*, another alkaloid of the bark. Indeed, Prof. Flückiger has found the commercial article to yield a very trifling amount, less than 25 per cent., of the pure alkaloid. It is in dark brown translucent scales, yellow when reduced to powder, of a strongly bitter taste, and soluble in water and alcohol. According to the Br. Pharmacopœia, "its watery solution gives with chloride of barium a white precipitate, and with caustic soda a yellowish-white precipitate, which is dissolved by agitating the mixture with twice its volume of ether; and the ethereal solution, separated by a pipette, and evaporated, leaves a yellow translucent residue, entirely soluble in diluted acids. If the whole of the precipitate produced is dissolved by ether, it cannot contain sipeerine, which is insoluble in that menstruum. It is "entirely destructible by heat, and water forms with it a clear brown solution." According to Dr. Flückiger (*P. J. Tr.*, xi. 193, 1869), pure beberine is a white, amorphous powder, whose concentrated watery solution is not precipitated by tartar emetic, but affords abundant white precipitates with phosphate of sodium, nitrate, iodide, or iodohydrargyrate of potassium, perchloride of mercury, platinocyanide of potassium, and nitric or iodic acid. Its acetate yields yellow amorphous precipitates with red or yellow prussiate of potassium, chromate or bichromate of potassium, or bichloride of platinum. Beberine was shown by Walz in 1860 to be identical with *buxine*, obtained from *Buxus sempervirens*. This statement was confirmed by Flückiger, who proved that *pelosine* was identical with both of the above principles. (*P. J. Tr.*, xi., 1870, p. 192.)

Sulphate of beberine is a tonic, supposed to possess antiperiodic powers, and has been given in intermittent fever and other periodical diseases. It is thought to be useful also in various uterine diseases, as dysmenorrhœa, menorrhagia, and leucorrhœa; and has been recommended in blennorrhœal discharges, and in atony of the kidneys and bladder. (Dr. A. P. Merrill, *Half-Yearly Abstract of Med. Sci.*, xlv. 249.) The dose is from two to five grains (0·13–0·33 Gm.) (See *Nectandra.*)

BELÆ FRUCTUS. *Br.* *Bael Fruit.*

(BĒ'LÆ FRŬC'TŬS.)

"The dried half-ripe fruit of Ægle Marmelos." *Br.*

Indian Bael, Bengal Quince, *E.;* Bael, Coing du Bengale, *Fr.;* Baelfrucht, Bengalische Quitte, *G.*

This is a newly introduced officinal of the British Pharmacopœia, known to some extent in Great Britain, but scarcely at all in the United States; and probably sanctioned by the British Council out of compliment to practitioners in the East Indies, who are said to have used it with advantage. It is the unripe fruit of the *Ægle Marmelos* of De Candolle, belonging to the Aurantiaceæ, and with the following generic character. "*Flowers* bi-sexual. *Petals* 4-5 patent. *Stamens* 30-40, with distinct filaments, and linear-oblong anthers. *Ovary* 8-15 celled, with numerous ovules in each cell. *Style* very short and thick. *Stigma* capitate. *Fruit* baccate, with a hard rind, 8-15 celled, the cells 6-10 seeded. *Seed* with a woolly coat, covered with a slimy liquid." (*Wight & Arnott.*)

This species of Ægle, sometimes called the *Bengal quince*, is a rather large tree, with an erect stem, and few and irregular branches, covered with an ash-colored bark, and furnished in general with strong, very sharp, axillary thorns, single or in pairs. The leaves are ternate, with oblong-lanceolate, crenulated, slightly dotted leaflets, of which the terminal is largest. The flowers are large, white, and in small terminal or axillary panicles. The fruit is a berry, of about the size of a large orange, somewhat spherical, but flattened at the base, and depressed at the insertion of the stem, with a hard smooth shell, and from 10 to 15 cells, containing besides the seeds a large quantity of exceedingly tenacious mucilage, which, when dried, is hard and transparent. The tree is a native of Hindostan and of Farther India. It is figured in *P. J. Tr.*, Oct. 1850, p. 166.

Several parts of the tree are used in India. The ripe fruit is described as fragrant, and of a delicious flavor; and a sort of sherbet prepared from it is deemed useful in febrile affections. The mucilage about the seeds is applied to various purposes in the arts, in connection with its viscid properties. The rind is used in dyeing. The flowers are deemed refrigerant by the native physicians. The fresh leaves yield by expression a bitterish and somewhat pungent juice, which, diluted with water, is occasionally used in the early stage of catarrhal and other fevers. The bark of the stem and root is thought to possess febrifuge properties. But it is the unripe or half-ripe fruit that is chiefly employed, and is the part recognized by the Br. Pharmacopœia.

Properties. The dried fruit is imported into England in vertical slices, or in broken pieces consisting of a part of the rind with the adherent pulp and seeds. The "rind is about a line and a half thick, covered with a smooth pale brown or grayish epidermis, and internally, as well as the dried pulp, brownish orange, or cherry-red" (*Br.*) When moistened, the pulp becomes mucilaginous. The fruit is astringent to the taste, and yields its virtues to water by maceration or decoction. Mr. Pollcck found in it tannic acid, a concrete essential oil, and a vegetable acid (*Med. Times and Gaz.*, Feb. 1864, p. 199), but Prof. Flückiger states that neither a ferric nor a ferrous salt shows the infusion to contain any appreciable quantity of tannin, nor is the drug in any sense possessed of astringent properties. (*Pharmacographia*, 2d ed., p. 131.)

The difficulty of obtaining bael in England is said to have led to the substitution for it of mangosteen, the fruit of *Garcinia Mangostana*. This is in irregular fragments of the rind, without any adhering pulp. The pieces are convex, three or four lines or more in thickness, externally covered with a smooth, deep reddish brown, easily separable coating, and internally pale reddish brown or reddish yellow, smooth, with projecting vertical lines. (Prof. Bentley, *P. J. Tr.*, May, 1867, p. 654.)

Medical Properties and Uses. Bael, as the medicine is called in India, is said to possess astringent properties which render it useful in diarrhœa, dysentery with debility of the mucous membrane, and other diseases of the bowels with relaxation, which it relieves without inducing constipation. It is much used by some practitioners in India, generally in the form of decoction, made by slowly boiling down a pint of water with two ounces of the dried fruit to four fluidounces. Of this one or two fluidounces (30–60 C.c.) are given in acute cases every two or three hours, in chronic cases two or three times a day. A liquid extract is directed in the Br. Pharmacopœia, the dose of which may be one or two fluidrachms (3·75–7·5 C.c.). Mr. Waring, of the East India medical service, recommends an extract in the dose of half a drachm or a drachm (1·95–3·9 Gm.).

Off. Prep. Extractum Belæ Liquidum, *Br.*

BELLADONNÆ FOLIA. *U.S.*, *Br.* *Belladonna Leaves.*

(BĔL-LA̤-DŎN'NÆ FŌ'LI̤-A̤.)

"The leaves of Atropa Belladonna. Linné. (*Nat. Ord.* Solanaceæ.)" *U. S.* "The fresh leaves, with the branches to which they are attached, of Deadly Nightshade, Atropa Belladonna; also the leaves separated from the branches and carefully dried; gathered from the wild or cultivated British plants when the fruit has begun to form." *Br.*

Folia (s. Herba) Belladonnæ; Feuilles de Belladone, *Fr.;* Tollkirschen-Blätter, Wolfskirschen-Blätter, Tollkraut, *G.*

BELLADONNÆ RADIX. *U.S.*, *Br.* *Belladonna Root.*

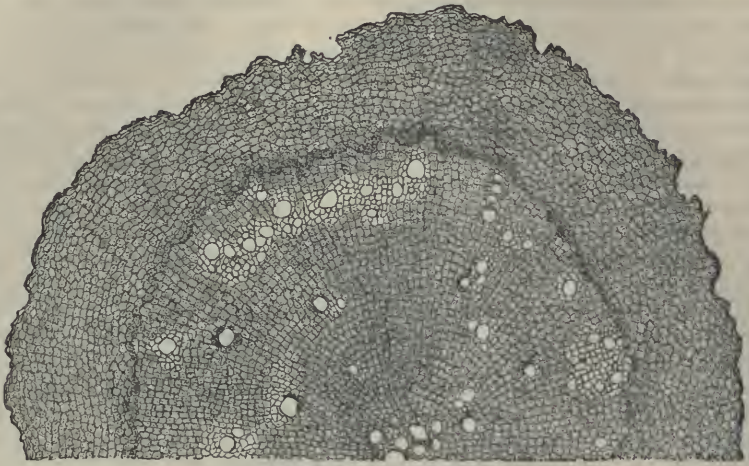
(BĔL-LA̤-DŎN'NÆ RĀ'DĬX.)

"The root of Atropa Belladonna. Linné. (*Nat. Ord.* Solanaceæ.)" *U. S.* "The dried root of Atropa Belladonna." *Br.*

Racine de Belladone, Belladone, *Fr.;* Gemeine Tollkirsche, Wolfskirsche, Tollkirschen-Wurzel, Wolfskirschen-Wurzel, *G.;* Belladonna, *It.;* Belladona, Belladama, *Sp.*

Gen. Ch. Corolla bell-shaped. *Stamens* distant. *Berry* globular, two-celled. *Willd.*

Atropa Belladonna. Willd. *Sp. Plant.* i. 1017; Carson, *Illust. of Med. Bot.* ii. 19, pl. lxv.; *B. & T.* 193. The belladonna, or *deadly nightshade*, is an herbaceous perennial, with a fleshy, creeping root, from which rise several erect, round, purplish, branching stems, to the height of about three feet. The leaves, which are attached by short footstalks to the stem, are in pairs of unequal size, oval, pointed, entire, of a dusky green on their upper surface, and paler beneath. The flowers are large, bell-shaped, pendent, of a dull reddish color, with solitary peduncles, rising from the axils of the leaves. The fruit is a roundish berry with a longitudinal furrow on each side, at first green, afterwards red, ultimately deep purple, slightly resembling a cherry, and containing, in two distinct cells, numerous seeds, and a sweetish violet-colored juice. The calyx adheres to the base of the fruit.



Transverse Section of Belladonna Root.

The plant is a native of Europe, where it grows in shady places, along walls, and amidst rubbish, flowering in June and July, and ripening its fruit in September. It grows vigorously under cultivation in this country, and retains all its activity, as shown by the observations of Mr. Alfred Jones. (*A. J. P.*, xxiv. 106.) All parts of it are active. The leaves and roots are directed by the United States and British Pharmacopœias; the latter including the young branches, which are probably not less efficient. The leaves should be collected in June or July, when the plant is in flower, the roots in the autumn or early in the spring, and from plants three years old or more. Leaves which have been kept long should not be used, as they undergo change through absorption of atmospheric moisture, emitting ammonia, and probably losing a portion of their active nitrogenous matter; and usually the large handsome leaves in commerce are not to be preferred, because they are very likely those of cultivated plants, which have been shown to be inferior in strength to smaller and less sightly leaves of the wild plant. (*A. J. P.*, xxvii. 455.)

Properties. The "leaves are from four to six inches (10 to 15 cm.) long, broadly ovate, narrowed into a petiole, tapering at the apex, entire on the margin, smooth, thin, the upper surface brownish green, the lower surface grayish green, having a slight odor, and a bitterish, disagreeable taste." *U. S.* The root occurs "in cylindrical, somewhat tapering, longitudinally wrinkled pieces, from half an inch to an inch (12 to 25 mm.) or more in thickness; externally brownish gray, internally whitish; nearly inodorous, having a sweetish, afterward bitterish and strongly acrid taste, and breaking with a nearly smooth and mealy fracture. Roots which are tough and woody, breaking with a splintery fracture, should be rejected."[*] *U. S.*

[*] *Japanese Belladonna.* There have recently appeared in European commerce certain rhizomes from two to six inches long, about one-half inch in diameter, rarely branched, cylindrical or slightly compressed, knotty, bent, with circular disk-like scars, of a pale brown color, not whitish when abraded, with a slightly mousy, narcotic odor, and a taste nearly free from bitterness. Mr. E. M. Holmes believes this Japanese belladonna to be derived from *Scopolia Japonica*, Max. Dr. A. Langgaard has found in it two alkaloids, one in very small amount, *scopolenine*, and one which is very closely allied to, if not identical with, atropine. (*A. J. P.*, 1880, pp. 356, 456; 1881, p. 450.)

As to the relative strength of these two parts, M. Hirtz, of Strasburg, has inferred from his experiments that the root yields an extract five times stronger than that obtained from the leaves, but did not determine the relative yield of extract; whilst Lefort obtained from young roots 0·6, old roots 0·25, dried leaves 0·44 per cent. of atropine; and Dragendorff obtained 0·66 from dried leaves, and 0·4 per cent. from the roots. (*Jahresb.*, 1874, p. 96.) Both the leaves and root, as well as all other parts of the plant, impart their active properties to water and alcohol. Brandes rendered it probable that these properties reside in a peculiar alkaline principle, which he supposed to exist in the plant combined with an excess of malic acid, and appropriately named *atropine.* Besides malate of atropine, Brandes found in the dried herb two principles, a green resin (chlorophyll), wax, gum, starch, albumen, lignin, and various salts. The alkaloid principle was afterwards detected by M. Runge; and the fact of its existence was established beyond question by Geiger and Hesse, who obtained it from an extract prepared from the stems and leaves of the plant. It was first, however, procured in a state of purity by Mein, a German apothecary, who extracted it from the root. Ladenburg (*Ann. der Ch. und Pharm.*, 206, p. 307) has quite recently studied the several sources of atropine and the allied alkaloids that exert a mydriatic action, and finds that there are three alkaloids in all,—*atropine*, *hyoscyamine*, and *hyoscine*,—all of which possess the common formula $C_{17}H_{23}NO_3$. Of these, atropine occurs in the *Atropa belladonna* and in *Datura stramonium*, hyoscyamine in these plants and also in *Hyoscyamus niger* and *Duboisia myoporoides*, whilst hyoscine is found in *Hyoscyamus niger* alone. The first of these, *atropine*, fuses at 114° C.–115° C. (237·2° F.–239° F.), and forms a double gold chloride, fusing at 135° C.–137° C. (275° F.–278·6° F.); the second, the alkaloid known under the several names of *hyoscyamine*, *daturine*, and *duboisine*,[*] fuses at 107° C. (224·6° F.), and yields a gold salt, fusing at 159° C. (318·2° F.); and the third, *hyoscine*, only obtained as yet in the form of a syrup, but forming a crystalline gold salt, which fuses at 196° C.–198° C. (384·8° F.–388·4° F.), and is less soluble than the hyoscyamine gold salt. In *Duboisia myoporoides* (see Part II.) the only alkaloid present seems to be the second of these, and the complete identity of it with the purified alkaloid of *hyoscyamus* has been established by Ladenburg, both by analysis of the free alkaloid and its salts, and by study of the action of different reagents upon it. Hyoscyamine is more soluble in water and dilute alcohol than atropine, and, as already stated, forms a gold salt of different fusing point. Its decomposition products under the influence of caustic baryta, or hydrochloric acid, are the same as those of atropine, viz., *tropine* and *tropic acid.* Regnauld and Valmont have confirmed Ladenburg's results as far as atropine and hyoscyamine are concerned (*A. J. P.*, Dec. 1881, p. 610). Lübekind described, under the name of *belladonnine*, a volatile alkaline principle, wholly distinct from atropine, which he obtained from belladonna. (See *A. J. P.*, xiii. 127.) Hübschmann (*Schweiz. Zeits. Pharm.*, 1858, p. 123) and Kraut (*Ann. der Ch. und Pharm.*, 148, p. 236) also both described, under the name of *belladonine*, a second alkaloid extracted from belladonna. The question has been authoritatively settled, however, by Ladenburg (*Ann. der Ch. und Phar.*, 206, p. 289), who finds that the second alkaloid of the *Atropa belladonna* is the same as the chief alkaloid of the *Hyoscyamus niger*, and is, therefore, called *hyoscyamine.* Its formula, $C_{17}H_{23}NO_3$, is the same as that of *atropine*, and its decomposition products are the same. It, however, fuses at 107° C. (224·6° F.) instead of 114° C. (237·2° F.), and yields a very different salt with gold chloride. For the mode of preparing atropine and its properties, see the article *Atropina.*[*]

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[*] *Medical Properties and Uses of Duboisine.* When about $\frac{1}{60}$th of a grain (0·001 Gm.) of duboisine is injected hypodermically in man, in the course of five or ten minutes, dryness of the mouth, thirst, acceleration of the pulse, and dryness and redness of the skin begin successively to appear. As these symptoms are accompanied by dilatation of the pupil and disorder of vision, the subject of them appears to be suffering from atropine poisoning. Even from the amount named, symptoms more severe are sometimes produced, such as vertigo, great muscular weakness, and, in several instances, a sudden very pronounced fall of the pulse, with great abatement of the force. In a case (*Detroit Lancet*, Feb. 1881, p. 369) in which an eighth of a grain is said to have been taken, at the end of three-quarters of an hour the patient could scarcely stand; he shortly afterwards passed into a state of complete unconsciousness, not preceded by delirium, and accompanied, it is stated, with natural breathing. In the absence of delirium and in the natural respiratory movements (if correctly reported), this case separates itself from one of atropine poisoning; whilst in the slowing of the pulse, after large doses of duboisine, first pointed out by Gubler (*Bull. Thérap.*, vol. xciv., p. 426), we have another point of difference.

The effect of the new alkaloid upon the lower mammals is similar to that which it exerts upon man. It has been studied physiologically by Ringer and Tweedy (*Lancet*, 1878, vol. i.), by N. Epifanon (*Hoffmann und Schwalbe's Jahresberichte*, ix. 206), and by G. Tiger (*Ibid.*), with results which want of space forbids us fully to discuss. The likeness in its action to that of atropine is maintained, excepting that the new alkaloid is much more powerful, and, according to Tiger, does not stimulate the respiratory centre, though this latter assertion needs confirmation.

When placed upon the conjunctiva, duboisine acts as a mydriatic more rapidly than does atropine, full dilatation being obtained with it in 10 to 15 minutes, soon followed by complete paralysis of accommodation. These effects pass off much more quickly than after the belladonna alkaloid, but it is so prone, when applied to the eye, to produce slight toxic symptoms, that its usefulness is much curtailed. Dr. Wm. F. Norris has found it less irritant to the eyes than the atropine, and therefore especially adapted to the treatment of inflammatory affections. Internally, duboisine may be used as a substitute for atropine, except, it may be, as a respiratory stimulant, in doses of about one-half less; thus more than $\frac{1}{100}$th of a grain (0·0006 Gm.) should never be given as a commencing dose.

The imported belladonna, especially that from Germany, is occasionally adulterated. Prof. J. M. Maisch (*A. J. P.*, xxxiv. 126) states that, in different packages of the German drug, he has met with the leaves of *Digitalis purpurea*, *Solanum nigrum* and *villosum*, and *Verbascum Thapsus*, the leaves, stem, and capsules of *Hyoscyamus niger*, and various other impurities, not to speak of the flowers and fruit and immature leaves of the belladonna plant itself. The apothecary can have no difficulty in detecting these adulterations, if acquainted with the characters of the genuine leaves. One of the most distinctive of these is the unequal size of the two leaves constituting each pair. But the plant is so easily cultivated, and grows so vigorously in this country, that all the demand for it might be readily supplied from our own gardens, without the need of recourse to Europe, were a little attention paid to the subject.

Medical Properties and Uses. The action of belladonna upon the system is that of atropine. (See p. 265.) All parts of the plant are poisonous. It is not uncommon, in countries where it grows wild, for children to pick and eat the berries, allured by their fine color and sweet taste. Soon after the poison has been swallowed, its peculiar influence is experienced in dryness of the mouth and fauces, burning in the throat and stomach, great thirst, difficult deglutition, nausea and ineffectual retching, loss of vision, vertigo, and intoxication or delirium, with violent gestures and sometimes fits of laughter, and followed by coma. A feeble pulse, cold extremities, subsultus tendinum, deep coma or delirium, and sometimes convulsions, precede death. To obviate the poisonous influence of the belladonna, the most effectual method is to evacuate the stomach as speedily as possible, by means of emetics or the stomach-pump, and afterwards to cleanse the bowels by purgatives and enemata. The infusion of galls may be serviceable as an antidote. Bouchardat recommends the ioduretted solution of iodide of potassium; and a case is recorded in which it seems to have been useful. (*Ann. de Thérap.*, 1854, p. 14.)

Belladonna has been used as a medicine from early times. The leaves were first employed externally to discuss scirrhous tumors, and heal cancerous and other ill-conditioned ulcers; and were afterwards administered internally for the same purpose. Much evidence of their usefulness in these affections is on record, and even Dr. Cullen spoke in their favor; but this application of the medicine has fallen into disuse. It is now more esteemed in nervous diseases; for an account of its use in these and other disorders the reader is referred to the article on atropine. Belladonna has acquired considerable credit as a preventive of scarlatina; an application of the remedy first suggested by the author of the *homœopathic* doctrine; but it is absolutely devoid of any such power.

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[*] *Homatropine. Homatropia. Oxytoluyl-tropeïne.* ($C_{16}H_{21}NO_3$.) This alkaloid is one of the derivatives of *tropeïne*, produced by heating *tropine* gently in contact with organic acids and diluted hydrochloric acid. The most important of this group from a therapeutic point of view is homatropine; it is prepared from tropine, amygdalic (phenyl-glycolic, or benzo-glycolic) acid, and diluted hydrochloric acid. Merck has succeeded in crystallizing it in transparent colorless prisms by recrystallization from its ethereal solution. It is not easily soluble in water, although it is *hygroscopic and very deliquescent;* the crystals melt at 95·5° C. to 98·5° C. (203·9° F. to 208·9° F.). (*Ber. d. Deutsch. Chem. Ges.*, 1880, p. 340.) The most useful salt has been shown to be the *hydrobromate of homatropine*, $C_{16}H_{21}NO_3.HBr$, which is crystallizable and not hygroscopic, soluble in 10 parts of water, making a solution which is reasonably permanent. The action of homatropine upon the system has not, that we are aware of, been studied, but probably it is similar to that of atropine. As a practical mydriatic the alkaloid has attracted attention, especially on account of the fugaciousness of its action. When its solution is dropped in the eye, the pupil usually begins to dilate in 15 minutes, and the effects to pass off in from six to ten hours. When it is only desired to examine the fundus oculi, a solution of the strength of 3 grains to the ounce is the best mydriatic at our command; but when it is necessary to paralyze the accommodation, the influence of homatropine is rather feeble and uncertain.

The extract is much used locally. Rubbed upon the areola of the breast, it has been found to arrest the secretion of milk; and upon the abdomen, to relieve the vomiting of pregnancy, and other irritations sympathetic with the gravid uterus. Applied, in the form of a large plaster, above the pubes, it has been found very useful in relieving dysenteric tenesmus, and, as a dressing to a blistered surface over the abdomen, has been asserted to effect a cure in epidemic cholera. (*Ann. de Thérap.*, 1860, p. 49.) In cardiac diseases the plaster is often applied with advantage over the heart. The decoction or extract, applied to the neck of the uterus, is asserted to have hastened tedious labor dependent on rigidity of the os tincæ; and spasmodic stricture of the urethra, neck of the bladder, and sphincter ani, anal fissures, and painful uterine affections, have been relieved by the local use of the extract, either smeared upon bougies, or administered by injection. In the latter mode it has relieved strangulated hernia. It is asserted also to be useful in paraphimosis. The inhalation of the vapor from a decoction of the leaves or extract has been recommended in spasmodic asthma. For this purpose, two drachms of the leaves, or fifteen grains of the aqueous extract, are employed to the pint of water. A much better plan is to smoke the dried leaves, either in the form of a cigarette or in a pipe. Relief is said to have been obtained in phthisis by smoking the leaves, infused when fresh in a strong solution of opium, and then dried.

Belladonna may be given in substance, but is very rarely used except in extract. The dose of the powdered leaves is for children from the eighth to the fourth of a grain (0·008–0·016 Gm.), for adults one or two grains (0·065–0·13 Gm.), repeated daily, or twice a day, and gradually increased till the characteristic effects are experienced.

From its quicker action, more uniform strength, and greater cleanliness, *atropine* has been largely substituted for extract of belladonna for local use. (See *Atropine.*)

Off. Prep. of the Leaves. Extractum Belladonnæ, *Br.;* Extract. Belladonnæ Alcoholicum, *U. S.;* Tinctura Belladonnæ.

Off. Prep. of the Root. Emplastrum Belladonnæ, *U. S.;* Extractum Belladonnæ Radicis Fluidum, *U. S.;* Linimentum Belladonnæ, *Br.*

BENZINUM. *U.S.* *Benzin.*

(BĔN-ZĪ′NŬM.)

"A purified distillate from American Petroleum, consisting of hydrocarbons, chiefly of the marsh-gas series [$\mathbf{C_5H_{12}}$; $\mathbf{C_6H_{14}}$.—$C_{10}H_{22}$; $C_{12}H_{26}$] and homologous compounds, having a sp. gr. from 0·670 to 0·675, and boiling at 50° to 60° C. (122° to 140° F.).

"Benzin should be carefully kept in well-stopped bottles or cans, in a cool place, remote from lights or fire." *U. S.*

Petroleum Benzin, Petroleum Ether.

This useful product of petroleum is officinal for the first time; it is obtained in the process of purifying petroleum by fractional distillation (see *Petroleum*, Part II.), and it is defined in the Pharmacopœia as "a transparent, colorless, diffusive liquid, of a strong, characteristic odor, slightly resembling that of petroleum, but much less disagreeable; neutral in reaction; insoluble in water, soluble in about 6 parts of alcohol, and readily so in ether, chloroform, benzol, and fixed and volatile oils. It is highly inflammable, and its vapor, when mixed with air and ignited, explodes violently. Benzin, when evaporated upon the hand, should leave no odor, and, when evaporated in a warmed dish, should leave no residue (abs. of heavy hydrocarbons). When boiled a few minutes with one-fourth its volume of spirit of ammonia and a few drops of test-solution of nitrate of silver, the ammoniacal liquid should not turn brown (abs. of pyrogenous products, and sulphur compounds); and it should require 6 parts of officinal alcohol to dissolve it (difference from benzol). If 5 drops are added to a mixture of 40 drops of sulphuric acid with 10 drops of nitric acid, in a test-tube, the liquid warmed and set aside for half an hour, and then diluted, in a shallow dish, with twice its volume of water, it should not have the bitter-almond-like odor of nitro-benzol (abs. of benzol)." *U. S.* At present it will be difficult to find benzin in commerce which will answer all of the Pharmacopœia tests, as it is very difficult to separate it from minute quantities of a hydrocarbon of a very disagreeable odor. Petroleum benzin must be carefully distinguished from benzol (called benzene by English chemists), a product derived from coal tar (see *Benzol*, Part II.). Although the Pharmacopœia gives a test to distinguish an admixture with benzol, this adulteration of benzin is hardly likely to take place here in the near future because of the great difference in price. The principal consumption of benzin at present is in the arts as a solvent, and as a substitute for oil of turpentine, which it resembles very much in its solvent properties. In pharmacy it has been used to deprive powdered drugs of their fixed oil by percolation (see *Charta Sinapis*), to obtain volatile oils by percolating the oily drug with the benzin, and subsequently evaporating the mixture spontaneously, as a substitute for ether in making oleoresins, and for many other purposes to which it is adapted on account of its powers as a solvent. Benzin is a good solvent for fats, resins, caoutchouc, and some of the alkaloids.

BENZOINUM. *U.S.*, *Br.* *Benzoin.*

(BĔN-ZO̩-Ī'NŬM.)

"A balsamic resin obtained from Styrax Benzoin. Dryander. (*Nat. Ord.* Styraceæ.)" *U. S.* "A balsamic resin obtained from Styrax Benzoin." *Br.*

Benzoe, *P.G.;* Resina Benzoe, Asa Dulcis; Gum Benjamin; Benjoin, *Fr.;* Benzöe, *G.;* Belzoino, *It.;* Benjui, *Sp.*

The botanical source of benzoin was long uncertain. At one time it was generally supposed in Europe to be derived from the *Laurus Benzoin* of this country. This error was corrected by Linnæus, who, however, committed another, in ascribing the drug to *Croton Benzoë*, a shrub which he afterwards described under the name of *Terminalia Benzoin.* Mr. Dryander was the first who ascertained the true benzoin-tree to be a *Styrax;* and his description, published in the 77th vol. of the London Philosophical Transactions, has been copied by most subsequent writers.

Gen. Ch. Calyx inferior. *Corolla* funnel-shaped. *Drupe* two-seeded. *Willd.*

Styrax Benzoin. Willd. *Sp. Plant.* ii. 623. (*B. & T.*, 169.) This is a tall tree of quick growth, sending off many strong round branches, covered with a whitish downy bark. Its leaves are alternate, entire, oblong, pointed, smooth above, and downy beneath. The flowers are in compound, axillary clusters, nearly as long as the leaves, and usually hang, all on the same side, upon short slender pedicels.

The benzoin, or *benjamin-tree*, is a native of Sumatra, Java, Borneo, Laos, and Siam. By wounding the bark near the origin of the lower branches, a juice exudes, which hardens upon exposure, and forms the *benzoin* of commerce. The trees, which are both wild and cultivated, are deemed of a proper age to be wounded at six years, when the trunks are usually about seven or eight inches in diameter. The operation is performed annually, and the product on each occasion from one tree never exceeds three pounds. The juice which first flows is the purest, and affords the whitest and most fragrant benzoin. It is exported chiefly from Bangkok in Siam, and Acheen in Sumatra; there are two varieties in the market. *Siam benzoin* is usually imported in cubic blocks, which take their form from the wooden boxes in which the soft resin has been packed. It is brittle, with a peculiar vanilla-like fragrance, but bitter taste. It may be a compact mass, containing more or less numerous opaque white tears imbedded in a rich amber-colored translucent resin, mixed to a greater or less extent with bits of bark, wood, etc. The finest variety is composed almost entirely of these tears, loosely agglutinated together. E. Lorgeon, Consular Agent of France, at Bangkok, reports that Siamese benzoin has become very scarce (May, 1881). The reason of this is not known. *Sumatra benzoin* differs from the Siam in having a much grayer color; the resin is grayish brown, the tears usually fewer than in the finer variety, and the bits of wood, etc., more abundant. *Palembang benzoin*, a subvariety of the Sumatra, is said to be distinguished by its tincture when dropped into water, not producing milkiness, but a flocculent deposit.*

Properties. Benzoin has a fragrant odor, with very little taste; but, when chewed for some time, leaves a sense of irritation in the mouth and fauces. It breaks with a resinous fracture, and presents a mottled surface of white and brown or reddish brown; the white spots being smooth and shining, while the remainder, though sometimes shining and even translucent, is usually more or less rough and porous, and often exhibits impurities. In the inferior kinds, the white spots are very few, or entirely wanting. Benzoin is easily pulverized, and, in the process of being powdered, is apt to excite sneezing. Its sp. gr. is from 1·063 to 1·092. "In lumps consisting of agglutinated, yellowish brown tears, which are internally milk white, or in the form of a reddish brown mass, more or less mottled from whitish tears imbedded in it. It is almost wholly soluble in 5 parts of moderately warm alcohol, and in solution of potassa. When Benzoin is boiled with milk of lime, the hot filtrate should not give off the odor of oil of bitter almond on the addition of test-solution of permanganate of potassium (abs. of cinnamic acid)." *U. S.* When heated it melts, and emits thick, white, pungent fumes, which excite cough when inhaled, and consist chiefly of benzoic acid. It is wholly soluble, with the exception of impurities, in alcohol, and is precipitated by water from the solution, rendering the liquor milky. It imparts to boiling water a notable proportion of benzoic acid. Lime-water and the alkaline solutions partially dissolve it, forming benzoates, from which the acid may be precipitated by the addition of other acids. Its chief constituents are resin and benzoic acid; and it therefore belongs to the balsams. The white tears and the brownish connecting medium are said by Stolze to contain nearly the same proportion of acid, which, according to Bucholz, is 12·5 per cent., to Stolze, 19·8 per cent. In a more recent examination by Kopp, the white tears were found to contain from 8 to 10 per cent. of acid, and the brown 15 per cent. (*Journ. de Pharm.*, 3e sér., iv. 46.) The resin is of three kinds, one extracted with the benzoic acid by a boiling solution of carbonate of potassium in excess, another dissolved by ether from the residue, and the third affected by neither of these solvents. Besides benzoic acid and resin, the balsam contains a little extractive, and traces of volatile oil. Benzoin retards the oxidation of fatty matters, and thus tends to prevent rancidity.

It appears from recent researches that benzoin, besides its own characteristic acid, often contains also cinnamic acid, which is found more especially in the white tears. Indeed, Hermann Aschoff obtained from some benzoin of Sumatra a pure cinnamic acid, without any benzoic; and Messrs. Kolbe and Lautermann, upon examining a specimen of the tears, discovered what they at first supposed to be a peculiar acid, but which, on further investigation, proved to be a mixture of the cinnamic and benzoic acids. Aschoff recommends the following method of detecting *cinnamic acid*. Boil the benzoin with milk of lime, filter, decompose with hydrochloric acid, and add either bichromate of potassium with sulphuric acid, or permanganate of potassium, when, if cinnamic acid be present, the odor of oil of bitter almonds will be perceived. The two acids, which, when they occur together in benzoin, are said to be always mixed in the same proportion, may be at least partially separated by simple crystallization; their melting points being very different, that of benzoic acid 121° C. (249° F.), and that of the mixed acid, consisting of one part of the cinnamic and two of the benzoic, only 25·5° C. (78° F.). (*P. J. Tr.*, 1863, p. 77.) According to Mr. A. C. Curtis, *cinnamein* may be obtained by boiling benzoin with twice its bulk of lime in forty parts of water for fifteen or twenty minutes, filtering, cooling, adding hydrochloric acid, washing the precipitate, and recrystallizing from water acidulated with hydrochloric acid. (*A. J. P.*, 1872, p. 486.)

Rump (1878) treated Siam benzoin with caustic lime, precipitated the benzoic acid with hydrochloric acid, and agitated the liquid with ether. The latter on evaporating afforded a mixture of benzoic acid and *vanillin*, $C_8H_8O_3$. Subjected to dry distillation, benzoin affords as chief product benzoic acid, together with empyreumatic products, among which Berthelot has proved the presence (in Siam benzoin) of *styrol*, C_8H_8. The latter was also obtained in 1874 by Theegarten from Sumatra benzoin by distilling it with water. (*Ber. Chem. Ges.*, 1874, p. 727.)

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* A factitious substance has been sold in our markets for benzoin, consisting of chips of wood agglutinated by a resinous substance, with no benzoic acid, and only a trace of cinnamic. (J. M. Maisch, *A. J. P.*, xxxv. 494.)

Medical Properties and Uses. Benzoin is stimulant and expectorant, and was formerly employed in pectoral affections; but, except as an ingredient of the compound tincture of benzoin, it has fallen into disuse. Trousseau and Pidoux recommend strongly its inhalation in chronic laryngitis. Either the air of the chamber may be impregnated with its vapor by placing a small portion upon some live coals, or the patient may inhale the vapor of boiling water to which the balsam has been added. It is employed in pharmacy for the preparation of benzoic acid (see *Acidum Benzoicum*); and the milky liquor resulting from the addition of water to its alcoholic solution is sometimes used as a cosmetic, under the impression that it renders the skin soft. A tincture has been strongly recommended in anal fissure. In the East Indies, the balsam is burnt by the Hindoos as a perfume in their temples.*

Off. Prep. Adeps Benzoatus, *Br.;* Tinctura Benzoini, *U.S.;* Tinctura Benzoini Composita; Adeps Benzoinatus, *U.S.*

BISMUTHI CITRAS. *U.S.* *Citrate of Bismuth.*

$Bi\,C_6\,H_5\,O_7$; 399. (BĬŞ-MŪ'THĪ CĪ'TRĂS.) $Bi\,O_3, C_{12}\,H_5\,O_{11}$; 399.

Bismuthum Citricum, Citrate de Bismuth, *Fr.;* Citronensaures Wismuth, *G.*

"Subnitrate of Bismuth, *ten parts;* Citric Acid, *seven parts;* Distilled Water, *a sufficient quantity.* Boil the Subnitrate of Bismuth and the Citric Acid with *forty* parts of Distilled Water, until a drop of the mixture yields a clear solution with water of ammonia. Then add *five hundred parts* of Distilled Water, allow the suspended matter to deposit, wash the precipitate (first by decantation, and afterward on a strainer), with Distilled Water, until the washings are tasteless, and dry the residue at a gentle heat." *U.S.*

Properties. "A white amorphous powder, permanent in the air, odorless and tasteless, insoluble in water or alcohol, but soluble in water of ammonia. When strongly heated, the salt chars, and, on ignition, leaves a more or less blackened residue with a yellow surface, which is dissolved by warm nitric acid. This solution, on being dropped into water, occasions a white turbidity. The ammoniacal solution, when treated with hydrosulphuric acid in excess, yields a black precipitate. The filtrate deprived, by heat, of the excess of hydrosulphuric acid and cooled, when boiled with lime-water, produces a white precipitate, and when a portion of it is mixed with an equal volume of concentrated sulphuric acid and cooled, a brown or brownish black zone should not appear around a crystal of ferrous sulphate dropped into the liquid (abs. of nitrate)." *U.S.*

Composition. As citric acid ($H_3C_6H_5O_7$) is tribasic, one atom of bismuth, being trivalent, will exactly replace the three hydrogen atoms of the citric acid and form a neutral citrate of bismuth. When subnitrate of bismuth is boiled with a solution of citric acid it is decomposed, the nitric acid is replaced by the citric acid, and the insoluble citrate of bismuth is formed; the completion of the process is known by the mixture yielding a clear solution with water of ammonia.

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* A styptic liquid, prepared by a Roman pharmaceutist named *Pagliari*, and kept secret for a time, has acquired some reputation among the French army surgeons. It is made by boiling, for six hours, eight ounces of tincture of benzoin (containing about two ounces of the balsam), a pound of alum, and ten pounds of water, in a glazed earthen vessel, stirring constantly, and supplying the loss with hot water. The liquor is then strained and kept in stopped bottles. It is limpid, styptic, of an aromatic smell, and said to have the property of causing an instantaneous coagulation of the blood. (See *Am. Journ. of Med. Sci.*, N.S., xxv. 199.)

M. Meyer, believing that the long boiling in the foregoing process is injurious, if in no other way, by dissipating the benzoic acid, proposes to dispense with it, and has substituted the following formula, which furnishes a product always identical. Take tears of benzoin, 6 grammes (about ʒiss), alcohol at 90° C. 15 grammes; dissolve and add of water 300 grammes, alum 30 grammes; mix and boil till the liquid becomes clear. The liquid should mark 6° on the hydrometer. (*Journ. de Pharm. et de Chim.*, 4e sér., v. 123.)

Fumigating pastiles are made from 16 parts of benzoin, 4 of balsam of Tolu, 4 of yellow saunders, 1 of labdanum, 48 of charcoal, 2 of nitre, 1 of tragacanth, 2 of gum arabic, and 12 of cinnamon-water, by reducing the solid ingredients to powder, and mixing the whole into a plastic mass, which is to be formed into cones, flattened at the base, and dried first in the air, and then in a stove. (Soubeiran, *Trait. de Pharm.*, 3e ed., i. 463.)

Medical Properties. This salt is not used itself in medicine, but has been made officinal for pharmaceutical purposes.

Off. Prep. Bismuthi et Ammonii Citras. *U. S.*

BISMUTHI ET AMMONII CITRAS. *U. S. Citrate of Bismuth and Ammonium.*

(BĬS̡-MŪ′THĪ ĔT A̤M-MŌ′NI̤-Ī CĪ′TRĂS.)

Citrate de Bismuth et d'Ammoniaque, *Fr.;* Citronensaures Wismuthoxyd-Ammonium, *G.*

"Citrate of Bismuth, *ten parts;* Water of Ammonia, Distilled Water, each, *a sufficient quantity.* Mix the Citrate of Bismuth with *twenty* (20) *parts* of Distilled Water to a smooth paste, and gradually add Water of Ammonia until the salt is dissolved, and the liquid has a neutral or only faintly alkaline reaction. Then filter the solution, evaporate it to a syrupy consistence, and spread it on plates of glass, so that, on drying, the salt may be obtained in scales. Keep the product in small, well-stopped vials, protected from light." *U. S.*

This salt is officinal for the first time, although it has been used quite extensively during the last ten years, principally for preparing extemporaneously the London Liquor Bismuthi originally suggested by Schacht. (See *Liquor Bismuthi et Ammoniæ Citratis.*)

Properties. "Small, shining, pearly or translucent scales, becoming opaque on exposure to air, odorless, having a slightly acidulous and metallic taste, and a neutral or faintly alkaline reaction. Very soluble in water and but sparingly soluble in alcohol. When strongly heated, the salt melts, then chars, and finally leaves a more or less blackened residue with a yellow surface, which is dissolved by warm nitric acid. This solution, on being dropped into water, occasions a white turbidity. The aqueous solution of the salt, when boiled with solution of potassa, evolves vapor of ammonia; and, when treated with hydrosulphuric acid, yields a black precipitate. If the filtrate be deprived, by heat, of the excess of hydrosulphuric acid and cooled, a portion of it, boiled with lime-water, produces a white precipitate. Another portion, after being mixed with an equal volume of concentrated sulphuric acid and cooled, should not produce a brown or brownish black zone around a crystal of ferrous sulphate dropped into the liquid (abs. of nitrate)." *U. S.* As frequently seen in commerce it is not entirely soluble in water: this is due to the loss of ammonia through exposure, and a few drops of water of ammonia, added to the turbid solution, are generally sufficient to restore its transparency. The Committee of Revision very properly omitted to give its chemical formula, as it is by no means proved that it has a definite composition. It is believed by some to be a true double citrate, $Bi,C_6H_5O_7(NH_4)_3C_6H_5O_7$. On the other hand, Bartlett (*Zeitsch. für Chem.*, 1865, p. 350) obtained on evaporation of the ammoniacal solution $BiC_6H_5O_7.NH_3 + 3H_2O$, and Rother (*Jahresbericht*, 1876, p. 564) obtained on crystallizing from warm ammonia $Bi,C_6H_5O_7, 3NH_3 + 3H_2O$.

Medical Properties. This salt differs from the older preparations of bismuth in its solubility, and for this reason probably is more rapid, more astringent, and more irritant in its action. In cases of irritation or inflammation of the gastro-intestinal mucous membrane it is very much inferior to the insoluble preparations, but when there is relaxation with excessive discharges it may usefully be employed. The dose is from one to three grains (·065–·20 Gm.).

BISMUTHI OXIDUM. *Br. Oxide of Bismuth.*

Bi_2O_3; 468. (BĬS̡-MŪ′THĪ ŎX′I̤-DŬM.) Bi_2O_3; 468.

Oxyde de Bismuth, *Fr.;* Bismuthum Oxydatum, Oxydum Bismuthicum; Wismuthoxyd, G.

"Take of Subnitrate of Bismuth *one pound* [avoirdupois]; Solution of Soda *four pints* [Imp. meas.]. Mix and boil for five minutes; then having allowed the mixture to cool and the oxide to subside, decant the supernatant liquid, wash the precipitate thoroughly with distilled water, and finally dry the oxide by the heat of a water-bath." *Br.*

The subnitrate of bismuth is decomposed by the solution of soda in this process, hydrate of bismuth being formed, which is precipitated, whilst nitrate of sodium remains in solution. $2(BiNO_4,H_2O) + 2NaHO = Bi_26HO$ (or $Bi_2O_3,3H_2O$) $+ 2NaNO_3$. At the temperature of 100° C. (212° F.) the hydrate of bismuth is decomposed, water is liberated, and the anhydrous oxide is left.

Properties. Oxide of bismuth is a powder of a dull lemon yellow color, insoluble in water, but soluble in nitric acid mixed with half its volume of water without effervescence.

Medical Properties. The oxide of bismuth resembles the subnitrate in its medical properties, and may be administered in similar doses. It is rarely used in this country.

BISMUTHI SUBCARBONAS. *U.S., Br.* *Subcarbonate of Bismuth.*

(BĬŞ-MŪ′THĪ SŬB-CẠR-BŌ′NĂS.)

$(BiO)_2CO_3, H_2O$; 530. BiO_3, CO_2HO; 265.

Bismuthi Carbonas, *Br.;* Carbonate of Bismuth: Bismuthum Subcarbonicum, Subcarbonas Bismuthicus; Souscarbonate de Bismuth, *Fr.;* Basisches Kohlensaures Wismuthoxyd, *G.*

A process for this salt is no longer officinal; that of the Pharm. 1870 will be found in the foot-note below.*

"Take of Purified Bismuth, in small pieces, *two ounces* [avoirdupois]; Nitric Acid *four fluidounces* [Imperial measure]; Carbonate of Ammonia *six ounces* [avoird.]; Distilled Water *a sufficiency.* Mix the Nitric Acid with three [fluid]ounces [Imp. meas.] of Distilled Water, and add the Bismuth in successive portions. When effervescence has ceased, apply for ten minutes a heat approaching that of ebullition, and afterwards decant the solution from any insoluble matter that may be present. Evaporate the solution until it is reduced to two fluidounces [Imp. meas.], and add this in small quantities at a time to a cold filtered solution of the Carbonate of Ammonia in two pints [Imp. meas.] of Distilled Water, constantly stirring the mixture as it is formed. Collect the precipitate on a calico filter, and wash it with Distilled Water until the washings pass tasteless. Remove now as much of the adhering water as can be separated from the precipitate by slight pressure with the hands, and finally dry the product at a temperature not exceeding 150°." *Br.*

This preparation was first made officinal in the 1860 edition of the U. S. Pharmacopœia. As metallic bismuth generally contains arsenic, it is very important to provide that this should be left behind, in the processes for making its medicinal preparations. It is on this account that the formula of U. S. Pharm. 1870 was so elaborate. The bismuth is first dissolved in nitric acid, a portion of which oxidizes the metal, with the evolution of nitrous vapors, while another portion combines with the oxide produced to form nitrate of bismuth. At the same time the arsenic is also oxidized at the expense of the nitric acid, and unites with a portion of the oxidized metal so as to produce the arseniate of bismuth. Both of these salts, therefore, are contained in the solution, which is very concentrated. Both have the property, when their solution is diluted with water, of separating into two salts, one an insoluble subsalt which is deposited, and the other a soluble acid salt which is held in solution. But the arseniate is more disposed to the change than the nitrate, and requires for the purpose a smaller amount of water of dilution. Hence, the first direction, after the metal has been dissolved, is to add a moderate quantity of distilled water, insufficient to cause the decomposition of the nitrate. From this diluted solution the insoluble subarseniate is slowly deposited, so as, in the course of twenty-four hours, to free it almost if not entirely from the poisonous metal. This is separated by filtration, and the solution is now diluted with a much larger quantity of distilled water, which causes a copious deposition of subnitrate of bismuth. But, in order not to waste the acid nitrate remaining in solution, this is decomposed by ammonia, which takes most of the nitric acid, and precipitates the bismuth combined with the remainder, in the form of subnitrate. The whole of the precipitated subnitrate, thus freed from arsenic, is redissolved in nitric acid, and the solution of the nitrate now obtained, being diluted with just so much water as to produce a commencing precipitation of subnitrate, is freed by filtering from the small quantity formed, and slowly added to a solution of carbonate of sodium. An interchange of principles takes place; nitrate of sodium and carbonate of bismuth are formed, the former of which remains in solution, and the latter is deposited. This part of the process tends still further to get rid of the arsenic; for if any of the arsenic acid or arseniate of bismuth exist in the solution, the poisonous acid would combine with the soda, and, thus forming a soluble salt, would be retained by the water. Nothing now remains but to wash, dry, and powder the precipitate.

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* "Take of Bismuth, in pieces, *two troyounces;* Nitric Acid *eight troyounces and a half;* Water of Ammonia *five fluidounces;* Carbonate of Sodium *ten troyounces;* Distilled Water *a sufficient quantity.* Mix four troyounces and a half of the Nitric Acid with four fluidounces of Distilled Water in a capacious glass vessel, and, having added the Bismuth, set the whole aside for twenty-four hours. Dilute the resulting solution with ten fluidounces of Distilled Water, stir it thoroughly, and, after twenty-four hours, filter through paper. To the filtered liquid, previously diluted with unequal measure of Distilled Water, slowly add the Water of Ammonia, constantly stirring. Transfer the whole to a strainer, and after the precipitate has been drained, wash it with two pints of Distilled Water, and drain it again. Then place the precipitate in a proper vessel, add the remainder of the Nitric Acid, and afterwards four fluidounces of Distilled Water, and set the solution aside. At the end of twenty-four hours, filter through paper. Dissolve the Carbonate of Sodium in twelve fluidounces of Distilled Water, with the aid of heat, and filter the solution through paper. To this, when cold, slowly add the solution of nitrate of bismuth, with constant stirring. Transfer the whole to a strainer, and after the precipitate has been drained, wash it with Distilled Water until the washings pass tasteless. Lastly, press, dry it on bibulous paper with a gentle heat, and rub it into powder." *U. S.* 1870.

The British process is more simple, because, using bismuth already purified, it is without the preliminary measures taken in the U. S. process to separate the arsenic.

Properties. Subcarbonate of bismuth is "a white, or pale yellowish white powder, permanent in the air, odorless and tasteless, and insoluble in water or alcohol. When heated to redness, the salt loses moisture and carbonic acid gas, and leaves a yellow residue which is soluble in nitric or in hydrochloric acid, and which is blackened by hydrosulphuric acid." *U. S.* Its sp. gr. is about 4. It effervesces with acids, and, when exposed to heat, loses 9·5 per cent. of its weight (*U. S.* 1870) in consequence of the escape of carbonic acid, and is converted into the anhydrous teroxide, of a light yellow color. When mixed with sulphuric acid, and subjected to Marsh's test, it should yield no arsenic, or merely a trace.

Tests. "On dissolving 1 part of the salt in 6 parts of warm nitric acid (sp. gr. 1·200), a copious effervescence takes place, and no residue should be left (abs. of insoluble foreign salts). On pouring this solution into 50 parts of water, a white precipitate is produced, and, on filtering and concentrating the filtrate to 6 parts, a portion of this, mixed with 5 times its volume of diluted sulphuric acid, should not become cloudy (abs. of lead). If another portion be precipitated with an excess of water of ammonia, the supernatant liquid should not exhibit a blue tint (copper). On diluting a third portion with 5 volumes of distilled water, the filtrate should not be affected by test-solution of nitrate of silver (chloride), or of nitrate of barium (sulphate); nor by hydrochloric acid (silver). If the salt be boiled with acetic acid diluted with an equal volume of water, and the cold filtrate freed from Bismuth by hydrosulphuric acid, the new filtrate should leave no fixed residue on evaporation (alkalies and alkaline earths). On boiling 1 Gm. of the salt with 10 C.c. of solution of soda (sp. gr. 1·260), and holding a glass rod dipped in acetic acid over the test-tube, not more than a faint, white cloud, but no heavy, white fumes, should appear (only traces of ammonia). If the preceding mixture, after thorough boiling, be diluted with water to 50 C.c. and filtered, the filtrate, when supersaturated with hydrochloric acid, and treated with hydrosulphuric acid, should not deposit more than a trace of a precipitate, which should not have a yellow or orange color (only traces of antimony, arsenic, tin). On boiling 1 Gm. of the salt with 10 C.c. of strong solution of soda, decanting the liquid from the precipitated oxide of bismuth into a long test-tube, and adding about 0·5 Gm. of aluminium wire cut into small pieces (a loose plug of cotton being pushed a short distance down the tube) the generated gas should not impart any color or tint to paper wet with test-solution of nitrate of silver and kept over the mouth of the test-tube for half an hour (abs. of more than traces of arsenic)." *U. S.* "The nitric acid solution gives no precipitate with diluted sulphuric acid or with solution of nitrate of silver. If to nitric acid mixed with half its volume of distilled water as much carbonate of bismuth be added as the acid will dissolve, one volume of this solution poured into twenty volumes of water will yield a white precipitate." *Br.* If arsenic were present, a precipitate would take place with a much smaller proportion of water.

Medical Properties and Uses. This salt was brought into notice by M. Hannon, of Brussels (*Ann. de Thérap.*, 1857, p. 214), who, conceiving that it was more tonic than the subnitrate, recommended it as a substitute. It is, however, therapeutically equivalent to the older preparation, having the same range of application to the treatment of disease and the same dose.

BISMUTHI SUBNITRAS. *U.S., Br.* *Subnitrate of Bismuth.*

$BiO\,NO_3.\,H_2O$; 306. (BĬŞ-MŪ'THĪ SŬB-NĪ'TRĂS.) $BiO_3,\,NO_5.\,2HO$; 306.

Bismuthum Album, *Br.;* White Bismuth; Bismuthum Subnitricum, *P.G.;* Bismuthum Hydrico-nitricum, Magisterium Bismuthi, Subazotas (s. Subnitras) Bismuthicus; Sous-azotate de Bismuth, *Fr.;* Basisches Salpetersaures Wismuthoxyd, *G.*

A process for subnitrate of bismuth is no longer officinal. The process of U. S. P. 1870 is given in the foot-note.*

"Take of purified Bismuth, in small pieces, *two ounces* [avoirdupois]; Nitric Acid *four fluidounces* [Imperial measure]; Distilled Water *a sufficiency*. Mix the Nitric Acid with three [fluid]ounces of Distilled Water, and add the Bismuth in successive portions. When effervescence has ceased, apply for ten minutes a heat approaching that of ebullition, and decant the solution from any insoluble matter that may be present. Evaporate the solution until it is reduced to two fluidounces, and pour it into half a gallon of Distilled Water. When the precipitate which forms has subsided, decant the supernatant liquid, add half a gallon [Imp. meas.] of Distilled Water to the precipitate, stir them well together, and, after two hours, decant off the liquid, collect and drain the precipitate in a calico filter, press it with the hands, and dry it at a temperature not exceeding 150°." *Br.*

The alterations from the old process, in the U. S. P. formula of 1870, were based upon the wish to get rid of any arsenic that might be present in the bismuth used. This is accomplished by first preparing the carbonate, by adding the nitric acid solution of bismuth to a solution of carbonate of sodium in excess, whereby most of the arsenic is retained in the solution, probably as arseniate of sodium, while the insoluble carbonate is precipitated. This is dissolved, with the aid of heat, in nitric acid, so as to make a very concentrated solution of the nitrate, to which, when cold, just so much water is added as to begin to produce a permanent turbidness. The object of this is to allow any arsenic that may be still present to be deposited, which happens for reasons stated in explaining the process for procuring the subcarbonate. (See page 291.) The deposited matter having been precipitated, only the pure nitrate remains in solution, which is made to yield the subnitrate by large dilution with water, and still more completely by the addition of ammonia.

In the British formula, the old method is pursued of simply dissolving the bismuth, which has been previously purified, in nitric acid somewhat diluted, concentrating the solution, and precipitating by adding it to a large quantity of water. When bismuth is added to dilute nitric acid, red fumes are copiously given off, and the metal, oxidized by the decomposition of part of the nitric acid, is dissolved by the remainder so as to form a solution of the ternitrate of bismuth. It is unnecessary to have the metal in powder; as it dissolves with great facility when added to the acid in fragments. When the solution is completed, the liquor should be added to the water, and not the water to the solution. In order to have a smooth light powder, which is most esteemed, the precipitate should be well washed to remove every trace of free nitric acid, and dried as speedily as possible. In the use of this formula it is taken for granted that the bismuth has been ascertained to be free from arsenic; and, if it prove upon the application of Marsh's test to be otherwise, means should certainly be employed to purify it before using it. Measures for this purpose are mentioned under *Bismuthum Purificatum.* Should the subnitrate or subcarbonate be ascertained to contain arsenic, it may, as suggested by Dr. Herapath, be purified by boiling it with solution of caustic soda or potassa, twice successively, then thoroughly washing the residue, which will be yellow oxide of bismuth, dissolving it again in nitric acid, and precipitating by water as before. (*Chem. News*, 1863, p. 77.) In the washing of subnitrate of bismuth, the salt is asserted to lose a portion of its nitric acid; and the change may be considerable, if the washing be continued so long as the liquid comes away in any degree acidulous. It has been ascertained by Julius Löwe that this effect may be avoided by washing with a very dilute solution of nitrate of ammonium, containing one part in 500 parts of water. (*Chem. Gaz.*, March 15, 1859, p. 119.)* *Bismuthous nitrate*, a crystalline salt ($Bi3NO_3{,}5H_2O$), is deposited from a solution of bismuth in nitric acid. This has been used by Dr. Balmanno Squire dissolved in glycerin, under the name of *Glycerole of Nitrate of Bismuth.* (*P. J. Tr.*, Nov. 11, 1876.) W. W. Moorhead prepares it by taking two troyounces of crystalline nitrate of bismuth and dissolving in sufficient glycerin to make eight fluidounces. No heat should be used. This preparation can be diluted with an equal bulk or less of water, or one part can be added to forty-eight of water without ready precipitation, but one part to twelve, eight, or six of water soon precipitates. (*A. J. P.*, 1877, p. 98; also pp. 23 and 89.)

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* Take of Bismuth, in pieces, *two troyounces;* Nitric Acid *eight troyounces and a half;* Carbonate of Sodium *ten troyounces;* Water of Ammonia *five fluidounces;* Distilled Water *a sufficient quantity.* Mix four troyounces and a half of the Nitric Acid with four fluidounces of Distilled Water, in a capacious glass vessel, and, having added the Bismuth, set the whole aside for twenty-four hours. Dilute the resulting solution with ten fluidounces of Distilled Water, stir it thoroughly, and, after twenty-four hours, filter through paper. Dissolve the Carbonate of Sodium in twenty fluidounces of Distilled Water with the aid of heat, and filter the solution through paper. To this, when cold, slowly add the solution of nitrate of bismuth, with constant stirring. Transfer the whole to a strainer, and, after the precipitate has been drained, wash it with Distilled Water until the washings pass tasteless, and drain again as completely as possible. Then place the moist precipitate in a capacious vessel, gradually add the remainder of the Nitric Acid, and afterwards four fluidounces of Distilled Water, and set the solution aside. At the end of twenty-four hours, filter through paper, and to the filtered liquid, previously diluted with four pints of Distilled Water, slowly add the Water of Ammonia, with constant stirring. Transfer the whole to a strainer, and, after the precipitate has been drained, wash it with two pints of Distilled Water, drain it again, and press out as much of the liquid as possible. Lastly, dry it upon bibulous paper with a gentle heat, and rub it into powder." *U. S.* 1870.

Properties. Subnitrate of bismuth is "a heavy, white powder, permanent in the air, odorless and almost tasteless, showing a slightly acid reaction when moistened on litmus paper, and insoluble in water or alcohol. When heated to redness, the salt gives off moisture, and afterward nitrous vapors, leaving a yellow residue which is soluble in nitric or in hydrochloric acid, and which is blackened by hydrosulphuric acid. On dissolving 1 part of the salt in 5 parts of warm nitric acid (sp. gr. 1·200), no effervescence should occur (abs. of carbonate), and no residue should be left (abs. of insoluble foreign salts). The reactions, for purity, of this solution, as well as those of the original salt, should be the same as those mentioned under *Bismuthi Subcarbonas.*" *U. S.* It is readily soluble in the strong acids, from which it is precipitated by water. The fixed alkalies dissolve it sparingly, and ammonia more readily. It is darkened by hydrosulphuric acid gas, but not by exposure to light, unless it contains a little silver, or is subjected to the influence of organic matter. If the nitric solution is not precipitated by dilute sulphuric acid, it is free from lead. It sometimes contains arsenic, which may be detected by acting on it with pure sulphuric acid, evaporating to dryness, dissolving in hot distilled water, and testing a part of the solution by Marsh's apparatus. By this method M. Lassaigne detected one-sixth of 1 per cent. of arsenic in a sample of subnitrate sold in Paris. M. Glénard proposes two new methods of searching for arsenic in the subnitrate ; one merely qualitative, the other quantitative. The first consists in strongly heating a mixture of the suspected salt with acetate of potassium. The least trace of arsenic will be detected by the strong and offensive odor produced, owing to the formation of cacodyl. In the second, the subnitrate of bismuth is heated with pure hydrochloric acid. If arsenic be present it will rise in vapors in the form of chloride. These should be carefully collected and condensed, and then treated with an excess of sulphuretted hydrogen. The sulphide of arsenic precipitated will be the measure of the metal. (*Ann. de Thérap.*, 1868, p. 176.) M. Lassaigne has found as much as 27 per cent. of chloride of bismuth in this preparation, when obtained by precipitating, with water, a solution of bismuth in a mixture of nitric and hydrochloric acids. The same impurity is introduced, to a small extent, by using common water containing chlorides ; and subsulphate of bismuth renders the preparation impure, when the water used contains sulphate of calcium. (*Journ. de Chim. & Méd.*, 1855, p. 276.) These facts show the necessity of using distilled water. As regards the origin of the chlorine sometimes existing in commercial subnitrate of bismuth, it is asserted by Mr. R. C. Tichborne to be a common practice with the manufacturer, in order to save the bismuth existing in the mother-liquor, after the deposition of the subnitrate, to precipitate it with chloride of sodium, thus obtaining an insoluble oxychloride of bismuth, which is then added to the previous product. (*P. J. Tr.*, 1860, p. 413.) For the modes of detecting and separating it, the reader is referred to the *Chemical News* (1863, p. 109). The metal thallium is said to be present in most specimens of the pharmaceutical preparations of bismuth, whilst the fetid odor of the breath so often produced when the subnitrate is administered is believed to be due to traces of tellurium. (Brownen, *P. J. Tr.*, Oct. 16, 1875.) It has also been said that the arsenic usually present in minute quantities is the cause of the garlicky odor of the breath. Dr. E. R. Squibb, in a recent communication (*Ephemeris*, Sept. 1882), states, however, that the " bismuth breath" has been noticed in patients who were taking a preparation of bismuth in which the absence of both tellurium and arsenic was conclusively shown. The cause of the peculiar odor is, therefore, at present doubtful. Phosphate of calcium has been ascertained to be an occasional adulteration of the subnitrate. A ready method of detecting it, suggested by M. Roussin, has proved to be fallacious, and may lead to false decisions as to the presence of the phosphate, and thus injuriously compromise the reputation of individuals. There can be no difficulty in detecting the adulteration by the U. S. P. tests. Subnitrate of bismuth was called, by the earlier chemists, *magistery of bismuth.* It is incompatible with iodide of potassium (slowly forming a brick red iodide of bismuth), and with alkaline bicarbonates.

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* In order to avoid the handling of large volumes of liquid, as well as the loss of bismuth by the production of soluble salts, A. Lalieu proposes the following process, which, he says, yields a much larger, purer, and denser product: 200 grammes of bismuth are dissolved in a sufficient quantity of nitric acid; the clear solution is decanted and poured into about 8 litres of water containing 500 grammes of water of ammonia. The precipitate is washed, transferred to a capsule, and 50 to 60 grammes of caustic soda, dissolved in a little water, are added to it. The capsule is then exposed for 15 to 20 minutes to the heat of a water-bath, and the contents stirred up several times. After having again become cold, the supernatant liquor is poured off, the precipitate is thoroughly washed, and a quantity of nitric acid, representing 48·5 grammes of anhydrous nitric acid (to be determined from the sp. gr., etc.), is added to it in small portions at a time, and under constant stirring. If, during this addition, the mass should become too thick, a little water may be added, but not enough to destroy the pasty consistence of the mass. The capsule is then replaced for a few minutes on the water-bath, and the mass well stirred. The latter, which had been yellow, becomes soon perfectly white, and somewhat more liquid. It is then diluted with a little water, the precipitate collected on a filter placed on a muslin strainer, washed, drained, pressed, and dried. The product amounts to about 265 grammes. (*L'Union Pharmaceutique*, No. 8; *N. R.*, Nov. 1878.)

Medical Properties. Owing to the difficulty of dissolving it, the subnitrate of bismuth has been thought not to be absorbed at all when ingested. The peculiar garlicky odor which it often imparts to the breath of those taking it, unless it be really due to the presence of tellurium in the bismuth, shows, however, that this is a mistake, and the French chemists MM. Bergeret and Mayençon affirm that they have found bismuth in the urine of those taking it. Its solution and absorption in the stomach must, however, be exceedingly slow, and it does not have the power of impressing the general system. First introduced as a medicine by Dr. Odier, of Geneva, it has come into very extensive use for its local effects upon irritated mucous membrane, to which it seems to be sedative, feebly astringent, and very soothing. It is one of our most useful remedies in subacute gastritis, gastralgia, pyrosis, gastric ulcers, and similar stomachic diseases. Owing to its great insolubility when taken into the stomach, it escapes into the intestine and there exerts its specific influence ; it is, therefore, very useful in diarrhœas of irritation, and even in dysentery. In diarrhœas of relaxation it is of little service. Subnitrate of bismuth is also a very useful topical application in various mucous inflammations, other than gastro-intestinal; thus it is used with advantage by injection (gr. v–xx to f℥i of mucilage) in the first stage of gonorrhea, and in rectal irritation, by snuffing in coryza, etc.

M. Trousseau has successfully employed subnitrate of bismuth in the diarrhœa of children in the form of enema, in the dose of two scruples, mixed with thick flaxseed tea. M. Monneret uses it thus in much larger doses. He thinks that in diarrhœa its action is entirely local. Its use always blackens the stools. The dose of subnitrate of bismuth, usually prescribed, is five to ten grains (0·33–0·65 Gm.) twice or thrice a day, given in powder or suspended in a thick mucilage. It may, however, be advantageously employed in much larger doses. M. Monneret, who was the first to recommend it in diarrhœa, used from half an ounce to an ounce (15·5–31·1 Gm.) daily, in divided doses, in the diarrhœa of adults; from half a drachm to a drachm (1·95–3·9 Gm.) in that of infants; and from a drachm to two drachms (3·9–7·8 Gm.) in painful affections of the stomach. In these large doses the medicine is said to be perfectly safe; and yet Orfila mentions, as resulting from an overdose, gastric distress, nausea, vomiting, diarrhœa or constipation, colic, heat in the breast, slight rigors, vertigo, and drowsiness. These effects are to be combated by mucilaginous drinks, enemata, and emollient fomentations, and, in case of inflammation, by bleeding, both general and local. The contradictory statements as to the safety of the preparation can be explained only on the supposition that it is sometimes rendered poisonous by the presence of the irritant impurities already mentioned. M. Rodolfi, of Breccia, has found the use of the subnitrate, associated with bicarbonate of sodium and sulphur, to be very efficient in controlling the night sweats of phthisis. Seven or eight grains (0·46–0·52 Gm.) of the bicarbonate, with two or three grains (0·13–0·20 Gm.) of each of the other ingredients, may be taken every two hours. The favorable effect may be expected in four or five days. (*Journ. de Pharm.*, 4e sér., iii. 468.)

M. Monneret recommends the external use of subnitrate of bismuth as a drying application. In the treatment of ulcers, especially scrofulous ones, he sprinkles the powder over the whole ulcerated surface. In leucorrhœa, the entire surface of the vagina may be dusted with the powder. The external use of subnitrate of bismuth is attended with no pain. (*Ranking's Abstract*, xx. 188.)

Off. Prep. Trochisci Bismuthi, *Br.*

BISMUTHUM. *Br.* *Bismuth.*

Bi; 210. (BĬṢ-MŪ′THŬM.) **Bi; 210.**

"A crystalline metal. As met with in commerce it is generally impure." *Br.*

Etain de Glace, Bismuth, *Fr.;* Wismuth, *G.;* Bismutte, *It.;* Bismut, *Sp.*

Bismuth occurs usually in the metallic state, occasionally as a sulphide or telluride, and rarely as an oxide. It is found principally in Saxony. It occurs also in Cornwall, and has been found at Monroe, in Connecticut, in Archer County, Texas (*A. J. P.*, 1871, p. 228), and in Colorado with gold and silver ores. It has also been discovered largely in South Australia, whence a quantity of it has been sent into commerce. (*P. J. Tr.*, Aug. 1867, p. 95.) It is obtained almost entirely from native bismuth, which is heated by means of wood or charcoal, whereby the metal is fused and separated from its gangue. Most of the bismuth of commerce comes from Saxony, although it is now (1881) also largely obtained from Bolivia. The bismuth from South America is said to be naturally free from arsenic, and to be therefore preferable for pharmaceutical purposes.

Bismuth was first recognized as a metal by Agricola in 1520. Before that period it was confounded with lead. It is a brittle, pulverizable, brilliant metal, of a crystalline texture, and of a white color with a slight reddish tint. Its crystals are rhombohedral, but with an angle of 87° 40′, which makes it difficult to distinguish them from cubes, in which the angle would be 90°. Indeed, many books still speak of it as cubical in form. It undergoes but a slight tarnish in the air. Its sp. gr. is 9·8, melting point 264° C. (507° F.). (*Brande and Taylor.*) When impure bismuth solidifies after fusion, globules of the metal, nearly pure, are thrown up from the mass. This takes place when the metal contains as much as 50 per cent. of impurity. The same phenomenon does not occur when pure bismuth is melted. (*R. Schneider.*) At a high temperature, in close vessels, bismuth volatilizes, and may be distilled over. When heated in the open air to a full red heat, it takes fire, and burns with a faint blue flame, forming an oxide of a yellow color. This is the *teroxide*, and consists of two atoms of bismuth 420, and three of oxygen 48 = 468. There is another compound of bismuth and oxygen, consisting of two atoms of the former and five atoms of the latter, which is called *bismuthic oxide*, Bi_2O_5. It is obtained in the form of a hydrate by boiling nitrate of bismuth in solution of potassa, washing the precipitate, and mixing it while moist with solution of potassa into which chlorine is passed. A mixture of bismuthous and bismuthic oxides is precipitated, from which the former is separated by digestion with nitric acid. The hydrated oxide remaining, when washed and dried, is in the form of a red powder, which gives up its water at 130° C. (266° F.), and at a higher heat loses oxygen. Bismuth is acted on feebly by hydrochloric acid, but violently by nitric acid, which dissolves it with a copious liberation of red fumes. Sulphuric acid, when cold, has no action on it, but at a boiling heat effects its solution with the liberation of sulphurous acid. As it occurs in commerce, it is generally contaminated with other metals, among which are arsenic in minute quantity, traces of silver, cadmium, nickel, and iron, and sometimes a very small proportion of thallium. It may be purified from all contaminating metals by dissolving the bismuth of commerce in diluted nitric acid, precipitating the clear solution by adding it to water, and reducing the white powder thus obtained with black flux. The same precipitate is obtained by adding ammonia to the nitric solution; if the supernatant liquor is blue, the presence of copper is indicated; if the precipitate is yellowish, iron is present.

Pharm. Uses, etc. Bismuth is not used in medicine in an uncombined state, but is employed pharmaceutically to obtain the subcarbonate and subnitrate of bismuth, the only medicinal preparations formed from this metal. In the arts it is used to form a white paint for the complexion, called *pearl white;* and as an ingredient of the best pewter.

Off. Prep. Bismuthum Purificatum. *Br.*

BISMUTHUM PURIFICATUM. *Br.* *Purified Bismuth.*

(BĬŞ-MŪ'THŬM PŪ-RỊ-FỊ-CĀ'TŬM.)

Bismuth purifié, *Fr.;* Gereinigtes Wismuth, *G.*

"Take of Bismuth *ten ounces*, Nitrate of Potash in powder *two ounces.* Put the Bismuth and one ounce of the Nitrate of Potash into a crucible, and heat them to a temperature at which both the metal and the salt are fused. Continue the heat, constantly stirring the contents of the crucible, for fifteen minutes, or until the salt has solidified into a slag over the metal. Then remove the salt, add the remainder of the nitrate of potash to the bismuth in the crucible, and repeat the process as before. Finally, pour the Bismuth while fused into a suitable mould and allow it to cool." *Br.*

A mode of purifying bismuth is given in the U. S. Pharmacopœia of 1870 in the process for preparing the subcarbonate and subnitrate. That of the Br. Pharmacopœia is different; consisting in the oxidation of the arsenic and other contaminating metals that may be present, by means of the nitric acid of the nitre, and their consequent separation from the bismuth, the great mass of which remains behind unaffected. This method was referred to in the twelfth edition of the Dispensatory (p. 1025); where also the plan of M. W. Pierre is mentioned, consisting in the addition of from 2·5 to 5 per cent. of zinc to the bismuth, and strongly heating the mixture in a crucible, with a piece of charcoal to prevent the oxidation of the zinc. Both the arsenic and zinc are driven off. (*Chem. News*, Jan. 16, 1861.) According to Mr. Tilden, the British officinal process is both wasteful of the bismuth and incapable of removing the impurities. (*P. J. Tr.*, ser. 3, i. 505.) For other methods of purification, see *Schweiz. Woch. f. Ph.*, No. 5; *A. J. P.*, Sept. 1877.

"Dissolved in a mixture of equal volumes of nitric acid and distilled water, it forms a solution which by evaporation yields colorless crystals, that are decomposed on the addition of water, giving a white precipitate. If the mother-liquors from which the crystals have been separated be added to solution of carbonate of ammonia, the precipitate formed and the solution are free or nearly free from color" (*Br.*); indicating the total or almost total absence of metals that yield colored salts, as copper, iron, etc.

Off. Prep. Bismuthi Carbonas, *Br.;* Bismuthi Subnitras, *Br.;* Liquor Bismuthi et Ammoniæ Citratis, *Br.*

BRAYERA. *U. S.*, *Br.* *Brayera.*

(BRĀY-Ē'RA.)

"The female inflorescence of Brayera anthelmintica. Kunth. (*Nat. Ord.* Rosaceæ, Roseæ)." *U. S.* "The flowers and tops of Brayera anthelmintica." *Br.*

Cusso, *Br.;* Kousso; Koosso; Flores Kosso, *P.G.;* Kusso, *E.;* Cousso, Kousso, *Fr.;* Kosso, Kusso, Cusso, *G.*

Gen. Ch. "*Calyx* with the tube bibracteolate at the base, turbinate; throat internally constricted by a membranous ring; the limb with two series of segments, each five in number, the outer much larger. *Petals* five, inserted in the throat of the calyx, small, linear. *Stamens* from 15 to 20, inserted with the petals. *Filaments* free, unequal. *Anthers* bilocular, dehiscing longitudinally. *Carpels* two at the bottom of the calyx, free, unilocular, containing one or two pendulous ovules. *Styles* terminal, exserted from the throat of the calyx, thickened upward. *Stigmas* subpeltate, dilated, crenate, oblong." The flowers are said to be diœcious; though the male have well-developed carpels.

Brayera anthelmintica. Kunth; De Cand. *Prodrom.* ii. 580; Pereira, *Mat. Med.*, 3d ed., ii. 1818.—*Hagenia Abyssinica.* Lamarck.—*B. & T.*, 102.—*Bancksia Abyssinica.* Bruce. This is a tree about twenty feet high, growing on the table-land of Abyssinia, at an elevation of from three thousand to eight thousand feet. The branches exhibit circular cicatrices, left by the fallen leaves. These are crowded near the ends of the branches, large, pinnate, sheathing at the base, with opposite, lanceolate, serrate leaflets, villose at the margin, and nerved beneath. The unisexual flowers are tinged with purple, pedicelled, with an involucre of four roundish, oblong, obtuse, membranous bracts, and are arranged in fours, upon hairy, flexuous, bractate peduncles, with alternate branches. They are small and of a greenish color, becoming purple. These and the unripe fruit are the parts of the plant employed. The petals are apt to be wanting in the dried flowers. They are brought from Abyssinia packed in boxes, reaching Europe chiefly by way of Aden and Bombay. The Abyssinian name of the medicine has been variously spelled by European writers kosso, kousso, cusso, cosso, etc.; but koosso is deemed the most appropriate English title, as it indicates the proper pronunciation of the word. The fruit of the tree is said to be used as an anthelmintic in Abyssinia, but Dragendorff failed to detect any active principle in it.

Properties. The dried flowers are in unbroken though compressed clusters. The male flowers are usually collected, so that ordinarily the general color of the mass is greenish yellow or light brown; sometimes the female flowers constitute the bulk of the drug, which then has a distinct reddish tint, and is often known in commerce as *Red Koosso.* In accordance with our Pharmacopœia this commercial variety should alone be used. The officinal description is as follows. "In bundles or rolls, or compressed clusters, consisting of panicles about ten inches (25 cm.) long, with a sheathing bract at the base of each branch; the two roundish bracts at the base of each flower, and the four or five obovate, outer sepals, are of a reddish color, membranous and veiny; calyx top-shaped, hairy, enclosing two carpels or nutlets. Its odor is slight, fragrant, and tea-like, and its taste bitter and nauseous." As the medicine, from its high price, is apt to be adulterated, it should be procured in the unpowdered state, in which the botanical characters of the flower will sufficiently test its genuineness. It has a fragrant balsamic odor; and the taste, slightly perceptible at first, becomes in a short time somewhat acrid and disagreeable. Analyzed by Wittstein, it was found to contain in 100 parts, 1·44 of fatty matter and chlorophyll, 2·02 of wax, 6·25 of bitter acrid resin, 0·77 of tasteless resin, 1·08 of sugar, 7·22 of gum, 24·40 of tannic acid, 40·97 of lignin, 15·71 of ashes, with 0·14 part of loss. To Clemens Willing it yielded a small quantity of volatile oil, having the odor of the flowers, much extractive, tannic acid coloring iron green, a crystallizable acid, and a resin with a bitter and astringent taste and the odor of the oil. (*Chem. Centralblatt*, 1855, p. 224.) In which of these constituents the virtues of the medicine reside, remained undetermined. Claims for this honor have been presented on the part of the *koossin* or *kosin* of Signor Pavesi, of Mortara, in Piedmont, and they would appear to have been recently confirmed.

The composition of koosso has been since investigated by Dr. C. Bedall, of Munich, who determined that the kosin or tæniin of Pavesi is identical with the bitter acrid resin of Wittstein. It may be obtained by treating koosso repeatedly with alcohol to which hydrate of lime has been added; the residue is boiled with water; the liquids are mixed, filtered, and distilled; and the residue treated with acetic acid, which precipitates the kosin in a white flocculent form, soon becoming denser and resin-like, and, on drying, yellowish, or, at a higher temperature, brown. The product is 3 per cent. In bulk, kosin has an odor like that of Russian leather, a persistent bitter and acrid taste, a yellowish or yellowish white color, and an indistinct crystalline appearance under the microscope. It is very sparingly soluble in water, but freely so in alcohol, ether, and alkaline solutions. (*A. J. P.*, 1872, p. 394.) Its formula, according to Flückiger, is $C_{31}H_{38}O_{10}$. It fuses at 142° C. (287·6° F.), and remains after cooling an amorphous yellow mass, but if touched with alcohol it immediately assumes the form of stellate tufts of crystals. This may be repeated at pleasure, kosin not being altered by cautious fusion. (*Pharmacog.*, 2d ed., p. 258.) Kosin is not decomposed by boiling dilute acids. It dissolves in strong sulphuric acid, giving a yellow solution, which becomes turbid by addition of water, white amorphous kosin being thrown down. From the fact that at the same time an odor of isobutyric acid is evolved, Flückiger considers that it may be a compound ether of that acid.

Medical Properties. Koosso is highly valued in Abyssinia as a vermifuge. Bruce speaks of it in his travels, and gives a figure of the plant. Dr. Brayer, a French physician, practising in Constantinople, employed the medicine effectively, and published a treatise on it at Paris, so long ago as 1823. It was in his honor that Kunth adopted the generic title of the plant. Much attention has recently been attracted to this medicine; and trials made with it have proved that it has extraordinary efficacy in the destruction and expulsion of the tape-worm. Its effects, when taken internally, are not very striking. In the ordinary dose it sometimes produces heat of stomach, nausea, and even vomiting, and shows a tendency to act on the bowels, though this effect is not always produced. It appears to act exclusively as a poison to the worms; and has been found equally effectual in both kinds of tape-worm. The medicine is taken in the morning upon an empty stomach, a light meal having been made the preceding evening. A previous evacuation of the bowels is also recommended. The flowers are given in the form of powder, mixed with half a pint of warm water; the mixture being allowed to stand for fifteen minutes, then stirred up, and taken in two or three draughts at short intervals. The medicine may be preceded and followed by lemonade. The medium dose for an adult is half an ounce (15·5 Gm.), which may be diminished one-third for a child of 12 years, one-half for one of 6, and two thirds for one of 3. Should the medicine not act on the bowels in three or four hours, a brisk cathartic should be administered. One dose is said to be sufficient to destroy the worm. Should the quantity mentioned not prove effectual, it may be increased to an ounce (31·1 Gm.).

The principle kosin has been considerably used in Germany, and Dr. Bedall recommends it as one of the best tæniafuges; two scruples (2·6 Gm.) being sufficient to discharge the worm; and, taken in 2 or 4 powders, it usually agrees with the patient; only exceptionally causing transient nausea and vomiting; but Buchheim found *pure* kosin less powerful as an anthelmintic than that which was not pure, whilst Arena (*Pharm. Zeitschr. f. Russl.*, 1879, p. 655) believes that kosin is not the active principle at all, but that the activity of koosso resides exclusively in the green slightly bitter resin, which is soluble in alcohol and ether. If this view be correct it explains the greater efficacy of freshly-powdered koosso, for the green resin turns yellow by age and loses its power.

Off. Prep. Extractum Brayeræ Fluidum, *U. S.;* Infusum Brayeræ, *U. S.;* Infusum Cusso, *Br.*

BROMUM. *U.S., Br.* *Bromine.*

Br; 79·8. (BRŌ'MŬM.) Br; 79·8.

"A liquid non-metallic element, obtained from sea-water, and from saline springs." *Br.*

Brominium, *U. S.,* 1870; **Bromum,** *P. G.;* **Brome,** *Fr.;* **Brom,** *G.;* **Bromo,** *It.*

Bromine is an elementary body, possessing many analogies to chlorine and iodine. It was discovered in 1826 by M. Balard, of Montpellier, in the bittern of sea-salt works, in which it exists as a bromide of magnesium. Since then it has been found in the waters of the ocean, in certain marine animals and vegetables, in various aquatic plants, as the water-cress, in numerous salt springs, and in the mineral kingdom. It has also been detected by M. Mène in the coal-gas liquor of the Paris gas works. In the United States it was first obtained by Professor Silliman, who found it in the bittern of the salt works at Salina, in the State of New York. It was discovered in the salt wells, near Freeport, Pa., by Dr. David Alter, but is now obtained in largest amount from the brines of West Virginia. The chief works are located at Parkersburg and Mason City, W. Va., and Pomeroy, Ohio. Bromine has been detected also in the waters of the Saratoga springs. Minute quantities of this, as well as of chlorine and iodine, may be detected in any mixture by means of spectrum analysis.

Preparation. The original salt-liquor or brine is pumped out of the ground at 9° B., evaporated to about 15° in large iron pans, then allowed to settle, and is further evaporated in wooden tanks heated by steam pipes to the point of crystallization. These tanks, five in number, are placed at different elevations, one above the other. Each day the liquor is run off from No. 1, the highest, to No. 2; next day to No. 3, and so on until it reaches No. 5, the crystallized salt being removed from each tank after draining off the liquor. The brine which reaches No. 5 is bittern, and consists chiefly of chlorides of calcium, magnesium, sodium, and some aluminium, with varying percentages of bromides of sodium and calcium.

The bittern marking 30° to 38° B. is evaporated to about 45° B. By this further evaporation an additional percentage of impure salt is removed, the liquor is then run into stone stills, materials for generation of chlorine added, and heat applied by means of steam until the bromine has been all eliminated and vaporized. It is condensed and collected in cooled receivers. (*Proc. A. P. A.*, 1877, p. 448.) An improved bromine still is figured in *N. R.*, April, 1877.

The bittern of the salt works of Schoenbeck, in Germany, which contains only seven-tenths of one part of bromine in 1000 parts, is subjected to several successive operations, whereby the solution is reduced in bulk, and so far purified as to contain chiefly the bromide and chloride of magnesium. The chlorine is separated in the form of hydrochloric acid gas, by heating the liquid with sulphuric acid, at a temperature not exceeding 259° F.; the sulphates are crystallized out; and the bromine is evolved in the usual manner by sulphuric acid and manganese dioxide. The last operation, occupying six hours, is performed in a leaden still, of sufficient capacity to contain a charge of 84 pounds of the concentrated bittern, 60 or 70 pounds of weak sulphuric acid from the leaden chambers, and 40 pounds of manganese dioxide. The product is 4 pounds of bromine. (Moritz Hermann, *Journ. de Pharm.*, Janv. 1854.)

Bromine has also been obtained from sea-weeds by carbonizing them, lixiviating the carbonaceous residue, and then separating the ingredients, among which are iodine and bromine. For details, see *Chem. News* (July 6, 1866, p. 2.)

Properties. Bromine is a volatile liquid, of a dark red color when viewed in mass, but hyacinth-red in thin layers. Its taste is very caustic, and its smell strong and disagreeable, having some resemblance to that of chlorine.[*] Its sp. gr. is very nearly 3 (2·99, *U.S.*, 2·966, *Br.*). At —24·5° C. (—12° F., *Baumhauer*,[†] —7·2° C., *Philipp*) it becomes a hard, brittle, crystalline solid, having a dark leaden color, and a lustre nearly metallic. It boils at about 63° C. (145·4° F.), forming a reddish vapor resembling that of nitrous acid, and of the sp. gr. 5·54. It evaporates readily, a single drop being sufficient to fill a large flask with its peculiar vapor. Shaken with solution of soda in slight excess it becomes colorless, and, if now colored again by a little bromine, does not assume a blue color on the addition of a cold solution of starch (*Br.*); thus showing the absence of iodine.

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[*] Inhaled in the form of vapor it produces intense irritation, and endangers asphyxia through spasm of the glottis. A case which had nearly proved fatal, was apparently saved by throwing steam sufficiently cooled into the larynx. (G. P. Duffield, *A. J. P.*, 1868, p. 288.)

[†] See *A. J. P.*, Oct. 1872, p. 452. The higher degree usually given in chemical works is ascribed by Baumhauer to the presence of water in the bromine examined.

Bromine is sparingly soluble in water (in 33 parts at 15° C. (59° F.), *U. S.*), to which it communicates an orange color, more soluble in alcohol, and still more so in ether, chloroform, and carbon bisulphide. By the aid, however, of bromide of potassium, it may be dissolved to any desirable extent in water. Its alcoholic and ethereal solutions lose their color in a few days, and become acid from the generation of hydrobromic acid. It bleaches vegetable substances like chlorine, destroys the color of sulphate of indigo, and decomposes organic matters. Its combination with starch has a yellow color. It corrodes the skin and gives it a deep yellow stain. Bromine is intermediate in its affinities between chlorine and iodine; since its combinations are decomposed by chlorine, while, in its turn, it decomposes those of iodine. It forms acids which are analogous in properties and composition to the corresponding acids of chlorine and iodine. It combines also with chlorine, forming chloride of bromine, which probably has the formula $BrCl_5$. This is prepared by passing chlorine through bromine, and condensing the vapors at a low temperature. It is a reddish yellow liquid, very volatile, soluble in water, with a penetrating odor and disagreeable taste.

Commercial bromine sometimes contains as much as 6 or 8 per cent. of *carbon tetrabromide*, as ascertained by M. Poselger. He discovered the impurity by submitting some bromine to distillation, during the progress of which the boiling point rose to 120° C. (248° F.). The residuary liquid at this temperature was colorless, and when freed from a little bromine, proved to be bromide of carbon, as an oily, aromatic liquid.* Chlorine and iodine are also frequently found in bromine, the former impurity being more common in the American and the latter in the German bromine.

The U. S. P. gives the following tests for determining the purity of bromine. "If 3 Gm. of Bromine be mixed with 30 C.c. of water and enough water of ammonia to render the solution colorless, the liquid then digested with carbonate of barium, filtered, evaporated to dryness, and the residue gently ignited, the latter should be soluble in absolute alcohol without leaving more than 0·26 Gm. of residue (abs. of more than 3 per cent. of chlorine). If an aqueous solution of Bromine be poured upon reduced iron and shaken with the latter until it has become nearly colorless, then filtered, mixed with gelatinized starch, and a few drops of bromine solution be now carefully poured on top, not more than a very faint blue zone should appear at the line of contact of the two liquids (limit of iodine)." *U. S.*

In testing for bromine in mineral or saline waters, the water is evaporated in order to crystallize most of the salts. The solution, after having been filtered, is placed in a narrow tube, and a few drops of strong chlorine-water are added. If this addition produces an orange color, bromine is present. The water examined, in order that the test may succeed, must be free from organic matter, and the chlorine not be added in excess. Bromine may be detected in marine vegetables by carbonizing them in a covered crucible, exhausting the charcoal, previously pulverized, with boiling distilled water, precipitating any alkaline sulphide present in the solution by sulphate of zinc, and then adding successively a few drops of nitric acid and a portion of ether, shaking the whole together. If bromine be present, it will be set free and dissolve in the ether, to which it will communicate an orange color. (*Dupasquier.*) According to Reynoso, a more delicate test is furnished by hydrogen peroxide (ozonized water), which liberates bromine from its compounds, without reacting on it when free. The mode of proceeding is as follows. Put a piece of barium peroxide in a test-tube, and add successively distilled water, pure hydrochloric acid, and ether. The materials are here present for generating hydrogen peroxide; and so soon as bubbles are seen to rise to the surface, the substance suspected to contain bromine is added, and the whole shaken together. If a bromide be present, the hydrochloric acid will give rise to hydrobromic acid; and the hydrogen peroxide, acting on this, will set free the bromine, which will dissolve in the ether, and give it a yellow tint.

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* It is stated by T. L. Phipson, that he has found in commercial bromine, accounted pure, a notable amount of cyanogen, and that it may be detected as follows. Take of iron filings and bromine, of each half an ounce; add to the filings 2 or 2·5 ounces of water; introduce the bromine very gradually, stirring steadily; filter rapidly while warm from the reaction; and put the filtered liquid in a partially closed bottle. In the course of some hours a deposit of ferricyanide of iron (Berlin blue) will have formed, and may be collected on a filter. In the course of two days, the whole of the cyanogen will be deposited. In the samples of bromine thus examined he had found from 0·5 to 1 per cent. of cyanogen. (*Chem. News*, 1873, p. 51.)

Medical Properties. Bromine, from its analogy to iodine, was early tried as a remedy, and the result has demonstrated its value as a therapeutic agent. It acts like iodine as an alterative, and probably also as a stimulant to the lymphatic system, thereby promoting absorption. It has been employed in bronchocele, scrofulous tumors and ulcers, secondary and tertiary syphilis, amenorrhœa, diphtheritic affections, chronic diseases of the skin, and hypertrophy of the ventricles. Magendie recommends it in cases in which iodine does not operate with sufficient activity, or has lost its effect by habit. The form in which it is employed is aqueous solution, the dose of which, containing one part of bromine to forty of distilled water, is about six drops (0·36 C.c.) taken several times a day in water. Locally in its concentrated state it is a very powerful and deep caustic. When used as a wash for ulcers, from ten to forty minims may be added to a pint of water. Bromine has been found by Dr. Goldsmith, Surgeon of the U. S. Volunteers, extremely efficacious as a local remedy in hospital gangrene, being applied either pure or dissolved in water; and the same remedy, dissolved in water, with the aid of bromide of potassium, in the proportion of from 15 to 40 drops to the fluidounce, has produced very good effects in erysipelas. (See *Am. Med. Times*, June 20, 1863.) Of the compounds of bromine, the bromides of potassium, ammonium, iron, and mercury have been chiefly used. Some of them have been found to exercise a remarkable influence in allaying nervous irritation, and are now much employed for that purpose. See these titles respectively in the different parts of this work.* The *chloride of bromine* has been used in cancer by Landolfi, of Naples, both externally as a caustic and internally. But a committee of the French Academy reported decidedly against it, not only as inefficacious, but as sometimes positively injurious. (*Gaz. Hebdom. de Méd. et Chir.*, Mai 9. 1856.)

Dr. J. Lawrence Smith, of Louisville, Ky., proposes the following as a convenient formula for a solution of bromine. Dissolve 160 grains of bromide of potassium in two fluidounces of water, add one troyounce of bromine, and, stirring diligently, pour in sufficient water to make the solution measure four fluidounces. The solution should be kept in accurately stopped bottles. This is a suitable preparation for application to hospital gangrene, and may be diluted to any desirable extent with water. (*A. J. P.*, 1863, p. 202.)

Bromine, in an overdose, acts as a corrosive poison. The best antidote, according to Mr. Alfred Smee, is ammonia. A case of poisoning by this substance, which proved fatal in seven hours and a half, is related by Dr. J. R. Snell. The amount swallowed was about an ounce, and the symptoms generally were those produced by the irritant poisons: such as violent inflammation of the lips, mouth, tongue, and œsophagus, with incessant burning pain, followed, in two hours and a half, by prostration, ending in death. (*New York Journ. of Med.*, Sept. 1850.)

Bromine is extensively used in photography.

BRYONIA. *U. S.* *Bryonia.* [*Bryony.*]

(BRȲ-Ō'NI-A.)

"The root of Bryonia alba, and of Bryonia dioica. Linné. (*Nat. Ord.* Cucurbitaceæ.)" *U. S.*

Bryone couleuvrée, *Fr.;* Zaunrübe, Gichtrübe, *G.*

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* *Bromide of Iodine* in aqueous solution is sometimes employed, which is made by rubbing 10 parts of iodine with 40 parts distilled water, introducing into a flask, adding 20 parts of bromine, and shaking until the iodine is dissolved. 530 parts of distilled water is added, and the whole filtered. 20 parts contain 1 part of terbromide of iodine. A solution containing 15 per cent. is sometimes found in commerce.

Bryonia alba, or white bryony, is a perennial, climbing, herbaceous plant, growing in thickets and hedges in different parts of Europe. It bears rough, heart-shaped, five-lobed leaves, small yellow monœcious flowers, arranged in racemes, and roundish black berries about the size of a pea. Another species, called *B. dioica*, with diœcious flowers and red berries, bears so close a resemblance in character and properties to the preceding, that it is considered by some botanists merely a variety. The roots of both plants are gathered for use. When fresh they are spindle-shaped, sometimes branched, a foot or two in length, as thick as the arm, or even thicker, externally yellowish gray and circularly wrinkled, within white, succulent, and fleshy, of a nauseous odor, which is lost in great measure by drying, and of a bitter, acrid, very disagreeable taste. The peasants are said sometimes to hollow out the top of the root, and to employ the juice which collects in the cavity as a drastic purge. (*Mérat and De Lens.*) The berries are also purgative, and are used in dyeing. *B. Americana*, Lam., and *B. Africana*, Thunb., are respectively used in the West Indies and Africa as hydragogue cathartics in dropsy.

Properties. As kept in the shops, the root is in circular transverse slices, externally yellowish gray and longitudinally wrinkled, internally of a whitish color, becoming darker by age, concentrically striated, light, brittle, and readily pulverizable, yielding a whitish powder. It is officinally described as follows. "In transverse sections about two inches (5 cm.) in diameter, the bark gray-brown, rough, thin, the central portion whitish or grayish, with numerous small wood-bundles arranged in circles and projecting, radiating lines; inodorous, taste disagreeably bitter." Besides a peculiar bitter principle called *bryonin*, the root contains starch in considerable proportion, gum, resin, sugar, a concrete oil, albumen, and various salts. It yields its active properties to water. *Bryonin*, $C_{48}H_{80}O_{19}$, may be obtained by mixing the powdered root with one-sixth of its weight of purified animal charcoal, in fine powder, putting the mixture into a percolator, already containing a quantity of animal charcoal equal to that mixed with the bryony, and then percolating successively with strong alcohol, diluted alcohol, and sufficient water to displace the alcoholic liquid. The tincture thus obtained yields the bryonin by spontaneous evaporation. This is extremely bitter, soluble in water and alcohol, insoluble in ether, unaltered by the alkalies, and dissolved by sulphuric acid, with the production of a blue color. It purges actively in the dose of two grains. (*A. J. P.*, xxviii. 166.) When treated with acids bryonin is resolved into sugar and two peculiar substances, one soluble in ether, called *bryoretin*, the other insoluble in that liquid, and named *hydrobryoretin*. It is, therefore, a glucoside. (G. F. Walz. See *A. J. P.*, 1859, p. 251.)

Medical Properties. Bryony is an active hydragogue cathartic, in large doses sometimes emetic, and disposed, if too largely administered, to occasion inflammation of the alimentary mucous membrane. A fatal case is recorded by Mr. Wm. Herapath, in which narcotic symptoms, with vomiting and purging, were produced in a woman by an overdose of bryony with jalap, ending in death in thirty-six hours. On dissection, the brain was found congested, the heart empty, and the gastric and intestinal mucous membrane inflamed. (*P. J. Tr.*, 1858, p. 542.) The recent root is highly irritant, and is said, when bruised and applied to the skin, to be capable of producing vesication. The medicine was well known to the ancients, and has been employed by modern physicians as a hydragogue cathartic in dropsy; but is now superseded by jalap. The dose of the powdered root is from a scruple to a drachm (1·3–3·9 Gm.).

Off. Prep. Tincturæ Bryoniæ.

BUCHU. *U.S.* *Buchu.*

(BŪ'ÇHŪ.)

"The leaves of Barosma betulina, Bartling, Barosma crenulata, Hooker, and Barosma serratifolia, Willdenow. (*Nat. Ord.* Rutaceæ, Diosmeæ.)" *U. S.* "The dried leaves of Barosma betulina, Barosma crenulata, and Barosma serratifolia." *Br.*

Buchu Folia, *Br.;* Folia Bucco, Folia Diosmæ, s. Barosmæ; Feuilles de Bucco (Booko, Buchu) *Fr.;* Buckublätter, Buccoblätter, *G.*

The leaves of the officinal and other Barosmas (so named from *βαρος*, and *οσμη* strong odor), and of some *Agathosmas*, are collected by the Hottentots, who value them on account of their odor, and, under the name of *bookoo* or *buchu*, rub them, in the state of powder, upon their greasy bodies.

Gen. Ch. Calyx five-cleft or five-parted. Disk lining the bottom of the calyx, generally with a short scarcely prominent rim. *Petals* five, with short claws. *Filaments* ten; the five opposite the petals sterile, petaloid; the other five longer, subulate. *Style* as long as the petals. *Stigma* minute, five-lobed. *Fruit* composed of five cocci, covered with granular dots at the back. These plants are small shrubs, with opposite leaves and peduncled flowers. *Lindley.*

The officinal species are all erect, slender shrubs with opposite leaves, dotted with conspicuous pellucid oil glands. smooth, angular, purplish branches, often of a purplish color, white flowers, and a fruit of five erect carpels. They are chiefly distinguished by their leaves.

Barosma crenata. Lindley, *Flor. Med.* p. 213.—*Diosma crenata.* De Cand. *Prodrom.* i. 714.—*Barosma crenulata.* Hooker. *B. & T.* 46. The leaves are opposite, ovate or obovate, acute, serrated and glandular at the edge, coriaceous, and full of small pellucid dots on the under surface. The flowers are white or of a reddish tint, and stand solitarily at the end of short, lateral leafy shoots.

B. serratifolia. Willd. *Sp. Plant.* p. 257; Lind. *Flora Med.* p. 213; *B. & T.* 47. The leaves are linear lanceolate, equally narrowed towards either end, three-nerved, with a truncate apex, which is always furnished with an oil cell, and a sharply serrulate margin. Their length is from an inch to an inch and a half; their width one-fifth of an inch.

B. betulina. Bartling. The leaves of this species are cuneate-obovate, apex recurved, with their margin sharply denticulate by spreading teeth. They are from one-half to three-quarters of an inch long, by three-tenths to five-tenths of an inch wide.

Properties. Buchu leaves are officinally described as follows. "About three-fifths of an inch (15 mm.) long, roundish-obovate with a rather wedge-shaped base, or varying between oval and obovate, obtuse, crenate or serrate, with a gland at the base of each tooth, pale green, thickish, pellucid-punctate; strongly aromatic, somewhat mint-like, pungent and bitterish. The leaves of *Barosma serratifolia* are about one inch (25 mm.) long, linear-lanceolate, thinner than, but otherwise like the preceding." *U. S.* The leaves of *B. crenata* constitute the *short buchu* or *round buchu*, whilst those of *B. serratifolia* are the *long buchu* of commerce. It is said that the leaves of *B. crenulata* are at present comparatively infrequent in commerce, the parcels usually consisting of those of one of the other species almost unmixed. The species can be recognized by the characters already given. Mixed with buchu leaves, or sometimes constituting the bulk of the parcel, the leaves of the *Empleurum serrulatum* sometimes occur. They are to be distinguished by being longer and narrower than any buchu leaf, with a sharp-pointed apex, parallel sides, and coarse denticulation.

Flückiger obtained from *B. betulina* 1·56 per cent. of volatile oil, which had the odor of peppermint rather than of buchu, and deviated the plane of polarization considerably to the left. On exposure to cold it furnished a camphor, which, after re-solution in alcohol, crystallized in needle-shaped forms. After repeated purification in this manner, the crystals of *Barosma camphor* have an almost pure peppermint odor; they fuse at 85° C. and begin to sublime at 110° C. After fusion they again solidify only at 50° C. Submitted to elementary analysis, the crystals yielded 74·08 per cent. of carbon and from 9 to 10 per cent. of hydrogen. Barosma camphor is abundantly soluble in bisulphide of carbon. The crude oil from which the camphor had been separated had a boiling point of about 200° C., quickly rising to 210° C. or even higher. The oil which distilled between these temperatures, rectified over sodium, gave approximately the formula $C_{10}H_{16}O$. (*Pharmacographia*, 2d ed., p. 109.) Wayne's experiments (*A. J. P.*, 1876, p. 19) appear to indicate that the oil also contains a substance capable of being converted into salicylic acid. Prof. J. M. Maisch believes that buchu leaves do not contain salicylic acid, although the stearopten of the oil gives a blackish color with ferric chloride. (*A. J. P.*, July, 1881.) The yield of ash varies, according to the researches of H. W. Jones (*P. J. Tr.*, ix. 673), from 4·69 to 4·40 in *B. betulina*, 4·32 to 5·39 in *B. crenulata*, 5·03 to 5·22 in *B. serratifolia;* the ash itself was remarkable as containing a great deal of manganese. The short-leaved buchu was found by Mr. P. W. Bedford to yield an average of 1·21 per cent. of volatile oil; while the long-leaved, though more highly valued in the market, gave only 0·66 per cent., showing its great inferiority in strength. (*Proc. A. P. A.*, 1863, p. 211.)

Medical Properties. The Hottentots have long used buchu in a variety of diseases. From these rude practitioners the remedy was borrowed by the resident English and Dutch physicians, by whose recommendation it was employed in Europe, and has come into general use. Its activity depends upon the volatile oil which is eliminated by the kidneys. Under its action there is no marked increase in the amount of the urine, hence the remedy is of no value in dropsies; but the oil affects very decidedly the mucous membrane of the genito-urinary tract. The remedy is very useful in diseases of the urinary organs, such as gravel, chronic catarrh of the bladder, morbid irritation of the bladder and urethra, diseases of the prostate, and retention or incontinence of urine from a loss of tone in the parts concerned in its evacuation. It should be given when the inflammation is not severe, but not when it is in that condition of chronicity requiring oil of turpentine, tincture of cantharides, or other more stimulant diuretics. The best preparation for use is the fluid extract, of which the dose is a fluidrachm (3·75 C.c.) repeated three or four times a day.

Off. Prep. Extractum Buchu Fluidum, *U. S.;* Infusum Buchu; Tinctura Buchu. *Br.*

CADMIUM. *Cadmium.*

Cd; 112. (CĂD′MĮ-ŬM.) Cd.; 56.

Cadmium, *Fr.*, *G.;* Kadmium, *G.*

This metal was introduced into the U. S. Pharmacopœia of 1870 because used in the preparation of sulphate of cadmium. It is associated with zinc in its ores, and, being more volatile than that metal, comes over with the first portions of it distilled in the process for obtaining it. (See *Zincum.*) The cadmium is separated by dissolving the mixed metal in dilute sulphuric acid, precipitating the sulphide by sulphuretted hydrogen, treating the precipitate with hydrochloric acid, and again precipitating with carbonate of ammonium. The carbonate of cadmium thus obtained, after being washed and dried, is mixed with charcoal, and exposed to a dull red heat in an earthen retort, when the reduced metal distils over.

Properties. Cadmium is a white metal, resembling tin, but somewhat heavier and more tenacious. Like that metal, it crackles when bent. Its sp. gr. is 8·7, melting point 316° C. to 320° C. (601°–608° F.). It begins to volatilize at a temperature slightly above this, but under the boiling point of mercury, while it boils only at 860° C. (1580° F.). It is little affected by the air, but, when heated, combines with an atom of oxygen, forming a reddish brown or orange-colored oxide, CdO, which combines with the acids to form salts. From its saline solutions the oxide is precipitated by the alkalies in the form of a white hydrate. Cadmium also combines with chlorine, iodine, bromine. and sulphur. It is distinguished by forming a colorless solution with nitric acid, from which sulphuretted hydrogen or ammonium sulphydrate precipitates a lemon yellow sulphide insoluble in an excess of the reagent, or in potassa or ammonia, and not volatilized at a red heat. Potassa produces a white precipitate insoluble in an excess, and ammonia a similar precipitate soluble in an excess of the precipitant. Zinc precipitates cadmium in the metallic state. "A neutral solution of the metal in nitric acid, after having been fully precipitated by carbonate of sodium in slight excess, yields a filtrate which is not affected by ammonium sulphide." *U. S.* 1870. This proves the absence of arsenic.

Medical Uses. According to Prof. Simpson, of Edinburgh, cadmium resembles antimony in its effects on the system. Dr. Garrod considers the metal, in this respect, more closely allied to zinc. In overdoses its salts appear to act as corrosive poisons. Three cases are recorded in which serious consequences resulted from inhaling the powdered carbonate, while used in polishing silver. The chief symptoms were constriction of the throat, embarrassed respiration, vomiting and purging, giddiness, and painful spasms. (*Annuaire de Thérap.*, 1859, p. 229.) Experiments by Dr. Wilh. Marmé demonstrate that the sulphide of cadmium is not poisonous, but that all its compounds soluble in water or in diluted acids at the heat of the body are so; and they all operate in an analogous manner, locally as powerful irritants, and internally producing giddiness, vomiting, purging, slowness of pulse and respiration, prostration, loss of consciousness, and spasms. (*Neues Repertorium*, 1867, xvi. 303.) It is chiefly, if not exclusively, for external application that the preparations of this metal are used. Two of them have especially engaged attention; the iodide and sulphate. The former is officinal in the British Pharmacopœia (see page 306), whilst the latter, which was officinal in the U. S. P. 1870, was dismissed at the last revision. On account of its being still used, it merits a notice here.

Off. Prep. of Cadmium. Cadmii Iodidum, *Br.*

CADMII SULPHAS. *Sulphate of Cadmium.* U. S. 1870, $CdSO_4, 4H_2O$. "Take of Cadmium, in small pieces, *a troyounce;* Nitric Acid *two troyounces;* Carbonate of Sodium *three troyounces;* Sulphuric Acid *four hundred and twenty grains;* Distilled Water *a sufficient quantity.* To the Cadmium and two fluidounces of Distilled Water, contained in a glass vessel, add by degrees the Nitric Acid, and, when the action slackens, apply a gentle heat until the metal is dissolved. Filter the solution, and, having dissolved the Carbonate of Sodium in six fluidounces of Distilled Water, mix the solutions thoroughly. Wash the precipitate obtained until the water passes tasteless, and dissolve it in the Sulphuric Acid, diluted with four fluidounces of Distilled Water. Then evaporate the solution to one-third, and set it aside to crystallize. Lastly, dry the crystals on bibulous paper." *U. S.* 1870.

A nitrate of cadmium is formed first, in consequence of the greater facility with which nitric acid acts upon that metal than sulphuric acid. The cadmium is oxidized at the expense of a part of the acid, with the production of fumes of nitrogen tetroxide, and the resulting oxide unites with the undecomposed part of the acid to form the nitrate, $3Cd_2 + 6H_2SO_4 + 4HNO_3 = 6CdSO_4 + 8H_2O + 2(N_2O_2)$. This is then decomposed in solution by carbonate of sodium, with a mutual interchange of principles; the nitric acid of the nitrate of cadmium taking the soda of the carbonate, and forming nitrate of sodium which is retained in solution, while the insoluble carbonate of the metal is deposited. This, having been washed, is treated with dilute sulphuric acid, by which the carbonic acid is expelled, and the sulphate of cadmium remains in solution, from which it is obtained by concentration and crystallization.

Properties. Sulphate of cadmium crystallizes in oblique prisms with rhomboidal bases, which are transparent and colorless, and said to resemble those of sulphate of zinc. They have an astringent, slightly acidulous, and austere taste, effloresce on exposure to the air, and are very soluble in water. The solution, even though acidulated, gives with hydrosulphuric acid a yellow precipitate, becoming orange yellow, of sulphide of cadmium, which is dissolved by strong hydrochloric acid, but is insoluble in solutions of potassa or ammonia, and is thus readily distinguished from the sulphide of arsenic. With sulphide of ammonium it gives a yellow precipitate insoluble in an excess of the sulphide. Ammonia produces a white precipitate, soluble in an excess of the precipitant; carbonate of ammonium a white one insoluble in an excess; ferrocyanide of potassium a white precipitate not dissolved by hydrochloric acid; and the ferricyanide a brownish yellow one soluble in a large excess of that acid. (*Brande and Taylor.*) By these tests sulphate of cadmium is distinguished as a salt of that metal. As a sulphate it is known by yielding a precipitate with chloride of barium not soluble in nitric acid. Zinc precipitates cadmium in the metallic state from the solution. Cadmium suspended in a solution of sulphate of copper precipitates that metal, leaving sulphate of cadmium in solution; and this has been proposed as a method of obtaining the salt. The formula of sulphate of cadmium, according to M. de Hauer, is $3CdSO_4.8H_2O$. (*Chem. News*, Nov. 29, 1862, p. 268.)

Medical Uses. Sulphate of cadmium is said to resemble but to exceed in power sulphate of zinc as an astringent and emetic. Besides these properties, it possesses, according to M. Grimaud, valuable powers as a remedy in syphilis, rheumatism, and gout, but it has been used almost exclusively as an astringent and stimulating remedy in diseases of the eyes and in gonorrhœa. In specks and opacities of the cornea it has been employed successfully by both American and European surgeons. It is used either in solution, in the proportion of from half a grain to four grains to the fluidounce of distilled water, or in the form of ointment, made by mixing two grains with four scruples of fresh lard.

CADMII IODIDUM. *Br.* *Iodide of Cadmium.*

$Cd\ I_2$; 366. (CĂD'MỊ-Ī Ī-ŎD'Ị-DŬM.) $Cd\ I_2$; 366.

Cadmium Iodatum, Iodidum Cadmicum; Iodure de Cadmium, *Fr.;* Jodcadmium, Kadmiumjodür, *G.*

Iodide of cadmium may be prepared by mixing iodine and filings of cadmium in a moist state, or by dissolving the metal in hydriodic acid, or by double decomposition between potassium iodide and cadmium sulphate. It is soluble in water and alcohol, and may be crystallized from either solution, in large, white, transparent crystals, in the form of six-sided tables, of a pearly lustre. These are permanent in the air, melt at about 315·6° C. (600° F.) forming an amber-colored liquid, and give off violet vapors at a dull red heat. The salt is freely soluble in water and in alcohol, and the solution has an acid reaction. The Br. Pharmacopœia gives the following tests. The aqueous solution gives a yellow precipitate with sulphuretted hydrogen or sulphide of ammonium, insoluble in excess of the sulphide; and a white gelatinous precipitate with excess of solution of potash, the filtrate from which is unaffected by sulphide of ammonium. Ten grains dissolved in water gives with an excess of nitrate of silver, a precipitate which, washed with water and afterwards with half an ounce of water of ammonia and dried, weighs 12·5 grains.

Iodide of cadmium was introduced as an external remedy by Dr. A. B. Garrod, of London. He has employed it, with good effects, in the form of ointment, made of one part of the iodide to eight of lard, as a local application by friction to enlarged scrofulous glands, nodes, chronic inflammations of joints, certain cutaneous diseases, and chilblains. The ointment is soft and white, readily yields its iodine for absorption, and is preferable to the corresponding ointment of iodide of lead, the use of which endangers lead poisoning. (*P. J. Tr.* 1857, p. 260.)

Off. Prep. Unguentum Cadmii Iodidi, *Br.*

CAFFEA. *Coffee.*

(CĂF'FẸ-Ạ.)

"The seed of Coffea Arabica." *U. S.* 1870. (*Nat. Ord.* Rubiaceæ.)

Semen Caffeæ; Café, *Fr.;* Kaffee, *G.;* Caffé, *It.;* Café, *Sp.;* Bun, *Ar.;* Copi cotta, *Cingalese;* Kaeva, *Malay.*

Although this substance was omitted in the Pharmacopœia of 1880, its great importance as a dietetic and its use as a medicine require a notice here.

Gen. Ch. "*Calyx* with a small, 4-5 toothed limb. *Corolla* tubular, funnel-shaped, with a 4-5 parted spreading limb. *Stamens* 4-5, inserted in the middle of the upper part of the tube, exserted or enclosed. *Style* bifid at the apex. *Berry* umbilicate, naked or crowned with the calyx, containing two seeds enclosed in a parchment-like putamen." *Lindley.*

Coffea Arabica. Linn. *Sp. Plant.* 245; *Bot. Mag.* t. 1303; *B. & T.* 144. The coffee plant is a small tree, from fifteen to thirty feet in height. The branches are opposite, the lower spreading, the upper somewhat declining, and gradually diminishing in length, as they ascend, so as to form a pyramidal summit, which is covered with green foliage throughout the year. The leaves are opposite, upon short footstalks, oblong-ovate, acuminate, entire, wavy, four or five inches long, smooth and shining, of a dark green color on their upper surface, paler beneath, and accompanied with a pair of small pointed stipules. The flowers are white, with an odor not unlike that of the jasmine, and stand in groups in the axils of the upper leaves. The calyx is very small, the corolla salver-form, with a nearly cylindrical tube, and a flat border divided into five lanceolate, pointed segments. The stamens project above the tube. The fruit, which is inferior, is a roundish berry, umbilicate at top, at first green, then red, and ultimately dark purple. It is about as large as a cherry, and contains two seeds surrounded by a paper-like membrane, and enclosed in a yellowish purple matter. These seeds, divested of their coverings, constitute coffee.

This tree is a native of Southern Arabia and Abyssinia, and probably pervades Africa about the same parallel of latitude, as it is found growing wild in Liberia, on the western coast of the continent. It is cultivated in various parts of the world where the temperature is sufficiently elevated and uniform. Considerable attention has long been paid to its culture in its native country, particularly in Yemen, in the vicinity of Mocha, from which the demands of commerce were at first almost exclusively supplied. About the year 1690, it was introduced by the Dutch into Java, and in 1718, into their colony of Surinam. Soon after this latter period, the French succeeded in introducing it into their West India Islands, Cayenne, and the Isles of France and Bourbon; and it has subsequently made its way into the other West India Islands, various parts of tropical America, Hindostan, and Ceylon.

The tree is raised from the seeds, which are sown in a soil properly prepared, and, germinating in less than a month, produce plants which, at the end of the year, are large enough to be transplanted. These are then set out in rows at suitable distances, and in three or four years begin to bear fruit. It is customary to top the trees at this age, in order to prevent their attaining an inconvenient height, and to increase the number of the fruit-bearing branches. It is said that they continue productive for 30 or 40 years. Though almost always covered with flowers and fruit, they yield most largely at two seasons, and thus afford two harvests during the year. Various methods are employed for freeing the seeds from their coverings; but that considered the best is, by means of machinery, to remove the fleshy portion of the fruit, leaving the seeds surrounded only by their papyraceous envelope, from which they are, after drying, separated by peeling and winnowing mills.

The character of coffee varies considerably with the climate and mode of culture. Consequently, several varieties exist in commerce, named usually from the sources from which they are derived. The *Mocha Coffee*, which is in small roundish grains, takes precedence of all others. The *Java Coffee* is highly esteemed in this country; but our chief supplies are derived from the West Indies and South America. Some good coffee has been brought from Liberia. Coffee improves by age, losing a portion of its strength, and acquiring a more agreeable flavor. It is said to be much better when allowed to ripen perfectly on the tree, than as usually collected. The grains should be hard, and should readily sink in water. When soft, light, black or dark colored, or musty, they are inferior.

Properties. Coffee has a faint, peculiar odor, and a slightly sweetish, somewhat austere taste. An analysis by M. Payen gives for its constituents, in 100 parts, 34 of cellulose, 12 of hygroscopic water, 10 to 13 of fatty matter, 15·5 of glucose, with dextrin and a vegetable acid, 10 of legumin, 3·5 of *chlorogenate of potassium and caffeine*, 3 of a nitrogenous body, 0·8 of free caffeine (see article *Caffeina*) 0·001 of concrete volatile oil, 0·002 of fluid volatile oil, and 6·697 of mineral substances. (*Journ. de Pharm.*, 3e sér., x. 266.) Pfaff recognized, in the precipitate produced by acetate of lead with the decoction of coffee, two peculiar principles, one resembling tannin, called *caffeo-tannic acid*, and the other an acid, called by him *caffeic acid*. The latter is thought to be identical with the chlorogenic acid of Payen. When strongly heated, it emits the odor of roasted coffee, and is supposed to be the principle to which the flavor of coffee as a drink is owing. A remarkable property of caffeic acid is that, when acted on by sulphuric acid and manganese dioxide, it is converted into quinone, being in this respect analogous to quinic acid. The *sugar* of coffee is probably neither glucose as supposed by Payen, nor cane-sugar as stated by Rochleder, but peculiar; for, when the coffee is roasted, it does not answer to Trommer's test for glucose. (*P. J. Tr.*, xvi. 526–8.) Caffeotannic acid has been ascertained by Hlasiwetz to be a glucoside, resolvable into glucose and a peculiar crystallizable acid, $C_9H_8O_4$, named by him caffeic acid (*Journ.*

de Pharm., 1867, p. 307), and which may be obtained from coffee, by boiling a solution of the extract with caustic potassa, treating the resulting liquid with sulphuric acid in excess, and extracting the caffeic acid with ether, which yields it somewhat impure by evaporation. (*Ibid.*, January, 1868, p. 75.) Another acid, named *viridic acid* (now generally regarded as an alteration product of caffeo-tannic acid) has been obtained by M. Cech from coffee, by bruising the grains, removing the fat by boiling etherized alcohol, and exposing the residue, moistened from time to time, to the air. In a few days the matter assumes a green color from the formation of *viridate of calcium*, which will yield the acid to alcohol mixed with acetic acid. (*Ibid.*, 1867, p. 318.)

Coffee undergoes considerable change during the roasting process. It swells up very much, acquiring almost double its original volume, while it loses from 15 to 20 per cent. of its weight. (*Pharm. Centralblatt*, 1850, p. 687.) It acquires, at the same time, a peculiar odor entirely different from that of the unroasted grains, and a decidedly bitter taste. An active empyreumatic oil is developed during the process, probably at the expense of a portion of the caffeine. Much of the alkaloid, however, escapes change, and a portion of it is volatilized. The excellence of the flavor of roasted coffee depends much upon the manner in which the process is conducted, and the extent to which it is carried. It should be performed in a covered vessel, over a moderate fire, and the grains should be kept in constant motion. When they have acquired a chestnut brown color, the process should cease. If too long continued, it renders the coffee bitter and acrid, or, by reducing it to charcoal, deprives it entirely of flavor. During a severe roasting it loses a portion of caffeine, which sublimes; while in a slight roasting it loses none: yet ordinary coffee for drinking, prepared by percolation, contains rather more caffeine when prepared from strongly roasted than from slightly roasted coffee, because the caffeine is more easily extracted from the former. (Herman Aubert. See *A. J. P.*, 1873, p. 121.) The coffee should not be burnt long before it is used, and should not be kept in the ground state.

Medical and Economical Uses. More attention has been paid to the effects of coffee on the system in the roasted than in the crude state. Unroasted coffee has been employed in intermittent fever; but it is much inferior to quinine. It has been given in powder, in the dose of a scruple every hour; in decoction, prepared by boiling an ounce with eighteen ounces of water down to six; or in extract, in the dose of from four to eight grains.

The action of coffee is directed chiefly to the nervous system. When swallowed it produces a warming cordial impression on the stomach, quickly followed by a diffused agreeable nervous excitement, which extends itself to the cerebral functions, giving rise to increased vigor of imagination and intellect, without any subsequent confusion or stupor such as characterizes the action of narcotic medicines. Indeed, one of its most extraordinary effects is a disposition to wakefulness, which continues for several hours after it has been taken. It is even capable of resisting, to a certain extent, the intoxicating and soporific influence of alcohol and opium, and may sometimes be advantageously employed for this purpose. It also moderately excites the circulatory system, and stimulates the digestive function. A cup of coffee, taken after a hearty meal, will often relieve the sense of oppression so apt to be experienced, and enable the stomach to perform its office with comparative facility. The exhilarating effects of coffee, united with its delicious flavor when suitably qualified by cream and sugar, have given rise to its habitual employment as an article of diet. Its use for this purpose has prevailed from time immemorial in Persia and Arabia. In 1517 it was introduced by the Turks into Constantinople, whence it was carried to France and England about the middle of the succeeding century, and has since gradually made its way into almost universal use. It cannot be supposed that a substance, capable of acting so energetically upon the system, should be entirely destitute of deleterious properties. Accordingly, if taken in large quantities, it leaves, after its first effects, a degree of nervous derangement or depression equivalent to the previous excitement; and its habitual immoderate employment is well known very greatly to injure the tone of the stomach, and frequently to occasion troublesome dyspeptic and nervous affections. This result is peculiarly apt to take place in individuals of susceptible nervous systems, and in those of sedentary habits. We have repeatedly known patients, who have long suffered with headache and vertigo, to get rid of them by abstaining from coffee.

In the treatment of disease, coffee has been less employed than might have been expected from its effect upon the system. There can be no doubt that it may be advantageously used in various nervous disorders. In a tendency to stupor or lethargy dependent on deficient energy of the brain, without congestion or inflammation, it would be found useful by stimulating the cerebral functions. In light nervous headaches, and even in sick headache not caused by the presence of offending matter in the stomach, it often proves temporarily useful. It has acquired much reputation as a palliative in the paroxysms of spasmodic asthma, and has been recommended in hooping-cough, and in hysterical affections. The Egyptians are said to have formerly employed it as a remedy in amenorrhœa. Hayne informs us that in a case of violent spasmodic disease, attended with short breath, palpitation of the heart, and a pulse so much increased in frequency that it could scarcely be counted, immediate relief was obtained from a cup of coffee, after the most powerful antispasmodics had been used in vain for several hours. By the late Dr. Dewees it was highly recommended in cholera infantum, and it has even been used with asserted advantage in cholera. It is said also to have been used successfully in obstinate chronic diarrhœa, and the late Dr. Chapman, of Philadelphia, found it highly useful in calculous nephritis. Under the impression of its diuretic powers, it has been recommended in dropsy. A very concentrated infusion of coffee is serviceable in opium poisoning, but the alkaloid caffeine is probably preferable.

Roasted coffee is said to have the effect of destroying offensive and noxious effluvia from decomposing animal and vegetable substances, and therefore to be capable of beneficial application as a disinfecting and deodorizing agent. The powder of the grains should be roasted until it becomes dark brown, and then sprinkled, or placed in plates, in the infected place.

Coffee is usually prepared in this country by boiling the roasted grains, previously ground into a coarse powder, in water for a short time, and then clarifying by the white of an egg. Some prefer the infusion, made by a process similar to that of percolation. It has more of the aroma of the coffee than the decoction, with less of its bitterness. The proper proportion for forming the infusion for medical use is an ounce to a pint of boiling water, of which a cupful may be given warm for a dose, and repeated, if necessary. A *syrup of coffee* is prepared by Dorvault in the following manner. Treat a pound of ground roasted coffee by percolation with boiling water until two pints have passed. Evaporate eight pounds of simple syrup to six, add the infusion, and strain. Two tablespoonfuls of this syrup may be added to a cup of hot water or milk. It is also used with carbonic acid water.

Coffee depends for its physiological activity upon caffeine and the empyreumatic oil formed during the roasting, probably at the expense of the caffeine. There is much reason for believing that coffee and tea when taken internally lessen the waste of tissue and the elimination of urea. The experiments of Prof. Lehmann seem to show that in this action the empyreumatic oil is at least as active as is caffeine.

The *leaves* of the coffee plant possess properties analogous to those of the fruit, and are extensively used, in the form of infusion, as a beverage, in the vicinity of Padang, in the island of Sumatra. An account of their employment was published in the *Singapore Free Press* by Mr. N. M. Ward, of Padang. Previously to this, Dr. John Gardener, of London, had proposed to introduce them into use in Europe, and is stated to have taken out a patent for the mode of preparing them. A specimen examined by Dr. Stenhouse has been found to contain caffeine in larger proportion than the coffee-bean, and also caffeic acid. Mr. Ward states that, in Sumatra, the leaves are prepared for use by moderately roasting them, and then powdering them coarsely by rubbing in the hands. The powder is made into an infusion like common tea. The taste is said to be like that of tea and coffee combined. (*P. J. Tr.*, xii. 443, and xiii. 207 and 382.)

CAFFEINA. *U. S.* *Caffeine.*

$C_8 H_{10} N_4 O_2 . H_2 O$; 212. (CĂF'FE̤-Ī'NA̤.) $C_{16} H_{10} N_4 O_4 . 2HO$; 212.

" A proximate principle of feebly alkaloidal power, generally prepared from the dried leaves of Camellia Thea, Link (*Nat. Ord.* Ternstrœmiaceæ), or from the dried seeds of Coffea Arabica, Linné (*Nat. Ord.* Rubiaceæ); or from Guarana, and occurring also in other plants." *U. S.*

Caffeine (*Caffeia*) was first discovered by Runge, and afterwards by Robiquet. According to Payen, it exists in coffee partly free, partly as a double salt, consisting of *chlorogenic acid* (caffeo-tannic acid), combined with potassa and caffeine.* It may be obtained in the following manner. Exhaust bruised coffee by two successive portions of boiling water, unite the infusions, add acetate of lead in order to precipitate various principles accompanying the caffeine, filter, decompose the excess of acetate of lead in the filtered liquor by sulphuretted hydrogen, concentrate by evaporation, and neutralize with ammonia. The caffeine is deposited in crystals upon cooling, and may be purified by redissolving in water, treating with animal charcoal, and evaporating. H. J. Versmann, of Lubeck, recommends the following process as more economical. Powdered coffee, mixed with one-fifth of its weight of slaked lime, is exhausted, by means of percolation, with alcohol of 0·863; the tincture is distilled to separate the alcohol; the residue is rinsed out of the still with warm water, and the supernatant oil separated; the liquid is evaporated so as to solidify on cooling; and the crystalline mass thus obtained, having been expressed and dried by pressure in bibulous paper, is purified by solution in water with animal charcoal, and recrystallization. (*Chem. Gaz.*, 1852, p. 67.) H. Leuchsenring obtains caffeine by availing himself of its property of subliming unchanged by heat. He precipitates a concentrated decoction of coffee by a weak solution of acetate of lead, filters, evaporates to dryness, mixes the residue with sand, and sublimes as in Mohr's process for procuring benzoic acid. (*A. J. P.*, xxxii. 25.) Still another method, proposed by Vogel, is to treat coffee, ground to powder, with benzin, which dissolves the caffeine and an oily substance, to separate the benzin by distillation, to treat the residue with boiling water which dissolves the caffeine, and deposits it in a crystalline form, after filtration and concentration. (*Journ. de Pharm.*, 3e sér., xxxv. 436.) Caffeine is in " colorless, soft and flexible crystals, generally quite long, and of a silky lustre, permanent in the air, odorless, having a bitter taste and a neutral reaction. Soluble in 75 parts of water and in 35 parts of alcohol at 15° C. (59° F.); in 9·5 parts of boiling water and very soluble in boiling alcohol; also soluble in about 6 parts of chloroform, but very slightly soluble in ether or in disulphide of carbon. When heated to 100° C. (212° F.), the crystals lose 8·49 per cent. in weight (of water of crystallization); and, when heated on platinum foil, they are completely volatilized without carbonizing. On heating Caffeine with chlorine water, or treating it with concentrated nitric acid, it is decomposed; on evaporating afterward at a gentle heat, a yellow mass is left, which, when moistened with water of ammonia, assumes a purplish color. Sulphuric or nitric acid should dissolve it without color, and its aqueous solution should not be precipitated by test-solution of iodide of mercury and potassium (abs. of other alkaloids)." *U. S.* It is precipitated from its aqueous solution by no reagent except tannic acid and solution of iodide of potassium and mercury. When this solution, made by saturating iodide of potassium with red oxide of mercury, is added to a solution of caffeine, a precipitate is produced, which soon takes the form of white, shining, acicular crystals. This reaction is proposed as a test of

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* In a recent examination of 25 varieties of coffee, Dragendorff found a variation in the amount of caffeine of 0·6 to 2·2 per cent. The most important varieties were as follows:

Brown Preang	0·71	per cent.	First native Ceylon	0·87	per cent.
Finest Mocha	0·64	"	Second " "	1·54	"
Yellow Menado	1·22	"	Third " "	1·59	"
Finest plantation Jamaica	1·43	"	Costa Rica	1·18	"
First Surinam	1·78	"	West Indian	1·22	"
Pearl plantation Ceylon	0·78	"	Rio	1·14	"
Yellow Java	0·88	"	Jamaica	0·67	"
Gray Java	2·21	"	Santos	1·46	"

caffeine by Prof. Dellfs; for, though the same solution will precipitate the other alkaloids, the product is always amorphous. (*Chem. Gaz.*, Feb. 15, 1855.) Caffeine is remarkable for containing a larger proportion of nitrogen than almost any other proximate vegetable principle, in this respect equalling some of the most highly animalized products.

Medical Properties. The alkaloid caffeine, given in large dose to the lower animals, produces hurried respiration, restlessness, slightly lowered followed by markedly elevated temperature, tetanic and clonic convulsions, progressive paralysis, and finally death from paralytic arrest of respiration. The cause of the convulsions in mammals is not determined, but in the frog the alkaloid certainly acts as a muscle poison. It would seem, also, that the cardiac muscle was influenced directly by it, although Leven affirms that in the beginning of the toxæmia the arterial pressure is increased. The symptoms produced by ordinary doses in man are not marked, but we have seen very decided cardiac depression, with much shortness of breath, produced by 5 grains of it. There is also frequently increased diuresis, probably produced by the effort of elimination. In doses of from eight to twelve grains it is said to produce great restlessness, tremulousness, anxiety, excited mental action, passing even into delirium, excessive urination, etc. It is almost certain that if in sufficient amount it is capable of causing toxic symptoms in man similar to those which it produces in the lower animals, the cerebral disturbance of course being more prominent. What little knowledge we have in regard to the empyeumatic oil of coffee indicates that it is a powerful cerebral stimulant. The usual dose of caffeine is 5 grains (0·33 Gm.); but, as already stated, we have seen this quantity produce unpleasant symptoms in the adult female. On the other hand, abroad it seems to be used more freely; at least it is affirmed that in France (*A. J. P.*, 1878, p. 297) the commencing dose is usually 7 grains (0·46 Gm.), rapidly increased to 60 grains (3·9 Gm.). In the form of *citrate of caffeine*, made by dissolving caffeine in a solution of citric acid with a gentle heat, and evaporating carefully, it has been recommended, as a remedy and preventive in sick headache (migraine), in the dose of a grain (0·065 Gm.) every hour, before and during the paroxysm. Two or three grains (0·13–0·20 Gm.) during the twenty-four hours is recommended under ordinary circumstances. (*Botkin.*) The *arseniate* has been given as an antiperiodic; but the arsenic is no doubt the main therapeutic agent in this case.

CALAMUS. *U. S.* *Calamus.* [*Sweet Flag.*]

(CĂL'A-MŬS.)

"The rhizome of Acorus Calamus. Linné. (*Nat. Ord.* Araceæ.)" *U. S.*

Rhizoma Calami, *P.G.;* Radix Calami Aromatici, Radix Acori; Acore vrai, Acore odorant, *Fr.;* Kalmuswurzel, *G.;* Calamo Aromatico, *It.*, *Sp.*

Gen. Ch. *Spadix* cylindrical, covered with florets. *Corolla* six-petalled, naked. *Style* none. *Capsule* three-celled. *Willd.*

Acorus Calamus. Willd. *Sp. Plant.* ii. 199; Barton, *Med. Bot.* ii. 63; *B. and T.* 279. The sweet flag, or calamus, has a perennial, horizontal, jointed, somewhat compressed root (rhizome), from half an inch to an inch thick, sometimes several feet in length, sending off numerous round and yellowish or whitish radicles from its base, and bunches of brown fibres resembling coarse hair from its joints, internally white and spongy, externally whitish with a tinge of green, variegated with triangular stains of light brown and rose color. The leaves are all radical, sheathing at the base, long, sword-shaped, smooth, green above, but, near their origin from the root, of a red color variegated with green and white. The scape or flower-stem resembles the leaves, but is longer, and from one side, near the middle of its length, sends out a cylindrical spadix, tapering at each end, about two inches in length, and crowded with greenish yellow flowers. These are without calyx, and have six small, concave, membranous, truncated petals. The fruit is an oblong capsule, divided into three cells, and containing numerous oval seeds.

This is an indigenous plant, growing throughout the United States, in low, wet, swampy places, and along the sides of ditches and streams, and flowering in May and June. It is also a native of Europe and Western Asia; and a variety is found in India. The European plant differs slightly from the American. The leaves as well as the root have an aromatic odor; but the latter only is employed. It should be collected late in the autumn, or in the spring. After removal from the ground, the rhizomes are washed, freed from their fibres, and dried with a moderate heat. By drying they lose nearly one-half their diameter, but are improved in odor and taste.

Properties. The roots, as kept in the shops, are "in sections of various lengths, unpeeled, about three-quarters of an inch (2 cm.) broad, subcylindrical, longitudinally wrinkled; on the lower surface marked with the circular scars of the rootlets in wavy lines, externally reddish brown, somewhat annulate from remnants of leaf-sheaths; internally whitish, of a spongy texture, breaking with a short, corky fracture, showing numerous oil-cells and scattered wood-bundles, the latter crowded within the subcircular nucleus-sheath. It has an aromatic odor, and a strongly pungent taste." *U. S.* Their texture is light and spongy, their color internally whitish or yellowish white, and their fracture short and rough. A variety imported from Germany consists exclusively of the interior portion of the root. The pieces are usually long, slender, irregularly quadrangular, and of a grayish white color.

The odor of calamus is strong and fragrant; its taste warm, bitterish, pungent, and aromatic. Its active principles are taken up by boiling water. From 100 parts of the fresh root of the European plant, Trommsdorff obtained 0·1 of volatile oil, 2·3 of soft resin, 3·3 of extractive with a little chloride of potassium, 5·5 of gum with some phosphate of potassium, 1·6 of starch analogous to inulin, 21·5 of lignin, and 65·7 of water. Sixteen ounces of the dried root afforded to Neumann about two scruples of volatile oil. The oil is at first yellow, but ultimately becomes red, and has the smell and taste of calamus. Kurbatow (*Annal. d. Chemie*, vol. 173, p. 4) examined oil of calamus, and found that the portion boiling below 170° C. (338° F.) yielded after treatment with sodium a terpene, $C_{10}H_{16}$ having sp. gr. ·8793 at 0° C. (32° F.); and having a boiling point of 158° C. (316·4° F.). The extractive matter has an acrid and sweetish taste. The root is sometimes attacked by worms, and deteriorates by keeping. The India variety is more slender than the European, and has a stronger and more pleasant flavor.

Medical Properties and Uses. Calamus is a feeble aromatic, which may be used with advantage in pain or uneasiness of the stomach or bowels arising from flatulence, and as an adjuvant to tonic or purgative medicines. It was probably known to the ancients, and is supposed to have been the *ἄκορον* of the Greeks; but the *calamus aromaticus* of Dioscorides was a different product, having been derived, according to Dr. Royle, from a species of *Andropogon.* The medicine is at present not much used. The dose in substance is from a scruple to a drachm (1·3–3·9 Gm.). An infusion, made in the proportion of an ounce of the root to a pint of boiling water, is sometimes given in the dose of a wineglassful (60 C.c.) or more.

Off. Prep. Extractum Calami Fluidum.

CALCIUM. *Calcium.*

Ca; 40. (CĂL′CI̤-ŬM.) Ca; 40.

This is the metal characteristic of lime, and consequently of all calcareous substances. It was obtained by Dr. Matthiessen, in 1855, in masses of the size of a pea, by the electrolysis of chloride of calcium with a Bunsen battery. It is a pale yellow metal, remarkably glittering when freshly filed. Its fracture is jagged, becoming granular. It is malleable and very ductile. In a dry air it remains unaltered; but it soon tarnishes in a moist one. It melts at a red heat, and afterwards burns with splendor, forming lime, or calcium oxide. (*Chem. Gaz.*, June 15, 1855.)

Calcium is a very abundant element in nature, existing in the mineral kingdom chiefly as a carbonate, in the form of limestone, marble, chalk, and calcareous spar; and as a phosphate and carbonate in the bones and shells of animals.

CALCII BROMIDUM. *U. S.* *Bromide of Calcium.*

Ca Br_2; 199·6. (CĂL′CI̤-Ī BRO̤-MĪ′DŬM.) Ca Br; 99·8.

Calcium Bromatum, Bromure de Calcium, Bromure de Chaux, *Fr.;* Brom calcium, *G.*

"Bromide of Calcium should be preserved in well-stopped bottles." *U.S.* Although this salt has been largely used, it has never been officinal until the present revision. It is prepared by M. Boedecker by first forming a bromide of sulphur, by the addition of 20 parts of the flowers of sulphur to 240 parts of bromine; this is added to a milk of lime containing 140 parts of fresh lime. The sulphate and bromide of calcium are formed and are readily separated. (*Journ. de Pharm.*, 4e sér., viii. 463.) Mr. Jas. R. Mercein puts five ounces of bromine and two and a half pints of water in a half gallon specie jar, passes a stream of sulphuretted hydrogen through the bromine until it is all taken up, filters, drives off excess of sulphuretted hydrogen by heat, distils the solution of hydrobromic acid thus obtained until four-fifths have passed over, saturates this with excess of precipitated carbonate of calcium, filters and evaporates. (*A. J. P.*, xliv. 100.) Mr. Macdonald (*Ibid.*, 1873) employs the following method. Dissolve 4 ounces of bromide of ammonium in a pint of water. Put in a flask and bring to the boiling point. Keep boiling, and add milk of lime (made from *pure* calcined lime) in small quantities, until ammoniacal vapors cease to be evolved. The operator can easily tell when this point has been reached, by the sense of smell. Filter the solution, evaporate to a syrupy consistency, remove from the fire, and stir until cold.

Properties. "A white, granular salt, very deliquescent, odorless, having a pungent, saline and bitter taste and a neutral reaction. Soluble in 0·7 part of water and in 1 part of alcohol at 15° C. (59° F.); very soluble in boiling water and in boiling alcohol. At a dull red heat the salt fuses without losing anything but moisture. At a higher temperature it is partially decomposed. An aqueous solution of the salt yields, with test-solution of oxalate of ammonium, a white precipitate soluble in hydrochloric, but insoluble in acetic acid. If disulphide of carbon be poured into a solution of the salt, then chlorine water added drop by drop, and the whole agitated, the disulphide will acquire a yellow or yellowish brown color without a violet tint." *U. S.*

Tests. "If diluted sulphuric acid be dropped upon the salt, the latter should not at once assume a yellow color (abs. of bromate). If 1 Gm. of the salt be dissolved in 10 C.c. of water, some gelatinized starch added and then a few drops of chlorine water carefully poured on top, no blue zone should make its appearance at the line of contact of the two liquids (iodide). On adding to 1 Gm. of the salt dissolved in 20 C.c. of water, 5 or 6 drops of test-solution of nitrate of barium, no immediate cloudiness or precipitate should make its appearance (sulphate). If a solution of the salt be precipitated with an excess of nitrate of silver, the washed precipitate for some time shaken with a cold, saturated solution of carbonate of ammonium, and the decanted and filtered liquid supersaturated with nitric acid, not more than a faint cloudiness, insufficient to produce a precipitate, should appear (limit of chloride). On adding to the aqueous solution, first, chloride of ammonium, then test-solution of carbonate of ammonium and water of ammonia in slight excess, and gently warming, the filtrate separated from the resulting precipitate should not be rendered more than faintly turbid by test-solution of phosphate of sodium (limit of magnesium). 1 Gm. of the dry salt, when completely precipitated by nitrate of silver, yields, if perfectly pure, 1·878 Gm. of dry bromide of silver." *U. S.*

Medical Properties and Uses. Bromide of calcium was proposed by Dr. Hammond, in 1871, as a substitute for the corresponding salt of potash. It has failed to gain much support from the medical profession, but is sometimes employed as an adjuvant in epilepsy and hysteria. Its action upon the lower animals has been partially investigated by Guttmann (*Phila. Med. Times*, iv. 361), who finds that it acts as a sedative to the nerve-centres, but lacks the depressant cardiac action of the bromide of potassium. The dose is half to two drachms (0·95–7·8 Gm.).

CALCII CARBONAS PRÆCIPITATUS. *U. S.* *Precipitated Carbonate of Calcium.*

$CaCO_3$; 100. (CĂL'CI-Ī CĂR-BŌ'NAS PRÆ-CĬP-I-TĀ'TŬS.) CaO, CO_2; 50.

Calcis Carbonas Præcipitata, *Br.;* Calcaria Carbonica Præcipitata, *P. G.;* Carbonas Calcicus Præcipitatus, Creta Præcipitata; Carbonate de Chaux précipité, Craie précipitée, *Fr.;* Präcipitirter kohlensauer Kalk, *G.*

A formula for this preparation is found in the Pharmacopœia of 1870.*

"Take of Chloride of Calcium *five ounces* [avoirdupois]; Carbonate of Soda *thirteen ounces* [avoird.]; Boiling Distilled Water *a sufficiency.* Dissolve the Chloride of Calcium and the Carbonate of Soda each in two pints [Imperial measure] of the Water; mix the two Solutions; and allow the precipitate to subside. Collect this on a calico filter, wash it with boiling Distilled Water until the washings cease to give a precipitate with nitrate of silver, and dry the product at the temperature of 212°." *Br.*

The processes do not essentially differ. In each a mutual interchange of principles takes place, resulting in the production of chloride of sodium which remains in solution, and carbonate of calcium which is deposited, $CaCl_2 + Na_2CO_3 = CaCO_3 + 2NaCl$. Any peculiar advantage of the preparation must depend on the minute division of its particles. According to Dr. Bridges, this effect is best obtained by employing the solutions at the boiling temperature, a precaution which is observed in most processes now. (*A. J. P.*, xvi. 163.) When properly made, it is "a very fine, white, impalpable powder, permanent in the air, odorless and tasteless, and insoluble in water or alcohol. Wholly soluble in hydrochloric, nitric, or acetic acid with copious effervescence. By exposure to a red heat the salt loses carbonic acid gas, and the residue has an alkaline reaction. A neutral solution of the salt in acetic acid yields, with test-solution of oxalate of ammonium, a white precipitate soluble in hydrochloric, but insoluble in acetic acid. On adding to another portion of the same solution, first, chloride of ammonium, then test-solution of carbonate of ammonium and water of ammonia in slight excess, and gently warming, the filtrate separated from the resulting precipitate should not be rendered more than faintly turbid by test-solution of phosphate of sodium (limit of magnesium). A solution of the salt in hydrochloric acid, freed from carbonic acid gas by heat, should not be rendered turbid, when supersaturated with water of ammonia (abs. of aluminium, iron, or phosphate)." *U. S.*

Medical Properties and Uses. For ordinary use, it probably has no such superiority over prepared chalk as to counterbalance its greater expensiveness, but it is preferred by some in the preparation of tooth-powders. The dose is from 10 to 40 grains (0·65–2·6 Gm.) or more.

Off. Prep. Trochisci Bismuthi, *Br.*

CALCII CHLORIDUM. *U.S., Br.* *Chloride of Calcium.*

Ca Cl₂; 110·8. (CĂL′CI̦-Ī C̦HLŌ′RI̦-DŬM.) Ca Cl; 55·4.

"Chloride of Calcium, deprived of its water by fusion at a low red heat. It should be preserved in well-stopped bottles." *U. S.*

Calcaria Muriatica, Chloridum Calcicum; Muriate of Lime, Hydrochlorate of Lime; Chlorure de Calcium, Hydrochlorate de Chaux, *Fr.;* Chlorcalcium, Salzsaures Kalk, *G.*

Chloride of calcium consists of chlorine, united with calcium, the metallic radical of lime. It may be readily formed by saturating hydrochloric acid with chalk or marble, evaporating to dryness, and heating to redness. The hydrochloric acid, by reacting with the lime, forms chloride of calcium and water, the latter of which is dissipated at a red heat, $CaCO_3 + 2HCl = CaCl_2 + CO_2 + H_2O$. The Br. Pharmacopœia, after neutralizing the acid with carbonate of calcium, adds a little solution of chlorinated lime and slaked lime, filters, evaporates till the chloride becomes solid, and, instead of igniting the residue, dries it at about 205° C. (400° F.).

Properties. Chloride of calcium is in "colorless, slightly translucent, hard and friable masses, very deliquescent, odorless, having a hot, sharp, saline taste, and a neutral or faintly alkaline reaction. Soluble in 1·5 parts of water and 8 parts of alcohol at 15° C. (59° F.); very soluble in boiling water, and soluble in 1·5 parts of boiling alcohol. At a low red heat the salt fuses to an oily liquid which, on cooling, solidifies to a mass of the original appearance, entirely soluble in water. The aqueous solution yields, with test-solution of oxalate of ammonium, a white precipitate, soluble in hydrochloric but insoluble in acetic acid. With test-solution of nitrate of silver, it yields a white precipitate soluble in ammonia. The dilute aqueous solution should not be precipitated by water of ammonia (aluminium, iron, etc.), nor by test-solution of chloride of barium (sulphate). On adding to the aqueous solution, first, chloride of ammonium, then test-solution of carbonate of ammonium and water of ammonia in slight excess, and gently warming, the filtrate separated from the resulting precipitate should not be rendered more than faintly turbid by test-solution of phosphate of sodium (limit of magnesium)." *U. S.* On account of its avidity for water, the fused salt is used for drying gases. The crystallized salt is also very deliquescent, and has the form of colorless, transparent, striated, six-sided prisms. The crystals, on exposure to heat, first dissolve in their water of crystallization, and after this has evaporated, undergo the igneous fusion. With ice or snow they form a powerful frigorific mixture. "The salt evolves no chlorine or hypochlorous acid on the addition of hydrochloric acid, is entirely soluble in twice its weight of water, and is not precipitated by lime-water." *Br.* Chloride of calcium exists in the water of the ocean and of many springs. It is usually associated with common salt and chloride of magnesium, from which it is separated with difficulty. When crystallized it contains six molecules of water.

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* "Take of Solution of Chloride of Calcium *five pints and a half;* Carbonate of Sodium *seventy-two troyounces;* Distilled Water *a sufficient quantity.* Dissolve the Carbonate of Sodium in six pints of Distilled Water. Heat this solution and the Solution of Chloride of Calcium, separately, to the boiling point, and mix them. After the precipitate has subsided, separate it from the supernatant liquid by decantation, and wash it with boiling Distilled Water until the washings cease to be affected by a solution of nitrate of silver. Lastly, dry the precipitate on bibulous paper." *U. S.* 1870.

Chloride of calcium is used medicinally in solution only.*

Pharm. Uses. In preparing Acidum Tartaricum, *Br.;* Æther, *Br.;* Æther Purus, *Br.;* Chloroformum, *Br.;* Ferrum Redactum, *Br.*

Off. Prep. Calcis Carbonas Præcipitata, *Br.;* Morphiæ Hydrochloras, *Br.*

CALCII HYPOPHOSPHIS. *U. S.* *Hypophosphite of Calcium.*

$CaH_4(PO_2)_2$; 170. (CĂL'CỊ-Ī HȲ-PỌ-PHŎS'PHỊS.) $CaO, 2HO, PO$; 85.

Calcis Hypophosphis; Hypophosphite of Lime: Calcaria Hypophosphorosa, Hypophosphis Calcicus; Hypophosphite de Chaux, *Fr.;* Unterphosphorigsaurer Kalk, *G.*

Attention has been called to the hypophosphites as a class of salts, in consequence of their recommendation by Dr. Churchill, of Paris, in the treatment of phthisis, in which they are thought to be useful by furnishing phosphorus to the tissues. One of the first papers on their mode of preparation and qualities was communicated by Prof. Procter. (See *A. J. P.*, xxx. 118.) Hypophosphorous acid consists of one atom of phosphorus, two of oxygen, and three of hydrogen, of which latter, however, only one is replaceable by metal. It is, therefore, a monobasic acid. It has a strong affinity for oxygen, and acts as a powerful deoxidizing or reducing agent, which property it is supposed to owe to the presence of the unreplaceable hydrogen atoms, sometimes termed "aldehydic" hydrogen. When heated, it is resolved into phosphuretted hydrogen and phosphoric acid. Its salts are generally soluble in water and deliquescent, and many of them are soluble in alcohol. They are converted into phosphates by heat, with the escape of phosphuretted hydrogen; and some of them are explosive.

Hypophosphite of calcium has attracted most attention, and would meet the views of those who wish to supply phosphate of calcium to the system, as the hypophosphorous acid is converted into the phosphoric by its deoxidizing power. To prepare it Prof. Procter gave the following formula. Slake 4 lbs. avoird. of lime with a gallon of water, add it, in a deep boiler, to 4 gallons of boiling water, and mix thoroughly. To the mixture add a pound (avoird.) of phosphorus, and continue the boiling, adding hot water from time to time to keep up the measure, until the combination is complete, and phosphuretted hydrogen is no longer evolved. It is necessary that provision should be made for the escape of the gas, which takes fire spontaneously in contact with the air. There are formed in the liquid, phosphate and hypophosphite of calcium, the phosphorus having become oxidized at the expense of the water, the hydrogen of which has escaped in combination with another portion of phosphorus, which is therefore lost. The liquid is filtered to separate the insoluble phosphate and residuary lime, then concentrated, and refiltered to separate the carbonate of calcium formed by the action of the air on a little lime held in solution, and lastly evaporated till a pellicle appears; after which the salt may be allowed to crystallize by setting the liquid aside, or may be obtained in the granular form by continuing the heat, and stirring. The salt should be introduced into bottles.

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* *Liquor Calcii Chloridi* was officinal in Pharm. 1870. A convenient method of making this preparation is to dissolve 228 grains of fused chloride of calcium in 1 fluidounce of distilled water and filter if necessary.

Hypophosphite of calcium is "in colorless or white, six-sided prisms, or thin, flexible scales, of a pearly lustre, permanent in dry air, odorless, having a nauseous, bitter taste and a neutral reaction. Soluble in 6·8 parts of water at 15° C. (59° F.), and in 6 parts of boiling water; insoluble in alcohol. When heated in a dry test-tube, the salt decrepitates, gives off water, then evolves spontaneously-inflammable phosphoretted hydrogen, leaving a reddish residue which amounts to about 80 per cent. The aqueous solution yields, with test-solution of oxalate of ammonium, a white precipitate soluble in hydrochloric, but insoluble in acetic acid. Acidified with hydrochloric acid and added to excess of test-solution of mercuric chloride, it produces a white precipitate of mercurous chloride, and, on further addition, metallic mercury separates.

"When dissolved in water, the salt should leave no insoluble residue (insoluble salts of calcium). The aqueous solution should yield no precipitate with test-solution of acetate of lead (soluble phosphate), nor, after being acidulated with nitric acid, with test-solution of chloride of barium (soluble sulphate). On adding to the aqueous solution, first, chloride of ammonium, then test-solution of carbonate of ammonium and water of ammonia in slight excess, and gently warming, the filtrate separated from the resulting precipitate should not be rendered more than faintly turbid by test-solution of phosphate of sodium (limit of magnesium)." *U. S.*

The solubility of hypophosphite of calcium is increased by the addition of hypophosphorous acid. For a method of purifying alkaline hypophosphites, see *Journ. de Ph. d'Anvers*, 1879, p. 57; *N. R.*, 1879, p. 142.

As the soluble salts of mercury, copper, and silver are reduced by the hypophosphites, they are of course incompatible with it in prescriptions. With the hypophosphite of calcium, all the soluble sulphates and carbonates produce precipitates. As the hypophosphites are insoluble in cod-liver oil, they should be dissolved in syrup before being added to the oil. (See *Syrupus Calcii Hypophosphitis.*)

Medical Properties and Uses. The hypophosphite of calcium has been with the other hypophosphites strongly recommended in chronic phthisis, and is still much used; but the weight of testimony appears to be opposed to the first favorable impressions; and, though some cases may have seemed to be benefited, yet great care must be taken not to allow a reliance on the hypophosphites to interfere with the use of remedies known to be efficient, as cod-liver oil, and supporting measures generally. The remedy has also been highly commended in scrofulous diseases and in cases of defective nutrition of the nerve centres; but in most of these latter cases some direct preparation of phosphorus is probably superior, as it is not proven and not probable that the hypophosphites can yield up their phosphorus to the nerve centres. The dose of either of the hypophosphites is from ten to thirty grains (0·65–1·95 Gm.), three times a day.

Off. Prep. Syrupus Hypophosphitum.

CALCII PHOSPHAS PRÆCIPITATUS. *U. S.* *Precipitated Phosphate of Calcium.*

$Ca_3(PO_4)_2$; 310. (CĂL′CI̤-Ī PHŎS′PHĂS PRÆ-CĬP-I̤-TĀ′TŬS.) $3CaO, PO_5$; 155.

Calcis Phosphas, *Br.;* Phosphate of Calcium; Calcaria Phosphorica, *P. G.;* Phosphas Calcicus Præcipitatus; Precipitated Phosphate of Lime; Phosphate de Chaux hydraté, *Fr.;* Phosphorsaurer Kalk, *G.*

A formula for this preparation was given in the U. S. Pharmacopœia of 1870.*

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* "Take of Bone, calcined to whiteness, and in fine powder, *four troyounces;* Muriatic Acid *eight troyounces;* Water of Ammonia *twelve fluidounces*, or *a sufficient quantity;* Distilled Water *a sufficient quantity.* Macerate the Bone in the Acid, diluted with a pint of Distilled Water, until

"Take of Bone Ash *four ounces* [avoirdupois]; Hydrochloric Acid *six fluidounces* [Imperial measure]; Water *two pints* [Imp. meas.]; Solution of Ammonia *twelve fluidounces*, or *a sufficiency;* Distilled Water *a sufficiency.* Digest the Bone Ash in the Hydrochloric Acid diluted with a pint of Water, until it is dissolved. Filter the solution, if necessary; add the remainder of the Water, and afterwards the Solution of Ammonia, until the mixture acquires an alkaline reaction; and, having collected the precipitate on a calico filter, wash it with boiling Distilled Water as long as the liquid which passes through occasions a precipitate, when dropped into solution of nitrate of silver acidulated with nitric acid. Dry the washed product at a temperature not exceeding 212°." *Br.**

This preparation, whatever opinion may be entertained of its real powers, has been very properly retained in the U. S. Pharmacopœia, as it is considerably used, and is by some much esteemed. One of its more recent uses was to replace carbonate of magnesium in the process for medicated waters. Experience has shown, however, that its insolubility is not as great as supposed, and cotton has been substituted.

The hydrochloric acid dissolves the phosphate of calcium of the bones, and lets it fall, on the addition of ammonia, in a state of minute division. The ablution is intended to free it from adhering chloride of ammonium. The salt thus obtained is, for the sake of distinction, called *bone phosphate of calcium.* It is "a light, white, amorphous powder, permanent in the air, odorless, tasteless, and insoluble in water or alcohol. Wholly soluble in nitric or in hydrochloric acid without effervescence (abs. of carbonate). At an intense heat it is fusible without decomposition. A solution of the salt in diluted nitric acid, after being mixed with an excess of acetate of sodium, yields a white precipitate with test-solution of oxalate of ammonium, and a lemon yellow precipitate with test-solution of ammonio-nitrate of silver. On dissolving 1 Gm. of the salt in hydrochloric acid, and subsequently adding water of ammonia, the salt is precipitated unaltered. The precipitate should yield nothing to a boiling solution of potassa (abs. of aluminium), and, when washed and dried, should weigh 1 Gm." *U. S.*

"Ten grains dissolve perfectly and without effervescence in diluted hydrochloric acid, and the solution yields with ammonia a white precipitate, insoluble in boiling solution of potash, and weighing ten grains when washed and dried." *Br.*

Medical Uses. In the form of burnt hartshorn, phosphate of calcium formerly enjoyed a brief popularity in the treatment of rickets and mollities ossium, in which its use seemed to be indicated upon obvious chemical grounds. In 1851, Benecke suggested that, as it is essential in animals as well as plants to the formation of cells, it might be found useful in certain pathological states of the system characterized by defective nutrition, such as the scrofulous affections, and from that time its use has gradually become more frequent, and, in connection with other phosphates, as those of iron, sodium, and potassium, it has acquired no little reputation in different forms of scrofula, mollities ossium, rickets, and even chronic phthisis. It is also thought to have proved useful by hastening the union of fractured bones; and M. Alphonse Milne-Edwards is said to have shown, by experiments upon dogs and rabbits, that, in these animals, the callus in fractured bones forms more quickly under its use than without it. (*Med. Times and Gaz.*, May, 1856, p. 489.) Though insoluble in water, it is probably in general dissolved by the gastric liquids, in consequence of the acid present in them; but it is best administered in acid solution, and is at present very extensively used dissolved in lactic acid and emulsified with cod-liver oil. The dose is from ten to thirty grains (0·65–1·95 Gm.).

Off. Prep. Syrupus Calcii Lactophosphatis. *U. S.*

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it is dissolved, and filter the solution. Add another pint of Distilled Water, and then, gradually, Water of Ammonia, until the liquid acquires an alkaline reaction. Mix the precipitate obtained, while yet in the state of magma, with twice its bulk of boiling Distilled Water, and pour the whole upon a strainer. Wash the precipitate with boiling Distilled Water until the washings cease to be affected by a solution of nitrate of silver, acidulated with nitric acid. Lastly, dry the precipitate with a gentle heat." *U. S.*

* For an apparatus for preparing *phosphate of calcium* on a large scale, see *Journ. de Pharm.*, Sept. 1, 1875, p. 193.

CALENDULA. *U. S.* *Calendula.* [*Marigold.*]

(CA-LĔN′DŪ-LA.)

"The fresh, flowering herb of Calendula officinalis. Linné. (*Nat. Ord.* Compositæ.)" *U. S.*

Fleurs de Tous les mois, Souci, *Fr.;* Ringelblume, *G.*

Gen. Ch. Flower-head heterogamous, rayed, with the female flowers of the ray fertile, in one or two rows, the hermaphrodite of the disk sterile. *Involucre* broad, with linear, acuminate, subequal, often scarious bracts in one or two rows. *Receptacle* flat, naked. *Corolla* of female flowers ligulate, with the lamina entire or three dentate. Hermaphrodite flowers, regular, tubular, with an enlarged limb shortly five cut at the apex. *Anthers* sagittate, with the auricles setaceous-mucronate or caudate. *Style* of the hermaphrodite flower undivided. *Achenia* bare; those of the ray incurved, 2-3 serrate, heteromorphous usually upon the back, or everywhere muricate; the outer often elongate, linear, sometimes empty; the intermediate broader, often alate; the interior shorter, more incurved; those of the disk thin, smooth, empty. (Bentham & Hooker, *Genera Plantarum*, ii. 454.)

Calendula officinalis. L. The common marigold of the gardens is too well known to need description, other than that of the Pharmacopœia.

Properties. "Stem somewhat angular, rough; leaves alternate, thickish, hairy, spatulate or oblanceolate, slightly toothed, the upper ones sessile; flower-heads nearly two inches (5 cm.) broad, the yellow strap-shaped ray-florets in one or several rows, fertile, the achenes incurved and muricate; odor slightly narcotic; taste bitter and saline." *U. S.* The odor is much stronger in the fresh than in the dry herb, and, on exposure to the sun, the yellow color fades into whitish. Among its constituents is a peculiar principle, called *calendulin*, discovered by Geiger most abundantly in the flowers, and considered by Berzelius as analogous to bassorin, though soluble in alcohol. *French* or *African Marigold*, so called, is very frequently substituted for the officinal drug. It is the *Tagetes patula L.* and *T. erecta*, Lin., both of Mexico. The flowers are readily distinguished by the scales of the involucre being united to form a tube, and by the slender, flattish achenes being crowned with a few chaffy or awned scales. The broadly strap-shaped ray-florets are toothed, and light or deep orange color sometimes striped with red.

Medical Properties and Uses. The medical properties of this new officinal are probably very feeble, if indeed they be not altogether apocryphal. In the days of therapeutic darkness the plant was thought to be antispasmodic, sudorific, deobstruent, and emmenagogue, and was given in low forms of fever, scrofula, jaundice, amenorrhœa, etc. Both the leaves and flowers were used; but the latter were preferred, and were usually administered in the recent state in the form of tea. An extract was also prepared, and employed in cancerous and other ulcers, sick stomach, etc. The tincture has been used to a considerable extent as an embrocation in sprains, bruises, etc., and probably is of as much value as simple alcohol.

Off. Prep. Tinctura Calendulæ, *U.S.*

CALUMBA. *U. S.* *Calumba.* [*Columbo.*]

(CA-LŬM′BA.)

"The root of Jateorrhiza Calumba. Miers. (*Nat. Ord.* Menispermaceæ.)" *U. S.* "The root, cut transversely and dried, of Jateorrhiza Calumba, *Miers;* Cocculus palmatus, *non D. C.; Steph. and Church. Med. Bot.*, plate 160." *Br.*

Calumbæ Radix, *Br.;* Radix Colombo, *P. G.;* Radix Columbo; Colomba, *U. S.* 1850; Colombo, *Fr.;* Columbowurzel, *G.;* Columba, *It.;* Raiz de Columbo, *Sp.;* Kalumbo, *Port.;* Calumb, *Mozambique.*

The columbo plant was long but imperfectly known. Flowering specimens of a plant gathered by Commerson, about the year 1770, in the garden of M. Poivre in the Isle of France, and sent to Europe with that botanist's collection, were examined by Lamarck, and described under the name of *Menispermum palmatum.* But its original locality was unknown, and it was only conjectured to be the source of columbo. In the year 1805, M. Forten, while engaged in purchasing the drug in Mozambique, obtained possession of a living offset of the root, which, being taken to Madras, and planted in the garden of Dr. Anderson, produced a male plant, which was figured and described by Dr. Berry. From the drawing thus made, the plant was referred to the natural family of the Menispermaceæ; but, as the female flowers were wanting, some difficulty was experienced in fixing its precise botanical position. De Candolle, who probably had the opportunity of examining Commerson's specimens, gave its generic and specific character; but confessed that he was not acquainted with the structure of the female flower and fruit. This desideratum, however, was supplied by ample drawings sent to England by Mr. Telfair, of Mauritius, made from plants which were propagated from roots obtained by Captain Owen in 1825, while prosecuting his survey of the eastern coast of Africa. The plant was first placed in the genus Cocculus, which was separated by De Candolle from Menispermum. Subsequently, Mr. J. Miers established a new genus, which has been received by botanists, giving to it the name of Jateorrhiza. M. Miers also separated his plant specifically from *C. palmatus* of De Candolle, describing it under the name of *Jateorrhiza Calumba.* This species is now recognized by both the U. S. and Br. Pharmacopœias. But the very careful researches of Mr. Hanbury (*Pharmacographia*, 2d ed., p. 23) have led him to consider the specific differences as unimportant and inconstant. These differences are that in *J. palmata* "the lobes at the base of the leaf overlap, and the male inflorescence is nearly glabrous; while in *J. Calumba* the basal lobes are rounded, but do not overlap, and the male inflorescence is setose-hispid." The plants are probably only varieties of one species, and it is almost certain that columbo is derived from each of them.

Gen. Ch. *Sepals* 6, in two rows, somewhat unequal, thin. *Petals* 6, shorter than the sepals. Male flowers: *Stamens* 6, free, with the apex recurved-clavate. *Anthers* unilocular with the apex extrorse, dehiscent by a transverse cleft. Female flowers: *Carpels* 3, with lacerate, reflex stigmata. *Drupe* ovoid with a subterminal cicatrix of the style. *Putamen* somewhat concave in its inner face. *Seed* meniscoid; albumen fleshy, ruminate; embryo somewhat curved. *Cotyledons* laterally bivaricate." (Bentham and Hooker, *Genera Plantarum*, i. 34.)

"The plants of this genus, natives of intertropical Africa, are all climbers, distinguished by a very peculiar habit, having very large deeply-lobed leaves, upon very long petioles, and clothed with long strigose hairs; their inflorescence is in long slender racemes: the fruit is a drupe containing a putamen covered with a dense hairy coating imbedded in the fleshy mesoderm." (*Ann. Mag. Nat. Hist.*, Feb. 1864.)

Cocculus palmatus. De Cand. *Syst. Veg.* i. 523; Woodv. *Med. Bot.* 3d ed., v. 21; Hooker, *Curtis's Bot. Mag.*, Nos. 2970, 2971. *Jateorrhiza palmata.* Miers, *Annals and Mag. of Nat. Hist.*, Feb. 1864, p. 183. *B. & T.* 13. This is a climbing plant, with a perennial root, consisting of several fasciculated, fusiform, somewhat curved, and descending tubers, as thick as an infant's arm. The stems, of which one or two proceed from the same root, are twining, simple in the male plant, branched in the female, round, hairy, and about as thick as the little finger. The leaves, which stand on rounded, glandular hairy footstalks, are alternate, distant, cordate, with three, five, or seven entire, acuminate, wavy, somewhat hairy lobes, and as many nerves, each running into one of the lobes. The flowers are small and inconspicuous, and arranged in solitary axillary racemes, which, in the male plant, are compound, in the female, simple, and in both, shorter than the leaves.

Jateorrhiza Calumba. Miers. Br. Pharm.—*Cocculus palmatus.* Wallich, non De Cand.—*Menispermum Columba.* Roxb. *Flor. Ind.* This species is characterized by "rounded, angularly striate, roughly pilose branches; broadly orbicular, sinuously lobed leaves, with rounded sinuses; the lobes being 5 in number, broadly ovate, acute, mucronately acuminate; the basal deeply divaricate and hence broadly cordate; 7 to 9 nerved, opaque above, on both sides furnished with short, adpressed, somewhat curved, reddish hairs, beneath, pale, strongly reticulate with prominent nerves and veins; the petiole somewhat slender, striate, tortuous, and roughly glandular; the racemes axillary, solitary or many; the rachis greatly elongated, striate, bristly, with elongated, smooth, divaricate, almost capillary, subflexuous, few-flowered branches; the flowers sessile, and almost without bracts." (*Miers.*)

Both of these so-called species are natives of Mozambique, on the southeastern coast of Africa, where they grow wild in great abundance in the thick forests extending from the sea many miles into the interior. They are not cultivated. The root is dug up in March, when dry weather prevails. From the base of the root numerous fusiform offsets proceed, less fibrous and woody than the parent stock. These offsets are separated and cut into transverse slices, which are dried in the shade. The old root is rejected.

Columbo is a staple export of the Portuguese from their dominions in the south-east of Africa. It is taken to India, and thence distributed. It was formerly supposed to be a product of Ceylon, and to have derived its name from Colombo, a city of that island, from which it was thought to be exported. It is possible that, when the Portuguese were in possession of Ceylon, Colombo may have been the entrepot for the drug brought from Africa, and thus have given origin to its name. Some, however, consider a more probable derivation to be from the word *calumb*, which is said to be the Mozambique name for the root. Dr. Christison has been misinformed in relation to the cultivation of the true columbo plant in this country. (*Dispensatory*, Am. ed., p. 304.)

Properties. "In nearly circular disks, one and one-fifth to two and two-fifths inches (3 to 6 cm.) in diameter, yellowish gray, depressed in the centre, with two or three interrupted circles of projecting wood-bundles, distinctly radiate in the outer portion; fracture short, mealy; odor slight; taste mucilaginous, slightly aromatic, persistently bitter." *U. S.* Along with the disks are sometimes a few cylindrical pieces an inch or two in length. The cortical portion is thick, of a bright yellow, slightly greenish color internally, but covered with a brownish, wrinkled epidermis. The interior or medullary portion, which is readily distinguishable from the cortical, is light, spongy, yellowish, usually more or less shrunk, so that the pieces are thinnest in the centre; and is often marked with concentric circles and radiating lines. Those pieces are to be preferred which have the brightest color, are most compact and uniform, and least worm-eaten. The odor of columbo is slightly aromatic. The taste is very bitter, that of the cortical much more so than that of the central portion, which is somewhat mucilaginous. The root is easily pulverized. The powder is greenish, becoming browner with age, and deepening when moistened. As it attracts moisture from the air, and is apt to undergo decomposition, it should be prepared in small quantities.

M. Planche analyzed columbo in 1811, and found it to contain a nitrogenous substance, probably albumen, in large quantity, a bitter yellow substance not precipitated by metallic salts, and one-third of its weight of starch. He obtained also a small proportion of volatile oil, salts of lime and potassa, oxide of iron, and silica. Wittstock, of Berlin, afterwards isolated a principle, which he called *colombin*. This crystallizes in beautiful transparent quadrilateral prisms of the formula $C_{21}H_{22}O_7$, is without smell, and is extremely bitter. It is but very slightly soluble in water, alcohol, or ether, at ordinary temperatures, and yet imparts to these fluids a strongly bitter taste. It is more soluble in boiling alcohol, which deposits it upon cooling. The best solvent is dilute acetic acid. It is taken up by alkaline solutions, from which it is precipitated by acids. It has neither acid nor alkaline properties, and its alcoholic and acetic solutions are not affected by the metallic salts, or the infusion of galls. It is obtained by exhausting columbo by means of alcohol of the sp. gr. 0·835, distilling off three-quarters of the alcohol, allowing the residue to stand for some days till crystals are deposited, and lastly treating these crystals with alcohol and animal charcoal. The mother-waters still contain a considerable quantity of colombin, which may be separated by evaporating with coarsely powdered glass to dryness, exhausting the residue with ether, distilling off the ether, treating the residue with boiling acetic acid, and evaporating the solution to crystallization.

From the researches of Dr. Bödeker it appears that another bitter principle exists in columbo, which corresponds in composition and chemical relations with *berberine*, the active principle of *Berberis vulgaris*, and is assumed to be identical with that substance. It was obtained by exhausting columbo with alcohol of 0·889, distilling off the alcohol, allowing the residual liquor to stand for three days so as to deposit the columbin, evaporating the supernatant liquid together with the aqueous washings of the colombin to dryness, exhausting the residue with boiling alcohol of 0·863, treating the solution thus obtained as the former one, submitting the residue to the action of the boiling water, filtering and adding hydrochloric acid, collecting the precipitate thus formed on a filter, drying it with bibulous paper, and finally, in order to separate adhering acid, dissolving it in alcohol, and precipitating with ether. The result was an imperfectly crystalline, bright yellow powder, of a disagreeable, bitter taste, supposed to be *berberine hydrochlorate.* It is stated that berberine is present in columbo in much larger proportion than columbin, and being freely soluble in hot water and alcohol, while columbin is but slightly so, is probably more largely extracted in the ordinary liquid preparations of the root. (*A. J. P.*, xx. 322.) A third constituent, *columbic acid*, was also discovered by Bödeker. It is yellow, amorphous, nearly insoluble in cold water, but dissolving in alcohol and in alkaline solutions. It tastes somewhat less bitter than *columbin.* Bödeker surmises that it may exist in combination with the berberine, and has pointed out a connection between the three bitter principles of columbo. If we suppose a molecule of ammonia, NH_3, to be added to two molecules of *columbin*, $C_{21}H_{22}O_7$, the complex molecule thence resulting will contain the elements of *berberine*, $C_{20}H_{17}NO_4$, *columbic acid*, $C_{22}H_{24}O_7$, and water, $3H_2O$. (*Pharmacographia*, p. 25.)

There can be little doubt that both columbin and berberine contribute to the remedial effects of columbo. The virtues of the root are extracted by boiling water and by alcohol. Precipitates are produced with the infusion and tincture by infusion of galls, and solutions of acetate and subacetate of lead; but the bitterness is not affected.

Adulterations. It is said that the root of *white bryony*, tinged yellow with the tincture of columbo, has sometimes been fraudulently substituted for the genuine root; but the adulteration is too gross to deceive those acquainted with the characters of either of these drugs. American columbo, which is the root of *Frasera Walteri*, is said to have been sold in some parts of Europe for the genuine. Independently of the sensible differences between the two roots (see *Frasera*), M. Stolze, of Halle, states that, while the tincture of columbo remains unaffected by the sulphate or sesquichloride of iron, and gives a dirty-gray precipitate with tincture of galls, the tincture of frasera acquires a dark green color with the former reagent, and is not affected by the latter. (*Duncan.*) Under the name of *columbo wood*, or *false columbo*, the wood of *Coscinium fenestratum*, a plant of the family of Menispermaceæ, growing in Ceylon, has been imported into England, and offered for sale in the drug market. (*P. J. Tr.*, x. 321, and xii. 185.)

Medical Properties and Uses. Columbo is among the most useful of the mild tonics. Without astringency, with very little stimulating power, and generally acceptable to the stomach, it answers admirably as a remedy in simple dyspepsia, and in the debility of convalescence, especially when the alimentary canal is left enfeebled. Hence, it is often prescribed in the declining stages of remittent fever, dysentery, diarrhœa, cholera morbus, and cholera infantum. The absence of irritating properties renders it also an appropriate tonic in the hectic fever of phthisis, and kindred affections. It has been highly recommended in vomiting, unconnected with inflammation of the stomach, as in the sickness of pregnant women. It is frequently administered in combination with other tonics, aromatics, mild cathartics, and antacids. A favorite remedy of Dr. Geo. B. Wood for the permanent cure of a disposition to the accumulation of flatus in the bowels, was an infusion made with half an ounce of columbo, half an ounce of ginger, a drachm of senna, and a pint of boiling water, and given in the dose of a wineglassful three times a day. Columbo is much used by the natives of Mozambique in dysentery and other diseases. (*Berry.*) It was first introduced to the notice of the profession in Europe by François Redi, in the year 1685. It is most commonly prescribed in the state of infusion. (See *Infusum Calumbæ.*) The dose of the powder is from ten to thirty grains (0·65–1·95 Gm.), and may be repeated three or four times a day. It is frequently combined with powdered ginger, subcarbonate of iron, and rhubarb.

Off. Prep. Extractum Calumbæ, *Br.;* Extract. Calumbæ Fluidum, *U. S.;* Infusum Calumbæ; Mistura Ferri Aromatica, *Br.;* Tinctura Calumbæ.

CALX. *U. S., Br.* *Lime.*

Ca O; 56. (CĂLX.) Ca, O; 28.

"An alkaline earth, CaO, with some impurities, obtained by calcining chalk or limestone so as to expel carbonic acid." *Br.*

Calcaria Usta, *P.G.;* Calcaria, Calx Viva, Calx Usta, Oxydum Calcicum; Burned Lime; Quicklime; Chaux, Chaux vive, *Fr.;* Kalk, Gebrannter Kalk, *G.;* Calce, *It.;* Calviva, *Sp.*

Lime, which is ranked among the alkaline earths, is a very important pharmaceutical agent, and forms the principal ingredient in several standard preparations. It is a very abundant natural production. It is never found pure, but mostly combined with acids; as with carbonic acid in chalk, marble, calcareous spar, limestone, and shells; with sulphuric acid in the different kinds of gypsum, with phosphoric acid in the bones of animals; and with silica in a great variety of minerals.

Preparation. Lime is prepared by calcining, by a strong heat, some form of the native carbonate. The carbonic acid is thus expelled, and the lime remains. When the lime is intended for nice chemical operations, it should be obtained from pure white marble or oyster shells. For the purpose of the arts it is procured from common limestone, by calcining it in kilns of peculiar construction. When obtained in this way it is generally impure, being of a grayish color, and containing alumina, silica, sesquioxide of iron, and occasionally a little magnesia and oxide of manganese.

The officinal lime of the United States and British Pharmacopœias is the lime of commerce, and therefore impure. It may be obtained purer by exposing pure white marble, broken into small fragments, in a covered crucible, to a full red heat for three hours, or till the residuum, when slaked and suspended in water, no longer effervesces on the addition of hydrochloric acid.

Properties. Lime is in "hard, white or grayish white masses, gradually attracting moisture and carbonic acid gas on exposure to air and falling to a white powder, odorless, having a sharp, caustic taste and an alkaline reaction. Soluble in 750 parts of water at 15° C. (59° F.) and in 1300 parts of boiling water; insoluble in alcohol. When heated to a white heat, lime is neither fused nor altered. Brought in contact with about half its weight of water, it absorbs the latter, becomes heated and is gradually converted into a white powder (slaked lime). Lime mixed with water to a thin milk, should be dissolved by nitric acid with but little effervescence (limit of carbonate), and without leaving more than a slight residue of insoluble matter. Lime should be preserved in well-closed vessels, in a dry place. Distilled water agitated with slaked lime should give the reactions mentioned under *Liquor Calcis.*" *U. S.*

Lime is the oxide of calcium, and consists of one atom of calcium 40, and one of oxygen 16. Its sp. gr. is 3·08, whilst the hydrate has the sp. gr. 2·078. (*Filhol.*) Its solubility in water is greatly increased by the addition of sugar or glycerin. (See *Syrupus Calcis.*) It is distinguished from the other alkaline earths by forming a very deliquescent salt (*chloride of calcium*) by reaction with hydrochloric acid, and a sparingly soluble one with sulphuric acid. All acids, acidulous, ammoniacal, and metallic salts, borates, alkaline carbonates, and astringent vegetable infusions are incompatible with it.

Medical Properties. Lime acts externally as an escharotic, and was formerly applied to ill-conditioned ulcers. The *lime ointment* of Spender is made by incorporating four parts of washed slaked lime with one part of fresh lard and three parts of olive oil, previously warmed together. Mixed with potassa, lime forms an officinal caustic. (See *Potassa cum Calce.*) As an internal remedy, it is always administered in solution. (See *Liquor Calcis.*)

Pharm. Uses. Liquor Potassæ, *U. S.;* Liquor Sodæ, *U. S.*

Off. Prep. Calcis Hydras, *Br.;* Liquor Calcis, *U. S.;* Potassa cum Calce, *U. S.;* Syrupus Calcis, *U. S.*

CALX CHLORATA. *U. S., Br.* *Chlorinated Lime.*

(CĂLX ȻHLỌ-RĀ'TẠ.)

Calx Chlorinata, *Pharm.* 1870. Chloride of Lime. "A compound resulting from the action of Chlorine upon Hydrate of Calcium, and containing at least 25 per cent. of available Chlorine." *U. S.* "A product obtained by exposing slaked lime to the action of chlorine gas so long as the latter is absorbed." *Br.*

"Chloride of Lime should be preserved in well-closed vessels, in a cool and dry place." *U. S.*

Hypochlorite of Lime or Calcium, Oxymuriate of Lime or Calcium, Bleaching Powder; Calcaria Chlorata, *P.G.;* Chloris Calcicus, Chloruretum Calcis, Calcis Chloridum, Calcii Hypochloris, *Lat.;* Chlorure de Chaux, Poudre de Tennant ou de Knox, *Fr.;* Chlorkalk, Bleichkalk, *G.;* Cloruro di Calce, *It.*

This compound was originally prepared and brought into notice as a bleaching agent, in 1798, by Tennant, of Glasgow. Subsequently it was found to have valuable properties as a medicine and disinfectant; and, accordingly, it has been introduced into the United States and British Pharmacopœias.

The following is an outline of the process for preparing chlorinated lime on the large scale. A rectangular chamber is constructed, generally of silicious sandstone, the joints being secured by a cement of pitch, rosin, and dry gypsum. At one end it is furnished with an air-tight door, and on each side with a glass window, to enable the operator to inspect the process during its progress. The slaked or hydrated lime is sifted, and placed on wooden trays eight or ten feet long, two broad, and one inch deep. These are piled within the chamber to a height of five or six feet on cross-bars, by which they are kept about an inch asunder, in order to favor the circulation of the gas over the lime. The chlorine is generated in a leaden vessel nearly spherical, the lower portion of which is surrounded with an iron case, leaving an interstice two inches wide, intended to receive the steam for the purpose of producing the requisite heat. In the leaden vessel are five apertures. The first is in the centre of the top, and receives a tube which descends nearly to the bottom, and through which a vertical stirrer passes, intended to mix the materials, and furnished, at the lower end, with horizontal cross-bars of iron, or of wood sheathed with lead. The second is for the introduction of the common salt and manganese. The third admits a siphon-shaped funnel, through which the sulphuric acid is introduced. The fourth is connected with a pipe to lead off the chlorine. The fifth, which is near the bottom, receives a discharge-pipe, passing through the iron case, and intended for drawing off the residuum of the operation. The pipe leading off the chlorine terminates, under water, in a leaden chest or cylinder, where the gas is washed from hydrochloric acid. From this intermediate vessel the chlorine finally passes, by means of a pretty large leaden pipe, through the ceiling of the chamber containing the lime. The process of impregnation generally lasts four days, this time being necessary to form a good bleaching powder. If it be hastened, heat will be generated, which will favor the production of chloride of calcium, with a proportional diminution of chloride of lime.

The proportions of the materials generally adopted are 10 cwt. of common salt, mixed with from 10 to 14 cwt. of manganese dioxide: to which are added, in successive portions, from 12 to 14 cwt. of strong sulphuric acid, diluted before being used until its sp. gr. is about 1·65, which is accomplished by adding about one-third of its weight of water. In factories in which sulphuric acid is also made, the acid intended for this process is brought to the sp. gr. 1·65 only, whereby the expense of further concentration is saved.

Properties. Chlorinated lime is "a white or grayish white, dry, or but slightly damp powder, or friable lumps, becoming moist and gradually decomposing on exposure to air, having a feeble, chlorine-like odor, and a disagreeable, saline taste. It is partially soluble in water and in alcohol. On dissolving Chlorinated Lime in diluted hydrochloric acid, chlorine gas is given off, and there should not remain more than a trifling amount of insoluble matter. Its solution in diluted acetic acid yields, with test-solution of oxalate of ammonium, a white precipitate soluble in hydrochloric acid. The aqueous solution quickly destroys the color of a dilute solution of litmus or of indigo." *U. S.* When perfectly saturated with chlorine it dissolves almost entirely in water. When exposed to heat, it gives off oxygen, and some chlorine, and is converted into chloride of calcium. It is incompatible with the mineral acids, carbonic acids, and the alkaline carbonates. The acids evolve chlorine copiously, and the alkaline carbonates cause a precipitate of carbonate of calcium. (See *Liquor Sodæ Chlorinatæ.*)*

Chlorinated lime is an oxidizing agent, the oxygen being derived from water, the hydrogen of which unites with the chlorine to form hydrochloric acid. It has a powerful action on organic matter, converting sugar, starch, cotton, linen, and similar substances into formic acid, which unites with the lime. (*W. Bastick.*) It also acts energetically on the volatile oils, including oil of turpentine, producing chloroform. (J. Chautart, *Journ. de Pharm.*, Mars, 1855.)

Composition. The composition of bleaching powder is represented by the formula $CaOCl_2$, and it was formerly supposed to be a direct compound of lime with chlorine. This view, however, is not consistent with its reactions, for when distilled with dilute nitric acid it readily yields a distillate of aqueous hypochlorous acid, and when treated with water it is resolved into chloride and hypochlorite of calcium, the latter of which may be separated in crystals by exposing the filtered solution to a freezing mixture, or by evaporating it in a vacuum over oil of vitriol, and leaving the dense frozen mass to thaw upon a filter. A solution of calcium chloride mixed with hypochlorite then passes through, and feathery crystals remain on the filter, very unstable, but consisting, when recently prepared, of hydrated calcium hypochlorite, $Ca(OCl)_2 4H_2O$. These results seem at first sight to show that the bleaching powder is a mixture of chloride and hypochlorite of calcium, formed according to the equation $2CaO + Cl_4 = CaCl_2 + Ca(ClO)_2$; but if this were its true constitution, the powder when digested with alcohol ought to yield a solution of calcium chloride containing half the chlorine of the original compound, which is not the case. Its constitution is, therefore, better represented by the formula $Ca\left\{\begin{matrix}Cl\\OCl\end{matrix}\right.$, suggested by Dr. Odling, this molecule being decomposed by water into chloride and hypochlorite in the manner just explained, and yielding with dilute nitric acid or sulphuric acid a distillate containing hydrochloric and hypochlorous acids, $CaCl(OCl) + 2HNO_3 = Ca(NO_3)_2 + HCl + HClO$. (*Fowne*, 12th ed., p. 337.)

These results have also been confirmed recently by Lunge (*A. J. P.*, Dec. 1881, p. 608.)

Impurities and Tests. Chlorinated lime may contain a great excess of lime, from imperfect impregnation with the gas. This defect will be shown by the large proportion insoluble in water. If it contain much chloride of calcium, it will be quite moist, which is always a sign of inferior quality. When long and insecurely kept, it deteriorates from the gradual formation of chloride of calcium and carbonate of calcium. Several methods have been proposed for determining its bleaching power, which depends solely on the proportion of loosely combined chlorine. Walter proposed to add a solution of the bleaching powder to a standard solution of sulphate of indigo, in order to ascertain its decolorizing power; but the objection to this test is that the indigo of commerce is very variable in its amount of coloring matter. Dalton recommended, as a test, to add a solution of the bleaching powder to one of the sulphate of iron, slightly acidulated with hydrochloric or sulphuric acid, until the odor of chlorine is perceived. According to Wittstein and Claude, the test of sulphate of iron, which was formerly officinal, is not reliable. The present volumetric method, which is based upon that of the British Pharmacopœia, is preferred. "If 0·71 Gm. of Chlorinated Lime be mixed with a solution of 1·25 Gm. of iodide of potassium in 120 C.c. of water, and 9 Gm. of diluted hydrochloric acid be then added, the red-brown liquid should require for complete decoloration not less than 50 C.c. of the volumetric solution of hyposulphite of sodium." *U. S.*

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* Chlorinated lime is constantly becoming weaker on exposure, giving off chlorine or hypochlorous acid, probably through the influence of the atmospheric carbonic acid, which sets them free by combining with the lime. But it would seem that, even when closely confined, it sometimes at least gives off gaseous matter, as we have an account of a well-stopped bottle containing it having been broken by a violent explosion, without any peculiar exposure to heat. (See *A. J. P.*, 1861, p. 72.) M. Barreswil has found that the subjection of chlorinated lime to strong pressure greatly diminishes the tendency to decomposition. It is rendered in this way as hard as a stone, and may be kept long without undergoing change. (*Chem. News*, No. 58, p. 33.)

Under the following conditions, it is stated by C. Schrader that good chlorinated lime may be prepared which will long retain its strength. 1. The lime used must be free from iron and alumina; but the hydrate may contain from 6 to 12 per cent. of moisture without injury. 2. The chlorine must be brought slowly in contact with the hydrate. 3. When the hydrate of lime is oversaturated with chlorine, decomposition speedily ensues. Hence the hydrate and the hydrochloric acid employed must be in due proportion, to be determined by practice. 4. To insure complete saturation, there should be free chlorine in the apparatus at the close of the process. By attending to these precautions, it is said that a product may be obtained, with from 33 to 35 per cent. of chlorine, and losing its strength only at the rate of 3 or 4 per cent. a year. (*Ibid.*, 1863, p. 78.)

The following is the test given in the British Pharmacopœia. "Ten grains mixed with thirty grains of iodide of potassium, and dissolved in four fluidounces of water, produce, when acidulated with two fluidrachms of hydrochloric acid, a reddish solution, which requires for the discharge of its color at least 850 grain-measures of the volumetric solution of hyposulphite of soda, corresponding to 30 per cent. of chlorine liberated by hydrochloric acid." In this process iodine is separated by the chlorine in equivalent quantity, and imparts color to the liquid, which is removed by the hyposulphite of sodium, by forming colorless compounds with the iodine; and the quantity required for this purpose measures the quantity of iodine, and consequently that of the chlorine present in the chlorinated solution. (See *Sodii Hyposulphis.*)

Medical Properties and Uses. Chlorinated lime, externally applied, is a desiccant and disinfectant, and has been used with advantage in solution, as an application to ill-conditioned ulcers, burns, chilblains, and cutaneous eruptions, especially itch; as a gargle in putrid sore throat; and as a wash for the mouth to disinfect the breath, and for ulcerated gums. Internally, it is stimulant and alterative. It has been used to some extent internally, in adynamic dysentery, typhus fever, and various other low diseases: it may be considered as therapeutically equivalent to chlorine. The dose internally is from three to six grains (0·2–0·4 Gm.), dissolved in one or two fluidounces (30–60 C.c.) of water, filtered and sweetened with syrup. It should never be given in pills. As it occurs of variable quality, and must be used in solution more or less dilute, according to the particular purpose to which it is to be applied, it is impossible to give any very precise directions for its strength as an external remedy. From one to four drachms of the powder added to a pint of water, and the solution filtered, will form a liquid within the limits of strength ordinarily required. For the cure of itch, M. Derheims has recommended a much stronger solution—three ounces of the chloride to a pint of water, the solution being filtered, and applied several times a day as a lotion, or constantly by wet cloths. When applied to ulcers, their surface may be covered with lint dipped in the solution. When used as an ointment, to be rubbed upon scrofulous enlargements of the lymphatic glands, this may be made of a drachm of the chloride to an ounce of lard. Chlorinated lime is less eligible for some purposes than the solution of chlorinated soda. (See *Liquor Sodæ Chlorinatæ.*)

In consequence of its powers as a disinfectant, chlorinated lime is a very important compound in its application to medical police. It possesses the property of preventing or arresting animal and vegetable putrefaction, and, perhaps, of destroying pestilential and infectious miasms. It may be used with advantage for preserving bodies from exhaling an unpleasant odor, before interment, in the summer season. In juridical exhumations its use is indispensable; as it effectually removes the disgusting and insupportable fetor of the corpse. The mode in which it is applied, in these cases, is to envelop the body with a sheet completely wet with a solution, made by adding about a pound of the chloride to a bucketful of water. It is employed also for disinfecting dissecting rooms, privies, common sewers, docks, and other places with offensive effluvia. In destroying contagion and infection, it appears to be highly useful; and hospitals, almshouses, jails, ships, etc., may be purified by it. In short, all places deemed infectious from having been the receptacle of disease, may be more or less disinfected by its use, after having undergone thorough cleansing. It should be carefully kept from contact with the air and organic substances, which cause rapid loss of chlorine, and the modern method of putting it up for ordinary use in hermetically sealed pasteboard boxes is a great convenience.

Chlorinated lime acts exclusively by its chlorine, which, being loosely combined, is disengaged by the slightest affinities. All acids, even the carbonic, disengage it; and, as this acid is a product of animal and vegetable decomposition, noxious effluvia furnish the means, to a certain extent, of their own disinfection. But the stronger acids disengage the chlorine far more readily, and among these, sulphuric acid is the most convenient. Accordingly, the powder may be dissolved in a very dilute solution of this acid; or a small quantity of the acid may be added to an aqueous solution ready formed, if a more copious evolution of chlorine be desired than that which takes place from the mere action of the carbonic acid of the atmosphere.

Chlorinated lime may be advantageously applied to the purpose of purifying offensive water, a property which makes it invaluable on long voyages. When used for this purpose, from one to two ounces of the chloride may be mixed with about sixty-five gallons of the water. The water must afterwards be exposed for some time to the air, and allowed to settle, before it is fit to drink.

Strong insecticide properties have been ascribed to chlorinated lime. Hence it is recommended to sprinkle it on vegetables, flowers, fruit-trees, etc., which are apt to be attacked by worms and insects.

Off. Prep. Chloroformum, *Br.;* Liquor Calcis Chloratæ, *Br.;* Liquor Sodæ Chloratæ, *U. S.;* Vapor Chlori, *Br.*

CALX SULPHURATA. *U. S.* *Sulphurated Lime.*

(CĂLX SŬL-PHŮ-RĀ'TẠ.)

"A mixture (commonly misnamed Sulphide of Calcium) consisting chiefly of Sulphide of Calcium [**CaS**; **72.**—CaS; 36] and Sulphate of Calcium [**$CaSO_4$**; **136.**—CaO,SO_3; 68], in varying proportions, but containing not less than 36 per cent. of absolute Sulphide of Calcium." *U. S.*

"Lime, in very fine powder, *one hundred parts;* Precipitated Sulphur, *ninety parts.* Mix the Lime and Sulphur intimately, pack the mixture with gentle pressure in a crucible so as to nearly fill it, and having luted down the cover, expose the crucible for one hour to a low red heat, by means of a charcoal fire so arranged that the upper part of the crucible shall be heated first. Then remove the crucible, allow it to cool, rub its contents to powder, and at once transfer the latter to small, glass-stoppered vials." *U. S.*

It may also be made by decomposing a mixture of three parts of sulphate of calcium and one part of charcoal, heated in a crucible to a red heat; carbonic oxide is formed, which combines with the oxygen of calcium sulphate, and calcium sulphide is produced, $CaSO_4 + 4CO = CaS + 4CO_2$. A less convenient method is to pass sulphuretted hydrogen over red hot lime, although if the lime be pure a better product is insured. This preparation, which is introduced in the U. S. Pharmacopœia for the first time, is of doubtful utility, particularly in the form in which it is produced when made by the officinal process. The amount of sulphide of calcium present must vary considerably according to circumstances. The medicinal activity is alone measured by the quantity of sulphide in the finished preparation, sulphate of calcium, the other constituent, being inert. It is to be regretted that a method of purification was not appended.

Properties. Sulphurated lime is "a grayish white or yellowish white powder, gradually altered by exposure to air, exhaling a faint odor of hydrosulphuric acid, having an offensive, alkaline taste and an alkaline reaction. Very slightly soluble in water and insoluble in alcohol. On dissolving Sulphurated Lime with the aid of acetic acid, hydrosulphuric acid is abundantly given off, and a white precipitate (sulphate of calcium) is thrown down. The filtrate yields, with test-solution of oxalate of ammonium, a white precipitate soluble in hydrochloric, but insoluble in acetic acid." *U. S.*

Test. "If 1 Gm. of Sulphurated Lime be gradually added to a boiling solution of 1·25 Gm. of sulphate of copper in 50 C.c. of water, the mixture digested on a water-bath for fifteen minutes, and filtered when cold, no color should be imparted to the filtrate by 1 drop of test-solution of ferrocyanide of potassium (presence of at least 36 per cent. of real sulphide of calcium)." *U. S.*

Sulphydrate of calcium is formed when sulphuretted hydrogen is passed into milk of lime as long as it is absorbed. It is in the form of a paste of a greenish gray color, and exhales a strong odor of sulphuretted hydrogen.

Medical Properties. It is used as a *depilatory*, and is applied in a layer on the part which is to be deprived of hair. At the end of fifteen minutes it is removed with a wet sponge, which at the same time detaches the hairs. On account of this preparation giving out sulphuretted hydrogen, it should not be applied near the mouth or nose. An impure aqueous solution of sulphide of calcium, necessarily containing hyposulphite of calcium from the manner of its preparation, is used with great success, in Belgium, in itch, the cure of which it effects in a few hours. It is made by boiling together one part of sublimed sulphur, two of lime, and ten of water. The liquid is allowed to cool, and the clear part poured off, and kept in well-stopped bottles. For an explanation of the reaction which takes place, see *Sulphur Præcipitatum.* The patient, after having been well washed with soap and tepid water in a bath, is rubbed over with the liquid, which is allowed to dry on the skin for a quarter of an hour. A second bath is then taken, which completes the cure. The preparation, when it dries, leaves on the skin a thin layer of the sulphur compound, which destroys the itch insect and its eggs. *Sulphide of calcium* has been strongly recommended by Ringer, Duhring, and other authorities as a remedy for furuncular eruptions. It is given in doses of from one-tenth to one-half grain.

CAMBOGIA. *U. S., Br.* *Gamboge.*

(CĂM-BŌ'ĢI-A.)

"A gum-resin obtained from Garcinia Hanburii. Hooker filius. (*Nat. Ord.* Guttiferæ.)" *U. S.* "A gum-resin obtained from Garcinia Morella (*Desrous.*), *var.* pedicellata." *Br.*

Gambogia, *Pharm.* 1870; Gomme gutte, *Fr.;* Gummigutt, *G.;* Gomma-gotta, *It.;* Gutta gamba, *Sp.*

Several plants belonging to the natural family of Guttiferæ, growing in the equatorial regions, yield on incision a yellow opaque juice, which hardens on exposure, and bears a close resemblance to gamboge; but it is only from a particular tree, growing in Siam, that the officinal gum-resin is procured.* Formerly the United States and all the British Pharmacopœias ascribed it to *Stalagmitis Cambogioides.* This genus and species were established by Murray, of Göttingen, in 1788, from dried specimens belonging to König, procured in Ceylon; and, from information derived from the same source, it was conjectured by Murray that the tree yielded not only the gamboge of Ceylon, but that also collected in Siam. On this authority the British Colleges made the references alluded to. But it was ascertained by Dr. Graham, of Edinburgh, that there is no such plant as *Stalagmitis Cambogioides;* the description of Murray having been drawn up from accidentally conjoined specimens of two trees belonging to different genera; one being the *Xanthochymus ovalifolius* of Roxburgh, and the other, the *Hebradendron Cambogioides* of Graham. By several botanists the gum-resin has been ascribed to *Garcinia Cambogia,* also a tree of Ceylon belonging to the Guttiferæ, and yielding a yellowish concrete juice; but a specimen of this juice, sent to Edinburgh, was found by Dr. Christison to differ from gamboge both in composition and appearance, being of a pale lemon-yellow color. Thus it appears that neither of these references is correct; and, besides, the fact seems to have been overlooked that commercial gamboge is never obtained from Ceylon, but exclusively from Siam and Cochin-China. A gum-resin from Ceylon having been found similar in composition to the gamboge of commerce, and the tree which produced it having been referred by Dr. Graham to a new genus, and named by him

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* According to observations of Messrs. Baildon and Jamie, gamboge is obtained exclusively from the province of Cambodia; the plant being found in no other part of Siam or in Cochin-China. (*Journ. de Pharm.,* Juillet, 1874, p. 65.)

Hebradendron Cambogioides, the Edinburgh College, in the last edition of its Pharmacopœia, was induced to adopt this Ceylon gamboge as officinal, and to recognize the name proposed by Dr. Graham for the tree producing it. But, as this variety is never found in western commerce, and exists only in cabinets, or the bazaars of India, it scarcely merited a place in an officinal catalogue; moreover the genus Hebradendron is not acknowledged by botanists. The *H. Cambogioides* is the *Garcinia pictoria* of Roxburgh (*Flor. Ind.*, ii. 627), which Sir Joseph Hooker considers to be a variety of the *G. Morella* (Desrous.); though Beddome keeps it distinct on account of its having the fertile flower bearing "the staminodes in bundles, and the stigma very small and 4-lobed." Several years since, Dr. Christison received from Singapore specimens of the gamboge plant cultivated in that island, and derived from Siam, which proved to be a Garcinia, differing from the *G. elliptica* of Wallich chiefly in having its male flower upon pedicels. More recently Mr. Hanbury obtained from the same source numerous specimens of the same plant, and was enabled to confirm the statement of Dr. Christison; but he also found that the plant approached very near to the *Garcinia Morella* of Desrousseaux, from which it could be distinguished only by its pedicellate flowers. These specimens were afterwards submitted to the inspection of Mr. Thwaites in Ceylon, who is perfectly familiar with the Garcinias of that island, and were pronounced by him to belong to a variety of *G. Morella*, scarcely differing from the Ceylon plant, except in having pedicelled instead of sessile flowers. Hence, in the existing editions of the British Pharmacopœias, the true Siam gamboge plant is recognized as the *Garcinia Morella*, var. *pedicellata;* while the Ceylon product, which never enters English or American commerce, must be derived from the other variety, having sessile flowers, and hence designated as *Garcinia Morella*, var. *sessile.* Sir Joseph Hooker, however, after a careful examination of the subject, concludes (*Journ. Linn. Soc.*, xiv. 485) that the var. *pedicellata* is a distinct species, differing from *G. Morella* not only in having its flowers pedicellate, but also its leaves more ovate and much larger, and its fruit larger, and has consequently given it a specific name, selecting very properly that of the late Mr. Hanbury to commemorate his contributions to pharmaceutical science, and his connection with the history of the present plant.

Gamboge is said to be procured in Siam by breaking off the leaves and shoots of the tree, the juice, which is contained in ducts or latex vessels in the bark, issuing in drops, and, being received in suitable vessels, it gradually thickens, and at length becomes solid. Dr. Jamie, of Singapore, states that incising the trunk and larger branches is often practised. The juice is frequently received into the hollow joints of the bamboo, and the water expelled by mild continuous heat. In this way the so-called pipe gamboge is formed, the contraction during drying causing the cylinders to be hollow. The name *gummi gutta*, by which it is generally known on the continent of Europe, probably originated from the circumstance that the juice escapes from the plant by drops. The officinal title was undoubtedly derived from the province of Cambodia, in which the gum-resin is collected. It was first brought to Europe by the Dutch about the middle of the seventeenth century. We import gamboge from Canton and Calcutta, whither it is carried by the native or resident merchants. There is no difference in the appearance or character of the drug as brought from these two ports; an evidence that it is originally derived from the same place.

Varieties. The best gamboge is in cylindrical rolls, from one to three inches in diameter, sometimes hollow in the centre, sometimes flattened, often folded double, or agglutinated in masses so that the original form is not always easily distinguishable. The pieces sometimes appear as if rolled, but are in general striated longitudinally from the impression made by the inner surface of the bamboo. They are externally of a dull orange color, which is occasionally displaced by greenish stains, or concealed by the bright yellow powder of the drug, slightly adhering to the surface. In this form the drug is sometimes called *pipe gamboge.* Another variety is imported under the name of *cake* or *lump gamboge.* It is in irregular masses of two or three pounds or more, often mixed with sticks and other impurities, containing many air cells, less dense, less uniform in texture, and less brittle than the former variety, and breaking with a dull and splintery instead of a shining and conchoidal fracture. The worst specimens of this variety, as well as of the cylindrical, are sometimes called by the druggists *coarse gamboge.* They differ, however, from the preceding, only in containing a greater amount of impurities. Indeed, it would appear, from the experiments of Christison, that all the commercial varieties of this drug have a common origin, and that cake or lump gamboge differs from the cylindrical, only in the circumstance that the latter is the pure concrete juice; while to the former, farinaceous matter and other impurities have been added for the purpose of adulteration. The inferior kinds of gamboge may be known by their greater hardness and coarser fracture; by the brownish or grayish color of their broken surface, which is often marked with black spots; by their obvious impurities; and by the green color which their decoction, after having been cooled, gives with tincture of iodine. When pure, the gum-resin is completely dissolved by the successive action of ether and water.*

Properties. The officinal description is as follows. "In cylindrical pieces, sometimes hollow in the centre, one to two inches (25 to 50 mm.) in diameter, longitudinally striate on the surface; fracture flattish-conchoidal, smooth, of a waxy lustre; orange red, or in powder, bright yellow; inodorous; taste very acrid; the powder sternutatory. Gamboge is partly soluble in alcohol and in ether; when triturated with water, it yields a yellow emulsion, and forms, with solution of potassa, an orange red solution, from which, on the addition of hydrochloric acid, yellow resin is precipitated. Boiled with water, Gamboge yields a liquid which, after cooling, does not become green with test-solution of iodine (abs. of starch)." *U. S.* From the brilliancy of its color, gamboge is highly esteemed as a pigment. It has no smell and little taste; but, after remaining a short time in the mouth, produces an acrid sensation in the fauces. Its sp. gr. is 1·221. Exposed to heat, it burns with a white flame, emitting much smoke, and leaving a light spongy charcoal. It is a gum-resin, without volatile oil. Christison has shown that the proportion of gum and resin varies in different specimens even of the purest drug. In one experiment, out of 100·8 parts he obtained 74·2 of resin, 21·8 of gum, and 4·8 of water. The gum is quite soluble in water, and of the variety denominated arabin. Flückiger, however, says that the gum is not identical with gum arabic, as its solution does not redden litmus, and is not precipitated by neutral acetate of lead, nor by ferric chloride, nor by silicate or biborate of sodium. By fusing purified gamboge resin with potash, Hlasiwetz and Barth (*Ann. Ch. und Pharm.*, 138, p. 61) obtained acetic and other acids of the same series, together with *phloroglucin*, $C_6H_3(OH)_3$, *pyrotartaric acid*, $C_5H_8O_4$, and *isuvitinic acid*, $C_6H_3,CH_3(COOH)_2$. Gamboge is readily and entirely diffusible in water, forming a yellow opaque emulsion, from which the resin is very slowly deposited. It yields its resinous ingredient to alcohol, forming a golden yellow tincture, which is rendered opaque and bright yellow by the addition of water. Its solution in ammoniated alcohol is not disturbed by water. Ether dissolves about four-fifths of it, taking up only the resin. It is wholly taken up by alkaline solutions, from which it is partially precipitated by the acids. The strong acids dissolve it; the solution when diluted deposits a yellow sediment. The color, acrimony, and medicinal power of gamboge are thought to reside in the resin.

Medical Properties and Uses. Gamboge is a powerful, drastic, hydragogue cathartic, so very apt to produce nausea and vomiting and much griping when given in the full dose that it is almost never employed except in combination with other cathartics. In large quantities it is capable of causing fatal effects, and death has resulted from a drachm. The full dose is from two to six grains (0·13–0·4 Gm.), which in cases of tænia has been raised to ten or fifteen grains. It may be given in pill or emulsion, or dissolved in an alkaline solution. In the dose of five grains the resin is said to produce copious watery stools, with little or no uneasiness. If this be the case, it is probable that, as it exists in the gum-resin, its purgative property is somewhat modified by the other ingredients.

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* *Ceylon gamboge,* derived from the *Hebradendron Cambogioides* of Graham (*Cambogia gutta,* Linn., *Garcinia Morella,* De Cand., *G. pictoria,* Roxb.), is procured by incisions, or by cutting away a portion of the bark, and scraping off the juice which exudes. The specimens sent to Dr. Christison were in flattish or round masses, eight or nine inches in diameter, apparently composed of aggregated irregular tears, with cavities which are lined with a grayish and brownish powdery incrustation. It resembled coarse gamboge, and was identical in composition. In Ceylon it is used as a pigment and purgative. (*Christison.*)

Off. Prep. Pilulæ Catharticæ Compositæ, *U. S.;* Pilula Cambogiæ Comp., *Br.*

CAMPHORA. *U. S., Br.* *Camphor.*

$C_{10}H_{16}O$; 152. (CĂM'PHỌ-RẠ.) $C_{20}H_{16}O_2$; 152.

"A stearopten derived from Cinnamomum Camphora, F. Nees et Ebermaier (*Nat. Ord.* Lauraceæ), and purified by sublimation." *U. S.* "A concrete volatile oil, obtained from the wood of Camphora officinarum; imported in the crude state from China and Japan, and purified by sublimation." *Br.*

Camphre, *Fr.;* Kampher, Kampfer, *G.;* Canfora, *It.;* Alcanfor, *Sp.*

The name of camphor has been applied to various concrete, white, odorous, volatile products, found in different aromatic plants, and resulting probably from chemical change in their volatile oil. But commercial camphor is derived exclusively from two plants, the *Camphora officinarum* of Nees or *Laurus Camphora* of Linnæus, and the *Dryobalanops Camphora;* the former of which yields our officinal camphor, the latter a product much valued in the East, but unknown in the commerce of this country and of Europe. A considerable quantity of camphor, said to be identical with the officinal, was a few years since obtained upon the Tenasserim Coast, in Farther India, by subliming the tops of an annual plant, abundant in that region, and thought to be a species of Blumia. This product, however, does not occur in general commerce. (*A. J. P.*, xvi. 56.) The Rev. Mr. Mason, an American missionary in Burmah, states that the Chinese settlers informed him that the same plant abounds in China, and that camphor is procured from it there. (*Proc. Acad. Nat. Sci. Phila.*, 1851, p. 201.) The following observations apply to the officinal camphor.

Gen. Ch. For characters of genus Cinnamon, see *Cinnamomum.* The genus Camphora as separated by Nees departs from the characters there given, in the segments of the perianth being completely deciduous, and falling off completely, leaving the berry resting upon the somewhat enlarged cup-shaped or disk-shaped, entire, or slightly serrate base or tube.

Camphora officinarum. Nees, *Laurin.* 88; Carson, *Illust. of Med. Bot.* ii. 29, pl. xxiv.—*Laurus Camphora.* Willd. *Sp. Plant.* ii. 478.—*Cinnamomum Camphora. B. & T.* 222. The camphor-tree is an evergreen of considerable size, having the aspect of the linden, with a trunk straight below, but divided above into many branches, which are covered with a smooth, greenish bark. Its leaves, which stand alternately upon long footstalks, are ovate-lanceolate, entire, smooth and shining, ribbed, of a bright yellowish green color on their upper surface, paler on the under, and two or three inches in length. The flowers are small, white, pedicelled, and collected in clusters, which are supported by long axillary peduncles. The fruit is a red berry, resembling that of the cinnamon. The tree is a native of China, Japan, and other parts of eastern Asia. It has been introduced into the botanical gardens of Europe, and is occasionally met with in our own conservatories.*

The leaves have when bruised the odor of camphor, which is diffused through all parts of the plant, and is obtained from the root, trunk, and branches by sublimation. The process is not precisely the same in all places. The following is said to be the one pursued in Japan. The parts mentioned, particularly the roots and smaller branches, are cut into chips, which are placed with a little water in large iron vessels, surmounted by earthen capitals, furnished with a lining of rice-straw. A moderate heat is then applied, and the camphor, volatilized by the steam, rises into the capital, where it is condensed upon the straw. In China the comminuted plant is said to be first boiled with water until the camphor adheres to the stick used

* The camphor-tree sometimes attains a great age and an enormous size. A tree seen by Kämpfer, in Japan, in 1691, with a trunk 36 feet in circumference, was in the year 1826 described by Siebold as having a circumference of 50 feet. (*Japan as it was and is*, by R. Hildreth. Boston, 1855, p. 337.) Dr. Geo. B. Wood saw a large tree growing in the open air at Naples, and had no doubt that it might be readily and perhaps profitably cultivated in the southern parts of our own country, and especially in California.

in stirring, when the strained liquor is allowed to cool; and the camphor which concretes, being alternated with layers of earth, is submitted to sublimation. In the island of Formosa, where the camphor-tree abounds, the chips are heated in a rough still. This is usually composed of a furnace surmounted with a trough or similar rude vessel, which is protected by clay. In this reservoir the chips are placed, with water upon them, and a perforated board luted upon the top; on this are set earthen pots. A fire having been lighted, steam rises through the chips and carries the camphor with it to deposit it in the pots. The crude camphor is taken to the towns in baskets and then put into large vats, with holes in the bottom, through which an oil escapes called *camphor-oil*, much used by the Chinese for medical purposes. It is said that of recent years hydraulic pressure is largely substituted for drainage, and that the camphor, thus drained, is packed in bags and exported. (*P. J. Tr.*, Dec. 1863, p. 280.)

Commercial History. Camphor, in the *crude* state, is brought to this country chiefly from Canton. It comes also from Batavia, Singapore, Calcutta, and frequently from London. All of it is probably derived originally from China and Japan. Two commercial varieties are found in the market. The cheapest and most abundant is the *Chinese camphor*, most of which is produced in the island of Formosa, and thence taken to Canton. It comes in chests lined with lead, each containing about 130 pounds. It is in small grains or granular masses, of a dirty-white color, and frequently mixed with impurities. It has occurred in commerce adulterated with chloride of ammonium. The other variety is variously called *Japan*, *Dutch*, or *tub* camphor, the first name being derived from the place of its origin, the second from the people through whom it was introduced into commerce, and the third from the recipient in which it is often contained. It has usually come from Batavia, to which port it was taken from Japan. Like the former variety, it is in grains or granular masses; but the grains are larger and of a pinkish color, and there are fewer impurities, so that it yields a larger product when refined.

Crude camphor, as brought from the East, is never found in the shop of the apothecary. It must be refined before it can be used for medicinal purposes. The process for refining camphor was first practised in Europe by the Venetians, who probably derived it from the Chinese. It was afterwards transferred to the Dutch, who long enjoyed a monopoly of this business; and it is only within a few years that the process has been generally known. It is now practised largely in this country, and the camphor refined in our domestic establishments is equal to any formerly imported. Crude camphor is mixed with about one-fiftieth of quicklime, and exposed, in an iron vessel placed in a sand-bath, to a gradually increasing heat, by which it is melted, and ultimately converted into vapor, which condenses in a suitable recipient.[*] Refined in this manner, it is usually in the form of large circular cakes, one or two inches thick, slightly convex on one side and concave on the other, and perforated in the centre.

Properties. "In white, translucent masses of a tough consistence and crystalline structure, readily pulverizable in the presence of a little alcohol, ether, or chloroform. It has the sp. gr. 0·990–0·995, melts at 175° C. (347° F.), boils at 205° C. (401° F.), sublimes without residue, and burns with a luminous, smoky flame. It has a penetrating odor, and a pungent taste, dissolves readily in alcohol, ether, chloroform, disulphide of carbon, benzin, fixed and volatile oils, and is sparingly soluble in water." *U. S.* Camphor has a peculiar, strong, penetrating, fragrant odor; and a bitter, pungent taste, with a slight sense of coolness. It is beautifully white and pellucid, somewhat unctuous to the touch, brittle, and yet possessed of a tenacity which renders its reduction to a fine powder very difficult, unless its cohesion be overcome by the addition of a minute proportion of alcohol, ether, chloroform, glycerin, essential or fatty oil, or other volatile liquid for which it has an affinity. It may be obtained in powder by pulverizing with an equal weight of sugar, by precipitating the tincture with water, or by grating and afterwards sifting it,* or better yet, by sublimation. The fracture of camphor is shining, and its texture crystalline. Its sp. gr. varies from 0·9857 to 0·996. When thrown in small fragments upon water, it assumes singular circulatory movements, which cease upon the addition of a drop of oil; and this property has been applied to the detection of grease in liquids, a very small proportion of which is sufficient to prevent the movements. Its volatility is so great that, even at ordinary temperatures, it is wholly dissipated if left exposed to the air. When it is confined in bottles, the vapor condenses on the inner surface, and, in large bottles partially filled, sometimes forms, after long standing, large and beautiful crystals. It melts at 175° C. (347° F.), boils at 204° C. (399·2° F.), and, in close vessels, sublimes unchanged. When allowed to concrete slowly from the state of vapor, it assumes the form of hexagonal plates. It is not altered by air and light. It readily takes fire, burning with a brilliant flame, with much smoke, and without residue. Water triturated with camphor dissolves, according to Berzelius, not more than 1000th part; which, however, is sufficient to impart a decided odor and taste to the solvent. By the intervention of sugar or magnesia, a much larger proportion is dissolved. (See *Aqua Camphoræ.*) Carbonic acid increases the solvent power of water, as also does the spirit of nitrous ether. Ordinary alcohol will take up 75 per cent. of its weight of camphor, which is precipitated upon the addition of water. Berzelius states that 100 parts of alcohol, of the sp. gr. 0·806, dissolve 120 parts at 10° C. (50° F.). It is soluble without change in ether, the volatile and fixed oils, strong acetic acid, and diluted mineral acids, and is extremely soluble in chloroform. Nitric acid on prolonged boiling with camphor oxidizes it into *camphoric acid*, $C_{10}H_{16}O_4$, and *camphoronic acid*, $C_9H_{12}O_5$. Schwanert's *camphresinic acid*, $C_{10}H_{14}O_{12}$, is, according to Kachler, a mixture of these two. Sulphuric acid in the proportion of ten parts to one gives, when heated with camphor, an oil isomeric with camphor, boiling at 200° C. (392° F.), and yielding a solid camphor when distilled repeatedly over solid caustic potash. Sulphuric acid in the proportion of four to one gives with camphor, according to Chautard, a volatile product which he calls *camphrene*, and to which Schwanert gives the formula $C_9H_{14}O$. Kachler (*Ann. Ch. und Pharm.*, 164, p. 90) considers, however, that camphrene is only *phorone* (a condensation product of acetone) with slight impurities. Alcoholic potash solution heated with camphor gives a derivative called *campholic acid*, $C_{10}H_{18}O_2$, a white solid, fusing at 95° C. (203° F.), and boiling at 250° C. (482° F.). Resins unite with it, forming a soft tenacious mass, in which the odor of the camphor is sometimes almost extinguished, and frequently diminished; and a similar softening effect results when it is triturated with the concrete oils.† Exposed to a strong heat, in close vessels, camphor is resolved into carbonic acid gas and hydrocarbons, among which cymol is especially to be recognized.

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[*] We are informed that the process is conducted in the following manner in some of the laboratories of Philadelphia. The vessels in which the camphor is put are of cast-iron, circular, from 12 to 15 inches or more in diameter, and 4 inches deep, with perpendicular sides, and a ledge at top, on which the cover rests. This consists of sheet-iron, with a hole through the centre about an inch in diameter, over which a small hollow cone of sheet-iron is placed loosely. The crude camphor mixed with the lime, the object of which is said to be to combine with the moisture present, which interferes with the due solidification of the camphor vapor, is placed in the iron vessels described, of which from 20 to 50 are arranged in a long sand-bath. Heat is then applied until the camphor melts, after which it is kept as nearly uniform as possible, so that the vaporation may take place regularly, without violent ebullition. The vapor condenses on the lower surface of the lid; and care is taken, by the occasional removal of the iron cone, and clearing of the opening by means of a knife, to allow the escape of any accidental excess of the vapor. They who desire to see minute details as to the mode of refining camphor practised in France, are referred to an article by M. Emile Perret, pharmacian at Moret, in the *Journ de. Pharm. et de Chimie* (Fév. 1868, p. 124).

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* But the powder thus formed is apt to aggregate on keeping. To obviate this it is recommended to rub it up with a minute proportion of carbonate of magnesium, from 10 to 20 grains to the ounce; or, as suggested by the late Mr. Henry F. Fish, of New York, by pouring an alcoholic solution of camphor into water in which carbonate of magnesium is suspended; the proportion employed being 16 ounces of camphor to a drachm of the carbonate, suspended in a gallon of water. The powder is allowed to settle on a filter. (*A. J. P.*, Nov. 1870, p. 506.) Another method of accomplishing the same object, proposed by Mr. John C. Lowd, is to sublime camphor from a retort into a large chamber, and collect the powder. (*Ibid.*, March, 1872, p. 112.)

William F. Simes, of Philadelphia, sublimes camphor on a considerable scale as a preliminary process in making compressed camphor. His apparatus consists of a retort, which is connected with a large cooling chamber, in which are board partitions with openings alternately above and below, for the purpose of compelling the camphor vapor to pass over a circuitous route and come in contact with the cool air, which condenses it in very small particles. These collect upon the bottom and sides, and it forms, after sifting, a very uniform powder.

† As this property of camphor may have a bearing, injuriously or otherwise, on pharmaceutical processes, it is desirable that the operator, as well as prescriber, should be aware of the degree of effect produced by different resinous substances which may be mixed with it. M. Planche has found that mixtures, formed by triturating powdered camphor with powdered *dragon's blood*,

Camphor, $C_{10}H_{16}O$, and borneol, $C_{10}H_{18}O$,* are classified together as belonging to the group called in general *camphors*, and which occur with the *terpenes* or essential oils, $C_{10}H_{16}$, and are to be considered as oxidation products of these latter.

Borneol is an alcohol, yielding compound ethers when heated to about 200° C.

guaiac, *asafetida*, and *galbanum*, assume, and preserve indefinitely the pilular consistence; with *benzoin*, *tolu*, *ammoniac*, and *mastic*, though at first of a pilular consistence, afterwards become soft by exposure to the air; with *sagapenum* and *animé*, assume a permanently semi-liquid form; with *olibanum*, *opopanax*, *gamboge*, *euphorbium*, *bdellium*, *myrrh*, and *amber*, remain pulverulent though somewhat grumous; and with *tacamahac*, *resin of jalap*, *sandarac*, and *resinoid matter of cinchona*, preserve the form of powder indefinitely. The same experimenter observed that camphor loses its odor entirely when mixed with *asafetida*, *galbanum*, *sagapenum*, *animé*, and *tolu*; retains a feeble odor with *dragon's blood*, *olibanum*, *mastic*, *benzoin*, *opopanax*, *tacamahac*, *guaiac*, and *ammoniac*; while with the other resinous substances above mentioned, it either has its odor increased, or retains it without material change. (*Journ. de Pharm.*, xxiv. 226.)

In mixing camphor with other substances in the form of powder, it is best to first pulverize the camphor with the aid of a little alcohol, then to pulverize the other substances together, and lastly to mix the two powders gently; much rubbing with the pestle having the effect of consolidating the granules of the camphor. (*Procter.*)

* *Sumatra Camphor. Borneo Camphor. Dryobalanops Camphor. Borneol.* It has long been known that a variety of camphor is produced in the islands of Sumatra and Borneo, by a forest tree, which remained until a recent period undetermined. It was at length, however, described by Colebrook, and is now recognized in systematic works as *Dryobalanops Camphora*, or *D. aromatica*. It is a very large tree, often exceeding one hundred feet in height, with a trunk six or seven feet in diameter, and ranking among the tallest and largest trees in India.* It is found in Sumatra and Borneo, and is abundant on the north-west coast of the former island. The camphor exists in concrete masses, which occupy longitudinal cavities or fissures in the heart of the tree, from a foot to a foot and a half long, at certain distances apart. The younger trees are generally less productive than the old. The only method of ascertaining whether a tree contains camphor is by incision. A party proceed through the forest, wounding the trees, till they find one which will answer their purpose; and hundreds may be examined before this object is attained. When discovered, the tree is felled and cut into logs, which are then split, and the camphor removed by means of sharp-pointed instruments. It is stated that the masses are sometimes as thick as a man's arm; and that the product of a middling-sized tree is nearly eleven pounds; of a large one double that quantity. The trees which have been wounded and left standing often produce camphor seven or eight years afterwards. Mrs. Ida Pfeiffer states, in her *Second Journey round the World* (Am. ed., p. 183), that the camphor is also found in a concrete state under the bark, and is swept down with long brooms. The Dryobalanops yields also a fragrant straw-colored liquid, called in the East Indies *oil of camphor*, and highly valued as an external application in rheumatism and other painful affections. It is said to be found in trees too young to produce camphor, and is supposed to constitute the first stage in the development of this substance; as it occupies the cavities in the trunk which are afterwards filled with the camphor. It has been stated to hold a large portion of this principle in solution; and to yield an inferior variety by artificial concretion; but this was not true of a specimen in the possession of Dr. Christison. A specimen examined by Professor Procter deposited a small quantity of the camphor at a temperature near the zero of Fahrenheit. By the action of nitric acid, it may be combined with oxygen, and converted into camphor of the same character as that deposited by refrigeration. The whole tree is pervaded more or less by the camphor or the oil. The wood retains a fragrant smell, and, being on this account less liable to the attacks of insects, is highly esteemed for carpenter's work. The camphor-wood chests, occasionally brought to this country from the East Indies, are probably made out of the wood of the Dryobalanops.

It has been supposed that this variety of camphor is occasionally brought into the markets of Europe and America; but this is a mistake; as the whole produce of the islands is engrossed by the Chinese, by whom it is so highly valued that it commands at Canton, according to Mr. Crawford, seventy-eight times, according to Mr. Reeves, one hundred times the price of ordinary camphor. A specimen which was sent to the late Prof. Joseph Carson from Canton as a curiosity, is in tabular plates of the size of a finger nail or smaller, of a foliaceous crystalline texture, white, somewhat translucent, of an odor analogous to that of common camphor, and yet decidedly distinct, and less agreeable. It has also a camphorous taste. It is more compact and brittle than ordinary camphor; and, though the pieces will often float for a time when thrown on water, yet they sink when thoroughly moistened, and deprived of adhering air. According to Dr. Christison, its sp. gr. is 1·009. It is easily pulverized without the addition of alcohol. It is, moreover, much less disposed to rise in vapor, and to condense on the inside of the bottle containing it; indeed, its value in China is largely dependent upon its being less volatile than the ordinary camphor, and hence preferable for embalming purposes. Like ordinary camphor, it is fusible, very slightly soluble in water, and freely soluble in alcohol and in ether. Its formula is $C_{10}H_{18}O$.

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* For a particular description of this tree, see a paper by Dr. W. H. De Vriese, of Leyden, in the *A. J. P.* (xxiv. 329), taken from Hooker's Journal of Botany. In this paper it is stated on the authority of Dr. Junghuhn, who witnessed the process of collection, that the camphor is deposited in very small quantities, in minute fissures between the fibres, from which it is scraped off by small splinters of wood, or by the nail; and the thickest and oldest trees seldom yield more than two ounces. This account as to the productiveness of the tree differs greatly from that of Colebrook, as stated in the note above.

(392° F.) with organic acids. It is a secondary alcohol, and therefore contains the group CH.OH linked to a more complex group. Secondary alcohols by oxidation yield *ketones*, by the change of the CH.OH group to CO. Common camphor bears this relation to borneol, and is therefore considered as a ketone, although not capable of being formed directly from borneol. The action of metallic sodium, however, upon common camphor, $C_{10}H_{16}O$, gives us borneol, $C_{10}H_{18}O$.

Genuine camphor is said to be sometimes adulterated with the artificial, which may be detected by the action of ammonia upon its alcoholic solution, causing a flocculent precipitate, which does not redissolve, and the quantity of which is proportionate to that of the artificial product in any mixture of the two. (*A. J. P.*, xxxiv. 189.) As a means of distinguishing from the artificial camphor resulting from the reaction between the oil of turpentine and hydrochloric acid, Mr. J. W. Bailey recommends that a drop of alcohol, holding a little of the camphor to be tested in solution, be allowed to evaporate on the slide of a microscope. The crystals then formed produced with polarized light beautiful colors, if of natural camphor, but not if of the artificial. (*Neues Repertorium*, xvi. 763, 1867.)

Medical Properties and Uses. Camphor does not seem to have been known to the ancient Greeks and Romans. Europe probably derived it from the Arabians, by whom it was employed as a refrigerant. Much difference of opinion has prevailed as to its mode of action; some maintaining its immediate sedative influence, others considering it as a direct and decided stimulant. Its operation appears to be primarily and chiefly directed to the cerebral and nervous systems; and the circulation, though usually affected to a greater or less extent, is probably involved, for the most part, through the brain. It acts, also, to a certain extent, as a direct irritant of the mucous membranes with which it is brought into contact, and may thus in some measure secondarily excite the pulse. The effects of the medicine vary with the quantity administered. In moderate doses it produces, in health, mental exhilaration, increased heat of skin, and occasional diaphoresis. The pulse is usually increased in fulness, but little, if at all, in force or frequency. According to the experiments of certain Italian physicians, it has a tendency to the urinary and genital organs, producing a burning sensation along the urethra, and exciting voluptuous dreams (*N. Am. Med. and Surg. Journ.*, ix. 442); and these experiments have been confirmed by the observations of Dr. Reynolds in a case of poisoning by camphor (*Brit. Am. Journ. of Med.*, June, 1846). Cullen, however, states that he has employed it fifty times, even in large doses, without having ever observed any effect upon the urinary passages. By many it is believed to calm irritation of the urinary and genital apparatus, and to possess antaphrodisiac properties. In its primary operation it allays nervous disorder, quiets restlessness, and produces a general placidity of feeling, and is thus highly useful in certain forms of disease attended with derangement of the nervous functions. In larger doses, it displays a more decided action on the brain, producing more or less giddiness and mental confusion, with a disposition to sleep; and in morbid states of the system, relieving pain, and allaying spasmodic action. In immoderate doses it occasions nausea, vomiting, anxiety, faintness, vertigo, delirium, insensibility, coma, and convulsions, which may end in death. The pulse, under these circumstances, is at first reduced in frequency and force (Alexander, *Experimental Essays*, p. 227); but, as the action advances, it sometimes happens that symptoms of strong sanguineous determination to the head become evident in the flushed countenance, inflamed and fiery eyes, and highly excited pulse. (*Quarin.*) In three cases of poisoning by camphor, reported by Schaaf, of Strasburg, the symptoms produced were violent and incessant convulsions, paleness and coolness of the surface, vomiting and frequent micturition, and finally stupor or coma. The patients were children, and the youngest, a girl of about eighteen months, died from the effects of the poison, of which she took about ten grains. (*Monthly Journ. of Med. Sci.*, Oct. 1850, p. 377.) There can be no doubt that camphor is absorbed; as its odor is observed in the breath and perspiration, and according to Dr. Reynolds, in the urine also, though the contrary has been asserted.

By its moderately stimulating powers, its diaphoretic tendency, and its influence over the nervous system, camphor is adapted to the treatment of diseases of a typhoid character, which combine, with the enfeebled condition of the system, a frequent irritated pulse, a dry skin, and much nervous derangement, indicated by restlessness, watchfulness, tremors, subsultus, and low muttering delirium. It is not, however, at present much used in serious disease, but is very extensively employed in various functional nervous disorders, such as hysteria, dysmenorrhœa, general nervousness, and even in nymphomania. It is much used in diarrhœa, in flatulence, spasmodic colic, etc., as a local stimulant to the alimentary canal. In some of these cases, advantage may be derived from combining it with opium. Camphor has also been employed internally to allay the strangury produced by cantharides.

It is much used locally as an anodyne, dissolved in alcohol, oil, or acetic acid, and frequently combined with laudanum.* In rheumatic and gouty affections, and various internal spasmodic and inflammatory complaints, it often yields relief in this way. The ardor urinæ of gonorrhœa may be alleviated by injecting an oleaginous solution of camphor into the urethra; and the tenesmus from ascarides and dysentery, by administering the same solution in the form of enema. Twenty or thirty grains of camphor, added to a poultice, and applied to the perineum, allay the chordee which is a painful attendant upon gonorrhœa. Its vapor has been inhaled into the lungs with benefit in asthma and spasmodic cough; and a lump of it held to the nose is said to relieve coryza. It has been employed for the same purpose, and for nervous headache, in the form of powder snuffed up the nostrils. It enters into the composition of certain tooth-powders.

Camphor may be given in substance, in the form of bolus or pill, or diffused in water by trituration with various substances. The form of pill is objectionable; as in this state the camphor is with difficulty dissolved in the gastric liquor, and, floating on the top, is apt to excite nausea, or pain and uneasiness at the upper orifice of the stomach. Orfila states that, when given in the solid form, it is capable of producing ulceration in the gastric mucous membrane.† The emulsion is almost always preferred. This is made by rubbing up the camphor with loaf sugar, gum arabic, and water; and the suspension will be rendered more complete and permanent by the addition of a little myrrh. Milk is sometimes used as a vehicle, but is objectionable, from its liability to become speedily sour. The aqueous solution is often employed where only a slight impression is desired. For this purpose, the *Aqua Camphoræ* of the U. S. Pharmacopœia is preferable to the solution made by simply pouring boiling water upon a lump of camphor, which is sometimes prescribed under the name of *camphor tea*. When chloroform is not inadmissible, an elegant preparation may be made by dissolving camphor in that liquid, in the proportion of two drachms of the former to a fluidrachm of the latter, and then mixing the solution with water by the intervention of the yolk of an egg.

The medium dose of camphor is from five to ten grains (0·33–0·65 Gm.); but, to meet various indications, it may be diminished to a single grain (0·065 Gm.) or increased to a scruple (1·3 Gm.). The injurious effects of an overdose are said to be best counteracted, after clearing out the stomach, by the use of opium.

Off. Prep. Aqua Camphoræ; Ceratum Plumbi Subacetatis, *U. S.;* Linimentum Aconiti, *Br.;* Linimentum Belladonnæ, *Br.;* Linimentum Camphoræ; Linimentum Camphoræ Comp., *Br.;* Linimentum Iodi, *Br.;* Linimentum Saponis; Linimentum Sinapis Comp., *Br.;* Linimentum Terebinthinæ, *Br.;* Mistura Chloroformi, *U. S.;* Spiritus Camphoræ; Tinctura Camphoræ Composita, *Br.;* Tinct. Opii Camphorata, *U. S.;* Unguentum Hydrargyri Comp., *Br.;* Unguentum Plumbi Subacetatis Comp., *Br.*

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* An *ointment of camphor* may be made by heating three parts, in powder, by means of a water-bath, with twelve parts of prepared lard, and stirring the solution thoroughly when it begins to thicken on cooling. (*P. J. Tr.*, July, 1860, p. 41.) M. Parisel recommends, as affording a better product, that the powdered camphor and the lard should be mixed, at ordinary temperatures, in a thin well-glazed earthen vessel, and allowed to stand for twelve hours, with occasional agitation. The solution of the camphor is effected without apparent liquefaction, each molecule being dissolved in the surrounding molecules of the lard. (*Journ. de Pharm.*, Mai, 1860, p. 362.)

† There is some difficulty in making a good pilular mass with powdered camphor. Mr. W. H. Githens states that this difficulty may be obviated by using soap and honey as excipients. (*A. J. P.*, xxxiii. 206.)

CAMPHORA MONOBROMATA. *U. S.* *Monobromated Camphor.*

$C_{10} H_{15} Br O$; 230·8. (CĂM′PHỌ-RẠ MŎN-Ọ-BRŌ-MĀ′TẠ.) $C_{20} H_{15} Br O_2$; 230·8.

Bromated Camphor, Brominated Camphor, Brom-camphor; Camphre monobromé, *Fr.;* Monobrom Camphor, *G.*

This substance was discovered in 1861 by Th. Swarts, who prepared it by heating bibromide of camphor in a sealed tube to 100° C. It may also be made by heating for three hours in a sealed tube, with the water-bath, bromine and camphor in the proper chemical proportions. The crystalline mass is washed with water, recrystallized from alcohol after treatment with animal charcoal, washed with an alcoholic solution of potassa, then with much water, and finally recrystallized from a mixture of alcohol and ether. It is very easy to prepare the monobromide on a small scale in this way. There is, however, at all times a very great pressure upon the inside of the tube, and the attempt to practise the method upon a large scale is very apt to result in shattering the tubes. This has led to numerous experiments as to the best method of preparing it. Prof. Maisch (*A. J. P.*, 1872, p. 339) introduces 4 oz bromine gradually into a retort, in which 13 oz. camphor have been previously placed. In 15 or 20 minutes a brisk reaction will commence. When this subsides, 8 or 9 oz. more bromine are to be poured in, in four portions, waiting after each addition until the reaction ceases. The liquid in the retort is now to be heated to about 132° C. (270° F.), then cooled, and sufficient petroleum benzin added to dissolve the crystalline mass. The crystals which are formed on cooling may be purified by recrystallization from benzin or hot alcohol. Various modifications of this process have been proposed. Prof. J. U. Lloyd (*A. J. P.*, April, 1875) directs the addition of water to the camphor and bromine in the retort, and boils the mixture for two hours, or until all of the water is evaporated. Then the contents are poured into a dish and treated with warm alcohol, and allowed to crystallize, the mother-liquor drained off and recrystallized from hot alcohol. C. C. Keller (*Schweiz. Wochensch. f. Pharm.*, 1880, p. 50) uses chloroform (instead of water, as proposed by Prof. Lloyd) with the camphor and bromine, and washes the crystals with absolute alcohol, crystallizing them finally from an ethereal solution. 300 parts of camphor yield 340 parts monobromated camphor.

Properties. "Colorless, prismatic needles or scales, permanent in the air and unaffected by light, having a mild, camphoraceous odor and taste, and a neutral reaction. Almost insoluble in water; freely soluble in alcohol, ether, chloroform, hot benzin, and fixed oils; slightly soluble in glycerin. When heated, Monobromated Camphor slowly volatilizes; at 65° C. (149° F.) it melts, and may be sublimed at a slightly higher temperature. At 274° C. (525° F.) it boils and is completely volatilized with partial decomposition. If boiled with test-solution of nitrate of silver, it is decomposed and yields bromide of silver, amounting to 81·2 per cent. of the weight of Monobromated Camphor taken. It is soluble, without decomposition, in cold, concentrated sulphuric acid, and will again separate unaltered, if the solution be poured into water." *U. S.*

Medical Properties. It was first proposed as a medicine by Professor Deneffe, and has been used by various practitioners as a nervous sedative in delirium tremens, hysteria, convulsive irritation of teething, sleeplessness, etc. According to the experiments of Dr. Bourneville (*Le Progrès Médical*, 1874) and of Dr. Lawson (*The Practitioner*, Aug. 1874), it produces in mammals muscular weakness, passing into paralysis, very decided progressive reduction of temperature, decrease in the respiration rate, sleep passing into stupor, and finally death. Dr. Bourneville states that the vessels of the ear and eyelids in the rabbit are contracted. Its therapeutic action resembles, but is not identical with, that of other bromides; in the experience of Dr. H. C. Wood, it has seemed to be of especial value in spermatorrhœa. It is not safe to give it too freely, as in some cases its ingestion has been followed by epileptiform convulsions. The dose of it is 5 grains (·33 Gm.),* given in pill or emulsion, and repeated every hour for 2 or 3 doses if necessary. The emulsion may be made by dissolving it in six times its weight of expressed oil of almonds, and then forming an emulsion with gum and water in the usual manner.

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* *Elixir of Monobromated Camphor* is proposed by Munday (*P. J. Tr.*, March 3, 1877). Monobromated camphor 3 parts, alcohol (90 per cent.) 120 parts, orange-flower water 80 parts, glycerin 100 parts. Mix the alcohol and glycerin; dissolve the monobromated camphor by the use of a gentle heat, and add the orange-flower water. This solution contains 1 per cent of monobromated camphor.

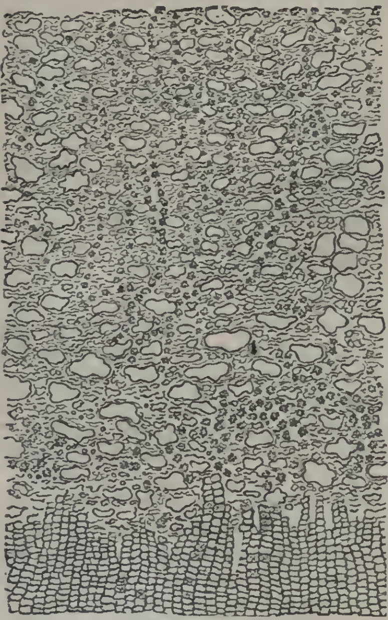
CANELLÆ ALBÆ CORTEX. *Br.* *Canella Alba Bark.*

(CA-NĔL'LÆ ĂL'BÆ CŎR'TĔX.)

Canella, *U. S.,* 1870. Canelle blanche, *Fr.;* Weisser Zimmt, Canell, Weisser Canel, *G.;* Canella bianca, *It.;* Canela blanca, *Sp.*

Gen. Ch. *Calyx* three-lobed. *Petals* five. *Anthers* sixteen, adhering to an urceolate nectary. *Berry* one-celled with two or four seeds. *Willd.* (*Nat. Ord.* Canellaceæ.)

Canella alba. Willd. *Sp. Plant.* ii. 851; Carson, *Illust. of Med. Bot.* i. 24, pl. 16; *B. and T.* 26. This is the only species of the genus. It is an erect tree, rising sometimes to the height of fifty feet, branching only at the top, and covered with a whitish bark, by which it is easily distinguished from other trees in the woods where it grows. The leaves are alternate, petiolate, oblong, obtuse, entire, of a dark green color, thick and shining like those of the laurel, and of a similar odor. The flowers are small, of a violet color, and grow in clusters upon divided footstalks, at the extremities of the branches. The fruit is an oblong berry, containing one, two, or three black, shining seeds.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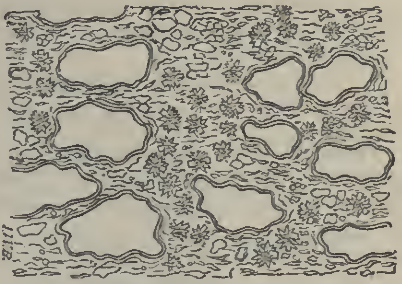
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Canella alba is a native of Florida, the Bahama Islands, and also of Jamaica and other West India islands. The bark of the branches, which is the part employed in medicine, is loosened and deprived of its epidermis by beating. After removal from the tree it is dried in the shade. It comes to us in pieces partially or completely quilled, occasionally somewhat twisted, of various sizes, from a few inches to two feet in length, from half a line to two or even three lines in thickness, and, in the quill, from half an inch to an inch and a half in diameter. It enters commerce solely from the Bahamas, where it is known as cinnamon bark, or as white wood bark.

Properties. Canella is of a pale orange yellow color externally, yellowish white on the inner surface, with an aromatic odor somewhat resembling that of cloves, and a warm, bitterish, very pungent taste. It is brittle, breaking with a short fracture, and yielding, when pulverized, a yellowish white powder. Boiling water extracts nearly one-fourth of its weight; but the infusion, though bitter, has comparatively little of the warmth and pungency of the bark. It yields all its virtues to alcohol, forming a bright yellow tincture, which is rendered milky by the addition of water. By distillation with water it affords a large proportion of a yellow or reddish, fragrant, and very acrid volatile oil. It contains, moreover, according to the analysis of MM. Petroz and Robinet, mannite, a peculiar very bitter extractive, resin, gum, starch, albumen, and various saline substances. Meyers and Reiche obtained twelve drachms of the volatile oil from ten pounds of the bark. They found it to consist of four different oils, the first being identical with the eugenol or eugenic acid of oil of cloves; the second is closely allied to the chief constituent of cajeput oil; the other oils require further examination. The bark yielded to Flückiger 0·74 per cent. of oil. Meyers and Reiche also obtained 8 per cent. of mannite and 6 per cent. of ash, chiefly calcium carbonate. (*Pharmacograph.*, 2d ed., p. 75.) Canella has been sometimes confounded with Winter's bark, from which, however, it differs both in sensible properties and composition. (See *Wintera.*)

Medical Properties and Uses. Canella is possessed of the ordinary properties of the aromatics, acting as a local stimulant and gentle tonic, and producing upon the stomach a warming cordial effect, which renders it useful as an addition to tonic or purgative medicines, in debilitated states of the digestive organs. It is scarcely ever prescribed except in combination. In the West Indies it is employed by the negroes as a condiment, and has some reputation as an antiscorbutic.

Off. Prep. Vinum Rhei, *Br.*

CANNABIS AMERICANA. *American Cannabis.*

(CĂN′NẠ-BĬS Ạ-MĔR-Ị-CĀ′NẠ.)

"Cannabis sativa, Linné (*Nat. Ord.* Urticaceæ, Cannabineæ), grown in the Southern United States, and collected while flowering." *U. S.*

American Hemp, *U. S.* 1870; Chanvre américain, *Fr.;* Amerikanischer Hanf, *G.*

CANNABIS INDICA. *U. S., Br.* *Indian Cannabis.*

(CĂN′NẠ-BĬS ĬN′DỊ-CẠ.)

"The flowering tops of the female plant of Cannabis sativa, Linné (*Nat. Ord.* Urticaceæ, Cannabineæ), grown in the East Indies." *U. S.* "The dried flowering tops of the female plants of Cannabis sativa. That which is grown in India, and from which the resin has not been removed, is alone to be employed." *Br.*

Hemp, Indian Hemp; Herba Cannabis Indicæ, *P. G.;* Chanvre Indien, *Fr.;* Indischer Hanf, *G.*

Gen. Ch. Male. *Calyx* five-parted. *Stamens* five. Female. *Calyx* one-leaved, rolled up. *Styles* two. *Lindley.*

Cannabis sativa. Linn. *Sp. Plant.* 1457; Griffith, *Med. Bot.* p. 572; *B. and T.* 231. Hemp is an annual plant, from four to eight feet or more in height, with an erect, branching, angular stem. The leaves are alternate or opposite, on long, lax footstalks, roughish, and digitate, with linear-lanceolate, serrated segments. The stipules are subulate. The flowers are axillary; the male in long, branched, drooping racemes; the female in erect, simple spikes. The stamens are five, with long pendulous anthers; the pistils two, with long, filiform, glandular stigmas. The fruit is ovate and one-seeded. The whole plant is covered with a fine pubescence, scarcely visible to the naked eye, and is somewhat viscid to the touch. The hemp plant of India, from which the drug is derived, has been considered by some as a distinct species, and named *Cannabis Indica;* but the most observant botanists, upon comparing it with our cultivated plant, have been unable to discover any specific difference. It is now, therefore, regarded merely as a variety, and is distinguished by the epithet *Indica.* Dr. Pereira states that, in the female plant, the flowers are somewhat more crowded than in the common hemp; but that the male plants in the two varieties are in all respects the same. It is unfortunate that the name of *Indian hemp* has been attached to the medicinal product; as, in the United States, the same name has long been appropriated to *Apocynum cannabinum*, and some confusion has hence arisen.

The American and true Indian hemp are respectively described as follows in the present edition U. S. P.

"Stem about six feet (2 m.) high, rough; leaves opposite below, alternate above, petiolate, digitate; the leaflets linear-lanceolate, serrate; diœcious, the staminate flowers in pedunculate clusters forming compound racemes; the pistillate flowers axillary, sessile and bracteate; odor heavy; taste bitter, slightly acrid." *U. S.*

"Branching, compressed, brittle, about two inches (5 cm.) long, with a few digitate leaves, having linear-lanceolate leaflets, and numerous, sheathing, pointed bracts, each containing two small, pistillate flowers, sometimes with the nearly ripe fruit, the whole more or less agglutinated with a resinous exudation. It has a brownish color, a peculiar, narcotic odor, and a slightly acrid taste." *U. S.*

C. sativa is a native of the Caucasus, Persia, and the hilly regions in the north of India. It is cultivated in many parts of Europe and Asia, and largely in our Western States. It is from the Indian variety exclusively that the medicine was formerly obtained; the heat of the climate in Hindostan apparently favoring the development of its active principle.* Dr. H. C. Wood having obtained a parcel of the male plant from Kentucky, made an alcoholic extract of the leaves and tops, and, upon trying it on the system, found it effective in less than a grain, and, having inadvertently taken too large a dose, experienced effects which left no doubt of the powers of the medicine, and of the identity of its influence with that of the Indian plant. How far the female tops might have the same effect is left uncertain; but, if we are to judge from analogy with the Indian plant, they would be preferable to the male. (*Proc. Am. Philos. Soc.*, vol. xi. p. 226.) The results obtained by Dr. Wood were so decisive that, at the 1870 revision of our Pharmacopœia, the American plant and an extract were introduced into the materia medica catalogue; but none of the extract has been made for commercial purposes, and in the present Pharmacopœia, Extractum Cannabis Americanæ has been dropped.

The seeds, though not now officinal, have been used in medicine. They are about the eighth of an inch long, roundish-ovate, somewhat compressed, of a shining ash-gray color, and of a disagreeable, oily, sweetish taste. They yield by expression about 20 per cent. of a fixed oil, which has the drying property, and is used in the arts. They contain also uncrystallizable sugar and albumen, and when rubbed with water form an emulsion, which may be used advantageously in inflammations of the mucous membranes, though without narcotic properties. They are much used as food for birds, which are fond of them. They are generally believed to be in no degree poisonous; but M. Michaud relates the case of a child, in which serious symptoms of narcotic poisoning occurred after taking a certain quantity of them. It is probable that some of the fruit eaten by the child was unripe; as, in this state, it would be more likely to partake of the peculiar qualities of the plant itself. (*Annuaire de Thérap.*, 1860, p. 159.)

In Hindostan, Persia, and other parts of the East, hemp has long been habitually employed as an intoxicating agent. The parts used are the tops of the plant, and a resinous product obtained from it. The plant is cut after flowering, and formed into bundles from two to four feet long by three inches in diameter, which are sold in the bazaars under the name of *gunjah*. The *hashish* of the Arabs is essentially the same. The name *bang* is given to a mixture of the larger leaves and capsules without the stems. There is on the surface of the plant a resinous exudation to which it owes its clammy feel. Men clothed in leather run through the hemp fields, brushing forcibly against the plants, and thus separating the resin, which is subsequently scraped from their dress, and formed into balls. These are called *churrus*. In these different states of preparation, the hemp is smoked like tobacco, with which it is said to be frequently mixed. An infusion or decoction of the plant is also sometimes used as an exhilarating drink.

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* On a visit to the botanical garden of Edinburgh, in the autumn of 1860, Dr. George B. Wood saw a full-grown specimen of *Cannabis sativa*, and was surprised to find that it was only about four feet high, had little or no odor, and was scarcely adhesive when handled. If this is the general character of the hemp plant in the north of Europe, it is not surprising that it should be destitute of the medicinal properties of the Indian plant. In Philadelphia, the plant attains a height usually of six or eight feet, has a decided narcotic odor, and exudes so much of its peculiar resin as to be very adhesive to the fingers. It is highly probable, therefore, that the hemp plant grown in this country might be advantageously used in medicine. On this occasion Dr. Christison informed Dr. Geo. B. Wood, from information he had received from India, that the plant there cultivated in the hot plains does not yield hashish satisfactorily; but that this product is chiefly if not exclusively obtained from it in the hilly regions. He said, moreover, that the story of the natives running through the hemp fields and collecting the resin on their clothing, from which it is afterwards scraped, is, if not quite untrue, at least apocryphal. He had been informed that the real mode of gathering it is to rub the hemp-tops between the hands, and, when the palms and fingers are sufficiently loaded with the resin, to scrape it off. It is possible, however, that different methods may be followed in different localities.

The imported *medicinal resin or extract of hemp*, directed by the U. S. Pharmacopœia of 1860, is made by evaporating a tincture of the dried tops. Dr. O'Shaughnessy directs it to be prepared by boiling the tops of the gunjah in alcohol until all the resin is dissolved, and evaporating to dryness by means of a water-bath. Mr. Robertson, of the Calcutta Medical College, prepares it by passing the vapor of boiling alcohol from the boiler of a still into the dried plant contained in a convenient receptacle, and evaporating the condensed liquor by a heat not exceeding 65·6° C. (150° F.). The Messrs. Smith, of Edinburgh, obtained a purer resin by the following process. Bruised gunjah is digested, first in successive portions of warm water, till the expressed liquid comes away colorless; and afterwards, for two days with a moderate heat, in a solution of carbonate of sodium, containing one part of the salt for two of the dried herb. It is then expressed, washed, dried, and exhausted by percolation with alcohol. The tincture, after being agitated with milk of lime containing one part of the earth for twelve of the gunjah used, is filtered; the lime is precipitated by sulphuric acid; the filtered liquor is agitated with animal charcoal, and again filtered; most of the alcohol is distilled off, and to the residue twice its weight of water is added; the liquor is then allowed to evaporate gradually; and, finally, the resin is washed with fresh water until it ceases to impart a sour or bitter taste to the liquid, and is then dried in thin layers. Thus obtained, it retains the odor and taste of the gunjah, of which 100 pounds yield 6 or 7 of the extract. Much of the commercial extract is very impure, and is but partially soluble in alcohol.

Under the name of *Extractum Cannabis Purificatum*, the U. S. Pharmacopœia of 1860 directed a preparation made by evaporating a tincture of the crude extract, which, from its greater uniformity of strength, was preferable for prescription. The British Pharmacopœia directs the Extract of Indian Hemp to be prepared by macerating an avoirdupois pound of the dried tops of the hemp, in coarse powder, in four Imperial pints of rectified spirit, for seven days, then expressing, and evaporating to the proper consistence. From this a tincture is ordered to be prepared.

Properties. Fresh hemp has a peculiar narcotic odor, which is said to be capable of producing vertigo, headache, and a species of intoxication. It is much less in the dried tops, which have a feeble bitterish taste. According to Dr. Royle, *churrus* is when pure of a blackish gray, blackish green, or dirty olive color, of a fragrant and narcotic odor, and a slightly warm, bitterish, and acrid taste. Schlesinger found in the leaves a bitter substance, chlorophyll, green resinous extractive, coloring matter, gummy extract, extractive, albumen, lignin, and salts. The plant also contains volatile oil in very small proportion, which probably has narcotic properties. The resin obtained by T. & H. Smith, of Edinburgh, in 1846, is probably the active principle, and has received the name of *cannabin*. It is neutral, soluble in alcohol and ether, and separable from the alcoholic solution by water as a white precipitate. Martino (*N. Rep. Pharm.*, 4, p. 529) obtained a resin fusing at 68° C. (154·4° F.), easily soluble in alcohol, ether, and volatile oils, difficultly soluble in aqueous alkalies and acids. By oxidation with nitric acid a product is formed, *oxycannabin*, $C_{20}H_{20}H_2O_7$, which, after purifying, is white and crystalline. Preobraschensky (*Pharm. Zeit. f. Russl.*, 1876, p. 705) believes that cannabis Indica contains the alkaloid nicotine; this has, however, not been confirmed, and is hardly probable, because the physiological actions of the two drugs differ very greatly. The taste of *cannabin* is warm, bitterish, acrid, somewhat balsamic, and its odor fragrant, especially when heated. From the effects on the system of the exhalations from fresh hemp, it was a very probable supposition that the plant owed its medical properties, in part at least, to a volatile principle. By repeated distillation of the same portion of water from relatively large quantities of hemp renewed at each distillation, M. J. Personne obtained a volatile oil, of a stupefying odor, and an action on the system such as to dispose him to think that it was the active principle of the plant. As the water distilled was strongly alkaline, he supposed that this volatile principle might be a new alkaloid; but the alkaline reaction was found to depend on ammonia; and the liquid obtained proved to be a volatile oil, lighter than water, of a deep amber color, a strong smell of hemp, and composed of two distinct oils, one colorless, with the formula $C_{15}H_{20}$, the other a hydride of the first, $C_{18}H_{22}$, which was solid, and separates from alcohol in plate-like crystals. For the former M. Personne proposes the name of *cannabene.* When this is inhaled, or taken into the stomach, a singular excitement is felt throughout the system, followed by a depression, sometimes amounting to syncope, with hallucinations which are generally disagreeable, but an action on the whole slighter and more fugitive than that of the resin.

Medical Properties. Extract of hemp is a powerful narcotic, causing exhilaration, intoxication, delirious hallucinations, and, in its subsequent action, drowsiness and stupor, with little effect upon the circulation. It is asserted also to act as a decided aphrodisiac, to increase the appetite, and occasionally to induce the cataleptic state. In overdoses it may produce poisonous effects. In morbid states of the system, it has been found to cause sleep, to allay spasm, to compose nervous disquietude, and to relieve pain. In these respects it resembles opium; but it differs from that narcotic in not diminishing the appetite, checking the secretions, or constipating the bowels. It is much less certain in its effects; but may sometimes be preferably employed, when opium is contraindicated by its nauseating or constipating effects, or its disposition to produce headache, and to check the bronchial secretion. The complaints in which it has been specially recommended are neuralgia, gout, rheumatism, tetanus, hydrophobia, epidemic cholera, convulsions, chorea, hysteria, mental depression, delirium tremens, insanity, and uterine hemorrhage. It has been found to cure obstinate intermittent fever, given before the paroxysm. Dr. Alexander Christison, of Edinburgh, affirms that it has the property of hastening and increasing the contractions of the uterus in delivery, and has employed it with advantage for this purpose. It acts very quickly, and without anæsthetic effect. It appears, however, to exert this influence only in a certain proportion of cases. (*Ed. Month. Journ. of Med. Sci.*, xiii. 117, and xv. 124.) The strength of the extract varies much as found in commerce, and therefore no definite dose can be fixed. When it is of good quality, half a grain or a grain (0·03–0·065 Gm.) will affect the system. The Messrs. Smith found two-thirds of a grain (0·04 Gm.) of their extract to produce powerful narcotic effects. In some instances it will be necessary to give as much as ten or twelve grains (0·65–0·80 Gm.) of the imported extract; and half an ounce (15·5 Gm.) of it has been taken without sensible effect. The proper plan is to begin with one-quarter or half a grain (0·016–0·03 Gm.), repeated at intervals of two, three, or four hours, and gradually increased until its influence is felt, and the strength of the parcel employed is thus ascertained. Afterwards the dose will be regulated by the ascertained strength; but, should a new parcel be employed, the same caution must be observed as to the commencing dose. A tincture is prepared by dissolving an ounce of the extract in a pint (Imp. meas.) of alcohol. A dose of this, equivalent to a grain of the extract, is about twenty minims (1·25 C.c.), or forty drops. Dr. O'Shaughnessy gave ten drops (0·6 C.c.) every half hour in cholera, and a fluidrachm (3·75 C.c.) every half hour in tetanus. As the resin is precipitated by water, the tincture should be administered in mucilage or sweetened water. Alarming effects have been produced by overdoses.

Off. Prep. Extractum Cannabis Indicæ, *U. S.;* Tinctura Cannabis Indicæ, *U. S.*, *Br.;* Extractum Cannabis Indicæ Fluidum, *U. S.*

CANTHARIS. *U. S., Br.* *Cantharides.* [*Spanish Flies.*]

(CĂN'THA̤-RĬS.)

"Cantharis vesicatoria. De Geer. (*Class*, Insecta; *Order*, Coleoptera.) Cantharides should be kept in well-closed vessels, containing a little camphor." *U. S.* "Cantharis vesicatoria." *Br.*

Cantharides, *P.G.:* Muscæ Hispanicæ; Cantharides, Cantharide, *Fr.;* Spanische Fliege, Kantharide, Canthariden, *G.;* Cantarelle, *It.;* Cantharidas, *Sp.*

The term *Cantharis* was employed by the ancient Greek writers to designate many coleopterous insects or beetles. Linnæus gave the title to a genus not including the officinal blistering insect, and placed this in the genus *Meloë*, which, however, has been since divided into several genera. Geoffrey made the Spanish fly (beetle)* the prototype of a new one called *Cantharis*, substituting *Cicindela* as the title of the Linnæan genus. Fabricius altered the arrangement of Geoffrey, and substituted *Lytta* for *Cantharis* as the generic name. The former was adopted by the London College, and at one time was in extensive use; but the latter, having been restored by Latreille, is now recognized in the British and American Pharmacopœias, and is universally employed. By this naturalist the vesicating insects were grouped in a small tribe, corresponding very nearly with the Linnæan genus Meloë, and distinguished by the title *Cantharidæ*. This tribe he divided into eleven genera, among which is Cantharis. Two others of these genera, *Meloë* properly so called, and *Mylabris*, have been employed as vesicatories. *Mylabris cichorii* is thought to be one of the insects described by Pliny and Dioscorides under the name of cantharides, and is to this day employed in Italy, Greece, the Levant, and Egypt; and another species, *M. pustulata*, is used for the same purpose in China. Mr. W. R. Warner has found 500 parts of *M. cichorii* to yield 2·13 parts of cantharidin, which somewhat exceeds the yield of Spanish flies (*A. J. P.*, xxviii. 195); and R. Wolff has obtained by ethereal extraction more than 4 parts of cantharidin in 500 of the *Lytta aspersa* of Buenos Ayres. The *M. cichorii* has been recently imported to some extent under the name of *Chinese blistering fly*. It is black, with the powder blackish gray and free from shining particles. *Meloë proscarabæus* and *M. majalis* have been occasionally substituted for cantharides in Europe, and *M. trianthemæ* is used in the upper provinces of Hindostan. Several species of Cantharis, closely analogous in medical properties, are found in various parts of the world; but *C. vesicatoria* is the only one recognized as officinal in the United States, Great Britain, and France. A second species, *C. vittata*, was introduced into our national Pharmacopœia, but has been discarded. Of this, and some other indigenous species, notice will be taken at the end of this article. At present we shall confine our observations to *C. vesicatoria*.†

CANTHARIS. *Class* Insecta. *Order* Coleoptera. *Linn.—Family* Trachelides. *Tribe* Cantharidæ. *Latreille.*

Gen. Ch. Tarsi entire; *nails* bifid; *head* not produced into a rostrum; *elytra* flexible, covering the whole abdomen, linear, semicylindric; *wings* perfect; *maxillæ* with two membranous *laciniæ*, the external one acute within, subunciuate; *antennæ* longer than the head and thorax, rectilinear; first joint largest, the second transverse, very short; *maxillary palpi* larger at tip. (*Say.*)

Cantharis vesicatoria. Latreille, *Gen. Crust. et Insect.*, ii. p. 220. This beetle is from six to ten lines in length, by two or three in breadth, and of a beautiful, shining, golden green color. The head is large and heart-shaped, bearing two thread-like, black, jointed feelers; the thorax short and quadrilateral; the wing-sheaths long and flexible, covering brownish membranous wings. When alive, the Spanish flies have a strong, penetrating, fetid odor, compared to that of mice, by which swarms of them may be detected at a considerable distance. They attach themselves preferably to certain trees and shrubs, such as the white poplar, privet, ash, elder, and lilac, upon the leaves of which they feed. They abound most in Spain, Italy, and the south of France, but are found also in all the temperate parts of Europe, and in the west of Asia. According to the researches of Lichtenstein, the eggs are laid by the female in the latter part of June in small cylindrical holes made in the ground. A week later the larvæ hatch out. They are a millimetre long, with two long caudal threads, and of a brown color. After many efforts, M. Lichtenstein succeeded in getting them to feed on the honey contained in the stomach of bees. In a few days they changed into milk-white larvæ, and about a month after this buried themselves in the ground, to assume the chrysalis stage and to hatch out the following spring as perfected beetles. In the wild state the larvæ are said to mount up flowers and attach themselves to bees or other hymenopterous insects; carried by the bee to the hive, the larvæ feed upon the young bees and the honey and bee bread stored up for use. The beetles usually make their appearance in swarms upon the trees in May and June, when they are collected. The time preferred for the purpose is in the morning at sunrise, when they are torpid from the cold of the night, and easily let go their hold. Persons with their faces protected by masks, and their hands with gloves, shake the trees, or beat them with poles; and the insects are received as they fall upon linen cloths spread underneath. They are then plunged into vinegar diluted with water, or exposed in sieves to the vapor of boiling vinegar, and, having been thus deprived of life, are dried either in the sun, or in apartments heated by stoves. This mode of killing the flies by the steam of vinegar is as ancient as the times of Dioscorides and Pliny. In some places they are gathered by smoking the trees with burning brimstone. It has been proposed by M. Lutrand to destroy them by the vapor of chloroform. When perfectly dry, they are introduced into casks or boxes, lined with paper and carefully closed, so as to exclude as much as possible the atmospheric moisture. According to M. Neutwich, the young fly has no vesicating power; and even those half-grown are equally destitute of it. (*P. J. Tr.*, Nov. and Dec., 1870, p. 355.)

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* A *beetle* is to be distinguished from a *fly* by its having the first pair of wings converted into elytra, or wing-cases—*i.e.*, thickened and hardened for protection.

† Those who wish to investigate the subject of vesicating insects generally are referred to the *P. J. Tr.* (Aug. 2, 1871), also *Proc. A. P. A.* (1876, p. 507).

Cantharides come chiefly from Spain, Italy, Sicily, and other parts of the Mediterranean. Considerable quantities are also brought from St. Petersburg, derived originally, in all probability, from the southern provinces of Russia, where the insect is very abundant. The Russian flies are most esteemed. They may be distinguished by their greater size, and their color approaching to that of copper.

In the United States are several species of Cantharis, which have been employed as substitutes for *C. vesicatoria*, and found equally efficient; but none of them are now recognized by our national Pharmacopœia; even *C. vittata*, which was at one time officinal, having been discarded. This we regret, as it seems to us that the native products of our country should always be encouraged when shown to be useful. We shall briefly notice all that have been submitted to experiment, and found to possess vesicating powers.

1. *Cantharis vittata.* Latreille, *Gen. Crust. et Insect.*; Durand, *Journ. of the Phil. Col. of Pharm.*, ii. 274, fig. 4. The *potato fly*[*] is rather smaller than *C. vesicatoria*, which it resembles in shape. Its length is about six lines. The head is light red, with dark spots upon the top; the feelers are black; the elytra or wing-cases are black, with a yellow longitudinal stripe in the centre, and with a yellow margin; the thorax is also black, with three yellow lines; and the abdomen and legs, which have the same color, are covered with a cinereous down. It inhabits chiefly the potato vine, and appears about the end of July or beginning of August, in some seasons very abundantly. It is found on the plant in the morning and evening, but during the heat of the day descends into the soil. The insects are collected by shaking them from the plant into hot water; and are afterwards carefully dried in the sun. They are natives of the Middle and Southern States. This species of Cantharis was first described by Fabricius in the year 1781, and was introduced to the notice of the profession by Dr. Isaac Chapman, of Bucks County, Pennsylvania, who found it equal if not superior to the Spanish fly as a vesicatory. The testimony of Dr. Chapman has been corroborated by that of many other practitioners. It may be applied to the same purposes, treated in the same manner, and given in the same dose as the foreign insect. Mr. W. R. Warner obtained 1·99 parts of cantharidin from 500 parts of this beetle, but by improved methods Mr. Fahnestock procured 1½ per cent. of the active principle. (*A. J. P.*, xxviii. 195; li. 298.) Professor Leidy, of the University of Pennsylvania, ascertained, by experiment, that the vesicating property of this insect resides in the blood, the eggs, and a peculiar fatty matter of certain accessory glands of the generative apparatus. (*Am. Journ. of Med. Sci.*, Jan. 1860, p. 60.)

2. *Cantharis cinerea.* Latreille, *Gen. Crust. et Insect.*; Durand, *Journ. of the Phil. Col. of Pharm.*, ii. 274, fig. 5. The *ash-colored cantharis* closely resembles the preceding species in figure and size; but differs from it in color. The elytra and body are black, without the yellow stripes that characterize *C. vittata*, and are

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[*] According to the researches of L. Dembinski, the Colorado potato-beetle (*Doryphora decemlineata*) contains no cantharidin. (*A. J. P.*, 1877, p. 550.)

entirely covered with a short and dense ash-colored down, which conceals the proper color of the insect. The feelers are black, and the first and second joints are very large in the male. This species also inhabits the potato plant, and is occasionally found on other plants, as the English bean and wild indigo. It is a native of the Northern and Middle States. Illiger in 1801 discovered its vesicating properties; but Dr. Gorham was first to call public attention particularly to the subject, and to the fact of its equality in all respects with the potato fly, in a communication addressed, in the year 1808, to the Medical Society of Massachusetts.

3. *Cantharis marginata.* Latreille, *Gen. Crust. et Insect.;* Durand, *Journ. of the Phil. Col. of Pharm.*, ii. 274, fig. 6. This is somewhat larger than *C. vittata*, and of a different shape. The elytra are black, with the suture and margin ash-colored. The head, thorax, and abdomen are black, but nearly covered with an ash-colored down; and, on the upper part of the abdomen, under the wings, are two longitudinal lines of a bright clay color. The insect is usually found, in the latter part of summer, upon different species of Clematis, and frequents especially the lower branches which trail along the ground. Professor Woodhouse, of Philadelphia, first ascertained its vesicating properties; but it had previously been described by Fabricius as a native of the Cape of Good Hope. Dr. Harris, of Massachusetts, found it as efficient as any other species.

4. *Cantharis atrata.* Latreille, *Gen. Crust. et Insect.;* Durand, *Journ. of the Phil. Col. of Pharm.*, ii. 274, fig. 7. The *black cantharis* is smaller than the indigenous species already described; but resembles *C. marginata* in figure. Its length is only four or five lines. It is distinguished by its size, and its uniform black color. It frequents more especially the different species of Aster and Solidago, though it is found also on *Prunella vulgaris*, *Ambrosia trifida*, and some other plants. Mr. Durand met with considerable numbers of this insect near Philadelphia, in the month of September; and they continued to appear till the middle of October. They are common in the Northern and Middle States, but are not confined exclusively to this country, being found also in Barbary. Drs. Oswood and Harris, of New England, satisfactorily ascertained their vesicating powers. They are probably identical with the insect noticed as vesicatory by Prof. Woodhouse, under the name of *Meloë niger.*

5. *Cantharis Vulnerata.* Harrison Allen, *Medical Zoology*, 1st ed., p. 150. Dr. Geo. H. Horn states that this is so abundant upon the Pacific coast that he has often seen bushels of it covering the ground. It has a black body, an orange-colored head, sometimes with a broad black stripe down the middle, and black wing-cases. Dr. Horn found it medicinally very active, as was also the less plentiful *C. Melæna.*

Several other species have been discovered in the United States, but not yet practically employed. Among these are *C. æneas*, a native of Pennsylvania, discovered by Mr. Say; *C. politus* and *C. aszelianus*, inhabiting the Southern States; *C. Nuttalli*, a large and beautiful insect of Missouri, first noticed by Mr. Nuttall, and said to surpass the Spanish fly in magnitude and splendor; and *C. albida*, another large species, found by Mr. Say near the Rocky Mountains. Of these, *C. Nuttalli* (*Lytta Nuttalli*, Say, *Am. Entomol.*, i. 9) bids fair, at some future period, to be an object of importance in the western section of this country. The head is of a deep greenish color, with a red spot in front; the thorax is of a golden green; the elytra red or golden purple and somewhat rugose on their outer surface, green and polished beneath; the feet black; the thighs blue or purplish. The exploring party under Colonel Long ascertained the vesicating powers of this insect. It was found in the plains of the Missouri, feeding on a scanty grass. In one spot it was so numerous as to be swept away by bushels, in order that a place might be cleared for encamping. There are also a number of beetles found in the United States which are plentiful enough to be capable of affording a commercial article, and which are so closely allied to the genus Cantharis as to render it probable that they possess blistering properties. For an account of the more important, see *Proc. A. P. A.*, 1876, p. 506.

Properties. "About one inch (25 mm.) long, and a quarter of an inch (6 mm.) broad; with filiform antennæ, black in the upper part, and ample, membranous, transparent, brownish wings; elsewhere of a shining, coppery-green color;

the powder is grayish brown and contains green, shining particles; odor strong and disagreeable." *U.S.* Dried Spanish flies preserve the form and color, and, to a certain extent, the disagreeable odor of the living insect. They have an acrid, burning, and urinous taste. Their powder is of a grayish brown color, interspersed with shining green particles, which are the fragments of the feet, head, and wing-cases. If kept perfectly dry, in well-stopped glass bottles, they retain their activity for a great length of time. A portion which had been preserved by Van Swieten for thirty years, in a glass vessel, was found still to possess vesicating properties. But, exposed to a damp air, they quickly undergo putrefaction; and this change takes place more speedily in the powder. Hence the insects should either be kept whole, and powdered as they are wanted for use, or, if kept in powder, should be well dried immediately after pulverization, and preserved in air-tight vessels. They should never be purchased in powder, as, independently of the consideration just mentioned, they may in this state be more easily adulterated. But, however carefully managed, cantharides are apt to be attacked by mites, which feed on the interior soft parts of the body, reducing them to powder, while the hard exterior parts are not affected. An idea was at one time prevalent that the vesicating property of the insect was not injured by the worm, which was supposed to devour only the inactive portion. But this has been proved to be a mistake. M. Farines, an apothecary of Perpignan, has satisfactorily shown that, though the hard parts left by these mites possess some vesicating power, and the powder produced by them still more, yet the sound flies are much stronger than either. Camphor, which has been recommended as a preservative, does not prevent the destructive agency of the worm.[*] It is stated by M. Farines that, when the flies are destroyed by the vapor of pyroligneous acid, instead of common vinegar, they acquire an odor which contributes to their preservation. Cantharides will bear a very considerable heat without losing the brilliant color of their elytra; nor is this color extracted by water, alcohol, ether, or the oils; so that the powder might be deprived of all its active principle, and yet retain the exterior characters unaltered. The wing-cases resist putrefaction for a long time, and the shining particles have been detected in the human stomach months after interment.

So early as 1778, Thouvenel attempted to analyze cantharides, and the attempt was repeated by Dr. Beaupoil in 1803; but no very interesting or valuable result was obtained till 1810, when Robiquet discovered in them a crystalline substance, which proved to be the vesicating principle of the insect, and received the name of *cantharidin.* The constituents, according to Robiquet, are—1, a green oil, insoluble in water, soluble in alcohol, and inert as a vesicatory; 2, a black matter, soluble in water, insoluble in alcohol, and inert; 3, a yellow viscid matter, soluble in water and alcohol, and without vesicating powers; 4, cantharidin; 5, a fatty matter, insoluble in alcohol; 6, phosphates of calcium and magnesium, acetic acid, and in the fresh insect, a small quantity of uric acid. Orfila afterwards discovered a volatile principle, upon which the fetid odor of the fly depends. It is separable by distillation with water. Prof. Dragendorff has found a volatile principle which acts on the system in the same manner as cantharidin. When powdered flies are moistened with water and distilled, the part which passes over, at or below 100° C. (212° F.), contains this principle. (*Chem. News*, May 31, 1867.) That the green coloring matter is chlorophyll seems to be shown by the experiments of Pocklington, who

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[*] It appears from the experiments of M. Nivet that, though camphor does not preserve the entire fly from the attacks of the larvæ of the *Anthrenus*, it actually destroys the mites of the Cantharis so often found in the powder, and may, therefore, be introduced with advantage, in small lumps, into bottles containing powdered cantharides. (*Journ. de Pharm.*, xix. 604.) Carbonate of ammonium has also been recommended as a preservative. Pereira has found that a few drops of strong acetic acid, added to the flies, are very effectual. Among the best means of preserving them, whether whole or in powder, is the application of the process of Apert, which consists in exposing them, for half an hour, confined in glass bottles, to the heat of boiling water, which destroys the eggs of the insect, without impairing the virtues of the flies. (*Ibid.*, xxii. 246.) Of course the access of water to the flies should be carefully avoided. Lutrand recommends chloroform as the best preservative that he has tried. (*Journ. de Pharm.*, xviii. 214.) We have little doubt that exposure, in a confined vessel, to the vapor of carbolic acid, would be a perfect protection against all forms of insect life.

(*P. J. Tr.*, [3] iii. p. 681) found that when cantharides was treated with alcohol, ether, and bisulphide of carbon, the solutions yielded absorption spectra agreeing with that of chlorophyll.

Cantharidin is a white substance, in the form of crystalline scales, of a shining micaceous appearance, inodorous, tasteless, almost insoluble in water and in cold alcohol, but soluble in ether, chloroform, benzol, the oils, and in hot alcohol and acetic acid, which deposit it upon cooling.* It fuses at 210° C. (410° F.), and is volatilizable by heat without decomposition, and its vapor condenses in acicular crystals. As determined by the experiments of Mr. Wm. A. Guy, the subliming heat of isolated cantharidin is 100° C. (212° F.), or the temperature of boiling water. (*P. J. Tr.*, Feb. 1868, p. 373.) According to MM. Masing and Dragendorff, cantharidin, with the composition $C_{10}H_{12}O_4$, is capable of combining with water, and thus becomes cantharidic acid, $2(C_5H_6O_2.H_2O)$, or $C_{10}H_{14}O_5$, and in this state forms definite compounds with bases, such as $2(C_5H_6O_2.KHO) + H_2O$, and $2(C_5H_6O_2.NaHO) + H_2O$, which are crystallizable. These may be obtained by heating cantharidin with an alkaline solution. (*Journ. de Pharm. et de Chim.*, Janv. 1868, p. 79.) Cantharidin itself has been found to combine like an acid with the salifiable and earthy bases, forming soluble compounds with potassium, sodium, and lithium hydrates, salts of very sparing solubility, with baryta, strontia, and lime, and, with magnesia a salt, which, though feebly soluble in water (100 parts of water dissolving only 0·24 of the salt) (see *P. J. Tr.*, March 13, 1880), is much more largely dissolved in cold than in hot water, and in cold than hot alcohol. (For further details concerning the relations of cantharidin with bases, and the preparation of its salts, see *P. J. Tr.*, Oct. 1873, p. 282.) The most satisfactory test of cantharidin is its vesicating property. Notwithstanding the insolubility of this principle in water and cold alcohol, the decoction and tincture of cantharides have the medicinal properties of the insect; and Lewis ascertained that both the aqueous and alcoholic extracts acted as effectually in exciting vesication as the flies themselves, while the residue was in each case inert. Cantharidin consequently exists in the insect, so combined with the yellow matter as to be rendered soluble in water and cold alcohol. H. G. Greenish calls attention to the fact that much loss of cantharidin takes place in making the various pharmaceutical preparations through insufficient exhaustion by the use of the ordinary solvents. He obtained 0·822 per cent. of cantharidin from exhausted residues. M. Ferrer found cantharidin in all parts of the fly, but somewhat more largely in the soft than the hard parts. (*Journ. de Pharm.*, Oct. 1859, p. 279.)

Adulterations. These are not common. Occasionally other insects are added, purposely, or through carelessness. These may be readily distinguished by their different shape or color. Flies exhausted of their cantharidin by ether are said to have been substituted for the genuine. An account has been published of considerable quantities of variously colored glass beads having been found in a parcel of the drug; but this would be too coarse a fraud to be extensively practised. Pereira states that powdered flies are sometimes adulterated with euphorbium. According to the researches of Mr. Fahnestock (*A. J. P.*, 1879, p. 298), age destroys the activity of the drug without of necessity impairing its physical appearance.

The percentage of cantharidin found in cantharides furnishes the best test of their virtues. Professor Procter succeeded, by means of chloroform, in isolating cantharidin with great facility. He treated the flies with chloroform by percolation, displacing the last portion by means of alcohol, and allowing the resulting solution to evaporate spontaneously. Cantharidin is thus obtained in crystals mixed with the green oil, the greater portion of which may be removed by bibulous paper. The residuary crystals are dissolved in a mixture of ether and alcohol, which, by the spontaneous evaporation of the ether, yield the cantharidin nearly pure. M. Mortreux, having ascertained that cantharidin is insoluble in bisulphide of carbon, proposed to use this fluid for removing the fatty matter associated with the cantharidin crystals obtained by the use of chloroform. He employed the same liquid in estimating the proportion of cantharidin, which he found to be about 20 centigrammes for 40 grammes of the flies, or half of one per cent. (*Journ. de Pharm. et de Chem.*, 3e sér., xlvi. 33, 1864.) Wittstein obtains it by digesting coarsely powdered flies repeatedly with water, straining through linen and expressing, allowing the liquid to settle for a day, separating the supernatant oil, adding a little wood charcoal, evaporating to dryness, treating the residue with ether so long as the solution affords a laminated substance on evaporation, evaporating the ethereal solution, treating the residue with cold alcohol of 80 per cent. for one day with frequent shaking, and finally drying the scales. (See *A. J. P.*, xxviii. 231.) Mr. Williams has obtained it by means of benzol. (*Ibid.*, xxvi. 340.)

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* The solubilities of cantharidin were examined with great care by Professor Procter, with the following results. It is insoluble in water. Cold alcohol dissolves it slightly, hot alcohol freely. It is more soluble in ether, which also dissolves it more freely hot than cold. Chloroform, cold or hot, is its best solvent; and acetone ranks next to it in this respect. Olive oil, at 250° F., dissolves one-twentieth of its weight, and oil of turpentine, boiling hot, one-seventieth; and both deposit the greater portion on cooling. The olive oil solution after deposition vesicates, the terebinthinate does not. Strong acetic, sulphuric, and nitric acid dissolve it, with the aid of heat, and deposit it unchanged on cooling. It is also dissolved by solutions of potassa and soda, and to a small extent by a strong solution of ammonia. (*A. J. P.*, xxiv. 296.)

Somewhat different results in relation to the solubility of cantharidin have been obtained by M. E. Rowan. Careful examination with distilled water showed that, when agitated for eight days at ordinary temperatures with pure cantharidin, it was capable of dissolving 0·0266 per cent. of that principle; boiling water dissolves 0·297 per cent.; alcohol (boiling at 99 Tralles.) 2·168 per cent. (*Journ. de Pharm.*, Mai, 1873, p. 409.)

Medical Properties and Uses. Internally administered, cantharides is a powerful irritant, with a peculiar direction to the urinary and genital organs. In moderate doses, this medicine sometimes acts as a diuretic, and generally excites some irritation in the urinary passages, which, if its use be persevered in, or the dose increased, often amounts to violent strangury, attended with excruciating pain, and the discharge of bloody urine. In still larger quantities, it produces, in addition to these effects, obstinate and painful priapism, vomiting, bloody stools, severe pains in the whole abdominal region, excessive salivation with a fetid cadaverous breath, hurried respiration, a hard and frequent pulse, burning thirst, exceeding difficulty of deglutition, sometimes a dread of liquids, frightful convulsions, tetanus, delirium, and death. Orfila has known twenty-four grains of the powder to prove fatal. Dissection reveals inflammation and ulceration of the mucous coat of the whole intestinal canal. According to M. Poumet, if the intestines be inflated, dried, cut into pieces, and examined in the sun between two pieces of glass, they will exhibit small shining yellow or green points, strongly contrasting with the matter around them. (*Journ. de Pharm.*, 3e sér., iii. 167.)* The poisonous effects are to be counteracted by emetics, cathartics, and opiates by the stomach and rectum. Dr. Mulock, of Dublin, recommends the officinal solution of potassa as an antidote, having found thirty drops given every hour an effectual remedy in strangury from blisters. (*Dub. Quart. Journ. of Med. Sci.*, N. S., vi. 222.) From the experiments of Schroff it seems that oils somewhat accelerate the poisonous action, probably by dissolving the cantharidin. (See *A. J. P.*, xxviii. 365.) By experiments upon dogs, M. Thouery, a French apothecary, has satisfied himself that animal charcoal possesses a real antidotal power. (*Journ. de Pharm.*, 1858, p. 65.) Notwithstanding their exceeding violence, cantharides have been long and beneficially used in medicine. Either these or other vesicating insects appear to have been given by Hippocrates in dropsy and amenorrhœa, in the latter of which complaints, when properly prescribed, they are a highly valuable remedy. In dropsy they sometimes prove useful when the system is in an atonic state, and the vessels of the kidneys feeble. They are also useful in obstinate gleet, leucorrhœa, and seminal weakness, and afford one of the most certain means of relief in incontinence of urine arising from debility or partial paralysis of the sphincter of the bladder. A case of diabetes is recorded in the *N. Am. Archives* (vol. ii. p. 175), in which recovery took place under the tincture of cantharides. They are used also in certain cutaneous eruptions, especially those of a scaly character, and in chronic eczema. Dr. Erven has employed them in scurvy (*Ann. de Thérap.*, 1845); and they have been found useful, internally administered, in obstinate ulcers. Their unpleasant effects upon the urinary passages are best obviated by the free use of diluent drinks, and, when not consequent upon great abuse of the medicine, may almost always be relieved by an anodyne injection, composed of laudanum with a small quantity of mucilaginous fluid. The dose of Spanish flies is one or two grains (0·065–0·13 Gm.) of the powder, which may be given twice a day, in the form of pill. The tincture, however, is more frequently employed.

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* Cantharidin may be detected in the body after death from poisoning. M. Dragendorff, contrary to the opinion that cantharidin is so rapidly decomposed in a case of poisoning as to render search for it futile, states that he has succeeded in finding it in the dead body of a cat three months after it had been taken, and is convinced that it might be discovered in the human corpse six months after burial. (*Journ. de Pharm.*, 1873, p. 443.)

Externally applied, cantharides excites inflammation in the skin, which terminates in a copious secretion of serum under the cuticle. Even thus employed, it not unfrequently gives rise to strangury or tenesmus; and this is one of the most troublesome attendants upon its operation. It results from the absorption of the active principle of the fly. For various methods employed for obviating strangury from blisters, see *Ceratum Cantharidis.*

The blistering fly may be used either as a rubefacient, or to produce a blister. In the former capacity it is seldom employed, except in low states of disease, where external stimulation is required to support the system; but as an epispastic it is preferred to all other substances.

Blisters are calculated to answer numerous indications. Their local effect is attended with a general excitement, which renders them valuable auxiliaries to internal stimulants in low conditions of disease; and they may sometimes be safely resorted to with this view, when the latter remedies are inadmissible. The powerful impression they make on the system is sufficient, in many instances, to subvert morbid associations, and thus to allow the re-establishment of healthy action. Hence their application to the cure of remittent and intermittent fevers, in which they often prove effectual, when so employed as to be in full operation at the period for the recurrence of the paroxysm. On the principle of revulsion, they are useful in a vast variety of complaints. Drawing both the nervous energy and the circulating fluid to the seat of their immediate action, they relieve irritations and inflammations of internal parts, and are employed for this purpose in every disease attended with these derangements. In such cases, however, arterial excitement should be reduced before the remedy is resorted to. Blisters are also capable of substituting their own action for one of a morbid nature, existing in the part to which they are directly applied. Hence their use in tinea capitis, obstinate herpes, and various cutaneous eruptions. Their local stimulation renders them useful in some cases of threatened gangrene, and in partial paralysis. From the serous discharge they occasion, much good results in erysipelas and various other local inflammations, in the immediate vicinity of which their action can be established; and the effects of an issue may be obtained by the continued application of irritants to the blistered surface. Perhaps the pain produced by blisters may be useful in some cases of nervous excitement or derangement, in which it is desirable to withdraw the attention of the patient from subjects of agitating reflection. On some constitutions they produce a poisonous impression, attended with frequent pulse, dryness of the mouth and fauces, heat of skin, subsultus tendinum, and even convulsions. What is the precise condition of system in which these effects result, it is impossible to determine. They probably arise from the absorption of the active principle, and depend on individual peculiarities of constitution. In this respect Spanish flies are analogous to mercury; and any argument drawn from this source against the use of the one would equally apply to the other. The general good resulting from their use far overbalances any partial and uncertain evil. For some rules relative to the application of blisters, the reader is referred to the article *Ceratum Cantharidis*, where also will be noticed other blistering preparations from cantharides.

Off. Prep. Acetum Cantharidis, *Br.;* Ceratum Cantharidis, *U. S.;* Ceratum Extracti Cantharidis, *U. S.;* Charta Cantharidis, *U. S.;* Charta Epispastica, *Br.;* Collodium cum Cantharide, *U. S.;* Emplastrum Calefaciens, *Br.;* Emplastrum Cantharidis, *Br.;* Extractum Cantharidis; Linimentum Cantharidis, *U. S.;* Liquor Epispasticus, *Br.;* Tinctura Cantharidis; Unguentum Cantharidis, *Br.*

CAPSICUM. *U.S.* *Capsicum.*

(CĂP'SỊ-CŬM.)

"The fruit of Capsicum fastigiatum. Blume. (*Nat. Ord.* Solanaceæ.)" *U.S.* "The dried fruit of Capsicum fastigiatum. Imported from Zanzibar, and distinguished in commerce as Guinea Pepper and Pod Pepper." *Br.*

Capsici Fructus, *Br.;* Cayenne Pepper, African Pepper; Fructus capsici, *P.G.;* Piper Hispanicum; Pod Pepper, *E.;* Capsique. Piment des Jardins, Piment rouge, Poivre de Cayenne, Poivre de Guinée, Poivre d'Inde, *Fr.;* Spanischer Pfeffer, *G.;* Pepperone, *It.:* Pimiento, *Sp.*

Gen. Ch. Corolla wheel-shaped. *Berry* without juice. *Willd.*

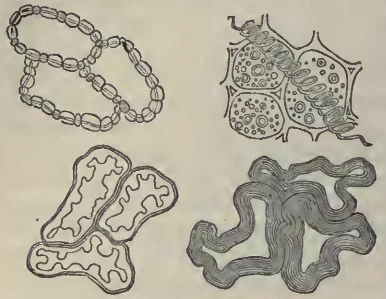
Numerous species of Capsicum, inhabiting the East Indies and tropical America, are enumerated by botanists, the fruit of which, differing simply in the degree of pungency, may be indiscriminately used. *C. baccatum*, or bird pepper, and *C. frutescens*, are said to yield most of the Cayenne pepper brought from the West Indies and South America; and Ainslie informs us that the latter is chiefly employed in the East Indies. Both Pharmacopœias now recognize, as the source of capsicum, *C. fastigiatum*, a species growing in the East Indies, and on the coast of Guinea. The one most extensively cultivated in Europe and this country is *C. annuum*. The first three are shrubby plants, the last is annual and herbaceous.

Capsicum annuum. Willd. *Sp. Plant.* i. 1052; *B. & T.* 189. The stem of the annual capsicum is thick, roundish, smooth, and branching; rises two or three feet in height; and supports ovate, pointed, smooth, entire leaves, which are placed without regular order on long footstalks. The flowers are solitary, white, and stand on long peduncles at the axils of the leaves. The calyx is persistent, tubular, and five-cleft; the corolla, monopetalous and wheel-shaped, with the limb divided into five spreading, pointed, and plaited segments; the filaments, short, tapering, and furnished with oblong anthers; the germen, ovate, supporting a slender style which is longer than the filaments, and terminates in a blunt stigma. The fruit is a pendulous, pod-like berry, of various shape and size, light, smooth, and shining, of a bright scarlet, orange, or sometimes yellow color, with two or three cells, containing a dry, loose pulp, and numerous flat, kidney-shaped, whitish seeds.

Capsicum fastigiatum. Blume. *B. & T.* 188. This species resembles closely *C. annuum*, but is distinguished by the lobes of the corolla being more acute, and especially by the fruit and seeds. The latter are smaller than those of *C. annuum*, and the erect, narrowly ovoid, oblong pod is nearly cylindrical, one-half to three-quarters of an inch long, and of a bright orange scarlet color when ripe.

These plants are natives of the warmer regions of Asia and America, and are cultivated in almost all parts of the world both for culinary and medicinal purposes. *C. annuum* is chiefly grown in this country; its flowers appear in July and August, and the fruit ripens in October. The several varieties of it differ in the shape of the fruit. The most abundant is probably that with a large irregularly ovate berry, depressed at the extremity, which is much used in the green state for pickling. The medicinal variety is that with long, conical, generally pointed, recurved fruit, usually not thicker than the finger. Sometimes we meet with small, spherical, slightly compressed berries, not greatly exceeding a large cherry in size. When perfectly ripe and dry, the fruit is ground into powder, and brought into market under the name of *red* or *Cayenne* pepper. Our markets are also partly supplied from the West Indies. A variety of capsicum, consisting of very small, conical, pointed, exceedingly pungent berries, less than an inch, is imported from Liberia. It is probably the *Capsicum fastigiatum.* In England the fruit of *C. annuum* is frequently called *chillies.* The officinal description of the fruit of *C. fastigiatum* is as follows: "Conical, from half to three-quarters of an inch (12 to 18 mm.) long, supported by a flattish, cup-shaped, five-toothed calyx, with a red, shining, membranous and translucent pericarp enclosing two cells, and containing flat, reniform, yellowish seeds attached to a thick, central placenta. It has a peculiar odor, and an intensely hot taste." *U.S.*

Powdered capsicum is usually of a more or less bright red color, which fades upon exposure to light, and ultimately disappears. The color of the Liberia or African pepper, in powder, is a light brownish yellow. The odor is peculiar and somewhat aromatic, stronger in the recent than in the dried fruit. The taste is bitterish, acrid, and burning, producing a fiery sensation in the mouth, which continues for a long time. The pungency appears to depend on a peculiar principle, which was obtained, though not in a perfectly isolated state, by Braconnot, and named *capsicin*. It is obtained as a thick yellowish red liquid, but slightly soluble in water. When gently heated it becomes very fluid, and at a higher temperature is dissipated in fumes, which are extremely irritating to the respiration. It is evidently a mixed substance, consisting of resinous and fatty matters.



In 1876, Thresh isolated, however, a well-defined highly active principle, *capsaicin*, from the extract, which he obtained by exhausting Cayenne pepper with petroleum. From the red liquor dilute caustic alkali removes capsaicin, which is to be precipitated in minute crystals by passing carbonic acid through the alkaline solution. The crystals may be purified by recrystallizing them from either alcohol, ether, benzin, glacial acetic acid, or hot bisulphide of carbon; in petroleum capsaicin is but sparingly soluble, yet dissolves abundantly on addition of fatty oil. The latter being present in the pericarp is the reason capsaicin can be extracted by the above process. The crystals of capsaicin are colorless, and answer to the formula $C_9H_{14}O_2$; they melt at 59° C. (138·2° F.), and begin to volatilize at 115° C. (239° F.), but decomposition can only be avoided with great care. The vapors of capsaicin are of the most dreadful acridity, and even the ordinary manipulation of that substance requires much precaution. Felletar (*Journ. de Pharm.*, Avril, 1870, p. 347) first obtained from capsicum fruits a volatile alkaloid, which resembles conine in odor, but is distinguished by the different shape of its hydrochlorate crystals. Red oxide of lead is sometimes added to the powdered capsicum sold in Europe. It may be detected by digesting in diluted nitric acid, and precipitating the lead by sulphate of sodium. Capsicum is said to be sometimes adulterated with colored sawdust; to be recognized by the microscope. The cut represents the characteristic cells of capsicum. It is occasionally attacked by insects.

Medical Properties and Uses. Cayenne pepper is a powerful stimulant, producing when swallowed a sense of heat in the stomach, and a general glow over the body, without any narcotic effect. Its influence upon the circulation, though considerable, is not in proportion to its local action. It is much employed as a condiment, and proves highly useful in correcting the flatulent tendency of certain vegetables, and aiding their digestion. Hence the advantage derived from it by the natives of tropical climates, who live chiefly on vegetable food. In the East Indies it has been used from time immemorial. From a passage in the works of Pliny, it appears to have been known to the Romans. As a medicine it is useful in cases of enfeebled and languid stomach, and is occasionally prescribed in dyspepsia and atonic gout, particularly when attended with much flatulence, or occurring in persons of intemperate habits. It has also been given as a stimulant in palsy and certain lethargic affections. To the sulphate of quinine it forms an excellent addition in some cases of intermittents, in which there is a great want of gastric susceptibility. Upon the same principle of rousing the susceptibility of the stomach, it may prove useful in low forms of fever, as an adjuvant to tonic or stimulant medicines. Its most important application, however, is to the treatment of malignant sore throat and scarlet fever, in which it is used both internally and as a gargle. The following formula was employed in malignant scarlatina, with great advantage, in the West Indies, where this application of the remedy originated. Two tablespoonfuls (31·1 Gm.) of the powdered pepper, with a teaspoonful (3·9 Gm.) of common salt, are infused for an hour in a pint of boiling liquid, composed of equal parts of water and vinegar. This is strained when cool through a fine linen cloth, and given in the dose of a tablespoonful (15 C.c.) every half hour. The same preparation is also used as a gargle. It is, however, only to the worst cases that the remedy is applied so energetically. In milder cases of scarlatina, with inflamed or ulcerated throat, much relief and positive advantage often follow the employment of the pepper in a more diluted state. Capsicum has been advantageously used in sea-sickness, in the dose of a teaspoonful (3·9 Gm.), given in some convenient vehicle on the first occurrence of nausea. It is thought also to have been beneficial in hemorrhoidal affections. It has long been used as a stomachic stimulant in the enfeebled digestion of drunkards, and has been recommended in delirium tremens, in which, when taken early, it is said sometimes to produce sleep, and thus to cut short the disease. (Dr. Lyons, *Med. Press and Circ.*, April 18, 1866.)

Applied externally, Cayenne pepper is a powerful rubefacient, very useful in local rheumatism, and in low forms of disease, where a stimulant impression upon the surface is demanded. It has the advantage of acting speedily without endangering vesication. It may be applied in the form of cataplasm, or more conveniently and efficiently as a lotion, mixed with heated spirit. The powder or tincture, brought into contact with a relaxed uvula, often acts very beneficially. The tincture has also been used advantageously in chilblain. The ethereal extract (*Oleoresina Capsici, U. S.*) is powerfully rubefacient.

The dose of the powder is from five to ten grains (0·33–0·65 Gm.), which is most conveniently given in the form of pill. Of an infusion prepared by adding two drachms to half a pint of boiling water, the dose is half a fluidounce (15 C.c.). A gargle may be prepared by infusing half a drachm of the powder in a pint of boiling water, or by adding half a fluidounce of the tincture to eight fluidounces of rose-water.

Off. Prep. Extractum Capsici Fluidum; Infusum Capsici, *U. S.;* Oleoresina Capsici, *U. S.;* Tinctura Capsici.

CARBO. *Carbon.*

C; 12. (CĂR'BŌ.) C; 6.

Pure Charcoal; Carbone, *Fr., It.;* Kohlenstoff, *G.;* Carbon, *Sp.*

Carbon is an element of great importance, and very extensively diffused in nature. It exists in large quantity in the mineral kingdom, and is the most abundant constituent of animal and vegetable matter. In the crystallized state it constitutes the diamond; and, more or less pure, it forms the substances called graphite, or black lead, plumbago, anthracite and bituminous coal, coke, animal charcoal, and vegetable charcoal. Combined with oxygen it forms *carbon dioxide*, or *carbonic acid gas*, which is a constituent of the atmosphere, and present in many natural waters, especially those which have an effervescing quality. United with oxygen and a base it forms the carbonates, among others *carbonate of calcium*, which is one of the most abundant minerals. There are three allotropic conditions of carbon, represented respectively by the diamond, graphite, and charcoal.

The *diamond* is found principally in India, Brazil, and Cape Colony, South Africa. Several diamonds have been found in the gold regions of Georgia and North Carolina. This gem is perfectly transparent, and the hardest and most brilliant substance in nature. Its sp. gr. is about 3·5. It is fixed and unalterable in the fire, provided air be excluded; but is combustible in air or oxygen, the product being the same as when charcoal is burned, namely, carbon dioxide.

Next to diamond, graphite or plumbago is the purest natural form of carbon. Graphite is the substance of which black-lead crucibles and pencils are made. It is found in greatest purity in the mine of Borrowdale, in England; but it also occurs very pure in this country, and in extensive deposits at Ticonderoga, N. Y., Stourbridge, Mass., and in Canada. In physical characters it is utterly different from the diamond; it crystallizes in hexagonal plates, is very soft and unctuous, of 2 to 2·5 sp. gr., and generally contains a little ash. It was formerly supposed to be a carbide of iron; but, in very pure specimens, it is nearly free from iron, which must, therefore, be deemed an accidental impurity. *Anthracite*, the purest variety of natural coal, occurs in different parts of the world, but particularly in the State of Pennsylvania. It contains from 90 to 95 per cent. of carbon, and several per cent. of ash. *Bituminous coal* is another variety, containing, besides the fixed or free carbon, some 10 to 15 per cent. of volatile hydrocarbons or gas-making material. When this is driven off by the process of charring, as in the manufacture of coal gas, a kind of mineral charcoal, called *coke*, is obtained, very useful in the arts as a fuel. When peat is charred, it is converted into *peat charcoal*, which forms a cheap disinfectant and deodorizer, applicable to the purification of hospitals, dissecting rooms, factories, privies, etc.

Carbon may be obtained in a state approaching to purity by several processes. One method is to expose lampblack to a full red heat in a close vessel. It may also be obtained, in a very pure state, by passing the vapor of volatile oils through an ignited porcelain tube; whereby the hydrogen and oxygen of the oil will be dissipated, and the charcoal left in the tube. A pure charcoal is procured by burning sugar, or other vegetable substances which leave no ashes, in close vessels.

Properties. Carbon, in its uncrystallized state, is an insoluble, infusible solid, generally of a black color, and without taste or smell. It burns when sufficiently heated, uniting with the oxygen of the air, and generating carbonic acid gas. Its sp. gr. in the solid state, apart from its pores when in mass, is 3·5; but with the air of the pores included, it is only 0·44. It is a very unalterable and indestructible substance, and has great power in resisting and correcting putrefaction in other bodies. When properly prepared, it possesses the property of absorbing the coloring and odorous principles of most liquids. (See *Carbo Animalis.*) Its other physical properties differ according to its source, and peculiar state of aggregation. As a chemical element it enjoys a very extensive range of combination. It forms two compounds with oxygen, *carbon dioxide* (carbonic acid gas) and *carbon monoxide* (carbonous oxide). With hydrogen it forms a number of compounds, called *hydrocarbons*, of which the most interesting, excluding hypothetical radicals, are light carburetted hydrogen or marsh-gas, olefiant gas, the light and concrete oils of wine, the hydrocarbons constituting petroleum, and the various essential oils. With nitrogen it constitutes cyanogen, the compound radical of hydrocyanic or prussic acid; and united in minute proportion with iron it forms steel.

To notice all the forms of the carbonaceous principle would be out of place in this work. We shall, therefore, restrict ourselves to the consideration of those which are officinal, namely, *animal charcoal* and *wood charcoal.*

CARBO ANIMALIS. *U.S., Br.* *Animal Charcoal.*

(CĂR′BŌ ĂN-Ị-MĀ′LĬS.)

“Animal [*sic*] charcoal prepared from bone.” *U.S.* “The residue of bones, which have been exposed to a red heat without access of the air.” *Br.*

Bone Black, Ivory Black, *Br.;* Charbon animal, Noir d'Os, *Fr.;* Thierische Kohle, Knochen Kohle, Beinschwarz, Thierkohle, *G.;* Carbone animale, *It.;* Carbon animal, *Sp.*

The animal charcoal employed in pharmacy and the arts is usually obtained from bones, by subjecting them to a red heat in close vessels. The residue of the ignition is a black matter, which, when reduced to powder, forms *bone-black*, sometimes incorrectly called *ivory-black*. Ivory by carbonization will furnish a black, which, on account of its fineness and intensely black color, is more esteemed than the ordinary bone-black; but it is much more expensive.

In manufacturing bone-black, the bones, first boiled in water to separate the fat, are subjected to destructive distillation in iron cylinders, connected with vessels which receive the ammoniacal liquor, called *bone-spirit*, together with a dark tarry liquid (*bone-oil*), this being a secondary product of the operation. When the bone-spirit ceases to come over, the residue is charred bone, or bone-black. Bone consists of animal matter with phosphate and carbonate of calcium. In consequence of the decomposition of the animal matter involved in this destructive distillation, the nitrogen and hydrogen, united as ammonia, and a part of the charcoal, in the form of carbonic acid gas, distil over; while the remainder of the charcoal is left in the cylinder, intermingled with the calcareous salts. M. Deiss, of Paris, proposes bisulphide of carbon as a solvent for the fat of bones; as it furnishes a larger and better product of fat, and renders the bones fitter for producing a good bone-black.

(*Chem. Gaz.*, April 1, 1856.) This form of animal charcoal necessarily contains phosphate and carbonate of calcium.

Properties. Animal charcoal is in the form of "dull black, granular fragments, or a dull black powder, odorless and nearly tasteless, and insoluble in water or alcohol. When ignited, it leaves a white ash, amounting to at least 86 per cent. of the original weight, which should be completely soluble in hydrochloric acid, with the aid of heat." *U. S.* It is, however, more dense and less combustible than vegetable charcoal; from which, moreover, it may be distinguished by burning a small portion of it on a red-hot iron, when it will leave a residuum imperfectly acted on by sulphuric acid; whereas the ashes from vegetable charcoal readily dissolve in this acid, forming a bitterish solution.

Animal charcoal by no means necessarily possesses the decolorizing property; as this depends upon its peculiar state of aggregation. If a piece of pure animal matter is carbonized, it usually enters into fusion, and from the gaseous matter which is extricated, becomes porous and cellular. The charcoal formed has generally a metallic lustre, and a color resembling that of black lead. It has, however, little or no decolorizing power, even though finely pulverized.

The decolorizing power of vegetable charcoal was first noticed by Lowitz, of St. Petersburg; and that of animal charcoal by Figuier, of Montpellier, in 1811. In 1822 the subject was ably investigated by Bussy, Payen, and Desfosses. The power is generally communicated to charcoal by igniting it in close vessels, but not always. The kind of charcoal, for example, obtained from substances which undergo fusion during carbonization scarcely possesses the property, even though it may be afterwards finely pulverized. The property in question is possessed to a certain extent by wood charcoal;[*] but is developed in it in a much greater degree by burning it with some chemical substance, which may have the effect of reducing it to an extreme degree of fineness. The most powerful of all the charcoals for discharging colors are those obtained from certain animal matters, such as dried blood, hair, etc., by first carbonizing them in connection with carbonate of potassium, and then washing the product with water. Charcoal, thus prepared, seems to be reduced to a state of extremely minute division, and is, therefore, very porous. The next most powerful decolorizing charcoal is *bone-black*, in which the separation of the carbonaceous particles is effected by the phosphate of calcium present in the bone. Vegetable substances also may be made to yield a good charcoal for destroying color, provided, before carbonization, they be well comminuted, and mixed with pumice stone, chalk, flint, or other similar substance in a pulverized state.

The following table, abridged from one drawn up by Bussy, denotes the relative decolorizing power of different charcoals.

KINDS OF CHARCOAL.	Decolorizing power on Syrup.	Decolorizing power on Indigo.
Bone-black	1	1
Bone charcoal treated with an acid	1·6	1·8
Lampblack, not ignited	3·3	4
Charcoal, from acetate of potassium	4·4	5·6
Blood ignited with phosphate of calcium	10	12
Lampblack ignited with carbonate of potassium	10·6	12·2
Blood ignited with chalk	11	18
White of egg ignited with carbonate of potassium	15·5	34
Glue ignited with carbonate of potassium	15·5	36
Bone charcoal, formed from bone deprived of phosphate of calcium by an acid, and subsequently ignited with carbonate of potassium	20	45
Blood ignited with carbonate of potassium	20	50

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[*] Dr. Stenhouse divides decolorizing charcoals into three classes. First, pure charcoals, which, being in a state of minute division, decolorize by their porosity alone. Second, those which, like aluminized charcoal and artificial bone-black, decolorize solely by the bases they contain, acting as mordants. Third, those which, like bone-black, decolorize, partly by the mineral matter, and partly by the minutely divided charcoal they contain. (*P. J. Tr.*, Jan. 1857, p. 366.)

In order to determine the commercial value of animal charcoal, M. Corenwinder has proposed to ascertain its power of absorbing lime from a solution of saccharate of lime of determinate strength. The value is in proportion to the absorbing power of the charcoal. A given weight of the charcoal to be tested is left in contact, for an hour, with a given volume of the solution of the saccharate, taken in excess. The liquid is then filtered, and a small measure of it saturated with dilute sulphuric acid of known strength. The less the acid necessary for this purpose, the greater the amount of lime absorbed, and the better the animal charcoal. (See *Chem. Gaz.*, 1854, p. 16; see also *Scientific American*, April 22, 1876. F. L. Bartlett.)

Spent animal charcoal, which has been used by the sugar refiners, may have its decolorizing power restored by calcination, which destroys the organic matters that have become fixed in it; and it is stated that it may be submitted to this process twenty times before becoming unfit for use. According to Pelouze, the same object may be accomplished by subjecting it to a weak solution of carbonate of potassium or of sodium. In removing the coloring matter, the alkaline solution becomes yellow. After its action the animal charcoal must be carefully washed, first with boiling water, and afterwards with acidulated water. But a process devised by MM. Leplay and Cuisinier is probably more effectual. The charcoal, without being removed from the cylinders, is thoroughly washed, treated by steam to remove viscous substances, and then percolated successively, 1, by a weak alkaline solution, which removes salts and some coloring matters; 2, by weak hydrochloric acid, which, in removing a certain amount of salts of lime, liberates coloring matter; 3, again with a weak alkaline solution to carry off the remaining coloring matter; and 4, lastly by a solution of biphosphate of calcium, by which the decolorizing power of the charcoal is restored. (Dr. F. C. Calvert, *A. J. P.*, 1865, p. 263.)

Animal charcoal is capable of taking the bitter principles from infusions and tinctures, and iodine from liquids which contain it in solution. Its power, however, of acting on solutions and chemical compounds is much more decided in its purified state, as shown by both Warington and Weppen. (See *Carbo Animalis Purificatus.*)

Bone-black consists of about 90 per cent. of phosphate and carbonate of calcium, and 10 per cent. of charcoal.

Pharm. Uses. Animal charcoal is used in pharmacy for decolorizing vegetable principles, such as gallic acid, quinine, morphine, veratrine, etc., and in the arts, principally for clarifying syrups in sugar refining, for depriving spirits distilled from grain of the peculiar volatile oil, called *fusel oil*, which imparts to them an unpleasant smell and taste, as first distilled, and for the filtration of petroleum residuums in the manufacture of petrolatum and petroleum jellies. (See *Petrolatum.*) The manner in which it is used as a decolorizer is to mix it with the substance to be decolorized, and to allow the mixture to stand for some time. The charcoal unites with the coloring matter, and the solution by filtration is obtained white and transparent. Its use, however, in decolorizing the organic alkalies and other vegetable principles, no doubt causes a loss by absorption; since it has been shown by the experiments of M. Lebourdais, mentioned under the head of purified animal charcoal, that several of these principles may be obtained by the sole action of charcoal. For most pharmaceutical operations, and for use as an antidote, animal charcoal must be purified by hydrochloric acid from phosphate and carbonate of calcium. (See *Carbo Animalis Purificatus.*) According to Guthe, a German chemist, bone charcoal, without purification, is to be preferred as a decolorizer, in all cases in which the calcareous salts exert no injurious effect.

Off. Prep. Carbo Animalis Purificatus.

CARBO ANIMALIS PURIFICATUS. *U.S., Br.* *Purified Animal Charcoal.*

(CĂR'BŌ ĂN-Ị-MĀ'LĬS PŪ-RỊ-FỊ-CĀ'TŬS.)

Charbon animal purifié, *Fr.;* Gereinigte Knochen Kohle, *G.*

"Animal Charcoal, in No. 60 powder, *two parts;* Hydrochloric Acid, *three parts;* Water, *a sufficient quantity.* Pour the Hydrochloric Acid, previously mixed with *fifteen* (15) *parts* of Water, upon the Animal Charcoal, and digest the mixture on a water-bath, for twenty-four hours, occasionally stirring. Pour off the supernatant liquid, and digest the undissolved portion with *fifteen* (15) *parts* of Water for two hours. Transfer the mixture to a strainer, and, when the liquid portion has run off, wash the residue with Water until the washings cease to be affected by test-solution of nitrate of silver. Dry the product, heat it to dull redness in a closely covered crucible, and, when cool, keep it in well-stopped bottles." *U. S.*

"Take of Bone Black, in powder, *sixteen ounces* [avoirdupois]; Hydrochloric Acid *ten fluidounces;* Distilled Water *a sufficiency.* Mix the Hydrochloric Acid with a pint of the Water, and add the Bone Black, stirring occasionally. Digest at a moderate heat for two days, agitating from time to time; collect the undissolved charcoal on a calico filter, and wash with Distilled Water till what passes through gives scarcely any precipitate with nitrate of silver. Dry the charcoal, and then heat it to redness in a covered crucible." *Br.*

Animal charcoal, as it is made by charring bones, necessarily contains bone-phosphate and carbonate of calcium, the presence of which does no harm in some decolorizing operations; but, in delicate chemical processes, these salts may be dissolved or decomposed, and thus become a source of impurity. It is on this account that animal charcoal requires to be purified from its calcareous salts; and this is accomplished by diluted hydrochloric acid, which dissolves the phosphate and decomposes the carbonate. According to Dr. Stenhouse, aluminized vegetable charcoal may be substituted for purified animal charcoal, and is equally efficacious as a decolorizer. (See page 357.)

Properties. Purified animal charcoal is "a dull black powder, odorless and tasteless, and insoluble in water, alcohol, or other solvents. When ignited at a high temperature with a little red oxide of mercury and with free access of air, it leaves at most only a trace of residue. If 1 part be digested with 2 parts of hydrochloric acid and 6 parts of water, the filtrate, after being supersaturated with water of ammonia, should remain unaffected by test-solution of magnesium (abs. of phosphate)." *U. S.*

It has been shown by Mr. Robert Warington that bitter vegetable substances, including the organic alkalies, are removed from solution by passing through purified animal charcoal, especially when the action is assisted by heat. M. Weppen finds that a similar effect is produced by it in removing resins from tinctures, tannic acid and bitter principles from astringent and bitter infusions, and certain metallic salts from their solutions. Purified animal charcoal, thus employed, has been resorted to by M. Lebourdais as an agent for obtaining the active principles of plants. A decoction or infusion of the plant is either boiled with or filtered through the charcoal, which takes up, more or less completely, the bitter and coloring principles. The charcoal, after having been washed and dried, is treated with boiling alcohol, which dissolves the principles taken up. Finally, the alcohol is distilled off, and the principles are obtained in a separate state. In this way digitalin, ilicin, scillitin, columbin, colocynthin, arnicine, strychnine, quinine, and other principles have been obtained by M. Lebourdais. (*Chem. Gaz.*, Nov. 15, 1848.) In relation to the method of M. Lebourdais, see a paper by Mr. J. S. Cobb. (*A. J. P.*, 1851.) Dr. A. B. Garrod has proposed purified animal charcoal as an antidote to vegetable and animal poisons, with which it appears to combine. According to his experiments, common bone-black has not one-fifth of the powder possessed by the purified substance; and vegetable charcoal and lampblack are nearly or quite useless. The amount of the antidote proposed by Dr. Garrod is half an ounce for each grain of a vegetable organic alkali. Dr. Alfred Taylor deems the results of Dr. Garrod inconclusive. Prof. B. H. Rand, of this city, made some interesting observations in relation to the antidotal powers of purified animal charcoal, and proved that poisonous doses of the strongest vegetable poisons may be swallowed with impunity, if mixed with that substance. (*Med. Exam.*, Sept. 1848.) It has also been recommended as an antidote for phosphorus (*N. Y. Med. Record*, 1874, p. 68), but its value is very doubtful.

In using animal charcoal for decolorizing active vegetable principles, great caution should be observed, as much loss is often incurred by the absorption of those principles by the charcoal.

Pharm. Uses. Atropia, *Br.;* Digitalinum; Morphiæ Hydrochloras, *Br.;* Santoninum, *Br.*

CARBO LIGNI. *U.S.*, *Br.* *Charcoal.*

(CĂR'BŌ LĬG'NĪ.)

"Charcoal prepared from soft wood." *U. S.* "Wood charred by exposure to a red heat without access of air." *Br.*

Wood Charcoal, Vegetable Charcoal; Carbo Pulveratus, *P.G.;* Carbo Præparatus, Carbo e Ligno; Charbon végétal, Charbon de Bois, *Fr.;* Holzkohle, Präparirte Kohle, *G.;* Carbone di Legno, *It.;* Carbon de Lena, *Sp.*

Preparation on the Large Scale. Billets of wood are piled in a conical form, and covered with earth and sod to prevent the free access of air; several holes being left at the bottom, and one at the top of the pile, in order to produce a draught to commence the combustion. The wood is then kindled from the bottom. In a little while the hole at the top is closed, and, after the ignition is found to have pervaded the whole pile, those at the bottom are stopped also. The combustion taking place with a smothered flame, the volatile portions of the wood, consisting of hydrogen and oxygen, are dissipated; while the carbon, in the form of charcoal, is left.

In this process for the carbonization of wood, all the volatile products are dissipated; and a portion of the charcoal itself is lost by combustion. Wood, thus carbonized, yields not more than 17 or 18 per cent. of charcoal. A better method is to char the wood in iron cylinders, when it yields from 22 to 23 parts in 100 of excellent charcoal; and, at the same time, the means are afforded for collecting the volatile products, consisting of pyroligneous acid, empyreumatic oil, and tar. This process for obtaining charcoal has been described under another head. (See *Acidum Aceticum.*) A method of preparing charcoal by subjecting wood to over-heated steam has been invented by M. Violette. When the temperature of the steam is 300° C. (572° F.), the wood is converted into a peculiar charcoal, called *red charcoal*, which is intermediate in its qualities between wood and ordinary charcoal. When the temperature is lower, the carbonization is incomplete; when higher, the product is black charcoal. The steam process yields a uniform charcoal for a given temperature, which may be easily regulated, and a product about double that obtained in closed cylinders. Charcoal, prepared in closed cylinders, yields ten times as much ash as that ordinarily made. Charcoal contains *carbon*, in proportion to the temperature at which it is formed; varying from 65 per cent. when made at 250° C. (482° F.), to 80 per cent. at 400° C. (752° F.). The gaseous matter present is always inversely as the temperature of carbonization. Thus, for charcoal made at 300° C. (572° F.), it is one-third of its weight; at 350° C. (662° F.), one-fourth. (*Journ. de Pharm.*, 1851, p. 35.)

Mr. E. C. C. Stanford has called attention to a variety of vegetable charcoal, obtained by charring a species of sea-weed, *Laminaria digitata*, gathered on the shores of the Hebrides, which, although, on account of the large proportion of carbonate of calcium contained in it (20 per cent.), unfit for use in refining sugar, possesses more of the deodorizing and decolorizing power than animal charcoal itself, which, with the exception referred to, it closely resembles in chemical composition. (*P. J. Tr.*, 1867, p. 186.)

Preparation for Medicinal Use. M. Belloc recommends charcoal for this purpose to be obtained from poplar shoots, cut at the time the sap rises, and deprived of their bark. The carbonization should be performed in cast-iron vessels at a red-white heat. The product is a light and brilliant charcoal, which must be purified by being macerated for three or four days in water, frequently renewed. It is then dried, powdered, and placed in bottles, which should be well stopped. The charcoal most esteemed in Philadelphia, for medicinal purposes, is that prepared by the Messrs. Dupont, near Wilmington, Delaware, for the manufacture of gunpowder. It is made from young willow shoots of two or three years' growth.

Properties. Charcoal is a black, shining, brittle, porous substance, tasteless and inodorous and insoluble in water. It is a good conductor of electricity, but a bad one of heat. It possesses the remarkable property of absorbing many times its own bulk of certain gases. When exposed to the air after ignition, it increases rapidly in weight, absorbing from 12 to 14 per cent. of moisture. As ordinarily prepared, it contains the incombustible part of the wood amounting to 1 or 2 per cent., which is left as ashes when the charcoal is burned. These may be removed by digesting the charcoal in diluted hydrochloric acid, and afterwards washing it thoroughly with boiling water.

Medical Properties, etc. Powdered charcoal is disinfectant and absorbent. It is employed with advantage in diarrhœa as an absorbent, and in dyspepsia with fetid breath and eructations. It was given in dysentery by the late Dr. Robert Jackson, who found it to have the effect of soothing the patient, and improving the character and consistence of the stools. It is also useful, in the form of injection, in putrid discharges from the uterus. M. Belloc recommends it strongly in gastralgia, and especially pyrosis, in which, if it fails to remove the disease, it abates the pain, nausea, and vomiting; and his observations have been confirmed by a committee of the French Academy of Medicine. As a remedy in obstinate constipation, Dr. Daniel, of Savannah, speaks of it in high terms. He also found it useful in nausea and constipation of pregnancy. On the other hand, some practitioners have found charcoal to confine the bowels. Dr. Wilson, of New Zealand, speaks highly of it in the diarrhœa of measles, and in epidemic cholera. Dr. Newman recommends it as a dressing to wounds and ulcers. Mr. Wormald, of St. Bartholomew's Hospital, has made a useful application of the disinfecting power of dry charcoal, in what he calls the *charcoal quilt*. This consists of two sheets of cotton wadding, quilted together in small segments, with a tolerably thick layer of powdered charcoal between them. The quilts, thus prepared, may be of any size, so as to fit a gangrenous sore or stump. Its use as an ingredient of poultices is noticed under *Cataplasma Carbonis*. Several of its varieties are used as tooth-powder. Those generally preferred are the charcoals of the cocoa-nut shell and of bread. It is said that charcoal proves useful in preserving the teeth by absorbing the acid sometimes morbidly present in the mucus of the mouth. The dose of charcoal varies from one to four teaspoonfuls (3·9–15·5 Gm.) or more. Dr. Daniel gave it in his case of constipation in doses of a tablespoonful (15·5 Gm.), repeated every half hour. *Charcoal biscuits* have been prepared, containing 15 or 20 per cent. of charcoal in fine powder, whilst *charcoal lozenges*, either with charcoal alone or associated with bismuth, have been employed with asserted good results in certain forms of gastric disturbances.

For internal use charcoal is preferred by some in the *granular form*. Mr. W. Lascelles Scott employs the following method of preparing it. He prefers the wood of the box, willow, or linden, which, after being charred, should be allowed to cool out of contact with air, then boiled for some time in diluted hydrochloric acid, and afterwards, having been thoroughly washed with pure water, in a little weak ammonia. The fragments are again ignited, and then quickly powdered, and passed through a sieve of 80 or 100 apertures to the inch. Nine pounds of this powder are mixed with one pound of pure sugar passed through a 30 sieve, and 4 ounces of gum arabic in impalpable powder. The whole is then moistened with a few ounces of warm distilled water, to which have been added an ounce and a quarter of tincture of benzoin, and a little mucilage. The mass is now granulated on flat steam pans, in the usual manner, at a temperature of 101·6°–107·2° C. (215° or 225° F.). When perfectly dry it is sifted, and secured in well-stopped bottles. (*Chem. News*, 1867, p. 204.)

Charcoal has been employed with good effect, as a deodorizer, in dissecting-rooms, placed in open pans through the room. It has the advantage over the chlorides that it has no smell. When it loses its effect, it may be recalcined. Water for long voyages is kept sweet by having a little powdered charcoal added to each cask.

Dr. Stenhouse has devised a process for combining alumina with common vegetable charcoal, forming what he calls *aluminized charcoal*, which is an economical substitute for purified animal charcoal, and equally efficacious as a decolorizer. It is prepared by digesting finely powdered charcoal with sufficient of the solution of sulphate of aluminium to give an impregnation of 7·5 per cent. of alumina. The whole is evaporated to dryness, and ignited in a covered Hessian crucible, until the water and acid have been dissipated. Aluminized charcoal is perfectly black, though thoroughly impregnated with anhydrous alumina, and only requires to be carefully pulverized to be ready for use. (*P. J. Tr.*, 1857, p. 364.) On similar principles, Dr. Stenhouse prepares his *artificial bone-black*, by impregnating powdered wood charcoal with 7·5 per cent. of phosphate of calcium, by digesting it in a solution of this salt in hydrochloric acid, evaporating to dryness, and igniting in covered vessels. This charcoal decolorizes well, but can be used only for neutral solutions.

Charcoal may act either as an oxidizer or deoxidizer; and these contrary powers seem to depend upon its having for oxygen a medium affinity, which enables it to take that element from some bodies, and to yield it to others, or at least by its porosity to facilitate atmospheric oxidation. Thus, it is known to reduce several oxides; while, on the other hand, it aids powerfully in the oxidation of animal matter. The bodies of two dogs having been laid in an open box on a bed of charcoal, a few inches deep, and covered by the same material, were kept by Mr. John Turnbull, of Glasgow, for six months in his laboratory, without emitting any perceptible effluvium; and, when they were examined at the end of this time, scarcely anything remained but the bones. Dr. Stenhouse, who relates this experiment, has confirmed it by observations of his own, and believes that the animal matter thus treated, undergoes putrefaction; though the products, by their rapid oxidation and absorption, are prevented from contaminating the air. He, therefore, considers charcoal not to be antiseptic, but the very opposite. (*Chem. Gaz.*, 1854, p. 132.)

The study of the absorbent and oxidizing properties of charcoal led Dr. Stenhouse to apply it to the purpose of preventing the access of noxious effluvia to the lungs in respiration. This object he proposed to effect by covering the nose and mouth with what he called the *charcoal respirator*. The instrument consists of a layer of coarsely powdered charcoal, a quarter of an inch thick, between two sheets of silvered wire gauze, covered with thin woollen cloth, by means of which the temperature of the inspired air is greatly increased. The frame is made of thin sheet-copper; but the edges of lead padded and lined with velvet so as to fit the lower part of the face. Dr. Stenhouse considered his respirator to act as an air filter, and to be peculiarly adapted to protect the wearer against infectious diseases. (*P. J. T.*, 1855, p. 328.) This instrument must not be confounded with Jeffrey's wire ventilator, which is intended solely to warm the air before entering the lungs.

Pharm. Uses. In the preparation of Acidum Sulphurosum; Potassii Bromidum, *Br.;* Potassii Iodidum.

Off. Prep. Cataplasma Carbonis, *Br.*

CARBONEI BISULPHIDUM. *U. S.* *Bisulphide of Carbon.* [*Disulphide of Carbon.*]

CS_2; 76. (CẠR-BŌ'NẸ-Ī BĪ-SŬL'PHỊ-DŬM.) CS_2; 38.

"Bisulphide of Carbon should be kept in well-stopped bottles, in a cool place, remote from lights or fire." *U. S.*

Carboneum Sulfuratum, Alcohol Sulfuris, *P.G.;* Carbonii Bisulphidum; Carbon Sulphide, Sulfure de Carbone, *Fr.;* Schwefelkohlenstoff, *G.*

This compound, corresponding to carbon dioxide (carbonic acid gas), CO_2, is prepared by the direct combination of carbon and sulphur at a moderate red heat. To effect this, charcoal is heated to redness in a vertical cylinder, while sulphur is admitted through a lateral tubulure near the bottom. As the sulphur melts and vaporizes, it combines with the carbon, and the carbon disulphide formed distils over through a series of condensing tubes, which, while they serve to collect the crude carbon disulphide, allow of the escape of the hydrogen sulphide formed at the same time. The crude product is then rectified, first over a solution of chlorinated lime to break up any hydrogen sulphide gas remaining, and then repeatedly either over mercury or mercuric chloride, or over a pure fatty oil, which withdraws from it all free sulphur and bad-smelling sulphur compounds.

The manufacture of carbon disulphide has within late years assumed large proportions. In the works of Deiss at Pantin, near Marseilles, France, 500 kilogrammes are turned out daily, and their annual production in 1880 exceeded 1,200,000 kilogrammes.

It is used in the arts for the extraction of oils from different oil-seeds, for the extraction of sulphur from some varieties of sulphur ores, for the cleansing of wool and recovering the fat, in the manufacture of india-rubber goods as a solvent for the caoutchouc, for the extraction of perfumes, and latterly on an enormous scale in France as a remedy against the *phylloxera*, or grape pest, using it either directly or to produce the alkaline xanthogenates (sulphocarbonates).

Properties. "A clear, colorless, highly refractive liquid, very diffusive, having a strong, characteristic odor, a sharp, aromatic taste, and a neutral reaction. It is insoluble in water; soluble in alcohol, ether, chloroform, and fixed or volatile oils. Sp. gr. 1·272. It vaporizes abundantly at ordinary temperatures, is highly inflammable, boils at 46° C. (114·8° F.), and, when ignited, burns with a blue flame, producing carbonic and sulphurous acids. It should not affect the color of blue litmus paper moistened with water (abs. of sulphurous acid). A portion evaporated spontaneously in a glass vessel should leave no residue (sulphur). Test-solution of acetate of lead agitated with it should not be blackened (abs. of hydrosulphuric acid)." *U. S.*

Medical Properties. Bisulphide of carbon is a powerful poison, but is not used as an internal remedy. According to M. Delpech, the workmen exposed to the fumes of the bisulphide are affected with headache, vertigo, and over-excitement of the nervous system, as evinced by voluble talking, incoherent singing, or immoderate laughter, or sometimes by weeping; and a continuance of the exposure is apt to cause at length a state of cachexia, characterized by general weakness, loss of sexual appetite, dulness of sight and hearing, and impairment of memory. M. S. Cloëz has made with it experiments on some of the smaller animals, as rats and rabbits, which were confined under a bell-glass with some cotton saturated with the bisulphide. In a few moments the animal exhibited signs of its action in great excitement, followed by retarded movements, with some convulsive shocks, then fell on its side and died in five minutes from the beginning. Congestion of the lungs and of the cavities of the heart, without any cerebral lesion, while the right auricle continued to contract two hours after apparent death, were the phenomena observed on dissection. (*Lancet*, Sept. 1866, p. 267.)

Externally, the bisulphide has been used as a counter-irritant and local anæsthetic. In enlarged lymphatic glands, Dr. Turnbull has used it with asserted good success. He applies it by means of a bottle with a proper sized mouth, containing a fluid-drachm of the bisulphide, imbibed by a piece of sponge. The skin over the gland is first well moistened with water. He employed the vapor also with benefit in deafness, when dependent on want of nervous energy, and a deficiency of wax. For this purpose, the bottle containing the bisulphide is made with a neck to fit the meatus, and, being applied to the ear, is held there until considerable warmth is produced. The remedy has been used often with very good results, in a similar manner, in facial and other neuralgias and various local pains. It causes a good deal of smarting, but its excessive odor is the chief objection to it.

CARDAMOMUM. *U. S.*, *Br.* *Cardamom.*

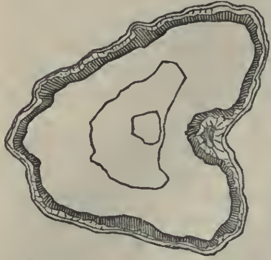
(CĂR-DA-MŌ′MŬM.)

"The fruit of Elettaria Cardamomum. Maton. (*Nat. Ord.* Zingiberaceæ.)" *U. S.* "The dried capsules of the Malabar Cardamom, Elettaria Cardamomum. The seeds are best kept in their pericarps, from which they should be separated when required for use, the pericarpial coats being rejected." *Br.*

Cardamoms, *Br.;* Fructus (Semen) Cardamomi Minoris, *P.G.;* Cardamomum Minus, Cardomomum Malabariam; Malabar Cardamoms; Cardamomes, Petit Cardamome, *Fr.;* Cardamomen, Kleine Cardamomen, *G.;* Cardamomo minore, *It.;* Cardamomo menor, *Sp.;* Ebil, *Arab.;* Kakelah seghar, *Pers.;* Capalaga, *Malay;* Gujaratii elachi, *Hindoost.*

The subject of Cardamom has been involved in some confusion and uncertainty, both in its commercial and botanical relations. The name has been applied to the aromatic capsules of various Indian plants belonging to the family of Scitamineæ.

Three varieties have long been designated by the several titles of the *lesser*, *middle*, and *larger*—*cardamomum minus*, *medium*, and *majus;* but these terms have been used differently by different writers, so that their precise signification remains doubtful. To the late Dr. Pereira we are mainly indebted for the clearing up of this confusion. It is well known that the *lesser cardamom* of most writers is the variety recognized by the Pharmacopœias, and generally kept in the shops. The other varieties, though circulating to a greater or less extent in European and Indian commerce, are little known in this country.* The following remarks have reference exclusively to the genuine Malabar, or officinal cardamom.


Transverse section of seed of cardamom.

Linnæus confounded, under the name of *Amomum Cardamomum*, two different vegetables—the genuine

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* The following is a sketch of the non-officinal cardamoms, compiled chiefly from the publications of Pereira and of Flückiger and Hanbury.

1. *Ceylon Cardamom.* This has been denominated variously *cardamomum medium*, *cardamomum majus*, and *cardamomum longum*, and is sometimes termed in English commerce *wild cardamom.* It is the *large cardamom* of Guibourt. In the East it is sometimes called *grains of Paradise;* but it is distinct from the product known with us by that name. It is derived from a plant cultivated in Candy, in the island of Ceylon, and also growing wild in the forests of the interior, which was designated by Sir James Edward Smith *Elletaria major*, but is now generally acknowledged to be only a variety of the officinal plant. This plant was described by Pereira in *P. J. Tr.* (ii. 388). The fruit is a lanceolate-oblong, acutely triangular capsule, somewhat curved, about an inch and a half long and four lines broad, with flat and ribbed sides, tough and coriaceous, brownish or yellow ash-colored, having frequently at one end the long, cylindrical, three-lobed calyx, and at the other the fruit-stalk. It is three-celled, and contains angular, rugged, yellowish red seeds, of a peculiar fragrant odor and spicy taste. Its effects are analogous to those of the officinal cardamom.

2. *Round Cardamom.* This is probably the Αμωμον of Dioscorides, and the *Amomi uva* of Pliny, and is believed to be the fruit of *Amomum Cardamomum* (Willd.), growing in Sumatra, Java, and other East India islands. The capsules are usually smaller than a cherry, roundish or somewhat ovate, with three convex sides, more or less striated longitudinally, yellowish or brownish white, and sometimes reddish, with brown, angular, cuneiform, shrivelled seeds, which have a spicy camphorous flavor. They are sometimes, though rarely, met with connected in their native clusters, constituting the *amomum racemosum*, or *amome en grappes* of the French. They are similar in medicinal properties to the officinal, but are seldom used except in the southern parts of Europe.

3. *Java Cardamom.* The plant producing this variety is supposed to be the *Amomum maximum* of Roxburgh, growing in Java and other Malay islands in the East. The capsules are oval, or oval-oblong, often somewhat ovate, from eight to fifteen lines long, and from four to eight broad, usually flattened on one side and convex on the other, sometimes curved, three-valved, and occasionally imperfectly three-lobed, of a dirty grayish brown color, and coarse fibrous appearance. When soaked in water, they exhibit as their distinguishing character from nine to thirteen ragged membranous wings along their whole length, which distinguish them from all other varieties. The seeds have a feebly aromatic taste and smell. This variety of cardamom affords but a very small proportion of volatile oil, is altogether of inferior quality, and, when imported into London, is usually sent to the continent.

4. *Madagascar Cardamom.* This is the *Cardamomum majus* of Geiger and some others, and is thought to be the fruit of *Amomum angustifolium* of Sonnerat, growing in marshy grounds in Madagascar. The capsule is ovate, pointed, flattened on one side, striated, with a broad circular scar at the bottom, surrounded by an elevated, notched, corrugated margin. The seeds have an aromatic flavor analogous to that of officinal cardamom.

5. *Bengal Cardamom.* The fruit of *Amomum subulatum*, Roxb., sometimes known by the name of Winged Bengal Cardamom. *Morung elachi*, or *Buro elachi*, is about an inch in length, obscurely three-sided, ovoid or somewhat obconic, with nine narrow, jagged ridges or wings (best seen after soaking in water) upon its distal end, which terminates in a truncate bristly nipple. The pericarp is coarsely striated, of a deep brown, splitting into three valves, disclosing a three-lobed mass of seeds, 60 to 80 in number, agglutinated by their viscid saccharine anthers.

6. *Nepaul Cardamom* is produced by an Amomum of undetermined species, and resembles the Bengal cardamom, except in having a long tubular calyx on its summit, and in being usually attached to a stalk.

7. *Grains of Paradise. Grana Paradisi.* Under this name and that of *Guinea grains*, and *Malegueta*, or *Mallaguetta pepper*, are found in commerce small seeds of a round or ovate form, often angular, and somewhat cuneiform, minutely rough, brown externally, white within, of a feebly aromatic odor when rubbed between the fingers, and of a strongly hot and peppery taste. Two kinds of them are known in the English market, one larger, plumper, and more warty, with a short conical projecting tuft of pale fibres on the umbilicus; the other smaller and smoother, and without the fibrous tuft. The latter are the most common. It is probable that one of the varieties is produced by *Amomum Grana Paradisi* of Sir J. E. Smith, and the other by Roscoe's *Amomum Melegueta.* (Pereira's *Mat. Med.*, 3d ed., p. 1134.) Dr. W. F. Daniell, who has published (*P. J. Tr.*, xiv. 312 and 356) an elaborate paper on the Amoma of Western Africa, states that the true Malla-

plant of Malabar, and another growing in Java. These were separated by Willdenow, who conferred on the former Sonnerat's title of *Amomum repens*, while he retained the original name for the latter, though not the true cardamom plant. In the tenth volume of the Linnæan Transactions, 1811, Mr. White, a British Army Surgeon in India, published a very minute description of the Malabar plant, which he had enjoyed frequent opportunities of examining in its native state. From this description, Dr. Maton inferred that the plant, according to Roscoe's arrangement of the Scitamineæ, could not be considered an *Amomum;* and, as he was unable to attach it to any other known genus, he proposed to construct a new one with the name of *Elettaria*, derived from *elettari* or *elatari*, the Malabar name of this vegetable. Sir James Smith afterwards suggested the propriety of naming the new genus *Matonia*, in honor of Dr. Maton; and the latter title, having been adopted by Roscoe, obtained a place in former editions of the London and U. S. Pharmacopœias. The celebrated Dr. Roxburgh described the Malabar cardamom plant as an *Alpinia*, with the specific name *Cardamomum.* As doubts were entertained of the necessity for the new genus proposed by Maton, Roxburgh was followed in the London and U. S. Pharmacopœias, and the fruit was referred to *Alpinia Cardamomum.* This decision, however, has been revised in the later editions of the U. S. and British Pharmacopœias. Finally Roscoe has arranged it with the abandoned genus *Renealmia* of Linnæus, which he has restored.

Gen. Ch. Corolla with the tube filiform and the inner limb one-lipped. *Anther* naked. *Capsule* often berried, three-celled, three-valved. *Seeds* numerous, arillate. *Blume.*

Elettaria Cardamomum. Maton; *B. & T.*, 267.—*Alpinia Cardamomum.* Roxburgh.—*Amomum Repens.* Sonnerat; Willd. *Sp. Plant.* i. 9.—*Renealmia Cardamomum.* Roscoe, *Monandrous Plants.* Figured in *Linn. Trans.* x. 248, and Carson's *Illust. of Med. Bot.* ii. 55. The cardamom plant has a tuberous horizontal root or rhizome, furnished with numerous fibres, and sending up from eight to twenty erect, simple, smooth, green and shining, perennial stems, which rise from six to twelve feet in height, and bear alternate sheathing leaves. These are from nine inches to two feet long, from one to five inches broad, elliptical-lanceolate, pointed, entire, smooth, and dark green on the upper surface, glossy and pale sea-green beneath, with strong midribs, and short footstalks. The flower-stalk proceeds from the base of the stem, and lies upon the ground, with the flowers arranged in a panicle. The calyx is monophyllous, tubular, and toothed at the margin; the corolla monophyllous and funnel-shaped, with the inferior border unilabiate, three-lobed, and spurred at the base. The fruit is a three-celled capsule, containing many seeds.

This valuable plant is a native of the mountains of Malabar, where it springs up spontaneously in the forests after the removal of the undergrowth, and is very extensively cultivated by the natives. The curious reader may find a detailed account of the method of culture in the *A. J. P.*, 1877, p. 605. The plant begins to yield fruit at the end of the fourth year, and continues to bear for several years afterwards. The capsules when ripe are picked from the fruit stems, dried over a gentle fire, and separated by rubbing with the hands from the footstalks and adhering calyx.

Thus prepared, they are ovate-oblong, from three to ten lines long, from two to four thick, three-sided with rounded angles, obtusely pointed at both ends, longitudinally wrinkled, and of a yellowish white color. The seeds which they contain

guetta pepper is obtained exclusively from varieties of the same species, to which belong the *Amomum Grana Paradisi* of Afzelius, and the *A. Melegueta* of Roscoe; while the *A. Grana Paradisi* of Sir J. E. Smith is a different plant, and yields a different product. These grains are imported from Guinea, and other parts of the western coast of Africa. Similar grains are taken to England from Demerara, where they are obtained from a plant cultivated by the negroes, supposed to have been brought from Africa, and believed by Dr. Pereira to be the *Amomum Melegueta* of Roscoe. (*Ibid.*, vi. 412.) At the international exhibition of 1862, at London, Dr. Geo. B. Wood noticed a specimen of similar grains, under the name of grains of Paradise, sent from the island of Trinidad. Their effects on the system are analogous to those of pepper; but they are seldom used except in veterinary practice, and to give artificial strength to spirits, wine, beer, and vinegar. In the same journal (ii. 443), Dr. Pereira points out seven distinct scitamineous fruits, to which the name of grains of Paradise has been applied by different authors.

Other products of different Scitamineæ, which have received the name of cardamom, are described; but the above are all that are known in commerce, or likely to be brought into our drug markets.

are small, angular, irregular, rough as if embossed upon their surface, of a brown color, easily reduced to powder, and thus separable from the capsular covering, which, though slightly aromatic, is much less so than the seeds, and should be rejected when the medicine is administered. The seeds constitute about 74 parts per cent. by weight. According to Pereira, three varieties are distinguished in commerce:—1, the *shorts*, from three to six lines long, from two to three broad, browner and more coarsely ribbed, and more highly esteemed than the others; 2, the *long-longs*, from seven lines to an inch in length by two or three lines in breadth, elongated, and somewhat acuminate; and 3, the *short-longs*, which are somewhat shorter and less pointed than the second variety. The odor of cardamom is fragrant, the taste warm, slightly pungent, and highly aromatic. "Ovoid or oblong, from two-fifths to four-fifths of an inch (1 to 2 cm.) long, obtusely triangular, rounded at the base, beaked, longitudinally striate; of a pale buff color, three-celled, with a thin, leathery, nearly tasteless pericarp and a central placenta. The seeds are reddish brown, angular, transversely rugose, depressed at the hilum, surrounded by a thin, membranous arillus, and have an agreeable odor and a pungent aromatic taste." *U. S.* Cardamom yields its virtues to water and alcohol, but more readily to the latter. The seeds contain 4·6 per cent. of volatile oil, 10·4 of fixed oil, 2·5 of a salt of potassa mixed with a coloring principle, 3·0 of starch, 1·8 of azotized mucilage, 0·4 of yellow coloring matter, and 77·3 of ligneous fibre. (Trommsdorff.) The volatile oil is colorless, of an agreeable and very penetrating odor, and of a strong aromatic,, burning, camphorous, and bitterish taste. It is dextrogyrate, and consists essentially of a terpene, $C_{10}H_{16}$. From old specimens of oil Dumas and Peligor claim to have obtained crystals of *terpin*, $C_{10}H_{16} + 3H_2O$, while Flückiger has obtained a crystalline deposit from Ceylon oil which he considers identical with common camphor. The sp. gr. of the oil is between 0·92 and 0·94. It cannot be kept long without undergoing change, and finally, even though excluded from the air, loses its peculiar odor and taste. If ether be made to percolate through the powdered seeds, and the liquor obtained be deprived of the ether, a light greenish brown fluid remains, consisting almost exclusively of the volatile and fixed oils. It has the odor of cardamom, and keeps better than the oil obtained by distillation. (*A. J. P.*, xxi. 116.) The seeds should be powdered only when wanted for use; as they retain their aromatic properties best while in the capsules.

Cardamoms are not often adulterated; but an instance has been mentioned by Mr. G. W. Kennedy, as having occurred under his own observation, in which orange seeds and unroasted grains of coffee were mixed with the cardamoms to the extent of nearly 4 per cent. (*A. J. P.*, 1872, p. 389.)

Medical Properties and Uses. Cardamom is a warm and grateful aromatic, less heating and stimulating than some others belonging to the class, and very useful as an adjuvant or corrective of cordial, tonic, and purgative medicines. Throughout the East Indies it is largely consumed as a condiment. It was known to the ancients, and derived its name from the Greek language. In this country it is employed chiefly as an ingredient in compound preparations.

Off. Prep. Extractum Colocynthidis Compositum; Pulvus Aromaticus, *U. S.;* Pulvis Cinnamomi Comp., *Br.;* Pulvis Cretæ Aromaticus, *Br.;* Tinctura Cardamomi, *U. S.;* Tinct. Cardamomi Comp.; Tinct. Gentianæ Comp.; Tinct. Rhei; Vinum Aloës.

CARUM. *U. S., Br.* *Caraway.*

(CĀ'RŬM.)

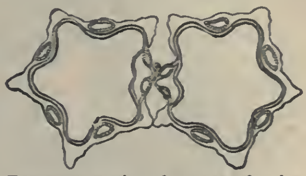
"The fruit of Carum Carvi. Linné. (*Nat. Ord.* Umbelliferæ, Orthospermæ.)" *U. S.* "The dried fruit of Carum Carui." *Br.*

Carui Fructis, *Br.;* Caraway Fruit; Fructus Carvi, *P.G.;* Cumin des Près, Carvi, *Fr.*, *It.;* Gemeiner Kümmel, Kümmel, *G.;* Alcaravea, *Sp.*

Gen. Ch. Fruit ovate-oblong, striated. *Involucre* one-leafed. *Petals* keeled, inflexed-emarginate. *Willd.*

Carum Carui. Willd. *Sp. Plant.* i. 1470; *B. & T.* 121. This plant is biennial and umbelliferous, with a spindle-shaped, fleshy, whitish root, and an erect stem, about two feet in height, branching above, and furnished with doubly pinnate, deeply incised leaves, the segments of which are linear and pointed. The flowers are small and white, and in erect terminal umbels, which are accompanied with an involucre, consisting sometimes of three or four leaflets, sometimes of one only, and are destitute of partial involucre.

The caraway plant is a native of Europe, growing wild in meadows and pastures, and cultivated in many places. It has been introduced into this country. The flowers appear in May and June, and the seeds, which are not perfected till the second year, ripen in August. The root, when improved by culture, resembles the parsnep, and is used as food in the north of Europe. The seeds are the part used in medicine. They are collected by cutting down the plant, and threshing it on a cloth. Our markets are supplied partly from Europe, partly from our own gardens. The American seeds are usually rather smaller than the German. Under the name of *Ajowan*, the fruit of the *Carum Ajowan*, Bentham & Hooker (*Ammi Copticum*, Linn.) are largely used in India. They are $\frac{1}{10}$ to $\frac{1}{16}$ of an inch long, and resemble the fruits of common parsley, but are distinguished by their odor, and their surface being very rough from numerous, very minute tubercles. They contain about 4 per cent. of a volatile oil, which has the odor of the oil of thyme, and contains thymol.


Transverse section of caraway, showing oil-tubes.

Caraway seeds (half-fruits) are about two lines in length, slightly curved, with five longitudinal ridges, which are of a light yellowish color, while the intervening spaces are dark brown. "Oblong, laterally compressed, about one-sixth of an inch (4 mm.) long, usually separated into the two mericarps, and these curved, narrower at both ends, brown, with five yellowish, filiform ribs, and with six oil-tubes." *U. S.* They have an agreeable aromatic smell, and a sweetish, warm, spicy taste. These properties depend on an essential oil, which they afford largely by distillation. (See *Oleum Cari.*) The residue is insipid. They yield their virtues readily to alcohol, and more slowly to water.

Medical Properties and Uses. Caraway is a pleasant stomachic and carminative, occasionally used in flatulent colic, and as an adjuvant or corrective of other medicines. The dose in substance is from a scruple to a drachm (1·3–3·9 Gm.). An infusion may be prepared by adding two drachms of the seeds to a pint of boiling water. The volatile oil, however, is most employed. (See *Oleum Cari.*) The seeds are baked in cakes, to which they communicate an agreeable flavor, while they stimulate the digestive organs.

Off. Prep. Aqua Carui, *Br.;* Confectio Piperis, *Br.;* Oleum Cari, *U. S.;* Oleum Carui, *Br.;* Pulvis Opii Compositus, *Br.;* Tinctura Cardamomi Composita; Tinct. Sennæ, *Br.*

CARYOPHYLLUS. *U. S., Br.* *Cloves.*

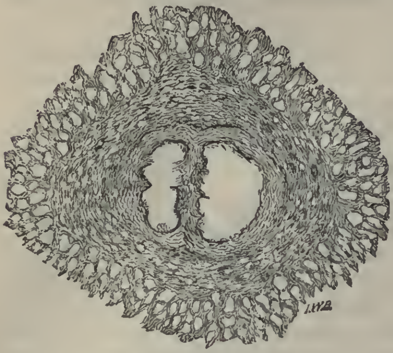
(CĂR-Y̤-O̤-PHY̆L′LṲS.)

"The unexpanded flowers of Eugenia caryophyllata. Thunberg. (*Nat. Ord.* Myrtaceæ.)" *U. S.* "The dried unexpanded flower-buds of Caryophyllus aromaticus." *Br.*

Caryophyllum, *Br.;* Caryophilli, *P. G.;* Caryophylli Aromatici; Girofle, Clous aromatiques, Clous de Girofles, *Fr.;* Gewurznelken, Nägelein, *G.;* Garofani, *It.;* Clavos de Espicia, *Sp.;* Cravo da India, *Portug.;* Kruidnagel, *Dutch;* Kerunfel, *Arab.*

Gen. Ch. Tube of the *calyx* cylindrical; limb, four-parted. *Petals* four, adhering by their ends in a sort of calyptra. *Stamens* distinct, arranged in four parcels in a quadrangular fleshy hollow, near the teeth of the calyx. *Ovary* two-celled, with about twenty ovules in each cell. *Berry* one or two celled, one or two seeded. *Seeds* cylindrical or half-ovate. *Cotyledons* thick, fleshy, convex externally, sinuous in various ways internally. *Lindley. De Cand.*

Eugenia caryophyllata. Willd. *Sp. Plant.* ii. 965; *B. & T.* 112.—*Caryophyllus aromaticus.* Linn. *Sp. Plant.*, 735; De Cand. *Prodrom.* iii. 262; Carson, *Illust. of Med. Bot.* i. 43, pl. 37. This small tree is one of the most elegant of those inhabiting the islands of India. It has a pyramidal form, is always green, and is adorned throughout the year with a succession of beautiful rosy flowers. The stem is of hard wood, and covered with a smooth, grayish bark. The leaves are about four inches in length by two in breadth, obovate-oblong, acuminate at both ends, entire, sinuated, with many parallel veins on each side of the midrib, supported on long footstalks, and opposite. They have a firm consistence, and a shining green color, and when bruised are highly fragrant. The flowers are disposed in terminal corymbose panicles, and exhale a strong, penetrating, and grateful odor.



Transverse section of calyx-tube of clove.

The natural geographical range of the clove is extremely limited. It was formerly confined to the Molucca Islands, in most of which it grew abundantly before their conquest by the Dutch. By the monopolizing policy of that commercial people, the trees were extirpated in nearly all the islands except Amboyna and Ternate, which were under their immediate inspection. Notwithstanding, however, their jealous vigilance, a French governor of the Isles of France and Bourbon, named Poivre, succeeded, in the year 1770, in obtaining plants from the Moluccas, and introducing them into the colonies under his control. Five years afterwards, the clove-tree was introduced into Cayenne and the West Indies, in 1803 into Sumatra, and in 1818 into Zanzibar. It is now cultivated largely in these and other places; and commerce has ceased to depend on the Moluccas for supplies of this spice.*

The unexpanded flower-buds are the part of the plant employed under the ordinary name of cloves.† They are first gathered when the tree is about six years old. The fruit has similar aromatic properties, but much weaker. The buds are at first white, then become green, and then bright red, when they must be at once collected, which is done sometimes by hand-picking, sometimes by beating the trees with bamboos, and catching the falling buds. In the Moluccas they are said to be sometimes immersed in boiling water, and afterwards exposed to smoke and artificial heat, before being spread out in the sun. In Zanzibar, Cayenne, and the West Indies, they are dried simply by solar heat.

Cloves appear to have been unknown to the ancients. They were introduced into Europe by the Arabians, and were distributed by the Venetians. After the discovery of the southern passage to India, the trade in this spice passed into the hands of the Portuguese; but was subsequently wrested from them by the Dutch, by whom it was long monopolized. Within a few years, however, the extended culture of the plant has thrown open the commerce in cloves to all nations. The United States derive much of their supply from the West Indies and Guiana; but the great source of cloves have been recently the islands of Zanzibar and Pemba, on the east coast of Africa. In 1872 the clove orchards in Zanzibar were nearly destroyed by a hurricane, but it is said that they have been replanted. The Molucca cloves are said to be thicker, darker, heavier, more oily, and more highly aromatic than those cultivated elsewhere. They are known by the name of *Amboyna cloves.* The *Bencoolen cloves,* from Sumatra, are deemed equal if not superior by the English druggists.

Properties. Cloves in shape resemble a nail, with a round head with four spreading points beneath it. "About half an inch (12 mm.) long, dark brown, consisting of a subcylindrical, solid and glandular calyx-tube, terminated by four teeth, and surmounted by a globular head, formed by four petals, which cover numerous, curved stamens and one style." *U. S.* Their color is externally deep brown, internally reddish; their odor strong and fragrant; their taste hot, pungent, aromatic, and very permanent. The best cloves are large, heavy, brittle, and exude a small quantity of oil on being pressed or scraped with the nail. When light, soft, wrinkled, pale, and of feeble taste and smell, they are inferior. Those from which the essential oil has been distilled are sometimes fraudulently mixed with the genuine. In powdered cloves this fraud appears to be extensively practised, and its detection is almost impossible.

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* Cloves from Cayenne, and from various West India islands, as Martinique, Guadaloupe, and Trinidad, have been for several years circulating in commerce. Dr. Geo. B. Wood saw a specimen from Para, in Brazil, at the international exhibition at London (1862). They were lighter colored than those from the East Indies.

† The peduncles of the flowers have been sometimes employed. They possess the odor and taste of the cloves, though in a less degree, and furnish a considerable quantity of essential oil. The French call them *griffes de girofles.*

Trommsdorff obtained from 1000 parts of cloves 180 of volatile oil, 170 of a peculiar tannin, 130 of gum, 60 of resin, 280 of vegetable fibre, and 180 of water. M. Lodibert afterwards discovered a fixed oil, aromatic and of a green color, and a white resinous substance which crystallizes in fasciculi, composed of very fine diverging silky needles, without taste or smell, soluble in ether and boiling alcohol, and exhibiting neither alkaline nor acid reaction. This substance, called by M. Bonastre *caryophyllin*, was found in the cloves of the Moluccas, of Bourbon, and of Barbadoes, but not in those of Cayenne, from which, however, it has since been procured. To obtain it, the ethereal extract of cloves is treated with water, and the white substance thrown down is separated by filtration, and treated repeatedly with ammonia to deprive it of impurities. The most recent determination of its formula by Mylius (*D. Chem. Ges.*, 1873, p. 1053) makes it $C_{20}H_{32}O_2$. Dr. Theod. Martius obtains it cheaply by exposing cloves, previously deprived as far as possible of oil by distillation with water, to distillation at a higher temperature, redistilling the brown liquid obtained until the distillate nearly ceases to have the taste or smell of cloves, and then purifying the residue by washing with water, and treating it with boiling alcohol and animal charcoal repeatedly, until the caryophyllin, which is deposited by the alcohol on cooling, is perfectly white. (See *A. J. P.*, xxxii. 65.) M. Dumas has discovered another crystalline principle, which forms in the water distilled from cloves, and is gradually deposited. Like caryophyllin, it is soluble in alcohol and ether, but differs from that substance in becoming red when touched with nitric acid. M. Bonastre proposes for it the name of *eugenin*. (*Journ. de Pharm.*, xx. 565.) It has the formula $C_{10}H_{12}O_2$, and is isomeric with eugenol or eugenic acid, a constituent of oil of cloves. Water extracts the odor of cloves with comparatively little of their taste. All their sensible properties are imparted to alcohol; and the tincture when evaporated leaves an excessively fiery extract, which becomes insipid if deprived of the oil by distillation with water, while the oil which comes over is mild. Hence it has been inferred that the pungency of this aromatic depends on a union of the essential oil with the resin. *Caryophyllic acid*, $C_{20}H_{32}O_6$, is obtained by gradually adding caryophyllin to fuming nitric acid, kept cool by immersing the vessel in water until crystals begin to separate; these are purified by dissolving them in ammonia, precipitating with hydrochloric acid, and redissolving in alcohol and crystallizing. For an account of the oil and its constituents, see *Oleum Caryophylli*. The infusion and oil of cloves are reddened by nitric acid, and rendered blue by tincture of chloride of iron; facts of some interest, as morphine gives the same reactions.

Medical Properties and Uses. Cloves are among the most stimulant of the aromatics, but, like others of this class, act less upon the system at large than on the part to which they are immediately applied. They are sometimes administered in substance or infusion to relieve nausea and vomiting, correct flatulence, and excite languid digestion; but their chief use is to assist or modify the action of other medicines. They enter into several officinal preparations. Their dose in substance is from five to ten grains (0·33–0·65 Gm.).

The French Codex directs a *tincture of cloves* to be prepared by digesting for six days, and afterwards filtering, a mixture of four ounces of powdered cloves and sixteen of alcohol of 31° Cartier. Three ounces to the pint of alcohol is a sufficiently near approximation.

Off. Prep. Infusum Aurantii Compositum, *Br.;* Infusum Caryophylli; Mistura Ferri Aromatica, *Br.;* Oleum Caryophylli; Pulvis Cretæ Aromaticus, *Br.;* Tinctura Lavandulæ Compositus, *U. S.;* Syrupus Rhei Aromaticus, *U. S.;* Vinum Opii.

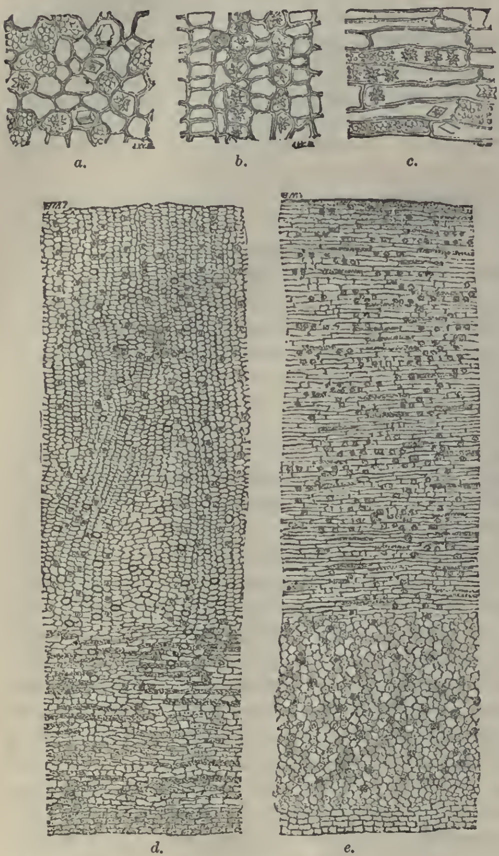
CASCARILLA. *U.S., Br.* *Cascarilla.*

(CĂS-CẠ-RĬL′LẠ.)

"The bark of Croton Eluteria. Bennett. (*Nat. Ord.* Euphorbiaceæ.)" *U.S.* "The bark of Croton Eluteria." *Br.*

Cascarillæ Cortex, *Br.;* Cascarilla Bark; Cortex Cascarillæ, *P.G.;* Cortex Eluteriæ, Cortex Thuris; Chacrille, Écorce éleuthérienne, Cascarille, *Fr.;* Cascarillrinde, Cascarilla, Kaskarillrinde, *G.;* Cascariglia, *It.;* Chacarila, *Sp.*

Gen. Ch. MALE. *Calyx* cylindrical, five-toothed. *Corolla* five-petalled. *Stamens* ten to fifteen. FEMALE. *Calyx* many-leaved. *Corolla* none. *Styles* three, bifid. *Capsule* three-celled. *Seed* one. *Willd.*


a. b. c.

d. e.

Figs. *a*, *c*, highly magnified sections, showing raphides and starch granules and a bast cell; *b*, longitudinal section highly magnified, showing raphides and starch granules; *d*, transverse section moderately magnified; *e*, longitudinal section.

There has been much confusion in relation to the different species of Croton growing in the West Indies, and as to which of them the Cascarilla of the shops is to be ascribed. At present, however, it is generally admitted that this bark, which is brought exclusively from the Bahama Islands, is the product of *Croton Eluteria;* and, though it is probable that the proper *C. Cascarilla* may at one time have yielded a portion of its bark to commerce, at present little or none is derived from that species. The London College committed the error, which it afterwards corrected, of recognizing *C. Cascarilla* of Don as the source of it. This botanist mistook the *Copalchi bark* of Mexico, which is produced by *Croton Pseudo-China* of Schiede, and somewhat resembles cascarilla, for the genuine bark, and hence proposed to transfer the specific name of Cascarilla to the Mexican plant.*

Croton Eluteria. Bennett, *Journ. of the Linn. Soc.* iv. 29; Daniell, *P. J. Tr.* 2d ser., iv. 145, figured at p. 150; *B. & T.* 238. —*Clutia Eluteria.* Woodv. *Med. Bot.* 3d ed., iv. 633, t. 223. As described by Dr. W. F. Daniell, who resided in the Bahama Islands, this, though commonly a shrub of from three to five feet high, sometimes appears in the form of a small tree with a stem from four to eight inches in diameter.* The stem is straight, and marked at intervals with white or grayish stains. The leaves are petiolate, from two to three inches in length by an inch or more in breadth, often somewhat cordate at the base, obtusely acuminate, pale or grayish green above, and densely covered beneath with shining silvery scales, appearing white at a distance. They are smaller and narrower in the plants of arborescent growth. The flowers, which have a delicious odor, are monœcious, small, white, petiolate, and closely set in simple terminal or axillary spikes. The shrub is a native of the Bahamas, scarce at present in the island of New Providence, but still abundant in Andros, Long, and Eleutheria islands, from the latter of which it derived its botanical title. Daniell calls the plant *sweet-wood.* The name of *seaside balsam* belongs to another species, *C. Balsamiferum* of Linnæus, which grows in the Bahamas and other West India islands, and owes its name to the exudation of a balsamic juice from its young branches when wounded.

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* *Copalchi bark* has been mistaken not only for cascarilla, but also for a variety of cinchona. Portions of it, having been taken to Europe, attracted the attention both of pharmacologists and physicians. Two kinds were noticed; one, in small slender quills, of an ash color, bearing some resemblance to a variety of pale cinchona, but having the flavor of cascarilla, and burning with a similar odor; the other in larger quills, with a thick cork-like epidermis, very bitter, and yielding an aromatic odor when burnt. The former is the product of *Croton Pseudo-China;* the latter is of unknown origin, but conjecturally referred to *C. suberosum.* Mr. J. E. Howard states that the quilled copalchi bark contains a bitter alkaloid, soluble in ether, and precipitable as a white hydrate from its acid solution. (*P. J. Tr.*, xiv. 319.) Copalchi bark is an aromatic tonic, employed in Mexico in intermittents, and capable of useful application in all cases requiring a mild aromatic bitter. Dr. Stark has employed it advantageously in feeble states of digestion with irritable bowels, and found it, in one or two cases, to exhibit antiperiodic properties. It may be given in infusion,

Croton Cascarilla. Bennett, *Journ. of the Linn. Soc.* iv. 30.—*Clutia Cascarilla.* Linn. *Sp. Plant.* ed. 1, p. 1042.—*Ricinoides elæagnifolia.* Catesby, *Hist. Carolin.* ii. t. 46. As described by Daniell, this is a shrub of from four to six feet, much branched, with a pale grayish green stem, without the white stains of the former species. The leaves are petiolate, long, narrow, lanceolate, tapering towards each end, pointed, with flat, or somewhat undular margins, above smooth and green, beneath pale and very hairy. The flowers are monœcious, in simple terminal spikes, with small white petals tinged with yellow. They are very fragrant. The plant is a native of the Bahamas, and is said also to grow in Hayti. In the Bahamas it is much scarcer than formerly, and is said by Dr. Daniell to yield at present none of the cascarilla of commerce, of which much was formerly derived from it. This species seems to have been confounded by some with *Croton lineare* of Jacquin, which grows in the Bahamas and most of the West India islands, where it is known by the name of *wild rosemary*, owing probably in part to its fragrant smell, but still more to its narrow linear leaves with reflected margins.

Cascarilla is brought to this market from the West Indies, and chiefly, as we have been informed, from the Bahamas. It comes in bags or casks. We have observed it in the shops in two forms, so distinct as to merit the titles of varieties. In one, the bark is in rolled pieces of every size, from three or four inches in length and half an inch in diameter to the smallest fragments, covered externally with a dull whitish or grayish white epidermis, which in many portions is partially, sometimes wholly removed, leaving a dark brown surface, while the inner surface has a chocolate color, and the fracture is a reddish brown. The small pieces are sometimes curled, but have a distinct abrupt edge as if broken from the branches. The second variety consists entirely of very small pieces, not more than an inch or two in length, very thin, without the white epidermis, not regularly quilled, but curved more or less in the direction of their length, often having a small portion of woody fibre attached to their inner surface, and appearing precisely as if shaved by a knife from the stem or branches. Whether these two varieties are derived from distinct species, or differ only from the mode of collection, it is difficult to determine. The officinal description of cascarilla is as follows. "In quills or curved pieces, about one-twelfth of an inch (2 mm.) thick, having a grayish, somewhat fissured, easily detached, corky layer, the remaining tissue being dull brown, and the inner surface smooth. It breaks with a short fracture, having a resinous and radially striate

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made with half an ounce of the bark to a pint of water, in the dose of one or two fluidounces three times a day. (*Ed. Med. and Surg. Journ.*, April, 1849, p. 410.)

* The plant referred to in very early editions of this work, as having been seen by Dr. Wright in Jamaica, and called by him *C. Eluteria*, is, according to Mr. Bennett, a distinct species, *C. Sloanei*, which was confounded by Linnæus with the genuine cascarilla plant, under the name of *Clutia Eluteria.* The genuine plant was first described by him in his *Hortus Cliffortianus* (pp. 486–7), from a specimen in Cliffort's herbarium in the British Museum, and afterwards apparently confused with a Jamaica specimen sent to him by Patrick Brown, from the latter of which the description of his *Clutia Eluteria* was drawn up, which is quite inapplicable to the original plant. It is the *C. Sloanei* also that was described by Schwartz in his *Flora Indiæ Occidentalis* (p. 1183), under the name of *Croton Eluteria*, and probably the same that was figured by Dr. Carson in his *Illust. of Med. Bot.* ii. 34, pl. 78. (See *P. J. Tr.*, 1859, pp. 132–3.)

appearance; when burned, it emits a strong, aromatic odor; its taste is warm and very bitter." *U. S.*

Properties. Cascarilla has an aromatic odor, rendered much more distinct by friction, and a warm, spicy, bitter taste. It is brittle, breaking with a short fracture. When burnt it emits a pleasant odor, closely resembling that of musk, but weaker and more agreeable. This property serves to distinguish it from other barks. It was analyzed by Trommsdorff, and more recently by M. Duval, of Liseux, in France. The constituents found by the latter were albumen, a peculiar kind of tannin, a bitter crystallizable principle called *cascarillin*, a red coloring matter, fatty matter of a nauseous odor, wax, gum, volatile oil, resin, starch, pectic acid, chloride of potassium, a salt of lime, and lignin. The oil, according to Trommsdorff, constitutes 1·6 per cent., is of a greenish yellow color, a penetrating odor analogous to that of the bark, and of the sp. gr. 0·938. It is probably a mixture of two oils, one of which is oxygenated. Gladstone (*Jahresbr. der Pharm.*, 1872, p. 450) gives to the hydrocarbon of cascarilla oil the composition of oil of turpentine. To obtain cascarillin, M. Duval treated the powdered bark with water, added acetate of lead to the solution, separated the lead by sulphuretted hydrogen, filtered, evaporated with the addition of animal charcoal, filtered again, evaporated at a low temperature to a syrupy consistence, and, having allowed the semi-liquid substance thus obtained to harden by cooling, purified it by twice successively treating it, first with a little cool alcohol, to separate the coloring and fatty matters, and afterwards with boiling alcohol and animal charcoal. The last alcoholic solution was allowed to evaporate spontaneously. Thus obtained, cascarillin is white, crystalline, inodorous, bitter, very slightly soluble in water, soluble in alcohol and ether. (*Journ. de Pharm.*, 3e sér., viii. 96.) It melts at 205° C. (401° F.), is not volatile nor a glucoside. Its composition answers to the formula $C_{12}H_{18}O_4$. Either alcohol or water will partially extract the active matters of cascarilla; but diluted alcohol is the proper menstruum.

Medical Properties and Uses. This bark is aromatic and tonic. It was known in Germany so early as the year 1690, and was much used as a substitute for Peruvian bark by those who were prejudiced against that febrifuge in the treatment of remittent and intermittent fevers. It has, however, lost much of its reputation, and is now employed only where a pleasant and gently stimulant tonic is desirable; as in dyspepsia, chronic diarrhœa and dysentery, flatulent colic, and other cases of debility of the stomach or bowels. It is said to promote the flow of milk in the lower animals, and has been proposed with a view to the same effect in the human subject. It is sometimes advantageously combined with the more powerful bitters. It may be given in powder or infusion. The dose of the former is from a scruple to half a drachm (1·3–1·95 Gm.), which may be repeated several times a day. Prof. Procter published a formula for a fluid extract, which contains the virtues of a troyounce of the bark in a fluidounce. (*A. J. P.*, 1863, p. 113.) In consequence of its pleasant odor when burnt, some smokers mix it in small quantity with their tobacco; but it is said, when thus employed, to occasion vertigo and intoxication.

Off. Prep. Infusum Cascarillæ; Tinctura Cascarillæ, *Br.*

CASSIA FISTULA. *U. S., Br.* *Cassia Fistula.* [*Purging Cassia.*]

(CĂS′SỊ-Ạ FĬS′TỦ-LẠ.)

"The fruit of Cassia Fistula. Linné. (*Nat Ord.* Leguminosæ, Cæsalpinieæ.)" *U. S.* "The pulp obtained from the pods of the Purging Cassia, Cassia Fistula." *Br.*

Cassiæ Pulpa, *Br.;* Cassia Pulp; Fructus Cassiæ Fistulæ; Casse officinale, Casse en Batons, Pulpe de Casse, Casse mondée, Casse, *Fr.;* Rohrenkassie, Purgiercassie, Fistelkassie, *G.;* Cassia, *It.;* Cana Fistula, *Sp.*

Gen. Ch. *Calyx* five-leaved. *Petals* five. *Anthers*, three upper sterile, three lower beaked. *Lomentum. Willd.*

The tree which yields the purging cassia is ranked by some botanists as a distinct genus, separated from the Cassia, and denominated *Cathartocarpus.* (See *Lindley's Flor. Med.*, 262.)

Cassia Fistula. Willd. *Sp. Plant.* ii. 518; Carson, *Illust. of Med. Bot.* i. 24, pl. 26.; *B. & T.* 87.—*Cathartocarpus Fistula.* Persoon, *Synops.* i. 459. This is a large tree, rising to the height of forty or fifty feet, with a trunk of hard, heavy wood, dividing towards the top into numerous spreading branches, and covered with a smooth ash-colored bark. The leaves are commonly composed of five or six pairs of opposite leaflets, which are ovate, pointed, undulated, smooth, of a pale green color, from three to five inches long, and supported upon short petioles. The flowers are large, of a golden yellow color, and arranged in long, pendent, axillary racemes. The fruit consists of long, cylindrical, woody, dark brown, pendulous pods, which, when agitated by the wind, strike against each other, and produce a sound that may be heard at a considerable distance.

This species of Cassia is a native of Upper Egypt and India, whence it is generally supposed to have been transplanted to other parts of the world. It is at present very extensively diffused through the tropical regions of the old and new continents, being found in Insular and Continental India, Cochin-China, Egypt, Nubia, the West Indies, and the warmer parts of the continent of America. The fruit is the officinal portion of the plant. It is imported from the East and West Indies, chiefly the latter, and from South America.

Properties. Cassia pods are a foot or more in length, straight, or but slightly curved, cylindrical, less than an inch in diameter, with a woody shell, externally of a dark brown color, and marked with three longitudinal shining bands, extending from one end to the other, two of which are in close proximity, appearing to constitute a single band, and the third is on the opposite side of the pod. These bands mark the place of junction of the valves of the legume, and are represented as sometimes excavated in the form of furrows. There are also circular depressions at unequal distances. The officinal description is as follows. "Cylindrical, eighteen to twenty-four inches (45 to 60 cm.) long, nearly one inch (25 mm.) in diameter, blackish brown, somewhat veined, the sutures smooth, forming two longitudinal bands; indehiscent, internally divided transversely into numerous cells, each containing a glossy seed imbedded in a blackish brown, sweet pulp." *U. S.* The pods brought from the East Indies are smaller, smoother, have a blacker pulp, and are more esteemed than those from the West Indies.

We have seen a quantity of pods in this market sold as cassia pods, which were an inch and a half in diameter, flattened on the sides, exceedingly rough on the outer surface, and marked by three longitudinal very elevated ridges, corresponding to the bands or furrows of the common cassia. The pulp was rather nauseous, but in other respects seemed to have the properties of the officinal purging cassia. They correspond exactly with a specimen of the fruit of *Cassia Brasiliana* brought from the West Indies, and were probably derived from that plant.

The heaviest pods, and those which do not make a rattling noise when shaken, are to be preferred; as they contain a larger portion of the pulp, which is the part employed. This should be black and shining, and have a sweet taste. It is apt to become sour if long exposed to the air, or mouldy if kept in a damp place. The pulp is extracted from the pods by first bruising them, then boiling them in water, and afterwards evaporating the decoction; or, when the pods are fresh, by opening them at the sutures, and removing the pulp by a spatula.

Cassia pulp has a slight rather sickly odor, and a sweet mucilaginous taste. From the analysis of M. Henry it appears to contain sugar, gum, a substance analogous to tannin, a coloring matter soluble in ether, traces of a principle resembling gluten, and a small quantity of water.

Medical Properties and Uses. Cassia pulp is laxative, and may be advantageously given in small doses in cases of habitual costiveness. In quantities sufficient to purge, it occasions nausea, flatulence, and griping. In this country it is rarely prescribed, except as an ingredient in the confection of senna, which is a pleasant and useful laxative preparation. The dose of the pulp as a laxative is one or two drachms (3·9–7·8 Gm.), as a purge one or two ounces (31·1–62·2 Gm.).

Off. Prep. Confectio Sennæ.

CASTANEA. *U.S.* *Castanea.* [*Chestnut.*]

(CĂS-TĀ′NẸ-Ạ.)

"The leaves of Castanea vesca, Linné (*Nat. Ord.* Cupuliferæ), collected in September or October, while still green." *U. S.*

Folia Castaneæ; Feuilles de Châtaignier, Feuilles de Marronier, Châtaigne, *Fr.;* Kastanie, Kastanienblätter, *G.;* Castagna, *It.;* Castaña, *Sp.*

Gen. Ch. MALE. *Ament* naked. *Calyx* none. *Corolla* five-petalled. *Stamens* ten to twenty. FEMALE. *Calyx* five or six-leaved, muricate. *Corolla* none. *Germs* three. Stigma pencil-formed. *Nuts* three, included in an echinated calyx. *Willd.*

This is a very small genus, separated from the original Fagus of Linn., including only two or three recognized species; the *Castanea vesca* of Europe and North America, and *C. pumila* of the United States, which will be found described in Part II. of the present work. The European and American chestnut-trees are known under the same botanical title; as no points of difference can be found between them, which botanists in general are willing to recognize as authorizing distinct specific designations. The late Dr. Geo. B. Wood, however, believed, for reasons given below, that they are distinct trees, differing in origin, and as much entitled to distinct names as the European and American white oaks, or indeed any other analogous species of the two continents. Thus, the general aspect of the two trees is such that the accustomed eye will at a glance recognize the difference, though it might be difficult to say in what exactly the difference consists. The much greater size and somewhat peculiar shape of the fruit of the European, or, as it is commonly called, in this country, the Spanish Chestnut, is another very striking distinction, and, if permanent, should, we think, be admitted as a sufficient specific character. Besides, the European tree does not lose its distinctive character, under complete change of circumstances. Transplanted into North America, and propagated by the seed, it has retained, through a succession of generations, the original superiority in the size of its fruit, which, had the tree been of the same species as the American, would have almost certainly more or less deteriorated.

Castanea vesca. Willd.; Michaux, *N. American Sylva,* iii. 9. *Castanea Americana.* Persoon. (See *Mérat and De Lens.*) The American chestnut is, under favorable circumstances, one of our largest and most magnificent native trees. Michaux states that he had measured several trees, the trunks of which, at six feet from the ground, were fifteen or sixteen feet in circumference, and their stature equal to that of the loftiest trees of the forest. So great a size, however, is rare. Its leaves, which are the officinal portion, serve also at once to distinguish the tree. They are from four to ten inches long by about two in breadth, oblong-elliptical, sharp at the end, strongly and somewhat unequally serrated, with prominent parallel nerves beneath, of a brilliant color, and firm consistence. The only leaves that are liable to be confounded with them are those of the chestnut-oak, which have a very similar form and structure, but are at once distinguishable by the rounded crenate projections on the edge, instead of the sharp serratures of the chestnut. The male flowers are whitish, and disposed on axillary peduncles, four or five inches long; the fertile aments similarly disposed, but less conspicuous. The fruit is a spherical burr, an inch or two in diameter, and very prickly, containing two or three brown nuts, the appearance of which is too well known to require description here. When perfectly ripe, it opens and lets fall the seeds. The bark is very peculiar and characteristic in its appearance, with a longitudinal arrangement of its fibres. The wood is firm and elastic, though not compact, with a remarkable power of resisting decomposition from the weather, and therefore very valuable for posts and rails in fencing. It is not well fitted for fuel, in consequence of a great disposition to snap in the fire, and to throw off burning particles to a considerable distance.

The American chestnut is spread largely through the eastern portions of the United States, from New Hampshire to the mountainous districts of Virginia, North and South Carolina, Georgia, and Tennessee, where it abounds; as also in the Middle States of New Jersey and Pennsylvania, though rare in the maritime parts of Virginia and the other Southern States. The leaves should be collected after perfect maturity, and before beginning to decay in autumn.

The European species is distributed in the south of Europe very much as the American is with us, preferring hilly regions, and abounding in Spain, the south and west of France, Switzerland, and Italy. It sometimes attains an enormous magnitude, and Michaux describes one, growing at Sancerre in France, which at six feet from the ground is thirty feet in circumference, and six hundred years ago was known as the *Great Chestnut.* Though supposed to be more than one thousand years old, its trunk is perfectly sound, and its branches are annually loaded with fruit. Much larger than this is the celebrated chestnut of Mount Etna, of which the trunk is said to be one hundred and sixty feet in circumference, though hollow in the centre, so that the tree lives by its bark. (*Mérat and De Lens.*) In Europe the young chestnut is much used for making hoops, for which it is preferred to all other wood on account of resisting the effects of air and moisture. For this purpose it is much cultivated in Europe, and cut when large enough. But the tree is still more valuable on account of its large nuts, which are much used as food, being a favorite on the table of the rich, and often the main dependence of the poor peasant, who considers himself well-off when possessed of a few healthy chestnut-trees. Whole provinces are said to be supported by this fruit. Though cultivated in small numbers in this country, they have not been so extensively introduced as they ought to be, chiefly, in all probability, from their difficulty of propagation. The inner bark of the chestnut has been vaunted in Europe as a remedy in dysentery. (*Mérat and De Lens.*)

Properties. The leaves, which have already been described, are so flexible and tenacious that it is difficult to powder them. In preparing them for the action of a solvent, they must be comminuted by cutting and bruising them in a mortar. They are not, therefore, well fitted for percolation. (*Maisch.*) They have little smell, and a slightly astringent, and scarcely bitterish taste, so that they are not offensive to children. They yield their virtues freely to water, and, probably, less so to alcohol. John B. Turner found in chestnut leaves chlorophyll, tannin, gallic acid, gum, and albumen. (*A. J. P.*, 1879, p. 542.) In addition to these constituents, L. J. Steltzer found carbonates, chlorides, and phosphates of potassium, calcium, magnesium, and iron, and a trace of resin and fat. (*A. J. P.*, 1880, p. 294.)

Medical Uses. The only remedial use of the leaves, so far as we have learned, has been in the treatment of hooping-cough. Their effects on the system do not appear to have been carefully studied; but their sensible properties do not indicate the possession of any extraordinary physiological power. A communication from Mr. G. C. Close, of Brooklyn, N. Y., calling attention to their efficacy in hooping-cough, made to the American Pharmaceutical Association, at the meeting of 1862, was the first intimation that has come to our notice of their claims to consideration as a medicine. Enough of favorable reports have been since published to indicate that the leaves have some control over the disease, but their use has not become general in the profession.

The leaves may be administered in infusion or fluid extract. Dr. Unzicker prepared an infusion with three or four drachms of the leaves and a pint of boiling water, and gave of it, well sweetened, as much as the child would drink.

Off. Prep. Extractum Castaneæ Fluidum, *U. S.*

CASTOREUM. *Br.* *Castor.*

(CĂS-TŌ′RḚ-ŬM.)

"The dried preputial follicles and their secretion, obtained from the Beaver, Castor Fiber, and separated from the somewhat shorter and smaller oil-sacs which are frequently attached to them." *Br.*

Castoreum, *Fr.;* Bibergeil, *G.;* Castoro, *It.;* Castoreo, *Sp.*

In the beaver, *Castor fiber* of naturalists, between the anus and external genitals of both sexes, are two pairs of membranous follicles, of which the lower and larger are pear-shaped, and contain an oily, viscid, highly odorous substance, secreted by glands which lie externally to the sac. This substance is called castor. After the death of the animal, the follicles containing it are removed, and dried either by smoke or in the sun; and in this state are brought into the market.

This drug is derived either from the northern and north-western parts of America, or from Russia, and is distinguished, according to its source, into the Canadian or American and Russian castor. It is supposed by some that the American and Russian beavers are distinct species, the former being a building, the latter a burrowing animal; and additional ground for the supposition is afforded by the fact that the products of the two differ considerably. Of the Russian but a very small portion reaches this country. That which is brought to Philadelphia is derived chiefly from Missouri; but large quantities are collected in the north-western regions of British America.*

Castor comes to us in the form of solid unctuous masses, contained in sacs about two inches in length, larger at one end than at the other, much flattened and wrinkled, of a brown or blackish color externally, and united in pairs by the excretory ducts which connect them in the living animal. In each pair one sac is generally larger than the other. They are divided internally into numerous cells, containing the castor, which, when the sacs are cut or torn open, is exhibited of a brown or reddish brown color, intermingled more or less with the whitish membrane forming the cells. Those brought from Russia are larger, fuller, heavier, and less tenacious than the American; and their contents, which are of a rusty or liver color, have a stronger taste and smell, and are considered more valuable as a medicine. A variety of Russian castor, described by Pereira under the name of *chalky Russian castor*,† is in smaller and rounder sacs than the American, has a peculiar empyreumatic odor very different from that of the other varieties, breaks like starch under the teeth, and is characterized by effervescing with dilute hydrochloric acid. In a specimen examined by Müller, 40·646 per cent. of carbonate of calcium was found. In the castor from Missouri, the contents of the sac are sometimes almost white, and evidently inferior. According to Jannarch, castor varies with the time of year at which it is collected, being lighter colored, more fluid, and less copious in the follicles from February to July than in the remainder of the year. (*Pharm. Centralb.*, Mai, 1847, p. 318.) It is said by M. Kohli that the Canadian castor, treated with distilled water and ammonia, affords an orange precipitate, while the matter thrown down from the Russian under similar treatment is white.

Properties. Good castor has a strong, fetid, peculiar odor; a bitter, acrid, and nauseous taste; and a color more or less tinged with red. It is of a softer or harder consistence, according as it is more or less thoroughly dried. When perfectly desiccated, though still somewhat unctuous, it is hard, brittle, and of a resinous fracture. Its chemical constituents, according to Brandes, are volatile oil; a resinous matter; albumen; a substance resembling *osmazome;* mucus; urate, carbonate, benzoate, phosphate, and sulphate of calcium; acetate and chloride of sodium; chloride, sulphate, and benzoate of potassium; carbonate of ammonium; membranous matter; and a peculiar proximate principle discovered by M. Bizio, an Italian chemist, and called by him *castorin.* This principle crystallizes in long, diaphanous, fasciculated prisms, has the smell of castor, and a copperish taste. It is insoluble in cold water and cold alcohol: but is dissolved by 100 parts of the latter liquid at the boiling temperature, and by the essential oils. It possesses neither alkaline nor acid properties. It may be obtained by treating castor, minutely divided, with six times its weight of boiling alcohol, filtering the liquor while hot, and allowing it to cool. The *castorin* is slowly deposited, and may be purified by means of cold alcohol. M. Valenciennes, who could not obtain the crystals white and pure by simple treatment with alcohol, succeeded by first boiling a mixture of equal parts of castor and hydrated lime with water, and acting upon the residue, separated and dried, with boiling alcohol of the sp. gr. 0·823. The product exceeded 1 per cent. (*P. J. Tr.*, Dec. 1861, p. 329.) It has been thought to be the active principle; but its claims are doubtful. The *volatile oil* may be obtained by repeated distillation with the same portion of water. It is pale yellow, and has the smell and taste of castor.

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* The statement in the text, that the lower of the two pairs of sacs is the one containing the castor, was made on the authority of Cuvier. In an appendix by Dr. W. W. Ely, to a treatise recently published on the "American Beaver and his Works," by Lewis H. Morgan, it is stated by Dr. Ely, who appears to have thoroughly studied the anatomy of the animal, at least in reference to this particular subject, that the upper pair are the real castor sacs, the lower containing an oily secretion, with very little dark-colored castor.

In the same communication by Dr. Ely, the question is discussed as to the identity of the Russian and American beavers; and the conclusion arrived at, that, though there are striking differences between the skulls of the two, as also in some respects in the contents of the castor sacs, yet these are nothing more than can be accounted for by the different circumstances in which they are placed, and by their long separation on the two continents; and consequently the Russian and American beavers should be considered merely as varieties of the same species.

† The normal proportion of carbonate of calcium is said by Dr. Godfrey (*Proc. A. P. A.*, xxvii. 289) to be about 3 per cent., but the proportion often far exceeds this, as much as 85 per cent. having been noted. This excess is believed to be due to disease in the animal, and unfits castor for use as medicine.

F. Wöhler ascertained the existence of salicin in a specimen of castor; also that it contained a small quantity of *carbolic acid*, to which he ascribes its odor. (See *Chem. Gaz.*, Jan. 1, 1849.) Dr. Pereira found that a portion of water distilled from American castor gradually lost its peculiar odor, and acquired that of the flowers of *Spiræa ulmaria*, and afterwards presented no trace of the presence of oil of castor. Upon testing it, he ascertained the existence in it of *salicylic aldehyde (oil of Spiræa ulmaria)*, and concluded that the oil of castor had been converted into that principle. He further inferred that the oil is probably a volatile product of the salicin of the castor, and ascribes the carbolic acid, found by Wöhler, to the same source. (*P. J. Tr.*, xi. 200.) The salicin of the castor probably proceeds from the willow and poplar on which the beaver feeds.

Alcohol and ether extract the virtues of castor. An infusion made with boiling water has its sensible properties in a slight degree; but the odorous principle of the drug is dissipated by decoction.

The virtues of castor are impaired by age. Warmth, and especially moisture, promotes its decomposition. In a dry cool place it may be kept for a long time without material deterioration. When quite black, with little taste or smell, it is unfit for use. The castor follicles are sometimes partly deprived of the castor, and its place supplied with sawdust. A factitious preparation has been sold, consisting of a mixture of various drugs, scented with genuine castor, intermingled with membrane, and stuffed into the scrotum of a goat. The fraud may be detected by the comparatively feeble odor, the absence of other characteristic sensible properties, and the want of the smaller follicles containing fatty matter, often attached to the bags of castor.

Medical Properties and Uses. Castor is moderately stimulant and antispasmodic. The experiments of Thouvenel prove that, in large doses, it quickens the pulse, increases the heat of the skin, and produces other symptoms of general excitement; but its force is directed chiefly to the nervous system, and in small doses it scarcely disturbs the circulation. It has also enjoyed a high reputation as an emmenagogue. It was employed by the ancients. Pliny and Dioscorides speak of it as useful in hysteria and amenorrhœa. In Europe, especially on the continent, it is still frequently prescribed in low forms of fever attended with nervous symptoms, in spasmodic diseases, such as hysteria and epilepsy, in many anomalous nervous affections, and in diseases dependent on or connected with suppression or retention of the menses. It is less used in this country. The dose in substance is from ten to thirty grains (0·65–1·95 Gm.), which may be given in bolus or emulsion. The tincture is sometimes employed.

CATAPLASMATA. *Cataplasms.*

(CĂT-Ạ-PLĂṢ′MẠ-TẠ.)

Poultices, *E.;* Cataplasmes, *Fr.;* Umschläge, Breiumschläge, *G.*

Cataplasms or *poultices** are moist substances intended for external application, of such a consistence as to accommodate themselves accurately to the surface to which they are applied, without being so liquid as to spread over the neighboring parts, or so tenacious as to adhere firmly to the skin. As they are in this country seldom made by the apothecary, they were not deemed by the compilers of the U. S. Pharmacopœia proper objects for officinal direction. The ounce used in the following processes is the avoirdupois.

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* *Spongio Piline* is a thick cloth into which sponge in very small pieces has been felted, and a layer of rubber applied upon the surface. It is used as a substitute for a poultice by simply soaking a piece of the desired size in warm or hot water, and, after wiping the rubber side dry, applying at once, using a bandage to keep it in place if necessary. Moisture is retained a long time, evaporation being prevented by the rubber coating. If desired, Fluid Extract of Belladonna, Conium, or any similar preparation, may be added in proper quantity to the warm water.

CATAPLASMA CARBONIS. *Br.* *Charcoal Poultice.*

(CĂT-Ạ-PLĂŞ′MẠ CÄR-BŌ′NĬS.)

Cataplasme au Charbon, *Fr.;* Kohlenumschlag, *G.*

"Take of Wood Charcoal, in powder, *half an ounce;* Crumb of Bread *two ounces;* Linseed Meal *one ounce and a half;* Boiling Water *ten fluidounces.* Macerate the Bread in the Water for ten minutes near the fire, then mix, and add the Linseed Meal gradually, stirring the ingredients, so that a soft poultice may be formed. Mix with this half the charcoal, and sprinkle the remainder on the surface of the poultice." *Br.*

Charcoal, recently prepared, has the property of absorbing those principles upon which the offensive odor of putrefying animal substances depends. In the form of poultice, it is an excellent application to foul and gangrenous ulcers, correcting their fetor, and improving the condition of the sore. It should be frequently renewed.

CATAPLASMA CONII. *Br.* *Hemlock Poultice.*

(CĂT-Ạ-PLĂŞ′MẠ CỌ-NĪ′Ī.)

Cataplasme avec la Ciguë, *Fr.;* Schierling-Umschlag, *G.*

"Take of Hemlock Leaf, in powder, *one ounce;* Linseed Meal *three ounces;* Boiling Water *ten fluidounces.* Mix the Hemlock and Linseed Meal, and add them to the Water gradually, with constant stirring." *Br.*

This cataplasm may be advantageously employed as an anodyne application to cancerous, scrofulous, syphilitic, and other painful ulcers; but its liability to produce narcotic effects, in consequence of the absorption of the active principle of the hemlock, should not be overlooked. (See *A. J. P.*, 1873, p. 177.)

CATAPLASMA FERMENTI. *Br.* *Yeast Poultice.*

(CĂT-Ạ-PLĂŞ′MẠ FẸR-MĔN′TĪ.)

Cataplasme avec le Levûre de Bière, *Fr.;* Hefenumschlag, *G.*

"Take of Beer Yeast *six fluidounces;* Wheaten Flour *fourteen ounces;* Water, heated to 100° F., *six fluidounces.* Mix the Yeast with the Water, and stir in the Flour. Place the mass near the fire till it rises." *Br.*

By exposing a mixture of yeast and flour to a gentle heat, fermentation takes place, and carbonic acid gas is extricated, which causes the mixture to swell, and is the source of its peculiar virtues. The yeast cataplasm is gently stimulant, and is sometimes applied with benefit to foul and gangrenous ulcers, the fetor of which it corrects, while it hastens the separation of the slough.

CATAPLASMA LINI. *Br.* *Linseed Poultice.*

(CĂT-Ạ-PLĂŞ′MẠ LĪ′NĪ.)

Cataplasma Emolliens, s. Communis; Flaxseed Poultice; Cataplasme de Farine de Lin, Cataplasme simple (commun), *Fr.;* Leinsamen-Umschlag, *G.*

"Take of Linseed Meal *four ounces;* Olive Oil *half a fluidounce;* Boiling Water *ten fluidounces.* Mix the Linseed Meal gradually with the Water, then add the Oil with constant stirring." *Br.*

The flaxseed meal which remains after the expression of the oil is here employed; but that which has not been submitted to pressure is decidedly preferable, and answers an excellent purpose when mixed with boiling water, without other addition. Fresh lard or olive oil, spread upon the surface of the poultice, serves to prevent its adhesion to the skin, and to preserve its softness.

The use of this and other emollient cataplasms is to relieve inflammation, or to promote suppuration. They act mainly by the sedative influence of their moisture, and by excluding the air. The one most extensively employed, perhaps because its materials are always at hand, is that prepared by heating together milk and the crumb of bread. The milk should be quite sweet, and fresh lard should be incorporated with the poultice. Mush made with the meal of Indian corn also forms an excellent emollient cataplasm.*

CATAPLASMA SINAPIS. *Br.* *Mustard Poultice.*

(CĂT-Ạ-PLĂŞ′MẠ SỊ-NĀ′PĬS.)

Sinapismus, *P.G.;* Cataplasma Rubefaciens; Sinapisme, Cataplasme de Moutarde, Cataplasme rubéfiant, *Fr.;* Senfteig, *G.*

"Take of Mustard, in powder, Linseed Meal, each, *two ounces and a half;* Boiling Water *ten fluidounces.* Mix the Linseed Meal gradually with the Water, and add the Mustard, with constant stirring." *Br.*

The simplest and most effectual mode of preparing a mustard poultice is to mix the powdered mustard of the shops with a sufficient quantity of warm water to give it a due consistence. When a weaker preparation is required, an equal portion or more of rye or wheat flour should be added. Vinegar never increases its efficiency, and, in the case of the black mustard seed, has been ascertained by MM. Trousseau and Blanc to diminish its rubefacient power. The same may be said of alcohol. A boiling temperature is also injurious by interfering with the development of the volatile oil or acrid principle. (See *Sinapis.*)

These poultices are frequently called *sinapisms.* They are powerfully rubefacient, exciting a sense of warmth in a few minutes, and usually becoming insupportably painful in less than an hour. When removed they leave the surface intensely red and burning; and the inflammation frequently terminates in desquamation, or even blistering if the application be too long continued. Obstinate ulcers and gangrene also sometimes result from the protracted action of mustard, especially on parts possessed of little vitality. As a general rule, the poultice should be removed when the patient complains much of pain; and in cases of insensibility should not, unless greatly diluted, be allowed to remain longer than one, or at most two hours; as violent inflammation, followed by obstinate ulceration, is apt to take place upon the occurrence of reaction. In children particular care is necessary to avoid this result. The poultice should be thickly spread on linen, and may be covered with gauze or unsized paper in order to prevent its adhesion to the skin. If hairs are present they should be removed by the razor. Sinapisms may be employed in all cases in which it is desirable to produce a speedy rubefacient impression. (See *Charta Sinapis.*)

CATAPLASMA SODÆ CHLORATÆ. *Br.* *Chlorine Poultice.*

(CĂT-Ạ-PLĂŞ′MẠ SŌ′DÆ ꞒHLỌ-RĀ′TÆ.)

"Take of Solution of Chlorinated Soda *two fluidounces;* Linseed Meal *four ounces;* Boiling Water *eight fluidounces.* Mix the Linseed Meal gradually with the Water, and add the Solution of Chlorinated Soda, with constant stirring." *Br.*

This is an excellent application to sloughing and other fetid ulcers, to correct the smell, and afford a moderate stimulation.

CATECHU. *U.S.* *Catechu.*

(CĂT′Ẹ-ꞒHŪ—kăt′ẹ-kū.)

"An extract prepared from the wood of Acacia Catechu. Willdenow. (*Nat. Ord.* Leguminosæ, Mimoseæ.)" *U. S.*

Cutch, Terra Japonica, Catechu Nigrum; Cachou, *Fr.;* Catechu, Katechu, Pegu Catechu, *G.;* Catecu, Catciu, Catto, *It.;* Catecu, *Sp.;* Cutt, *Hindostanee.*

CATECHU PALLIDUM. *Br.* *Pale Catechu.*

(CĂT′Ẹ-ꞒHŪ PĂL′LỊ-DŬM.)

"An extract of the leaves and young shoots of Uncaria Gambir (Nauclea Gambir)." *Br.*

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* A substitute for linseed meal poultices has been prepared by saturating a piece of thick felt paper with a decoction of linseed and drying. When intended to be used, the prepared paper is dipped in hot water. It swells considerably, and is applied to the desired part, covered with waxed paper, rubber tissue, or oiled silk, fastened with bandages, and allowed to remain 12 hours. (Volkhausen, *Pharm. Ztg.*, 1879, p. 95.)

The British Pharmacopœia has entirely rejected the proper catechu, which, in the former edition, was recognized under the inappropriate name of Catechu Nigrum, retaining, by the name of Catechu Pallidum, a product which, though analogous to catechu, is entirely distinct, being derived from a different plant, and known commonly by a different name, that, namely, of gambir. We treat in the text of the proper catechu, and, in a note, of gambir among the catechus not recognized by the U. S. Pharmacopœia.

Acacia Catechu. Willd. *Sp. Plant.* iv. 1079; Carson, *Illust. of Med. Bot.* i. 32, pl. 24; *B. & T.* 95. According to Mr. Kerr, whose description has been followed by most subsequent writers, *Acacia Catechu* is a small tree, seldom more than twelve feet in height, with a trunk one foot in diameter, dividing towards the top into many close branches, and covered with a thick, rough, brown bark. The leaves, which stand alternately upon the younger branches, are composed of from fifteen to thirty pairs of pinnæ nearly two inches long, each of which is furnished with about forty pairs of linear leaflets, beset with short hairs. At the base of each pair of pinnæ is a small gland upon the common footstalk. Two short recurved spines are attached to the stem at the base of each leaf. The flowers are in close spikes, which arise from the axils of the leaves, and are about four or five inches long. The fruit is a lanceolate, compressed, smooth, brown pod, with an undulated thin margin, and contains six or eight roundish flattened seeds, which when chewed emit a nauseous odor.

This species of Acacia is a native of the East Indies, growing abundantly in various provinces of Hindostan, and in the Burmese Empire. Pereira says that it is now common in Jamaica. Like most others of the same genus, it abounds in astringent matter, which may be extracted by decoction. Catechu is an extract from the wood of the tree.

This drug had been long known before its source was discovered. It was at first called *terra Japonica*, under the erroneous impression that it was an earthy substance derived from Japan. When ascertained by analysis to be of vegetable origin, it was generally considered by writers on the Materia Medica to be an extract of the *betel nut*, which is the fruit of a species of palm, denominated *Areca Catechu.* Its true origin was made known by Mr. Kerr, assistant surgeon of the civil hospital in Bengal, who had an opportunity of examining the tree from which it was obtained, and observing the process of extraction. According to Mr. Kerr, the manufacturer, having cut off the exterior white part of the wood, reduces the interior brown or reddish-colored portion into chips, which he then boils in water in unglazed earthen vessels, till all the soluble matter is dissolved. The decoction thus obtained is evaporated first by artificial heat, and afterwards in the sun, till it has assumed a thick consistence, when it is spread out to dry upon a mat or cloth, being, while yet soft, divided by means of a string into square or quadrangular pieces. The account subsequently given by Dr. Royle, of the preparation of the extract in Northern India, is essentially the same. The process, as he observed it, was completed by the pouring of the extract into quadrangular earthen moulds. Our countryman, the Rev. Howard Malcom, states, in his "Travels in South-Eastern Asia," that catechu is largely prepared from the wood of *Acacia Catechu* near Prome, in Burmah. Two kinds, he observes, are prepared from the same tree; one *black*, which is preferred in China, and the other *red*, which is most esteemed in Bengal. It is said that the unripe fruit and leaves are also sometimes submitted to decoction.

The name *catechu* in the native language signifies the *juice of a tree*, and appears to have been applied to astringent extracts obtained from various plants. According to the U. S. Pharmacopœia, however, the term is properly restricted to the extract of *Acacia Catechu;* as it was not intended to recognize all the astringent products which are floating in Asiatic commerce; and those from other sources than the Acacia, though they may occasionally find their way into our shops, do so as an exception to the general rule. A minute account of the diversified forms and exterior characters which officinal catechu presents as produced in different localities, would rather tend to perplex the reader than to serve any good practical purpose. These characters are, moreover, frequently changing, as the drug is procured from new sources, or as slight variations may occur in the mode of its preparation. Commerce is chiefly supplied with catechu from Bahar, Northern India, and Nepaul through Calcutta, from Canara through Bombay, and from the Burmese dominions. We derive it directly from Calcutta, or by orders from London, and it is sold in our markets without reference to its origin. It is frequently called *cutch* by the English traders, a name derived, no doubt, from the Hindoostanee word *cutt.**

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* In order not to embarrass the text unnecessarily, we have thrown together, in the form of a note, the following observations upon the varieties of catechu; those being first considered which are probably derived from *Acacia Catechu,* and, therefore, recognized as officinal in the U. S. Pharmacopœia.

1. *Officinal Catechu. U. S.*

The following, so far as we have been able to distinguish them, are the varieties of officinal catechu to be found in the markets of Philadelphia.

1. *Plano-convex Catechu. Cake Catechu.* This is in the form of circular cakes, flat on one side, convex on the other, and usually somewhat rounded at the edge, as if the soft extract had been placed in saucers, or vessels of a similar shape, to harden. As found in the retail shops, it is generally in fragments, most of which, however, exhibit some evidences of the original form. The cakes are of various sizes, from two or three to six inches or more in diameter, and weighing from a few ounces to nearly two pounds. Their exterior is usually smooth and dark brown; but we have seen a specimen in which the flat surface exhibited impressions as if produced by coarse matting. The color internally is always brown, sometimes of a light yellowish brown or chocolate color, but more frequently dark reddish brown, and sometimes almost black. The cakes are almost always more or less cellular in their interior; but in this respect great diversity exists. Sometimes they are very porous, so as almost to present a spongy appearance, sometimes compact and nearly uniform; and this difference may be observed even in the same piece. The fracture is sometimes rough and dull, but in the more compact parts is usually smooth and somewhat shining; and occasionally a piece split in one direction will exhibit a spongy fracture, while in another it will be shining and resinous, indicating the consolidation of the extract in layers. This variety of catechu is often of good quality. It is common at present in our market, but we have been unable to trace its origin accurately. There can be little doubt, from its internal character, that it comes from the East Indies, and is the product of *A. Catechu:* but no accounts that we have seen of the preparation of the drug, in particular geographical sites, indicate this particular shape; and it is not impossible that portions of it may be formed out of other varieties of catechu by a new solution and evaporation.

2. *Pegu Catechu.* This is the product derived from the Burmese dominions, and named from that section of the country whence it is exported. It enters commerce, probably in general through Calcutta, in large masses, sometimes of one cwt., consisting of layers of flat cakes, each wrapped in leaves, said to be those of the *Nauclea Brunonis.* In this form, however, we do not see it in the shops; but almost always in angular, irregular fragments, in which portions of two layers sometimes cohere with leaves between them, indicating their origin. It is characterized by its compactness, shining fracture, and blackish brown or dark port-wine color, so that when finely broken it bears considerable resemblance to kino. This is an excellent variety of catechu, and is not unfrequent in the shops.

3. *Catechu in Quadrangular Cakes.* This is scarcely ever found in the shops in its complete form, and the fragments are often such that it would be impossible to infer from them the original shape of the cake. This is usually between two and three inches in length and breadth, and somewhat less in thickness, of a rusty brown color externally, and dark brown or brownish gray within, with a somewhat rough and dull fracture, but, when broken across the layers in which it is sometimes disposed, exhibiting a smoother and more shining surface. Guibourt speaks of the layers as being blackish externally and grayish within, and bearing some resemblance to the bark of a tree, a resemblance, however, which has not struck us in the specimens which have fallen under our notice. There is little doubt that this variety comes from the provinces of Bahar and Northern India, where the preparation of the drug was witnessed by Mr. Kerr and Dr. Royle, who both speak of it as being brought, when drying, into the quadrangular form. It has been called *Bengal Catechu,* because exported from that province.

Pale catechu, so far as the term is not applied to *gambir,* may be considered as belonging to this variety. A specimen with this name, which was sent from India to the great London exhibition, and which Dr. G. B. Wood had an opportunity of examining, was in oblong rectangular pieces, or fragments of such pieces, about three and a half inches long by an inch and a half in breadth, of a dirty yellowish color within, and an earthy fracture, quite free from gloss, and bearing a much stronger resemblance to gambir than to ordinary catechu.

4. *Catechu in Balls.* We have seen this in two forms—one consisting of globular balls about as large as an orange, very hard and heavy, of a ferruginous aspect externally, very rough when broken, and so full of sand as to be gritty under the teeth; the other in cakes, originally, in all probability, globular, and of about the same dimensions, but flattened and otherwise pressed out of shape before being perfectly dried, sometimes adhering two together, as happens with the lumps of Smyrna opium, and closely resembling in external and internal color, and in the character of their fracture, the quadrangular variety last described. The former kind is rare, and the specimens we have seen had been twenty years in the shop, and had very much the appearance of a factitious product. The latter is in all probability the kind known formerly as the *Bombay catechu;* as Dr. Hamilton, and, more recently, Major Mackintosh, in describing the mode of preparing catechu on the Malabar coast, of which Bombay is the entrepot, say that, while the extract is soft, it is shaped into balls about the size of an orange.

Properties. Catechu, as it comes to us, is in masses of different shapes, some in balls more or less flattened, some in circular cakes, some saucer-shaped, others

2. *Catechus not recognized in the U. S. Pharmacopœia.*

1. **Catechu Pallidum,** *Br. Gambir. Terra Japonica. Pale Catechu.* An astringent extract is abundantly prepared in certain parts of the East Indies, under the name of *gambir* or *gambeer*, and imported into Europe and America under that of terra Japonica. The plant from which it is obtained, called by Mr. Hunter, who first minutely described it, *Nauclea Gambir*, but by Roxburgh, De Candolle, and others, *Uncaria Gambir*, is a climbing shrub of the natural order Rubiaceæ of Jussieu, Cinchonaceæ of Lindley. (*B. & T.* 139.) It is a native of Malacca, Sumatra, Cochin-China, and other parts of Eastern Asia, and is largely cultivated in the islands of Bintang, Singapore, and Prince of Wales. The gambir is prepared by boiling the leaves and young shoots in water, and evaporating the decoction either by artificial or solar heat. When of a proper consistence, it is spread out into flat cakes in moulds or otherwise, and then cut into small cubes, which are dried in the sun. Sometimes these cohere into a mass when packed before being quite dry.

Gambir is in cubes, with sides about an inch square, is light and porous, so that it floats when thrown in water, is deep yellowish, or reddish brown externally, but pale yellowish within, presents a dull earthy surface when broken, is inodorous, and has a strongly astringent, bitter, and subsequently sweetish taste. It softens and swells up when heated, and leaves a minute proportion of ashes when burnt. It is partially soluble in cold water, and almost wholly so in boiling water, which deposits a portion upon cooling. Duhamel, Ecky, and Procter dissolved 87·5 per cent. of it in cold water by means of percolation. (*A. J. P.*, xvi. 166.) Nees von Esenbeck found it to consist of from 36 to 40 per cent. of catechu-tannic acid, a peculiar principle called *catechuin, catechin*, or catechuic acid, gum or gummy extractive, a deposit like the cinchonic red, and 2·5 per cent. of lignin. *Catechuic acid*, when perfectly pure, is snow-white, of a silky appearance, crystallizable in fine needles, unalterable if dry in the air, fusible by heat, very slightly soluble in cold water with which it softens and swells up, soluble in boiling water which deposits it on cooling, and soluble also in alcohol and ether. It very slightly reddens litmus paper, and, though coloring the solution of chloride of iron green, and producing with it a grayish green precipitate, differs from tannic acid in not affecting a solution of gelatin. It bears considerable analogy to gallic acid in its relations to the metallic salts, but does not, according to Neubauer, bear the same relation to the tannic acid of catechu that gallic acid does to that of galls. On the contrary, instead of resulting from the oxidation of tannic acid, it is by heat converted into a substance analogous to tannin. (*A. J. P.*, xxviii. 329 and 331; from *Liebig's Annalen*, xcvi. 337.) The very great discordance of different authors as to its formula seems to be explained by some recent experiments of Etti (*Liebig's Ann.*, 186, p. 327), who shows that *catechin*, $C_{19}H_{18}O_8$, readily gives at 100° C. (212° F.), or even when kept for some time over sulphuric acid, an anhydride, $C_{38}H_{34}O_{15}$, and at 160° C. (320° F.) a second anhydride, $C_{38}H_{32}O_{14}$, which, mixed in varying proportions, explain the varying results. Gautier (*Journ. de Pharm. et de Chim.*, 1878, p. 368) assigns to catechin the formula $C_{21}H_{18}O_8$.

Several varieties of gambir are described. Sometimes it is in oblong instead of cubical pieces, without differing in other respects from the ordinary kind; sometimes in small circular cakes, or short cylindrical pieces, heavier than water, of a pale reddish yellow color, moderately astringent, gritty under the teeth, and quite impure; sometimes in very small cubes, distinguishable by the black color they afford with tincture of iodine, indicating the admixture of sago, or other amylaceous matter; and, finally, in circular cakes of the size of a small lozenge flat on one side, and somewhat convex on the other, of a pale pinkish yellowish white color, and a chalky feel. This is most highly esteemed by the natives in India. (*Pereira.*) None of these varieties occur to any extent in our commerce.

Gambir was probably the substance first brought from the East under the name of *terra Japonica*. It is largely consumed in the East by the betel-chewers. Great quantities are imported into Europe, where it is used for tanning, calico-printing, dyeing, etc. In this country it is also largely consumed by the calico-printer. It is a strong astringent, and applicable to the same purposes as the officinal catechu.

2. *Areca Catechu.* This is obtained from the *areca nut*, or *betel nut*, which is the seed of *Areca Catechu*, a palm cultivated in all parts of India. (See Part II.) It is prepared by boiling the nuts in water, and evaporating the decoction. There are two varieties; one of a black color, very astringent, mixed with paddy husks and other impurities, and obtained by evaporating the first decoction; the other, yellowish brown, of an earthy fracture, and pure, resulting from the evaporation of a decoction of the nuts which had been submitted to the previous boiling. The first is called *kassu*, the other *coury*. (Heyne, *Tracts, etc., on India.*) They are prepared in Mysore, and Ainslie states that both varieties are sold in the bazaars of Lower India, and used for the same purpose as the officinal catechu by the native and European practitioners. They are also much used for chewing by the natives. But they are seldom exported, and it is uncertain whether they find their way into European or American commerce. Pereira thought he had identified the *kassu* with a variety of catechu derived from Ceylon, where he had been informed that an extract of the areca nut is prepared. It was in circular flat cakes, from two to three inches in diameter, scarcely an inch thick, covered on one side with paddy husks, and internally blackish brown and shining, like Pegu catechu.

Guibourt and Pereira describe other varieties, which we have not met with, and which are probably rare. One of these is the *Siam catechu*, in conical masses shaped like a betel nut, and weighing about a pound and a half. Its fracture is shining and liver-colored, like that of hepatic aloes; in other respects it resembles Pegu catechu. Another is the *black mucilaginous catechu* of Guibourt, in parallelopipeds, an inch and a half in length by an inch in breadth. Internally it is black and shining, and its taste is mucilaginous and feebly astringent. A third is the *dull reddish catechu* of Guibourt, in somewhat flattened balls, weighing three or four ounces, of a dull reddish, wavy, cubical or oblong, or quite irregular, and of every grade in size, from small angular pieces, which are evidently fragments of the original cakes, to lumps which weigh one or two pounds. The color is externally of a rusty brown more or less dark, internally varying from a pale reddish or yellowish brown to a dark liver color. In some specimens it is almost black, in others somewhat like the color of port wine, and in others again, though rarely, dull red like annotta. The extract has been distinguished into the *pale* and *dark* varieties; but there does not appear to be sufficient ground for retaining this distinction, at least in relation to the proper catechu obtained from the wood of *A. Catechu.* Catechu is inodorous, with an astringent and bitter taste, followed by a sense of sweetness. It is brittle, and breaks with a fracture which is rough in some specimens, in others uniform, resinous, and shining. That which is preferred in our market is of a dark color, easily broken into small angular fragments, with a smooth glossy surface, bearing some resemblance to kino. Catechu is often mixed with sand, sticks, and other impurities. From 200 parts of Bombay catechu, Sir H. Davy obtained 109 parts of tannic acid, 68 of extractive, 13 of mucilage, and 10 of insoluble residue. The same quantity of Bengal catechu yielded 97 of tannic acid, 73 of extractive, 16 of mucilage, and 14 of insoluble residue. Other experimenters have obtained results somewhat different. The proportion of tannic acid, which may be considered the efficient principle, varies from about 30 to 55 per cent. in the different varieties of the drug. The portion designated by Davy as extractive is said to contain, if it does not chiefly consist of, a principle discovered by Buchner, and now called *catechin*, *catechuin*, or *catechuic acid*, $C_{19}H_{18}O_8$. (See preceding page.) To prepare pure catechin, Etti (*loc. cit.*) proceeds as follows. Catechu is dissolved in eight times its weight of boiling water, and the liquid, after being strained through a cloth, is left for some days until the insoluble catechin has subsided. The crude catechin is collected in a linen cloth and submitted to the action of a screw-press, then dissolved in a sufficient amount of dilute alcohol, and the filtered solution is shaken up with ether as long as any catechin is thereby dissolved; and after the ether has been removed by distillation the residue is taken up with distilled water, and the solution is left for a few days, when the catechin crystallizes out in an almost colorless state. After pressure in a cloth it is again dissolved in boiling water, when a yellowish white body remains behind, which appears to be *quercetin.* The deep red liquid remaining behind after the catechin has been dissolved out with ether contains *catechin red.* The *tannic acid* is of the variety which precipitates iron of a greenish black color, and differs from most of the other varieties in not yielding grape-sugar when digested with dilute sulphuric acid. It is not, therefore, a glucoside. It precipitates gelatin, but not tartar emetic (*Kane*), and is not, like the tannic acid of galls, converted into gallic acid by exposure to the air. It may be distinguished by the name of *catechu-tannic acid.* Catechu is almost wholly soluble in a large quantity of water, to which it imparts a brown color. The extractive or catechuic acid is much less soluble than the astringent principle, which may be almost entirely separated from it by the frequent application of small quantities of cold water. Boiling water dissolves it much more readily than cold, and deposits it of a reddish brown color upon cooling. Both principles are readily dissolved by alcohol or proof spirit, and also by ether. For the important reactions of catechu, see *Acidum Tannicum.*

M. de Meyer affirms that the best method of detecting adulteration of catechu is to treat the suspected drug with ether. Catechu of good quality, after repeated treatment with ether, loses 53 per cent. of its weight, and the dried residue weighs only 47 per cent. of the catechu employed. If this be exceeded, the drug must be proportionately impure. (*Journ. de Pharm.*, Juin, 1870, p. 479.) A. Jossart (*Journ. Pharm. d'Anvers*, 1881, p. 41) examined a catechu which was adulterated with 60 to 65 per cent. of ferrous carbonate.

Medical Properties and Uses. Catechu is a powerful astringent. The dark-

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and often marbled fracture. Many years since an extract like this was brought to Philadelphia upon speculation by a merchant from Calcutta, but it is not now in the market. Lastly, there is a *pale* or *whitish* catechu, in small roundish or oval lumps, with an irregular surface, dark or blackish brown externally, very pale and dull internally, and of a bitter, astringent, and sweetish taste, with a smoky flavor. It is unknown in commerce.

colored is somewhat more powerful than the light, and is therefore usually preferred; but the light, being rather sweeter, is chosen by the Malays, Hindoos, and other East Indians, who consume vast quantities of this extract by chewing it, mixed with aromatics and a small proportion of lime, and wrapped in the leaf of the *Piper Betel.* Catechu may be advantageously used in most cases where astringents are indicated. The complaints to which it is best adapted are diarrhœa dependent on debility or relaxation of the intestinal mucous membrane, and passive hemorrhages, particularly that from the uterus. A small piece held in the mouth and allowed slowly to dissolve, is an excellent remedy in relaxation of the uvula, and the irritation of the fauces and troublesome cough which depend upon it. Applied to spongy gums, in the state of powder, it sometimes proves useful; and it has been recommended as a dentifrice in combination with powdered charcoal, Peruvian bark, myrrh, etc. Sprinkled upon the surface of indolent ulcers, it is occasionally beneficial, and is much used in India for the same purpose, in the form of an ointment. An infusion of catechu may be used as an injection in obstinate gonorrhœa, gleet, and leucorrhœa, and we have found it highly beneficial, when thrown up the nostrils, in arresting epistaxis. The dose is from ten grains to half a drachm (0·65–1·95 Gm.), which should be frequently repeated, and is best given with sugar, gum arabic, and water.*

Off. Prep. Tinctura Catechu Composita, *U. S.*

Off. Prep. of Pale Catechu (*Gambir*). Infusum Catechu, *Br.;* Pulvis Catechu Compositus, *Br.;* Tinctura Catechu, *Br.;* Trochisci Catechu, *Br.*

CAULOPHYLLUM. *U. S.* *Caulophyllum.* [*Blue Cohosh.*]

(CÂU-LỌ-PHY̆L′LỤM.)

"The rhizome and rootlets of Caulophyllum thalictroides. Michaux. (*Nat. Ord.* Berberidaceæ.)" *U. S.*

Pappoose Root, Squaw Root, Blueberry Root.

Gen. Ch. Sepals 6, with three small bractlets at the base, ovate-oblong. *Petals* 6, thick and gland-like, somewhat kidney-shaped or hooded bodies, with short claws much smaller than the sepals, one at the base of each of them. *Stamens* 6: *anthers* oblong. *Pistil* gibbous, style short. *Stigma* minute and unilateral. *Ovary* bursting soon after flowering by the pressure of the two erect, enlarging seeds and withering away. The spherical *seeds* naked on their thick seed-stalks, looking like drupes; the fleshy integument turning blue; albumen of the texture of horn. (*Gray's Manual.*)

Caulophyllum thalictroides. Michaux. *Leontice thalictroides.* Linn. This is an indigenous, perennial, herbaceous plant, with matted, knotty rhizomes, from which rises a single smooth stem, about two feet high, naked till near the summit, where it sends out a large triternately compound leaf, and ending in a small raceme or panicle of greenish yellow flowers, at the base of which is often a smaller biternate leaf. The whole plant when young, as well as the seeds, which are about as large as peas, is glaucous. It is the only known species of the genus. It is found in most parts of the United States, growing in moist rich woods.

Properties. The root stock is the only part used. It has a sweetish, pungent taste, and yields its virtues to water and alcohol. It is officinally described as follows. "Rhizome about four inches (10 cm.) long, and about one-fourth to two-fifths of an inch (6 to 10 mm.) thick, bent; on the upper side with broad, concave stem-scars and short, knotty branches; externally gray brown, internally whitish, tough and woody. Rootlets numerous, matted, about four inches (10 cm.) long, and one twenty-fifth of an inch (1 mm.) thick, rather tough; nearly inodorous; taste sweetish, slightly bitter, and somewhat acrid." *U. S.*

Caulophyllum was examined by Mayer, who found it to contain *saponin.* (*A. J. P.*,

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* *Fluid Extract of Catechu.* Prof. Procter suggested the following formula for a *fluid extract of catechu* based on the solvent power of glycerin over this extract. Eight *troyounces* of pure catechu, in moderately coarse powder, are mixed in a mortar with *four fluidounces* of glycerin so as to form a paste, to which enough diluted alcohol is added to make a pint. The liquid is poured into a bottle, shaken occasionally for twenty-four hours, and then strained through muslin. Each fluidrachm of the fluid extract represents thirty grains of catechu. (*Proc. A. P. A.*, 1863, p. 241.)

1863, p. 99.) A. E. Ebert subsequently made an investigation of its constituents, and found albumen, gum, starch, phosphoric acid, extractive, two resins, coloring matter, and a body analogous to saponin. The *caulophyllin* of the eclectics is made in the usual way, by pouring a concentrated alcoholic tincture into water and collecting, washing, and drying the resinous precipitate.

Medical Properties. We have no positive evidence of the possession by this drug of any medical properties entitling it to entrance into the Pharmacopœia. It is deemed especially emmenagogue, and is thought also to act like ergot in promoting the contractions of the uterus, for which purpose it is much employed by the "eclectic" practitioners, who consider it also possessed of diaphoretic and various other remedial properties. It is given in decoction, infusion, or tincture, the first two being made in the proportion of an ounce to a pint of water, the last of four ounces to a pint of spirit. The dose of the decoction or infusion is one or two fluidounces, of the tincture one or two fluidrachms.

CERA ALBA. *U. S., Br.* *White Wax.*

(CĒ'RẠ ĂL'BẠ.)

"Yellow wax bleached." *U. S.* "Bleached by exposure to moisture, air, and light." *Br.*

Cire blanche, *Fr.;* Weisses Wachs, *G.;* Cera bianca, *It.;* Cere blanca, *Sp.*

CERA FLAVA. *U. S., Br.* *Yellow Wax.*

(CĒ'RẠ FLĀ'VẠ.)

"A peculiar, concrete substance, prepared by Apis mellifica. Linné. (*Class*, Insecta; *Order*, Hymenoptera.)" *U. S.* "The prepared honeycomb of the Hive Bee, Apis mellifica." *Br.*

Cera Citrina; Beeswax; Cire jaune, *Fr.;* Gelbes Wachs, *G.;* Cera gialla, *It.;* Cera amarilla, *Sp.*

Wax is a product of the common bee, *Apis mellifica* of naturalists, which constructs with it the cells of the comb in which the honey and larvæ are deposited. It was at one time doubted whether the insect elaborated the wax by its own organs, or merely gathered it from vegetables. The question was set at rest by Huber, who fed a swarm of bees exclusively on honey and water, and found that they formed a comb consisting of wax. This, therefore, is a proper secretion of the insect. It is produced in the form of scales under the rings of the belly. But wax also exists in plants, bearing in this, as in other respects, a close analogy to the fixed oils. It is, however, the product of the bee only that is recognized by the Pharmacopœias.* This is directed in two forms: 1, that of *yellow wax* procured immediately from the comb;

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* *China wax*, called *pe-la* by the Chinese, resembles spermaceti in whiteness and crystalline appearance, but is distinguished by greater hardness and friability, and a somewhat fibrous fracture. It melts at about 83° C. (181° F.), is very slightly soluble in alcohol or ether, is insoluble in cold oil of turpentine and rectified petroleum, but is dissolved by these fluids with the aid of heat. These solubilities distinguish it from spermaceti. (*P. J. Tr.*, xiv. 9.) It was formerly supposed to be of vegetable origin; but has been ascertained to be the product of an insect belonging to the genus Coccus, which fixes itself to the branches of a certain tree, and, investing them closely, becomes imbedded in a waxy material, which is scraped off with the insects, and constitutes the crude wax. It is purified by melting and straining. (Hanbury, *P. J. Tr.*, xii. 476.) The tree from which the wax is obtained has been ascertained to be the *Fraxinus Chinensis* of Roxburgh. (*Ibid.*, Sept. 1, 1859, p. 176.)

Mr. T. T. Cooper, in his "Travels of a Pioneer" in China, gives some interesting statements as to the production of this wax, which are the result of his own personal observations. It is chiefly the province of S'zchuan which is the seat of this industry; the cultivation of the China wax being a source of great wealth to this province, second only in importance to the silk culture. The "wax trees" are all cut down at the height of 8 feet, leaving no branches, the trunks being about as thick as a man's thigh, and sending forth shoots in the spring. The insects are cultivated in a different province, that of Yunnan, whence vast quantities of the eggs are sent annually to S'zchuan, where they are received in little balls of the size of a pea. These are suspended, enclosed in young leaves, to the shoots of the tree in March. In about two months the larvæ appear, and feeding on the leaves soon attain the size of small butterflies, which spread themselves in immense numbers over the branches, which are whitened by them, so as to seem covered with feathery snow. The grub, as it advances to the chrysalis form, buries itself in a white secretion by which all the branches are coated an inch in thickness. These are then cut off near the stem and divided into small pieces, which are tied in bundles, and put into large caldrons, where they are boiled in water till all the wax melts and rises to the surface. It is then skimmed off and run into moulds where it hardens. In the form thus produced, it is spread over the Empire, where it is used for candles and as medicine. (*P. J. Tr.*, 1872, p. 569.)

and, 2, that of *white wax* prepared by bleaching the former. We shall consider these separately, and afterwards give an account of *vegetable wax.*

1. CERA FLAVA, or *Yellow Wax.* This is obtained by slicing the comb taken from the hive, draining and afterwards expressing the honey, and melting the residue in boiling water, which is kept hot for some time in order to allow the impurities to separate, and either subside or be dissolved by the water. When the liquid cools the wax concretes, and, having been removed and again melted in boiling water, is strained and poured into pans or other suitable vessels. It is usually brought to market in round flat cakes of considerable thickness. The druggists of Philadelphia are supplied chiefly from the Western States and North Carolina, especially the latter, and from Cuba. Some of inferior quality is imported from Africa.

Properties. Yellow wax is "a yellowish or brownish yellow solid, having an agreeable, honey-like odor, and a faint, balsamic taste. It is brittle when cold, but becomes plastic by the heat of the hand. It melts at 63°–64° C. (145·4°–147·2° F.), and congeals with a smooth and level surface. Sp. gr. 0·955 to 0·967. It is insoluble in water, but soluble in 35 parts of ether and in 11 parts of chloroform; also soluble in oil of turpentine, and in fixed or volatile oils. Cold alcohol dissolves it only partially, but it is almost completely soluble in boiling alcohol. If 1 Gm. of Wax be boiled, for half an hour, with 40 Gm. of solution of soda (sp. gr. 1·180), the volume being preserved by the occasional addition of water, the Wax should separate, on cooling, without rendering the liquid opaque, and no precipitate should be produced in the filtered liquid by hydrochloric acid (abs. of fats or fatty acids, Japan wax, resin); nor should the same reagent produce a precipitate in water which has been boiled with a portion of the Wax (abs. of soap). If 5 Gm. of Wax be heated in a flask, for fifteen minutes, with 25 Gm. of sulphuric acid to 160° C. (320° F.), and the mixture diluted with water, no solid, wax-like body should separate (abs. of paraffin)." *U. S.*

Various adulterations have been practised, most of which may be readily detected. Meal, earth, and other insoluble substances are at the same time discovered and separated by melting and straining the wax. When the fracture is smooth and shining instead of being granular, the presence of resin may be suspected. This is dissolved by cold alcohol, while the wax is left untouched. Yellow wax is frequently adulterated with a mixture of paraffin and rosin; such wax is usually translucent on the edges. Dr. A. W. Miller has observed that when a large quantity of paraffin is present the upper surface of the cake is concave, whilst pure yellow wax presents either a plane or slightly convex surface. For other adulterating substances used, and the modes of detecting them, see the remarks which follow on white wax.

Yellow wax is used chiefly as an ingredient of plasters and cerates.

2. CERA ALBA, *Bleached Yellow Wax*, or *White Wax.* The color of yellow wax is discharged by exposing it, with an extended surface, to the combined influence of air, light, and moisture. The process of bleaching is carried on to a considerable extent in this country. The wax, previously melted, is made to fall in streams upon a revolving cylinder, kept constantly wet, upon which it concretes, forming thin riband-like layers. These, having been removed, are spread upon linen cloths stretched on frames, and exposed to the air and light, care being taken to water and occasionally turn them. In a few days they are partially bleached; but, to deprive the wax completely of color, it is necessary to repeat the whole process once, if not oftener. When sufficiently white, it is melted and cast into small circular cakes. The color may also be discharged by chlorine; but the wax is said to be somewhat altered.* White wax sometimes contains one or more free fatty acids,

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* The following process for purifying wax by steam has been patented by M. Cassgrand, in France, and is said to have been employed advantageously. Wax melted by steam is passed along with the steam through a coiled tube or worm, is received into a double bottom heated by steam, where it is washed with water, and is then raised by a pump into another pan, also heated by steam, where it is again washed with water; and the whole operation is repeated three or four times; the wax being allowed to rest for about four or five minutes in the upper pan after each operation, and, after the last one, an hour or two for the subsidence of impurities. The wax is then granulated by means of cold water, allowed to dry for two or three days, and then exposed to light and air. The whole process is completed in a few days. (See *A. J. P.*, xxvi. 525.)

consequent probably upon the employment of alkalies in bleaching it, which render it an unfit ingredient in the unctuous preparations of certain salts. Of these acids it may be deprived by means of alcohol.

Perfectly pure wax is white, shining, diaphanous in thin layers, inodorous, insipid, harder and less unctuous to the touch than the yellow, soft and ductile at 35° C. (95° F.), and fusible at 65° C. (149° F.), retaining its fluidity at a lower temperature. According to Saussure, its sp. gr. in the solid state is 0·966. The U. S. Pharmacopœia describes it as "a yellowish white solid, generally in form of circular cakes, about four inches (10 cm.) in diameter, somewhat translucent in thin layers, having a slightly rancid odor and an insipid taste. It melts at about 65° C. (149° F.). Sp. gr. 0·965–0·975. In other respects it has the characteristics and answers to the tests mentioned under Yellow Wax (see *Cera Flava*)." *U. S.* By a great heat it is partly volatilized, partly decomposed; and, when flame is applied to its vapor, it takes fire and burns with a clear bright light. It is insoluble in water, and in cold alcohol or ether, but is slightly soluble in boiling alcohol and ether, which deposit it in a great measure upon cooling. The volatile and fixed oils dissolve it with facility, resin readily unites with it by fusion, and soaps are formed by the action of soda and potassa in solution. It is not affected by the acids at ordinary temperatures, but is converted into a black mass when boiled with concentrated sulphuric acid. Bleached wax contains, according to Lewy's analysis, 80·2 per cent. of carbon, 13·4 of hydrogen, and 6·4 of oxygen. It is a mixture of three different substances, which may be separated from one another by alcohol, viz.: 1, *myricin*, insoluble in boiling alcohol, and consisting chiefly of myricyl palmitate, $C_{16}H_{31}(C_{30}H_{61}O_2)$,—that is, a compound of *palmitic acid*, $C_{16}H_{31}O.OH$, and *myricyl alcohol*, $C_{30}H_{61}OH$; 2, *cerotic acid*, $C_{27}H_{54}O_2$ (formerly called *cerin* when obtained only in an impure state), which is dissolved by boiling alcohol, but crystallizes out on cooling; 3, *cerolein*, which remains dissolved in the cold alcoholic liquid. This latter is probably a mixture of fatty acids, as indicated by its acid reaction. It has not been investigated fully, however.

Wax has been variously adulterated. *White lead* sinks to the bottom of the vessel when the wax is melted. *Starch*, *meal*, and other *insoluble substances* remain behind when the wax is dissolved in oil of turpentine or benzin; and the starch is known by producing a blue color with iodine added to water in which the wax has been boiled. *Water*, which is said to be sometimes fraudulently incorporated with it, by agitation when partially melted, is driven off by heat. *Fatty substances* render lime-water turbid, when agitated with it and allowed to stand. For the detection of stearin and stearic acid, M. Lebel dissolves the suspected wax in two parts of oil, beats the cerate thus formed with its weight of pure water, and then adds a few drops of solution of subacetate of lead. If stearin is present, there is an immediate decomposition, and the mixture acquires an extraordinary solidity from the formation of stearate of lead. (*Journ. de Pharm.*, 3e sér., xv. 302.) Vogel proposes chloroform as a means of detecting the adulteration with fatty matters. That liquid dissolves only 25 per cent. of wax, but stearin and stearic acid completely. If, therefore, wax, treated with 6 or 8 parts of chloroform, loses more than one-quarter of its weight, it may be considered as impure. (*Ibid.*, xvii. 374.) Overbeck detects stearic acid by the abundant effervescence produced from the escape of carbonic acid, when a small portion of the suspected wax is boiled in a solution composed of one part of carbonate of sodium and fifty of distilled water. (*P. J. Tr.*, xi. 128.) Fehling detects *stearic acid* and *resin* by boiling one part of the wax in twenty of alcohol, filtering the solution when cold, and then adding water. If either of these substances be present, there will be a flocculent precipitate, whereas if the wax be pure there will scarcely be an observable turbidness. The natural fats, as *tallow*, *suet*, *lard*, etc., are not amenable to this test; but it may be applied by first saponifying them, and thus converting them into the fatty acids, as the stearic. But, as wax itself is somewhat liable to be affected, it is necessary to avoid too strong an alkaline solution, and too long boiling in the process. To obviate such a result, 30 grains of the wax are to be boiled with two or three fluidounces of water containing 6 grains of pure hydrate of soda, and the mass saturated with a very dilute acid, and heated. The wax is then to be separated, dried between folds of blotting-paper, and treated as above for stearic acid. (*Neues Repert. für Pharm.*, viii. 78.) For the detection of rosin cold alcohol is sufficient. It dissolves the rosin, and yields it on evaporation, attended with a very small portion of pure wax, which yields 2·4 per cent. to cold alcohol. (Ed. Davies, *A. J. P.*, 1870, p. 537.) F. Jean states that a few drops of sulphuric acid added to the melted wax, adulterated with rosin, cause a red color, or, if only 1 per cent. be present, a greenish tint. (*A. J. P.*, 1881, p. 307.) To detect *paraffin*, which is another adulteration said to be frequent, Prof. Landolt, of Bonn, heats the wax with fuming sulphuric acid (*Nordhausen*), which destroys the wax, converting it into a black jelly-like mass, while the paraffin is left as a transparent layer on the surface. (See *A. J. P.*, xxxiv. 35.) M. Lies Bodart detects the same impurity by a somewhat complex process, based on the etherification of the wax; the paraffin being left sufficiently pure to enable its proportion to be estimated. For the particulars of the process, the reader is referred to the *Journ. de Pharm. et de Chim.* (4e sér., iii. 287, 1866). A simpler method is that of M. Dullo, who treats the adulterated wax with ether. If this dissolves more than 50 per cent., the presence of paraffin is indicated. M. Payen resorts to the point of fusion as a means of detecting paraffin. This substance melts at a lower temperature than wax, and lowers the melting point of wax with which it is mixed. (*Ibid.*, 4e sér., ii. 233.) White wax should not melt below 65·5° C. (150° F.); yellow not below 60° C. (140° F.). (*Br.*) *Japan wax* is said also to be largely employed for adulterating beeswax; so that sometimes but little of the product of the bee is to be found in the mixture. To detect Japan wax, M. Dullo boils together for a minute 10 Gm. (150 grains) of wax, 120 Gm. of water, and 1 of soda. If there be Japan wax present, a soap will immediately form, which will slowly solidify on cooling. Beeswax does not saponify under these circumstances. (*Ibid.*, 4e sér., i. 448.) Ceresin, a principle obtained from ozokerit (see Part II.), is also employed as an adulterant, and is manufactured largely for that purpose in Vienna. It is only native paraffin, and of course answers to the tests for that substance. There are other less precise methods of detecting adulterations. Thus, spermaceti and lard render wax softer and less cohesive, of a smoother and less granular fracture, and of a different odor when heated. The melting point and specific gravity are lowered by tallow, suet, and lard. Legrip's cereometer is based upon the altered specific gravity of wax when adulterated. Any one may apply this principle by making such a mixture of alcohol and water that pure wax will neither sink nor rise in it, but remain wherever placed. Adulterated wax would either swim or sink in this liquid. Pereira says that pure wax is yellowish white; and that the white wax in circular cakes always contains spermaceti, added to improve its color.

Medical Properties and Uses. Wax has little effect upon the system. Under the impression that it sheathes the inflamed mucous membrane of the bowels, it has been occasionally prescribed in diarrhœa and dysentery; and it is mentioned by Dioscorides as a remedy in the latter complaint. By Pœrner it is highly recommended in excoriations of the bowels, attended with pain and obstinate diarrhœa. His mode of using it is to melt the wax with oil of almonds or olive oil, and, while the mixture is still hot, to incorporate it by means of the yolk of an egg with some mucilaginous fluid. The dose is half a drachm three or four times a day. Another method is to form an emulsion by means of soap; but it is evident that the soap would be the most energetic ingredient. Wax is also used to fill cavities in carious teeth. Its chief employment, however, is in the formation of ointments, cerates, plasters, and suppositories. It is an ingredient in almost all the officinal cerates, which owe to it their general title.

3. VEGETABLE WAX. Many vegetable products contain wax. It exists in the pollen of numerous plants, and forms the bloom or glaucous powder which covers certain fruits, and the coating of varnish with which leaves are sometimes supplied. In some plants it is so abundant as to be profitably extracted for use. Such is the *Ceroxylon Andicola*, a lofty palm growing in the South American Andes. Upon the trunk of this tree, in the rings left by the fall of the leaves, is a coating of wax-like

matter, about one-sixth of an inch thick, which is removed by the natives, and employed in the manufacture of tapers. It contains, according to Vauquelin, two-thirds of a resinous substance, and one-third of pure wax. Two kinds of wax are collected in Brazil, one called *carnauba*,* from the leaves of the *Copernicus cerifera*, a palm, which forms large forests in the province of Ceara, the other *ocuba*, from the fruit of a shrub of the province of Para. (*Journ. de Pharm.*, 3e sér., v. 154.)† A form of vegetable wax sometimes seen in this country is that derived from *Myrica cerifera*, and commonly called *myrtle wax*. The *wax myrtle* is an aromatic shrub, from one to twelve feet high, growing in the United States, from New England to Louisiana, and flourishing especially on the sea-coast. The fruit, which grows in clusters closely attached to the stems and branches, is small, globular, and covered with a whitish coat of wax, which may be separated for use. Other parts of the plant are said to possess medical virtues. The bark of the root is acrid and astringent, and in large doses emetic, and has been popularly employed in jaundice. The process for collecting the wax is simple. The berries are boiled in water, and the wax, melting and floating on the surface, is either skimmed off and strained, or allowed to concrete as the liquor cools, and then removed. To render it pure, it is again melted and strained, and cast into large cakes. It is collected in New Jersey, North Carolina, and New England, and particularly in Rhode Island.

Myrtle wax is of a pale grayish green color, somewhat diaphanous, more brittle and unctuous to the touch than beeswax, of a feeble odor, and a slightly bitterish taste. It is about as heavy as water, and melts, according to Dr. G. E. Moore, at from 46·6° C.–48·8° C. (116° F.–120° F.). It is insoluble in water, scarcely soluble in cold alcohol, soluble, excepting about 13 per cent., in twenty parts of boiling alcohol, which deposits the greater portion on cooling, soluble also in boiling ether, and slightly so in oil of turpentine. It is readily saponifiable with the alkalies. By Dr. John it was found to consist, like beeswax, of cerin and myricin, containing 87 per cent. of the former and 13 of the latter; but a more accurate analysis by Dr. Moore gives as its constituents one part of palmitin and four of palmitic acid, with a little laurin or lauric acid. (*Am. Journ. of Sci. and Arts*, 1852, p. 319.) The green color and bitterness depend upon distinct principles, which may be separated by boiling with ether. On cooling, the wax is deposited colorless, while the ether remains green. The color is ascribed by Dr. Moore to chlorophyll.

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* *Carnauba Wax* is collected by cutting out the leaf buds, drying and beating them, and melting the powder thus detached in water. According to Nevil Story Maskelyne, it consists chiefly of melissyl-alcohol, $C_{30}H_{62}.O$, which saponifies, another alcohol, $C_{23}H_{48}O$, and small quantities of resin and a substance melting at 150° C. (221° F.). Berard believes it to be composed of free cerotic acid and melissyl ether. It is hard, brittle, and buff-colored, yellow, or greenish, resembling the resins more than wax, and melts at 89° C. (192° F.), which is much higher than the fusing point of other kinds of vegetable wax. "It takes a fine polish when rubbed with any soft material," does not receive impressions from the finger at the natural temperature of the hand, and is adapted for polishing furniture, either alone or mixed with wax. 2,000,000 pounds of it are said to be annually produced in Brazil, where it is largely used, mixed with tallow, in making candles, etc.

† *Japan Wax.* A substance under this name has been imported into Europe in considerable quantities, either directly from Japan, or through the Chinese ports. It is obtained from the berries of the *Rhus Succedaneum* of Linnæus, and in small amount from the *R. Sylvestris* and *R. Vernicifera*, or lacquer plant. The partially dried berries are crushed, winnowed, steamed, placed in hemp cloth bags, steamed again, and pressed in a wooden wedge press. They yield about 15 per cent. of a coarse greenish tallowy mass. It has come in two forms, the one, as originally distinguished by Mr. Hanbury, of circular cakes, about four inches in diameter, and an inch thick, flat on one side and somewhat convex on the other; the second, as brought directly from Japan, of large rectangular blocks, which are packed in chests. It bears a considerable resemblance to purified beeswax, but is not quite so white, having a slightly yellowish tint, is softer, more friable, and has a somewhat rancid smell and taste. Its melting point is below that of wax, varying from 49° C. (120° F.), as stated by Prof. Procter, to 52° C. (125° F.), and even 55° C. (131° F.), as observed in different specimens by Mr. Hanbury. Meyer noticed a sample melting at 42° C. (107° F.). It is much more soluble in alcohol than is beeswax, is saponifiable with the alkalies, and is said to contain palmitic acid. It has been employed in the preparation of candles, which yield as brilliant light as those made of common wax. It has been found useful in the preparation of cerates, etc.

From Roucher's experiments it appears that there are two melting points of this wax, one corresponding closely with Prof. Procter's results, while the same wax rapidly heated to a point above that of fusion and then allowed to cool, if plunged into water at 42° C., melts into a transparent liquid; consequently melting at a point 12° C. below its freezing point in its ordinary state, which was 54° C.; the two temperatures being about equivalent in Fahrenheit's scale to 107° and 129°. (*P. J. Tr.*, Aug. 1872, p. 122.)

Medical Properties and Uses. This variety of wax has been popularly employed in the United States as a remedy for dysentery; and we are told by Dr. Fahnestock that he found great advantage from its use in numerous cases during an epidemic prevalence of that complaint. He gave the powdered wax in doses of a teaspoonful (3·75 C.c.) frequently repeated, mixed with mucilage or syrup. (*Am. Journ. of Med. Sci.*, ii. 313.) It is occasionally substituted by apothecaries for beeswax in the formation of plasters, and is used in the preparation of tapers and candles. It is somewhat fragrant when burning, but emits a less brilliant light than common lamp oil.

Off. Prep. of White Wax. Ceratum, *U. S.*

Off. Prep. of Yellow Wax. Ceratum Resinæ; Unguentum, *U. S.*

CERATA. *Cerates.*

(CE̦-RĀ'TA̦.)

Cérats, Céréotés, *Fr.;* Cerate, Wachssalben, *G.*

These are unctuous substances consisting of oil or lard, mixed with wax, spermaceti, or resin, to which various medicaments are frequently added. Their consistence, which is intermediate between that of ointments and of plasters, is such that they may be spread at ordinary temperatures upon linen or leather, by means of a spatula, and do not melt or run when applied to the skin. In preparing them, care should usually be taken to select the oil or lard perfectly free from rancidity. In reference to the wax, too, there would seem to be a choice, as experience has shown that cerates made with yellow wax keep longer unchanged than those made with white or bleached wax, probably because there is in yellow wax some principle which corrects the tendency of fatty matters to become rancid. (F. Bringhurst, *A. J. P.*, 1869, p. 59.) The liquefaction should be effected by a very gentle heat, which may be applied by means of a water-bath; and during the refrigeration the mixture should be well stirred, and the portions which solidify on the sides of the vessel should be made to mix again with the liquid portion, until the whole assumes the proper consistence, or, as some prefer, the melted cerate is allowed to cool quickly without stirring. When a large quantity is prepared, the mortar or other vessel into which the mixture may be poured for cooling, should be previously heated by means of boiling water. It has been proposed to substitute paraffin for wax in the preparation of the cerates, but the great tendency to produce granulations in the finished cerate has largely prevented its use. It is, we think, unfortunate that this class of preparations has been abandoned in the British Pharmacopœia; the several cerates having been rejected, or transferred to the class of Ointments. Independently of the connection between the name and one of the characteristic constituents of the cerates, there is a ground of difference between them and the ointments in their consistence; that of the cerates being such as to render them especially suitable for spreading on linen, while that of ointments is peculiarly adapted to inunction.*

CERATUM. *U. S.* *Cerate.*

(CE̦-RĀ'TŬM.)

Ceratum Adipis, *U. S.* 1860; Ceratum Simplex, *U. S.* 1850; Cérat simple, *Fr.;* Einfaches Cerat, Wachssalbe, *G.*

"White Wax, *thirty parts* [or three ounces av.]; Lard, *seventy parts* [or seven ounces av.], To make *one hundred parts* [or ten ounces av.]. Melt them together, and stir the mixture constantly until cool." *U. S.*

Cerate, or, as it is usually called, *simple cerate*, has been changed very slightly in the last revision; the proportion of wax has been slightly decreased; formerly it was 33·3 per cent., it is now 30 per cent. This change will be regarded by many as an improvement. In the preparation of this cerate, peculiar care should be taken that the oleaginous ingredient be entirely free from rancidity, and that the heat employed be not sufficient to produce the slightest decomposition; for the value of the preparation depends on its perfect blandness. To avoid change, it should be put up in small jars, and covered closely with tin foil so as to exclude the air. It is used for dressing blisters, wounds, etc., in all cases in which the object is to prevent the contact of air and preserve the moisture of the part, and at the same time to avoid all irritation. It is sometimes improperly employed as the vehicle of substances to be applied by inunction. For this purpose lard should be used in winter, and simple ointment in summer; the cerate having too firm a consistence.

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* Dr. W. H. Mielcke (*Pharm. Centralb.*, 1881, Nos. 20, 21) proposes a new class of preparations, to which he has given the name "*Steatins*," "*Steatinum.*" These are about the consistence of cerates, of varied composition, and contain usually a considerable portion of tallow. The *Steatinum Iodoformi* offers a fair specimen of the class. "Take of mutton tallow 18 parts, expressed oil of nutmeg 2 parts, iodoform, in fine powder, 1 part. Melt the tallow and add the other ingredients." For other formulas, see *A. J. P.*, 1881, p. 404.

The simple ointment, Unguentum Simplex, of the British Pharmacopœia is very nearly equivalent to this preparation, but contains some olive oil. It will be described among the ointments.

CERATUM CAMPHORÆ. *U.S.* *Camphor Cerate.*

(CẸ-RĀ'TŬM CĂM'PHỌ-RÆ.)

"Camphor Liniment, *three parts* [or fifteen minims]; Olive Oil, *twelve parts* [or one fluidrachm]; Cerate, *eighty-five parts* [or four hundred grains], To make *one hundred parts* [or about one ounce]. Mix the Camphor Liniment and the Olive Oil, and incorporate with the Cerate." *U. S.*

This is a new officinal preparation; it was introduced primarily for use in making cerate of subacetate of lead by the extemporaneous process. It will no doubt be found useful for its own sake as a slightly stimulating dressing.

CERATUM CANTHARIDIS. *U. S.* *Cantharides Cerate. Blistering Cerate.*

(CẸ-RĀ'TŬM CẠN-THĂR'Ị-DĬS.)

Emplastrum Cantharidis, *Br.:* Cantharides Plaster; Emplastrum Cantharidum (Vesicatorium) Ordinarium, *P.G.;* Emplastrum Epispasticum, s. Vesicatorium, s. Vesicans; Emplâtre de Cantharides, Emplâtre vésicatoire, *Fr.;* Spanischfliegen Pflaster, Blasenpflaster, *G.*

"Cantharides, in No. 60 powder, *thirty-five parts* [or seven ounces av.]; Yellow Wax, *twenty parts* [or four ounces av.]; Resin, *twenty parts* [or four ounces av.]; Lard, *twenty-five parts* [or five ounces av.], To make *one hundred parts* [or twenty ounces av.]. To the Wax, Resin, and Lard, previously melted together and strained through muslin, add the Cantharides, and, by means of a water-bath, keep the mixture in a liquid state, for half an hour, stirring occasionally. Then remove it from the water-bath, and stir constantly until cool." *U.S.*

The British Pharmacopœia directs of Cantharides, in powder, *twelve ounces* [avoirdupois]; Yellow Wax, and Prepared Suet, each, *seven ounces and a half;* Prepared Lard *six ounces;* and Resin *three ounces;* melts the Wax, Suet, and Lard together, by a water-bath, and adds the Resin previously melted; then introduces the Cantharides, mixes the whole thoroughly, and continues to stir the mixture while cooling.

This is the common well-known *blistering plaster.* As it can be readily spread without the aid of heat, it is properly a cerate, and is, therefore, correctly named in the U. S. Pharmacopœia. The process now officinal differs but slightly from that of the U. S. P. 1870. The quantity of lard is about 4 per cent. less, thus making the cerate a trifle stronger. It is essentially the same as prepared by the two processes; though the U. S. formula has a decided advantage over the British, in keeping the mixture of the flies and the other ingredients for some time at an elevated temperature, while in the latter they are allowed to cool after being mixed with the fatty matters. Care was formerly considered requisite, in making the cerate, not to injure the flies by heat. It was, therefore, recommended that they should not be added to the other ingredients until immediately before these begin to stiffen, after having been removed from the fire; and, though this direction has been omitted, no provision is made for the continued application of heat. From the experiments of Mr. Donovan (*Dublin Med. Press*, Aug. 1840), and those of Professor Procter (*A. J. P.*, xiii. 302, and xxiv. 296), it may be inferred that the vesicating principle of Spanish flies is not injured or dissipated by a heat under 148·8° C.

(300° F.), and that an elevated temperature, instead of being hurtful, is positively advantageous in the preparation of the cerate. The cantharidin is thus more thoroughly dissolved by the oleaginous matter, and consequently brought more efficiently into contact with the skin, than when retained in the interior of the tissue of the fly. Another advantage, stated by Donovan, is that the moisture, usually existing to a certain extent in all the ingredients of the cerate, is thus dissipated, and the preparation is less apt to become mouldy, or otherwise to undergo decomposition. Instead, therefore, of waiting until the melted wax, resin, and lard begin to stiffen, it is better to add the powder before the vessel is removed from the fire. Mr. Donovan recommends that, as soon as the other ingredients are melted, the powdered flies should be added, and the mixture stirred until the heat is shown by a thermometer to have risen to 121·1° C. (250° F.), when the vessel is to be removed from the fire, and the mixture stirred constantly until cool. At the heat mentioned, ebullition takes place in consequence of the escape of the moisture contained in the materials. In the cerate thus prepared, the active matter has been dissolved by the lard, and the powder may be separated, if deemed advisable, by straining the mixture before it solidifies. Care should be taken that the temperature be not so high as to decompose the ingredients; and it would be better to keep it within 100° C. (212° F.), by means of a water-bath, as in the U. S. process, than to incur any risk from its excess. Violent irritation and even vesication of the face of the operator are stated to have resulted from exposure to the vapors of the liquid, at a temperature of 121·1° C. (250° F.). (*P. J. Tr.*, ii. 391.) From an experiment, however, of Professor Procter, it appears that, though cantharidin begins to volatilize slightly at 121·1° C. (250° F.), and rapidly rises in vapor and sublimes at from 205·5° C. to 211·1° C. (402° F. to 412° F.), yet it is not decomposed unless by increasing the heat considerably above the last-mentioned point. (*A. J. P.*, xxiv. 296 and 298.) It is desirable that the flies should be very finely pulverized. Coarsely-powdered cantharides should not be used, because of the imperfect and unequal distribution of the vesicating agent. Powdered euphorbium is said to be sometimes fraudulently added.

The cerate will always raise a blister in ordinary conditions of the system, if the flies are good, and not injured in the preparation. It should be spread on soft leather, though linen or even paper will answer the purpose when that is not to be had. An elegant mode of preparing it for use is to spread a piece of leather, of a proper size, first with adhesive plaster, and afterwards with the cerate, leaving a margin of the former uncovered, in order that it may adhere to the skin. Heat is not requisite, and should not be employed in spreading the cerate. Some sprinkle powdered flies upon the surface of the plaster, press them lightly with a roller, and then shake off the portion which has not adhered; but, if the flies originally employed were good, this addition is superfluous. The habit of applying over the surface with a brush an ethereal tincture of cantharides, which leaves a thin coating of extract, renders the preparation more certain.

Upon the application of the plaster, the skin should be moistened with warm vinegar or other liquid; and a good rule is to cover the surface of the plaster closely with very thin gauze or unsized paper, which prevents any of the cerate from adhering to the cuticle, and is thought by some to diminish its liability to occasion strangury, but it must at the same time be remembered that the plaster must come in contact with the skin or the cantharidin will not be absorbed, and thus vesication prevented. In adults, when the full action of the flies is desired, and the object is to produce a permanent effect, the application should be continued for twelve hours, and on the scalp for twenty-four hours. In very delicate persons, however, or those subject to strangury, or upon parts of a loose texture, or when the object is merely to produce a blister to be healed as quickly as possible, the plaster should remain no longer than is necessary for the production of full redness of the skin, which generally occurs in five or six hours, or even in a shorter time. It should then be removed, and followed by a bread and milk poultice, or some other emollient dressing, under which the cuticle rises, and a full blister is usually produced. By this management the patient will generally escape strangury, and the blister will very quickly heal after the discharge of the serum.[*] In young children, cantharides sometimes produce alarming and even fatal ulceration, if too long applied. From two to four hours are usually sufficient for any desirable purpose. When the head, or other very hairy part, is to be blistered, an interval of ten or twelve hours should, if possible, be allowed between the shaving of the part and the application of the plaster; so that the abrasions may heal, and some impediment be offered to the absorption of the flies. After the blister has been formed, it should be opened at the most depending parts, and, the cuticle being allowed to remain, should be dressed with simple cerate; but, if it be desirable to maintain the discharge for a short time, resin cerate should be used, and the cuticle removed if it can be done without inconvenience. When it is wished that the blistered surface should heal as soon as possible, and with the least inconvenience to the patient, Dr. Maclagan recommends a dressing of cotton wadding; an emollient poultice being first applied for two hours after the removal of the blistering cerate, the cuticle then cut, and the surface afterwards covered with the cotton, with its raw surface next the skin. Should the dressing become soaked, so much of the cotton may be removed as can be done without disturbing the cuticle, and a new batch applied. The cotton is to be allowed to remain until the old cuticle spontaneously separates. The effects of an issue may be obtained by employing savine ointment, or the ointment of Spanish flies, as a dressing. If much inflammation take place in the blistered surface, it may be relieved by emollient poultices, weak lead-water, or Goulard's cerate. When there is an obstinate indisposition to heal, we have found nothing so effectual as the cerate of subacetate of lead, mixed with an equal weight of simple cerate. When deep and extensive ulceration occurs in consequence of general debility, bark or sulphate of quinine should be used, with nutritious aliment.

Various preparations of cantharides have been proposed and employed as substitutes for the cerate. They consist for the most part of cantharidin, more or less pure, either dissolved in olive oil and applied to the skin by means of a piece of paper saturated with it, or incorporated with wax and spread in a very thin layer upon fine waxed cloth, silk, or paper, constituting the *blistering cloth*, *blistering paper*, *vesicating taffetas*, etc., of the shops. The advantages of these preparations are that they occupy less space, are more portable, and, being very pliable, are more easily adapted to irregularities of the surface. Absolutely pure cantharidin is expensive and not requisite;[†] as extracts of cantharides, made with ether, alcohol, or boiling water, will answer every purpose. Henry and Guibourt give the following formula. Digest powdered cantharides in ether, distil off the ether, evaporate the residue by means of a salt-water bath, until ebullition ceases, melt the mass which remains with twice its weight of wax, and spread the mixture upon waxed cloth. The *waxed cloth* may be prepared by spreading upon linen or muslin a mixture composed of 8 parts of white wax, 4 of olive oil, and 1 of turpentine, melted together. An extract of cantharides of a buttery consistence, said to act very efficiently when applied by means of paper greased with it, is prepared by digesting 4 parts of flies with one part of strong acetic acid, and 16 of alcohol, straining, filtering, and evaporating at a moderate heat. A preparation which received the favorable report of a committee of the Society of Pharmacy, at Paris, is the following, proposed by M. Dubuison. Four parts of a hydro-alcoholic extract of the flies, made by maceration, are mixed with an aqueous solution of one part of pure gelatin, so as to obtain a solution of suitable consistence, which is then applied upon a piece of extended waxed cloth, care being taken that the brush should always have the same direction. When the first layer has dried, a second and a third are to be applied in the same manner. The gelatin renders the cloth more adhesive and less deliquescent. The hydro-alcoholic extract is preferred to the alcoholic, because it contains less of the green oil, which does not readily mix with the other ingredients. The committee, however, preferred the aqueous extract, as cheaper and more active. This taffeta has been tried, and found to raise blisters in four hours. (*Journ. de Pharm.*, 3e sér., viii. 67.) For very speedy vesication, an infusion of the flies in strong acetic acid is sometimes employed. None of these preparations are likely to supersede the cerate, but the demand for them has been met by introducing into the Pharmacopœia the Charta Cantharidis and the Collodium cum Cantharide.

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[*] The late Dr. M. B. Smith, of Philadelphia, informed us that he had frequently employed uva ursi, as a preventive of strangury from blisters, and had never found it to fail. He gave a small wineglassful of the officinal decoction (see *Decoctum Uvæ Ursi*) every hour, commencing two hours after the application of the blister. Camphor is sometimes incorporated with the blistering cerate to prevent strangury, though with doubtful effect. A plan proposed by M. Vée is to spread over the surface of the plaster, when ready for delivery, by means of the finger, a saturated solution of camphor in ether. The ether evaporates, leaving a thin coating of camphor uniformly diffused. (*Journ. de Pharm.*, 3e sér., viii. 68.) Guyot Dannecy believes camphor to be useless in this connection, and recommends dusting the blister with bicarbonate of sodium and powdered cantharides in equal parts. The late Dr. Joseph Hartshorne, of Philadelphia, was in the habit, in cases where he apprehended strangury, of directing four grains of opium and twenty of camphor to be mixed with the cerate of a blister of large size, and experienced the happiest effects from the addition.

[†] Dragendorff (*A. J. P.* 1872, p. 273) recommends *cantharidate of sodium.* M. E. Delpech (*A. J. P.*, xlii. 240) proposes the use of *cantharidate of potassium* in substance or solution. He prepares it by dissolving two parts of cantharides in 150 parts of alcohol, and adding 1·6 parts of caustic potash dissolved in a very little water. The whole becomes a crystalline mass from which the alcohol may be separated by pressure. See also R. Rother, *Chicago Pharmacist,* Nov. 1872.

Off. Prep. Emplastrum Picis cum Cantharide, *U. S.*

CERATUM CETACEI. *U.S.* *Spermaceti Cerate.*

(CẸ-RĀ′TŬM CẸ-TĀ′CẸ-Ī.)

Emplastrum Spermatis Ceti, Ceratum Labiale Album; Cérat de Blanc de Baleine, Onguent blanc, *Fr.;* Wallrath-Cerat, *G.*

"Spermaceti, *ten parts* [or one ounce av.]; White Wax, *thirty-five parts* [or three and a half ounces av.]; Olive Oil, *fifty-five parts* [or five and a half ounces av.], To make *one hundred parts* [or ten ounces av.]. Melt together the Spermaceti and Wax; then add the Olive Oil, previously heated, and stir the mixture constantly until cool." *U. S.*

The direction to heat the oil before adding it to the other ingredients is important. If added cold, it is apt to produce an irregular congelation of the wax and spermaceti, and thus to render the preparation lumpy. The cerate is employed as a dressing for blisters, excoriated surfaces, and wounds, and as the basis of more active preparations. When the ingredients are pure and sweet, it is perfectly free from irritating properties. The present formula contains a little less spermaceti than that of U. S. P. 1870. From experiments made by Mr. J. B. Barnes, it appears that this cerate keeps much better when made of unbleached materials, than when prepared with olive oil and wax previously bleached. (*P. J. Tr.*, 1861, p. 352.)

CERATUM EXTRACTI CANTHARIDIS. *U. S.* *Cerate of Extract of Cantharides.*

(CẸ-RĀ′TŬM Ẹ X-TRĂC′TĪ CẠN-THĂR′Ị-DĬS.)

Cérat d'Extrait de Cantharides, *Fr.;* Cantharidenextract-Cerat, *G.*

"Cantharides, in No. 60 powder, *thirty parts* [or six ounces av.]; Resin, *fifteen parts* [or three ounces av.]; Yellow Wax, *thirty-five parts* [or seven ounces av.]; Lard, *thirty-five parts* [or seven ounces av.]; Alcohol, *a sufficient quantity.* Moisten the Cantharides with *eighteen parts* [or four fluidounces] of Alcohol, and pack firmly in a cylindrical percolator; then gradually pour on Alcohol, until *one hundred and eighty parts* [or two and a half pints] of percolate are obtained, or until the Cantharides are exhausted. Distil off the Alcohol by means of a water-bath, transfer the residue to a tared capsule and evaporate it, on a water-bath, until it weighs *fifteen parts* [or three ounces av.]. Add to this the Resin, Wax, and Lard, previously melted together, and keep the whole at a temperature of 100° C. (212° F.) for fifteen minutes. Lastly, strain the mixture through muslin, and stir it constantly until cool." *U. S.*

This preparation of the Pharmacopœia of 1860, adopted from a formula of Mr. Wm. R. Warner, published in the *A. J. P.*, 1860, p. 11, was intended as a substitute for the old Ceratum Cantharidis, from which it differs mainly in containing an alcoholic extract of the flies instead of the flies themselves. If the percolation be well conducted, so as to exhaust the cantharides, of which the active matter is soluble in alcohol, this cerate ought theoretically to be more effective than the old blistering cerate; as the active principles are separated from the inert matter of the flies which envelops them in the natural state, and must in some measure interfere with their action; and it is said that its superior efficacy has been practically ascertained. It is to be used in the same manner as the cerate of cantharides.

CERATUM PLUMBI SUBACETATIS. *U.S.* *Cerate of Subacetate of Lead.* [*Goulard's Cerate.*]

(CẸ-RĀ'TŬM PLŬM'BĪ SŬB-ĂÇ-Ẹ-TĀ'TĬS.)

Unguentum Plumbi Subacetatis Compositum, *Br.;* Compound Ointment of Subacetate of Lead; Unguentum Plumbi. *P.G.;* Ceratum cum Subacetate Plumbico; Cérat de Saturne, Saturné de Goulard, *Fr.;* Bleisalbe, Bleicerat, *G.*

"Solution of Subacetate of Lead, *twenty parts* [or one ounce av.]; Camphor Cerate, *eighty parts* [or four ounces av.], To make *one hundred parts* [or five ounces av.]. Mix them thoroughly. This Cerate should be freshly prepared, when wanted for use." *U.S.*

The British Pharmacopœia takes *six fluidounces* of the Solution of Subacetate of Lead, *eight ounces* [avoirdupois] of White Wax, *a pint* [Imperial measure] of Oil of Almonds, and *sixty grains* of Camphor. The wax and four-fifths of the oil are melted by means of a water-bath, and the solution of subacetate of lead added gradually, stirring as the mixture cools; the camphor dissolved in the remaining fifth of the oil is then added, and the whole mixed thoroughly.

The process now officinal differs from that of U. S. P. 1870, experience having shown the futility of all expedients to prevent rancidity. The camphor cerate keeps well with care, but it can be readily made extemporaneously, and thus dispensed in a fresh, non-irritating condition. This plan was proposed by Prof. Remington, and adopted by the Pharmacopœia committee of the Philadelphia College of Pharmacy.

This cerate received the name by which it is commonly known from M. Goulard, by whom it was employed and recommended. It immediately begins to assume a yellowish color, and after a short time becomes so rancid as to be scarcely fit for use. Hence it should be prepared in small quantities at once. The addition of a few drops of acetic acid prevents the yellow color from remaining permanent. The late Mr. Jacob Bell found it more satisfactory when made with yellow wax. (*P. J. Tr.*, 1859, p. 459.) Eggenfels, a German pharmaceutist, recommends the following method of proceeding to prevent its change of color. The wax and oil are melted in a water-bath; the solution of subacetate of lead, previously heated, is added in small portions successively, and the mixture well stirred, and digested for some time; a partial saponification takes place, and an emulsion afterwards; and the cerate retains its white color. (See *A. J. P.*, 1861, p. 408.) It is used chiefly in excoriations, burns, scalds, and chilblains, and in cutaneous eruptions. Wherever there is an acute active inflammation of the skin it is a most efficient remedy.

CERATUM RESINÆ. *U.S.* *Resin Cerate.* [*Basilicon Ointment.*]

(CẸ-RĀ'TŬM RẸ-ŞĪ'NÆ.)

Unguentum Resinæ, *Br.;* Ointment of Resin, Unguentum Basilicum; Cérat de Résine anglais, *Fr.;* Harzcerat, *G.*

"Resin, *thirty-five parts* [or seven ounces av.]; Yellow Wax, *fifteen parts* [or three ounces av.]; Lard, *fifty parts* [or ten ounces av.], To make *one hundred parts* [or twenty ounces av.]. Melt them together at a moderate heat, strain the mixture through muslin, and allow it to cool without stirring." *U. S.*

"Take of Resin, in coarse powder, *eight ounces;* Yellow Wax *four ounces;* Simple Ointment *sixteen ounces.* Melt with a gentle heat, strain the mixture while hot through flannel, and stir constantly while it cools." *Br.*

This preparation does not differ greatly from that formerly officinal; it contains now about 1 per cent. less wax, and 6 per cent. less lard. An improvement has been made in the manipulation, however, in directing the ointment not to be stirred, a better consistence being secured by this change. The straining is directed in consequence of the impurities which resin often contains. Resin cerate, commonly called *basilicon ointment*, is much used as a gently stimulant application to blistered surfaces, indolent ulcers, burns, scalds, and chilblains. We have found no application more effectual in disposing the ulcers which follow burns, to heal.*

Off. Prep. Ceratum Sabinæ, *U. S.;* Linimentum Terebinthinæ, *U. S.*, *Br.*

CERATUM SABINÆ. *U. S.* *Savine Cerate.*

(CE-RĀ'TŬM SA-BĪ'NÆ.)

Unguentum Sabinæ, *Br.;* Ointment of Savine, Unguentum Sabinæ, *P.G.;* Cérat de Sabine, *Fr.;* Sadebaum Salbe, *G.*

"Fluid Extract of Savine, *twenty-five parts* [or five ounces av.]; Resin Cerate, *ninety parts* [or eighteen ounces av.]. Melt the Resin Cerate by means of a water-bath, add the Fluid Extract of Savine, and continue the heat until the alcohol has evaporated; then remove the heat, and stir constantly until cool." *U. S.*

"Take of Fresh Savine Tops, bruised, *eight ounces;* White Wax *three ounces;* Prepared Lard *sixteen ounces.* Melt the Lard and Wax together on a water-bath, add the Savine, and digest for twenty minutes. Then remove the mixture, and express through calico." *Br.* The U.S. preparation is identical with that formerly officinal.

As the savine used in this country is generally brought from Europe in the dried state, we are compelled to resort to a mode of preparing the cerate different from that usually employed in Europe. In the Pharmacopœia of 1850, the dried savine was simply mixed, in powder, with resin cerate previously softened; and the proportion used was one part of the powder to six parts of the cerate. Nor did we find the preparation thus made to be "intolerably acrid and almost caustic," as Dr. Duncan described it. On the contrary, it answered very well the purpose for which it was used, that of maintaining the discharge from blistered surfaces. The process, however, of the present edition of the Pharmacopœia is certainly more elegant than the former, and probably, if the fluid extract has been carefully made, yields a more effective product. A cerate, prepared in the same manner as the former cerate, from the leaves of the red cedar (*Juniperus Virginiana*), is sometimes substituted for that of savine, but is less efficient. Prepared according to the process of the British Pharmacopœia, savine cerate has a fine deep green color, and the odor of the leaves. It should be kept in closely-covered vessels.

Savine cerate is preferable to the ointment of Spanish flies as a dressing for perpetual blisters, from the circumstance that it has no tendency to produce strangury. The white coating which forms, during its use, upon the blistered surface should be occasionally removed, as it prevents the contact of the cerate. It is sometimes applied to seton cords, to increase the discharge.

CEREVISIÆ FERMENTUM. *Br.* *Beer Yeast.*

(CĔR-E-VĬS'I-Æ FER-MĔN'TUM.)

"The ferment obtained in brewing beer." *Br.*

Fermentum, *U. S.* 1870; Levûre de Bière, Levûre, *Fr.;* Bierhefen, Oberhefe, *G.;* Fermento di Cervegia, *It.;* Espuma de Cerveza, *Sp.*

This is the substance which rises, in the form of froth, to the surface of beer, and subsides, during the process of fermentation. A similar substance is produced during the fermentation of other saccharine liquids.

It is flocculent, frothy, somewhat viscid, semifluid, of a dirty yellowish color, a sour vinous odor, and a bitter taste. At the temperature of 60° or 70° F., in a close vessel or damp atmosphere, it soon undergoes putrefaction. Exposed to a moderate heat it loses its liquid portion, becomes dry, hard, and brittle, and may in this state be preserved for a long time, though with the loss of much of its peculiar power.

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* *Ceratum Resinæ Compositum, U. S.* 1870. *Compound Resin Cerate.* Deshler's Salve; Cérat de résine composé, *Fr.* "Take of Resin, Suet, Yellow Wax, each, *twelve troyounces;* Turpentine *six troyounces;* Flaxseed Oil *seven troyounces.* Melt them together, strain the mixture through muslin, and stir it constantly until cool." *U. S.* 1870. This is somewhat more stimulating than the Ceratum Resinæ, but is applicable to similar purposes, particularly to the treatment of indolent ulcers. Under the name of *Deshler's salve*, it is popularly employed in some parts of the United States. It should be kept well protected from the air, in consequence of its liability when exposed to acquire a tough consistence. It was officinal in 1870, but was dropped at the last revision.

Yeast cakes are made by putting yeast into sacks, washing it with water, then submitting it to pressure, and ultimately drying it.

Yeast is insoluble in alcohol or water. Its ultimate composition, according to Schlossberger (*Ann. Chem. und Pharm.*, 51, p. 199), is carbon 49·9 per cent., hydrogen 6·6 per cent., nitrogen 12·1 per cent., and oxygen 31·4 per cent. Its proximate constituents are albuminoids, cellulose, fats, and resinous substances. Its bitterness is attributable to a principle derived from the hops The property for which it is chiefly valued is that of exciting the vinous fermentation in saccharine liquids, and in various farinaceous substances. This property it owes to its nitrogenous ingredient; for, if separated from this, it loses its powers as a ferment, and reacquires them upon its subsequent addition. It is also rendered ineffective by strong alcohol, by several of the acids, as sulphuric and concentrated acetic acids, by various other substances, and by a heat of 212°. At a high temperature the yeast is decomposed, affording products similar to those which result from the decomposition of animal matters. From experiments by Mr. Horace T. Brown, it would appear that the degree of atmospheric pressure has much influence upon the progress of the alcoholic fermentation, which is considerably retarded by a diminution of that pressure. (*P. J. Tr.*, Jan. 1874, p. 615.)

Besides alcohol and carbonic acid. which are the characteristic products of the vinous fermentation, various other substances are generated in smaller or larger proportions, and, among the rest, an organic alkaloid, which, according to M. Oser, is always produced when solutions of sugar ferment under the influence of yeast, and is always present in fermented liquors, either in the pure state, or that of saline combination. Its formula is $C_{26}H_{20}N_4$. Its hydrochlorate is in hygroscopic tables, which become brown on exposure to the air, and have a bitter taste. (*Journ. de Pharm.*, Oct. 1869, p. 305.)

The opacity of yeast is due to the presence of a microscopic fungus, first discovered in it by Leuwenhoek in 1680. As originally announced by Thénard in 1803, this yeast plant is the cause of the alcoholic fermentation. It consists of numerous cells, irregular, roundish, or cylindrical in shape, separate, joined into rows, or budding one from the other. During fermentation the yeast plant multiplies very rapidly: and when the fermentation is very active the plant rises to the surface, constituting the so-called *top yeast* of the brewer; when the process is restrained by cold the yeast settles and constitutes *bottom yeast.* Top and bottom yeast have a tendency to produce the form of fermentation by which they were developed. It is most probable that the yeast plant is the mycelium, or early vegetative stage, of more than one species of mucor or mould; and some authorities recognize various species of the yeast fungus. The name of *Torula*, or *Torula cerevisiæ*, was first given to the yeast plant, which was subsequently called *Mycoderma vini;* Dr. M. Reess, in his elaborate work (*Botan. Untersuch. Alkoholsgährungspilze*, Leipsic, 1870), makes a distinct genus of it, *Saccharomyces*, including many species.

There have been three theories in regard to fermentation: 1st, that it is a chemical process; 2d, that it is of galvanic origin; 3d, that it is the result of the vital actions of the yeast plant. The chemical theory founded by Trommsdorff and Meissner has been very ably advocated by Liebig, but, chiefly owing to the labors of Pasteur, the vital theory is now almost universally accepted.

Medical Properties. Yeast has been highly commended as a stimulant remedy in *typhoid*, *hectic*, and other similar fevers, but is at present very rarely used. In some of these cases it has been given with great asserted advantage in doses of a pint (472 C.c.) a day. It still continues to be employed to a considerable extent as a remedy against successive eruptions of boils, in doses of an ounce (30 C.c.) three times a day. Locally applied it is probably stimulant, although it may be the products of fermentation rather than the yeast which give the peculiar value to the "yeast poultice."

Pharm. Uses. In preparing Acidum Citricum, *Br.*

Off. Prep. Cataplasma Fermenti, *Br.*

CERII OXALAS. *U. S., Br.* *Oxalate of Cerium.*

$Ce_2(C_2O_4)_3.9H_2O$; 708. (CĒ'RỊ-Ī ŎX'Ạ-LĂS.) $Ce_2O_3, 3C_2O_3.9HO$; 354.

"A salt which may be obtained as a precipitate by adding solution of oxalate of ammonia to a soluble salt of cerium." *Br.*

Cerium Oxalicum, Oxalas Ciricus; Oxalate de Cérium, *Fr.;* Oxalsaures Ceroxydul, Cerium Oxalat, *G.*

Cerium is a metal, which was discovered in 1803 by Berzelius and Hisinger, and about the same time by Klaproth, who, however, described it as an earth. By the two former chemists it was recognized as a metal, and named cerium in honor of the goddess Ceres. It was obtained from a Swedish mineral, formerly from its great weight called *heavy stone of Bastnas* (Bastnas Schwerstein), but now named *cerite*, after the metal extracted from it. Besides cerite, it has been found in several other minerals, as *gadolinite*, *orthite*, etc., in the north of Europe, a number of different minerals from Greenland, and *allanite* near Bethlehem, in Pennsylvania. It is not easy to obtain it pure in the metallic state, as its oxides and salts are difficult of reduction. Berzelius describes it as in the form of pulverulent masses, of a deep chocolate-brown, which exhibit, however, under the burnisher a metallic appearance, and a dark gray color. Hildebrand and Norton have since prepared it in large quantity by the electrolysis of its chloride. It is a bad conductor of electricity. Heated in the air it takes fire before the point of ignition, and burns vividly, passing to the state of peroxide. At ordinary temperatures it is oxidized in a moist atmosphere, giving out a strong and disagreeable smell of hydrogen. In water, especially when moderately heated, it rapidly oxidizes with the evolution of hydrogen, and the water does not become alkaline. There are two oxides of cerium hitherto considered as the protoxide and sesquioxide. (According to more recent investigators, cerium forms a sesquioxide and a dioxide only, so that cerous oxalate, which is the officinal salt, is an oxalate of the sesquioxide, a fact recognized in the Pharmacopœia of 1880.) Sulphur and phosphorus combine with it. Of its compounds two only have been introduced into medicine, the nitrate and oxalate, of which the latter was recognized for the first time officinally in the last edition of the British Pharmacopœia, and in the U. S. Pharmacopœia of 1870.

Oxalate of cerium may be obtained from cerite, and Prof. F. F. Mayer, of New York, gives a process for the purpose, of which the following is an outline.

The mineral consists of silicates of cerium, lanthanum, and didymium, with numerous other substances in smaller proportion, the oxide of cerium constituting about 39 per cent. of the whole. The powdered mineral is made into a paste with sulphuric acid, and then heated over a lamp until the mass ceases to swell up, and no longer absorbs sulphuric acid very cautiously added. Upon the cooling of the mass, it is powdered, and exposed in a crucible to the heat of an anthracite fire until it assumes a pale brownish red color. It is now lixiviated first with hot water and then with nitric acid, and the solution treated with sulphuretted hydrogen in order to get rid of various metals by precipitation. To the clear liquid some hydrochloric acid is first added, and then a solution of oxalic acid, the former of which holds in solution the oxalate of calcium produced, the latter throws down oxalates of cerium and other metals. The precipitate, having been washed with warm water, is formed into a paste with a quantity of carbonate of magnesium equal to half that of the mineral employed; and the paste is dried on porous fire brick, finely powdered, and calcined till it becomes of a cinnamon color. It now contains all of the cerium in the form of ceroso-ceric oxide. To separate this the mass is treated with an excess of nitric acid, the solution evaporated to get rid of the excess of acid, then diluted with warm water, and lastly poured into a vessel containing boiling water acidulated with a little more than half of one per cent. of sulphuric acid. A yellow precipitate of basic sulphate of cerium is formed, while a little of the neutral sulphate, and all the lanthanum and didymium, remain dissolved. The precipitate is now dissolved in stronger sulphuric acid, the solution digested with a few crystals of hyposulphite of sodium, in order to reduce the ceroso-ceric oxide of cerium to cerous oxide, and the liquid, having been filtered, is treated with solution of oxalic acid, which causes a precipitate of oxalate of cerium. This is washed with warm water, and dried. (*A. J. P.*, 1860, p. 4.)

Oxalate of cerium is "a white, slightly granular powder, permanent in the air, odorless and tasteless, insoluble in water or alcohol, but soluble in hydrochloric acid. On heating the salt to a dull red heat, a yellow or yellowish-red residue of oxide of cerium is left (a brown color would indicate the presence of oxide of didymium). On boiling the salt with solution of potassa, filtering, supersaturating a portion of the cold filtrate with acetic acid, and adding test-solution of chloride of calcium, a white precipitate is obtained, soluble in hydrochloric acid. The other portion of the filtrate should not yield a precipitate on the addition of an excess of test-solution of chloride of ammonium (aluminium), or of test-solution of sulphide of ammonium (zinc). On dissolving the salt in hydrochloric acid, no effervescence should occur (abs. of carbonate), and the solution should not be precipitated or rendered turbid by hydrosulphuric acid (abs. of metallic impurities)." *U. S.* As usually seen in commerce it has a pinkish tinge, due to the presence of a trace of a compound of didymium. The British Pharmacopœia states that "if the salt be boiled with solution of potash and filtered, the filtrate is not affected by solution of chloride of ammonium, but, when supersaturated with acetic acid, it gives with chloride of calcium a white precipitate, soluble in hydrochloric acid." When heated to dull redness it yields a reddish brown powder, which is wholly soluble without effervescence in boiling hydrochloric acid, and the resulting solution gives with solution of sulphate of potassium a white crystalline precipitate. *Br.*

Medical Properties. The oxalate of cerium is supposed to act in a manner very similar to the subnitrate of bismuth. It was originally brought forward by Sir James Y. Simpson as a remedy in the vomiting of pregnancy, and has been extensively used in this affection, and also in gastric disturbances of various diseases, such as phthisis, uterine disorder, hysteria, dyspepsia, pyrosis, etc. To a less extent it has been used in intestinal inflammatory diseases. Prof. Simpson also considered it to be a good nervine tonic, and used it with great asserted advantage in chorea. The dose is a grain (0·065 Gm.), doubled if necessary, and repeated three times a day, or more frequently if a return of the vomiting should seem to require it. It may be given in pill or suspended in water.

Nitrate of cerium has also been employed, though not officinal. The late Dr. Simpson believed it to act as a nervine tonic, and has seen it useful in chronic intestinal eruption, irritable dyspepsia with gastrodynia and pyrosis, and chronic vomiting generally, as well as in that of pregnancy. The dose is the same as that of the oxalate, though it would be prudent to begin with a smaller quantity, as, being a soluble salt, it might be more disposed to irritate in overdoses.

CETACEUM. *U. S., Br.* *Spermaceti.*

(CẸ-TĀ'CẸ-ŬM.)

"A peculiar, concrete, fatty substance, obtained from Physeter macrocephalus. Linné. (*Class*, Mammalia; *Order*, Cetacea.)" *U. S.* "Nearly pure cetine, obtained, mixed with oil, from the head of the Sperm Whale, Physeter macrocephalus; separated from the oil by filtration and pressure, and afterwards purified." *Br.*

Ambre blanc, Blanc de Baleine, Spermaceti, Cétine, *Fr.;* Wallrath, Spermacetis, *G.;* Spermaceti, *It.;* Esperma de Ballena, *Sp.*

The spermaceti whale is from sixty to eighty feet long, with an enormous head, not less in its largest part than thirty feet in circumference, and constituting one-third of the whole length of the body. The upper part of the head is occupied by large cavities, separated by cartilaginous partitions, and containing an oily liquid, which, after the death of the animal, concretes into a white spongy mass consisting of spermaceti mixed with oil. This mass is removed, and the oil allowed to separate by draining. The crude spermaceti, obtained from a whale of the ordinary size, is more than sufficient to fill twelve large barrels. It still contains much oil and other impurities, from which it is freed by expression, washing with hot water, melting, straining, and repeated washing with a weak boiling lye of potash. Common whale oil and the oil of other cetaceous animals contain small quantities of spermaceti, which they slowly deposit on standing.*

Spermaceti is in white, pearly, semitransparent masses; of a neutral reaction; of a crystalline foliaceous texture; friable, soft, and somewhat unctuous to the touch; slightly odorous; insipid; of the sp. gr. 0·943; fusible at 44·5° C. (112° F.) (*Bostock*), not under 38° C. (100° F.) (*Br.*); volatilizable at a high temperature without change, *in vacuo*, but partially decomposed if the air is admitted; inflammable; insoluble in water; soluble in small proportion in boiling alcohol, ether, and oil of turpentine, but deposited as the liquids cool; and in the fixed oils; not affected by the mineral acids, except sulphuric, which decomposes and dissolves it; rendered yellowish and rancid by long exposure to hot air, but capable of being again purified by washing with a warm lye of potash. "Sp. gr. about 0·945. It melts near 50° C. (122° F.), and congeals near 45° C. (113° F.). It is soluble in ether, chloroform,† disulphide of carbon, and in boiling alcohol; but slightly soluble in cold benzin." *U. S.* As found in the shops it is not chemically pure, containing a fixed oil, and often a peculiar coloring principle. From these it is separated by boiling in alcohol, which on cooling deposits it in crystalline scales. Thus purified, it does not melt under 49° C. (120° F.), is soluble in 40 parts of boiling alcohol of the sp. gr. 0·821 (*Thenard*), and is harder, more shining, and less unctuous than ordinary spermaceti.

Spermaceti is a mixture of various fats. When recrystallized from alcohol as just described, the purified *cetin* is obtained, while the alcohol on evaporation deposits an oil, the *cetin-elaine* of Berzelius, which saponified yields *cetin-elaic acid*, an acid resembling but distinct from oleic acid. The cetin which crystallizes out of the alcohol is essentially *cetyl palmitate*, $C_{16}H_{31}(C_{16}H_{33}O_2)$,—that is, a compound of *cetyl alcohol* (*ethal of Chevreul*), $C_{16}H_{33}.OH$, and *palmitic acid*, $C_{16}H_{32}O_2$. According to Heintz, however, there are small amounts of other fats with the cetin; fats containing the acids, *stearic*, $C_{18}H_{36}O_2$, *myristic*, $C_{14}H_{28}O_2$, and *lauro-stearic*, $C_{12}H_{21}O_2$, and the alcohol radicles corresponding to these acids.

Medical Properties and Uses. Spermaceti has been given as a demulcent in irritations of the mucous membranes; but it possesses no peculiar virtues, and its internal use has generally been abandoned. It may be reduced to powder by the addition of a little alcohol or almond oil, or administered in emulsion, conveniently made by mixing the spermaceti, first with half its weight of olive oil, then with powdered gum arabic, and lastly with water gradually added. It is an ingredient of many ointments and cerates.

Off. Prep. Ceratum Cetacei, *U. S.;* Charta Cantharidis, *U. S.;* Charta Epispastica, *Br.;* Unguentum Aquæ Rosæ, *U. S.;* Unguentum Cetacei, *Br.*

CETRARIA. *U. S.*, *Br.* *Cetraria.* [*Iceland Moss.*]

(CE̤-TRĀ′RI̤-A̤.)

"Cetraria Islandica. Acharius. (*Nat. Ord.* Lichenes.)" *U. S.* "The entire Lichen." *Br.*

Lichen Islandicus, *P.G.;* Mousse d'Islande, Lichen d'Islande, *Fr.;* Isländisches Moos, Isländische Flechte, Lungenmoos, *G.;* Lichene islandico, *It.;* Liquen islandico, *Sp.*

Gen. Ch. Plant cartilagino-membranous, ascending or spreading, lobed, smooth, and naked on both sides. *Apothecia* shield-like, obliquely adnate with the margin, the disk colored, plano-concave; border inflexed, derived from the frond. *Loudon's Encyc.*

Cetraria Islandica. Acharius, *Lichenog. Univ.* 512; *B. & T.* 302.—*Lichen Islandicus.* Woodv. *Med. Bot.* p. 803, t. 271. Iceland moss is foliaceous, erect, from two to four inches high, with a dry, coriaceous, smooth, shining, laciniated frond or leaf, the lobes of which are irregularly subdivided, channelled and fringed at their edges with rigid hairs. Those divisions upon which the fruit is borne are dilated. The color is olive-brown or greenish gray above, reddish at the base, and lighter on the under than the upper surface. The fructification is in flat, shield-like, reddish brown receptacles, with elevated entire edges, placed upon the surface of the frond near its border. The plant is found in the northern latitudes of the old and new continents, and on the elevated mountains farther south. It received its name from the abundance with which it prevails in Iceland. It is also abundant on the mountains and in the sandy plains of New England. "It should be freed from pine leaves, mosses and other lichens, which are frequently found mixed with it." *U. S.*

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* According to W. Gilmour, *sperm oil* should contain not less than 4 per cent. of cetin, and if much less be obtained by the following process, adulteration has been practised. Shake one part by weight of sulphuric acid (sp. gr. 1·84) with four parts of the oil; allow to stand 20 minutes, shaking twice; add 3 ounces of distilled water: shake this thoroughly, and allow to stand 16 to 20 hours; dilute with 3 or 4 times its volume of distilled water; agitate thoroughly. On standing the cetin floats upon the top, and can readily be skimmed off, washed, dried, and weighed. (*P. J. Tr.*, vii. 328.)

† In consequence of its solubility in chloroform, stains made by dropping it on cloth may be quickly removed by that liquid.

The dried moss is of diversified color, grayish white, brown, and red, in different parts, with less of the green tint than in the recent state. It is officinally characterized as follows. "From two to four inches (5 to 10 cm.) long, foliaceous, with fringed and channelled lobes, brownish above, whitish beneath, brittle and inodorous; when softened in water, cartilaginous, and having a slight odor; its taste is mucilaginous and bitter." It is inodorous, and has a mucilaginous, bitter taste. Macerated in water, it absorbs rather more than its own weight of the fluid, and, if the water be warm, renders it bitter. Boiling water extracts all its soluble principles. The decoction thickens upon cooling, and acquires a gelatinous consistence, resembling that of starch in appearance, but without its viscidity. After some time the dissolved matter separates, and when dried forms semi-transparent masses, insoluble in cold water, alcohol, or ether, but soluble in boiling water, and in solution forming a blue compound with iodine. *Lichenin*, or *Lichen Starch*, $C_{12}H_{20}O_{10}$, resembles starch in its general characters, but differs from it in some respects. Berzelius found in 100 parts of Iceland moss 1·6 of chlorophyll, 3·0 of a peculiar bitter principle, 3·6 of uncrystallizable sugar, 3·7 of gum, 7·0 of the apotheme of extractive, 44·6 of the peculiar starch-like principle, 1·9 of the bilichenates of potassium and calcium mixed with phosphate of calcium, and 36·2 of amylaceous fibrin—the excess being 1·6 parts.

The starch-like substance named lichenin has been found to consist of two distinct proximate principles, one, for which the name of lichenin may be retained, while for the other no particular designation has been chosen, but which we may call *lichenoid.* According to Th. Berg (*Thèse de Dorpat*, 1872), cetraria yields 35·15 per cent. of the mixed principles, of which 20 per cent. is of lichenin, and 11·5 of the so-called lichenoid. To separate them, a decoction of the moss, concentrated to a small bulk, and still hot, is treated by alcohol at 85°. The lichenoid is deposited in flocculi, which gradually unite in a viscid mass. This, being washed by alcohol, until it ceases to be bitter, and then dried, yields a light friable matter partly soluble in cold water, with which it forms a yellow, limpid solution. To deprive it of mineral and coloring substances, it is dissolved in a little water, and precipitated afresh by alcohol. Lichenin is insoluble in cold water, but swells up and easily dissolves in hot water. It is insoluble in alcohol and in ether. It is only tinged by iodine. Lichenoid is, on the contrary, colored blue by that reagent. It is in part dissolved in cold water; and the undissolved part is equally colored blue by iodine. It is, like lichenin, insoluble in alcohol and ether. Both substances have strong analogies with starch, yet are distinct. For a further account of these principles, see *Journ. de Pharm.*, 1873, p. 154.

The name of *cetrarin* has been conferred on the bitter principle. The following process for obtaining it is that of Dr. Herberger. The moss, coarsely powdered, is boiled for half an hour in four times its weight of alcohol of 0·883. The liquid when cool is expressed and filtered, and treated with diluted hydrochloric acid, in the proportion of three drachms to every pound of moss employed. Water is then added in the quantity of about four times the bulk of the liquid, and the mixture left for a night in a closed matrass. The deposit which forms is collected on a filter, allowed to drain as much as possible, and submitted to the press. To purify it, the mass, while still moist, is broken into small pieces, washed with alcohol or ether, and treated with two hundred times its weight of boiling alcohol, which dissolves the cetrarin, leaving the other organic principles by which it has hitherto been accompanied. The greater part is deposited as the liquor cools, and the remainder may be obtained by evaporation. By this process one pound of moss yielded to Dr. Herberger 133 grains of cetrarin. This principle is white, not crystalline, light, unalterable in the air, inodorous, and exceedingly bitter, especially in alcoholic solution. Its best solvent is absolute alcohol, of which 100 parts dissolve 1·7 of cetrarin at the boiling temperature. Ether also dissolves it, and it is slightly soluble in water. Its solutions are quite neutral to test-paper. It is precipitated by the acids, and rendered much more soluble by the alkalies. Concentrated hydrochloric acid changes its color to a bright blue. It precipitates the salts of iron, copper, lead, and silver. In the dose of two grains, every two hours, it has been used successfully in intermittent fever. (*Journ. de Pharm.*, xxiii. 505.) Drs. Schnedermann and Knop have ascertained that the cetrarin above referred to consists of three distinct substances; 1, *cetraric acid*, $C_{18}H_{16}O_8$, which is the true bitter principle, crystallizable, and intensely bitter; 2, a substance resembling the fatty acids, called *lichen stearic acid*, $C_{14}H_{34}O_3$, the crystals of which melt at 120° C. (248° F.); and, 3, a green coloring substance, which they name *thallochlor*. These principles are obtained perfectly pure with great difficulty. (*Ann. der Pharm.*, lv. 144.)

The gum and starch contained in the moss render it sufficiently nutritive to serve as food for the Lapps and Icelanders, who employ it powdered and made into bread, or boiled with milk, after having partially freed it from the bitter principle by repeated maceration in water. As suggested by Berzelius, the bitterness may be entirely extracted by macerating the powdered moss, for 24 hours, in twenty-four times its weight of a solution formed with 1 part of an alkaline carbonate and 375 parts of water, then decanting the liquid, and repeating the process with an equal quantity of the solution. The powder, being now dried, is perfectly sweet.

Medical Properties and Uses. Iceland moss is demulcent, nutritious, and tonic, and well calculated for affections of the mucous membrane of the lungs and bowels, with debility of the digestive organs, or of the system generally. Hence it has been found useful in chronic catarrhs, and other chronic pulmonary affections attended with copious puruloid expectoration, in dyspepsia, in chronic dysentery and diarrhœa, and in the debility succeeding acute disease, or dependent on copious purulent discharge from external ulcers. At one time it possessed much reputation as a remedy in pulmonary consumption. It had long been employed in this disease, and in hæmoptysis, by the Danish physicians, before it became generally known. In the latter half of the last century it came into extensive use, and numerous cures supposed to have been effected by it are on record. We now know that it acts only as a mild, nutritious, demulcent tonic, and can exercise no specific influence over the tuberculous affection, though it may be of value in chronic bronchitis.

It is usually employed in the form of decoction. (See *Decoctum Cetrariæ.*) By some writers it is recommended to deprive it of the bitter principle by maceration in water or a weak alkaline solution, before preparing the decoction; but we thus reduce it to the state of a simple demulcent, or mild article of diet, in which respect it is not superior to the ordinary farinaceous or gummy substances used in medicine. The powder is sometimes given in the dose of thirty grains or a drachm (1·95–3·9 Gm.); and a preparation at one time obtained some repute, in which the ground moss was incorporated with chocolate, and used at the morning and evening meal as an ordinary beverage.

Off. Prep. Decoctum Cetrariæ.

CHARTÆ. *Papers.*

(CHĂR'TÆ.)

Papiers sparadrapiques, *Fr.;* Medicamentirte Papiere, *G.*

This class of preparations, long officinal in the French Codex, was some time since adopted into the British Pharmacopœia, but was not introduced into that of the United States until the revision of 1870.

CHARTA CANTHARIDIS. *U.S.* *Cantharides Paper.*

(CHÄR'TẠ CẠN-THĂR'Ị-DĬS.)

Charta Epispastica, *Br.;* Blistering Paper, Charta Vesicatoria; Papier épispastique, Papier à Vésicatoire aux Cantharides, *Fr.;* Spanischfliegen-Papier, *G.*

"White Wax, *eight parts* [or four ounces av.]; Spermaceti, *three parts* [or one and a half ounces av.]; Olive Oil, *four parts* [or two fluidounces]; Canada Turpentine, *one part* [or half an ounce av.]; Cantharides, in No. 40 powder, *one part* [or half an ounce av.]; Water, *ten parts* [or five fluidounces]. Mix all the substances in a tinned vessel, and boil gently for two hours, constantly stirring. Strain through a woollen strainer without expressing, and, by means of a water-bath, keep the mixture in a liquid state in a shallow, flat-bottomed vessel with an extended surface. Coat strips of sized paper with the melted plaster, on one side only, by passing them successively over the surface of the liquid; when dry, cut the strips into rectangular pieces." *U. S.*

"Take of White Wax *four ounces;* Spermaceti *one and a half ounces;* Olive Oil *two fluidounces;* Resin *three-quarters of an ounce;* Canada Balsam *one-quarter of an ounce;* Cantharides, in powder, *one ounce;* Distilled Water *six fluidounces.* Digest all the ingredients, excepting the Canada Balsam, in a water-bath for two hours, stirring them constantly; then strain, and separate the plaster from the watery liquid. Mix the Canada Balsam with the plaster melted in a shallow vessel, and pass strips of paper over the surface of the hot liquid, so that one surface of the paper shall receive a thin coating of the plaster. It may be convenient to employ paper ruled so as to indicate divisions each of which is one square inch." *Br.* The weights employed in this process are avoirdupois, and the measures Imperial.

This was intended as a convenient substitute for the common blistering plaster, and, if equally effectual, would be frequently preferred, from being already spread, as well as for its greater cleanliness and facility of application. The proportion of flies, however, is considerably less. From this cause it must be very greatly inferior in blistering power, and consequently less certain; this is a point which has been determined by experience; although it is said that, when properly applied, so as to insure close adhesion to the skin, it is not less efficient than the British plaster, or the *Cerate of Cantharides* of the U. S. Pharmacopœia. (*Med. Times and Gaz.*, 1867, p. 284.) It has been so seldom used, however, since its introduction, that it would seem hardly proper to venture an opinion upon its value.

CHARTA POTASSII NITRATIS. *U.S.* *Nitrate of Potassium Paper.*

(CHÄR'TẠ PỌ-TĂS'SỊ-Ī NĪ-TRĀ'TĬS.)

Papier nitré, *Fr.*

"Nitrate of Potassium, *twenty parts* [one ounce av.]; Distilled Water, *eighty parts* [four fluidounces]. Dissolve the Nitrate of Potassium in the Distilled Water. Immerse strips of white, unsized paper in the solution and dry them. Keep the paper in securely closed vessels." *U. S.*

This is a new officinal preparation, and is identical with the *Charta Nitrata* of the German Pharmacopœia; it is sometimes called *asthma paper.* Care should be taken to dissolve thoroughly all of the nitrate of potassium, so that it shall not be deposited upon the paper in large particles, and thus interfere with the slow and steady combustion of the paper.

Medical Properties. This paper is an excellent remedy, which in many cases of asthma affords much relief. It is used by burning in front of the patient, who inhales its fumes. Its efficacy is much increased by saturating it with fluid extract of belladonna and drying. Paper thus prepared must be used with some caution.

CHARTA SINAPIS. *U.S.* *Mustard Paper.*

(CHÄR'TẠ SỊ-NĀ'PĬS.)

Papier sinapisé, *Fr.;* Senfpapier, *G.*

"Black Mustard, in No. 60 powder; Benzin, Solution of Gutta-percha, each, *a sufficient quantity.* Pack the Mustard tightly in a conical percolator, and gradually pour Benzin upon it until the percolate ceases to produce a permanent, greasy stain upon blotting paper. Remove the powder from the percolator, and dry it by exposure to the air. Then mix it with so much of Solution of Gutta-percha as may be necessary to give it a semi-liquid consistence, apply the mixture, by means of a suitable brush, to one side of a piece of rather stiff, well sized paper, so as to cover it completely, and allow the surface to dry. Each square inch (or 6·5 square centimeters) of paper should contain about *six* (6) *grains* or *forty* (40) *centigrammes* of Mustard. Before being applied to the skin, the Mustard Paper should be dipped in warm water for about fifteen seconds." *U. S.*

"Take of Black Mustard Seeds, in powder, *one ounce;* Solution of Gutta-percha *two fluidounces*, or *a sufficiency.* Mix the Mustard with the Gutta-percha Solution so as to form a semi-fluid mixture, and having poured this into a shallow, flat-bottomed vessel, such as a dinner plate, pass strips of cartridge-paper over its surface, so that one side of the paper shall receive a thin coating of the mixture. Then lay the paper on a table with the coated side upwards, and let it remain exposed to the air until the coating has hardened. Before being applied to the skin, let the Mustard Paper be immersed for a few seconds in tepid water." *Br.*

The British preparation is at fault in not providing for the extraction of the fixed oil of mustard by previously percolating with benzin or carbon disulphide, otherwise the paper will be greasy, giving to the plaster an untidy appearance, and causing it to adhere to the skin. Solution of gutta-percha is unsuited for use in this preparation on account of want of adhesiveness, and tendency of the mixture, when dry, to crack and peel off. We have used instead a solution of 1 part of pure rubber in 30 of equal parts of bisulphide of carbon and benzin. On the large scale, by means of a plaster-spreading apparatus a uniform coat of this solution may be applied to paper. As the latter passes out from under the apparatus, a sieve containing the powdered mustard is shaken over it; this is fixed by the adhesive coat and firmly retained after the evaporation of the volatile liquids in a warm place. The application of the powdered mustard must be properly regulated according to the speed with which the machine delivers the coated paper. The paper is cut into pieces of convenient size, and needs only to be wetted to be ready for use.

Owing to the fact that the large manufacturers can put mustard paper upon the market at such low rates that it pays the apothecary better to buy, than to prepare it, Charta Sinapis, so far as we can learn, is rarely made in the retail stores. Experience has shown that the ready-made mustard papers err rather from too much than from too little activity. Moreover, their action cannot be regulated with the same nicety as can that of the mustard poultice. Unless in the case of travellers and of others who must wait upon themselves, the domestic application is preferable. The mustard leaves can rarely be borne for more than ten or fifteen minutes.

CHELIDONIUM. *U. S.* *Chelidonium.* [*Celandine.*]

(ȻHĔL-Ị-DŌ′NỊ-ŬM.)

"Chelidonium majus. Linné. (*Nat. Ord.* Papaveraceæ.)" *U. S.*

Herba Chelidonii, *P.G.;* Tetterwort; Chélidoine, Herbe à l'Hirondelle, *Fr.;* Schällkraut, *G.*

"Root several-headed, branching, red-brown. Stem about twenty inches (50 cm.) long, light green, hairy; leaves about six inches (15 cm.) long, petiolate, the upper ones smaller and sessile, light green, on the lower side glaucous, lyrate-pinnatifid, the pinnæ ovate-oblong, obtuse, coarsely crenate or incised, and the terminal one often three-lobed; flowers in small, long-peduncled umbels with two sepals and four yellow petals; capsule linear, two-valved, and many-seeded. The fresh plant contains a saffron-colored milk-juice, and has an unpleasant odor and acrid taste." *U.S.*

For an account of the constituents and properties of this new officinal drug, see *Chelidonium majus* (Part II.).

CHENOPODIUM. *U. S.* *Chenopodium.* [*American Wormseed.*]

(ȻHĒ-NỌ-PŌ′DỊ-ŬM.)

"The fruit of Chenopodium ambrosioides. Linné. *Var.* anthelminticum. Gray. (*Nat. Ord.* Chenopodiaceæ.)" *U. S.*

Fructus Chenopodii Anthelmintici; Semences de Chénopode anthelmintique, *Fr.;* Amerikanischer Wurmsamen, *G.*

Gen. Ch. Calyx five-leaved, four-cornered. *Corolla* none. *Seed* one, lenticular, superior. *Willd.*

Chenopodium anthelminticum. Willd. *Sp. Plant.* i. 1304; Barton, *Med. Bot.* ii. 183; *B. & T.* 216. This is an indigenous perennial plant, with an herbaceous, erect, branching, furrowed stem, which rises from two to five feet in height. The leaves are alternate or scattered, sessile, oblong-lanceolate, attenuated at both ends, sinuated and toothed on the margin, conspicuously veined, of a yellowish green color, and dotted on their under surface. The flowers are very numerous, small, of the same color with the leaves, and arranged in long, leafless, terminal panicles, composed of slender, dense, glomerate, alternating spikes.

This species of Chenopodium, known commonly by the names of *wormseed* and *Jerusalem oak*, grows in almost all parts of the United States, but most vigorously and abundantly in the southern section. It is usually found in the vicinity of rubbish, along fences, in the streets of villages, and in open grounds about the larger towns. It flowers from July to September, and ripens its seeds successively through the autumn. The whole herb has a strong, peculiar, offensive, yet somewhat aromatic odor, which it retains when dry. All parts of the plant are occasionally employed; but the fruit only is strictly officinal. This should be collected in October.*

Wormseed, as found in the shops, is in small grains, not larger than the head of a pin, irregularly spherical, very light, of a dull, greenish yellow, or brownish color, a bitterish, somewhat aromatic, pungent taste, and possessed in a high degree of the peculiar smell of the plant. These grains, when deprived, by rubbing them in the hand, of a capsular covering which invests the proper seed, exhibit the shining, blackish surface of the obtusely-edged seed. They abound in a volatile oil, upon which their sensible properties and medical virtues depend, and which is obtained by distillation. (See *Oleum Chenopodii.*) The same oil impregnates to a greater or less extent the whole plant.

Medical Properties and Uses. Wormseed is one of our most efficient indigenous anthelmintics, and is thought to be particularly adapted to the expulsion of the round worms in children. A dose of it is usually given before breakfast in the morning, and at bedtime in the evening, for three or four days successively, and then followed by calomel or some other brisk cathartic. If the worms are not expelled, the same plan is repeated. The medicine is most conveniently administered in powder, mixed with syrup, in the form of an electuary. The dose for a child two or three years old is from one to two scruples (1·3–2·6 Gm.). The volatile oil is more frequently given than the fruit in substance; though its offensive odor and taste sometimes render it of difficult administration. The dose for a child is from five to ten drops (0·3–0·6 C.c.) mixed with sugar, or in the form of emulsion. A tablespoonful (15 C.c.) of the expressed juice of the leaves, or a wineglassful (60 C.c.) of the decoction prepared by boiling an ounce of the fresh plant in a pint of milk, with the addition of orange-peel or other aromatic, is sometimes substituted in domestic practice for the ordinary dose of the fruit and oil.

The fruit of *Chenopodium ambrosioides*, which is very prevalent in the Middle States, is said to be used indiscriminately with that of *C. anthelminticum*, and to be employed in Brazil, under the name of *Herba Santa Maria*, as an anthelmintic and in pectoral complaints. (*P. J. Tr.*, ix. 713.) It may be distinguished by its odor, which is weaker and less offensive, and to some persons agreeable. The plant itself is often confounded with the true wormseed, from which it differs in having its flowers in leafy racemes. This Chenopodium has been employed in Europe as a remedy in nervous affections, particularly chorea. A cupful of an infusion (ʒii to 10f℥) is said to have been given with excellent results, morning and evening.

* *C. anthelminticum* is cultivated to a considerable extent in Maryland, twenty or thirty miles north of Baltimore. The seeds are sown in small beds of rich mould early in spring, and during the month of June the young plants are pulled up, and set out in ridges three feet apart, with intervals of from six to ten inches. The plants do not require to be renewed oftener than once in four or five years. The crop of the second year is more productive than that of the first. The plant is fit for distillation during the first half of September. The distillation is carried on in the same neighborhood. The whole herbaceous part of the plant is used. It is said to yield from 1·5 to 2 per cent. of the oil, and the produce of an acre will yield 20 pounds. (See *A. J. P.*, xxii. 304.)

C. Botrys, or *Jerusalem oak*, is another indigenous species, possessing anthelmintic virtues. It is said to have been used in France with advantage in catarrh and humoral asthma.

Off. Prep. Oleum Chenopodii, *U. S.*

CHIMAPHILA. *U. S.* *Chimaphila.* [*Pipsissewa.*]

(ÇHỊ-MĂPH'Ị-LẠ.)

"The leaves of Chimaphila umbellata. Nuttall. (*Nat. Ord.* Ericaceæ.)" *U. S.*

Prince's Pine, Wintergreen; Herbe de Pyrole ombellée, *Fr.;* Doldenblüthiges Harnkraut, Wintergrün, *G.*

Gen. Ch. *Calyx* five-toothed. *Petals* five. *Style* very short, immersed in the germ. *Stigma* annular, orbicular, with a five-lobed disk. *Filaments* stipitate; stipe discoid, ciliate. *Capsules* five-celled, opening from the summits, margins unconnected; *Nuttall.*

This genus was separated from *Pyrola* by Pursh. It embraces two species, *C. umbellata* and *C. maculata*, which are both indigenous, and known by the common title of *winter-green.* The generic title is formed of two Greek words, χειμα winter, and φιλος a friend. *C. umbellata* only is officinal.

Chimaphila umbellata. Barton, *Med. Bot.* i. 17; Carson, *Illust. of Med. Bot.* i. 62, pl. 53.—*Pyrola umbellata.* Willd. *Sp. Plant.* ii. 622; Bigelow, *Am. Med. Bot.* ii. 15.—*Chimaphila corymbosa.* Pursh. *B. & T.* 165. The pipsissewa is a small evergreen plant, with a perennial, creeping, yellowish root (rhizome), which gives rise to several simple, erect or semiprocumbent stems, from four to eight inches in height, and ligneous at their base. The leaves are wedge-shaped, somewhat lanceolate, serrate, coriaceous, smooth, of a shining, sap-green color on the upper surface, paler beneath, and supported upon short footstalks, in irregular whorls, of which there are usually two on the same stem. The flowers are disposed in a small terminal corymb, and stand upon nodding peduncles. The calyx is small and divided at its border into five teeth or segments. The corolla is composed of five roundish, concave, spreading petals, which are of a white color tinged with red, and exhale an agreeable odor. The stamens are ten, with filaments shorter than the petals, and with large, nodding, bifurcated, purple anthers. The germ is globular and depressed, supporting a thick and apparently sessile stigma, the style being short and immersed in the germ. The seeds are numerous, linear, chaffy, and enclosed in a roundish, depressed, five-celled, five-valved capsule, having the persistent calyx at the base.

This humble but beautiful evergreen is a native of the northern latitudes of America, Europe, and Asia. It is found in all parts of the United States. It grows under the shade of woods, and prefers a loose sandy soil, enriched by decaying leaves. The flowers appear in June and July. All parts of the plant are endowed with active properties. The leaves and stems are kept in the shops.

C. maculata, or *spotted winter-green*, probably possesses similar virtues. The character of the leaves of the two plants will serve to distinguish them. Those of *C. maculata* are lanceolate, rounded at the base, where they are broader than near the summit, and of a deep olive green, veined with greenish white; those of the officinal species are broadest near the summit, gradually narrowing to the base, and of a uniform shining green.

Properties. Pipsissewa, when fresh and bruised, exhales a peculiar odor. The leaves have been already described. Their taste is pleasantly bitter, astringent, and sweetish; that of the stems and root unites with these qualities a considerable degree of pungency. Boiling water extracts the active properties of the plant, which are also imparted to alcohol. The leaves have been examined by Mr. Samuel Fairbank, who found in them gum, starch, sugar, extractive, pectic acid, tannic acid, resin, fatty matter, chlorophyll, yellow coloring matter, lignin, a peculiar whitish substance which he calls *chimaphilin*, and various inorganic substances, as potassa, lime, magnesia, chloride of sodium, and sulphuric, phosphoric, and silicic acids. The chimaphilin was obtained by agitating a tincture with chloroform, allowing the mixture to stand, removing the lighter liquid, and allowing the chloroformic solution to evaporate. A yellow crystalline substance was left, which, purified by solution in alcohol, filtration, and spontaneous evaporation, constituted the substance in question. It was also obtained by simply distilling the stems with water. It is in beautiful, golden yellow, acicular crystals, inodorous, tasteless, fusible, volatilizable unchanged, insoluble or nearly so in water, soluble in alcohol, ether, chloroform, and the fixed and volatile oils, and possessed of neither acid nor alkaline properties. (*Journ. and Trans. of the Md. Col. of Pharm.*, March, 1860.) The active principle of the leaves does not appear to have been isolated, though probably contained in the substance called bitter extractive. The so-named chimaphilin has no claims to this character, nor, we think, to the name given to it, which should be reserved for the active principle when discovered. The pungency of the stems is said by Mr. Fairbank to reside in the resin.

Medical Properties and Uses. This plant is diuretic, tonic, and astringent. It was employed by the aborigines in various complaints, especially scrofula, rheumatism, and nephritic affections. From their hands it passed into those of the European settlers, and was long a popular remedy in certain parts of the country, before it was adopted by the profession. The first regular treatise in relation to it that has come to our knowledge, was the thesis of Dr. Mitchell, published in the year 1803; but it was little thought of till the appearance of the paper of Dr. Sommerville, in *Lond. Med.-Chir. Trans.*, vol. v. It has been particularly recommended in dropsy attended with disordered digestion and general debility, and is usually very acceptable to the stomach, but it cannot be relied on, and is at present very little used in this complaint. Other disorders, in which it is said to have proved useful, are calculous and nephritic affections, and in general all those complaints of the urinary passages for which uva ursi is prescribed. It is much esteemed by some practitioners as a remedy in scrofula, both before and after the occurrence of ulceration; and it has certainly proved highly advantageous in obstinate ill-conditioned ulcers and cutaneous eruptions, supposed to be connected with the strumous diathesis. In these cases it is used both internally, and locally as a wash. It is best administered in the form of the officinal fluid extract, which may readily be made into a syrup. The dose is two fluidrachms (7·5 C.c.) three or four times a day. The decoction was formerly preferred.

Off. Prep. Decoctum Chimaphilæ, *U. S.;* Extractum Chimaphilæ Fluidum, *U. S.*

CHINOIDINUM. *U. S.* *Chinoidin.* [*Quinoidin.*]

(ɛHỊN-ŎĬ′DỊ-NŬM.)

"A mixture of alkaloids, mostly amorphous, obtained as a by-product in the manufacture of the crystallizable alkaloids from Cinchona." *U. S.*

Chinoidine, Quinoidine, Precipitated Extract of Bark, Amorphous Quinine; Quinine brute ou amorphe, *Fr.*

This preparation is a *revived* officinal. It was adopted in the edition of the Pharmacopœia for 1830 under the name of impure sulphate of quinia, but was abandoned in the edition of 1840 on account of the difficulty of ascertaining its purity, and we think it unfortunate that the Committee of Revision have decided to introduce it in the present Pharmacopœia, for it is now very variable in quality and the tests introduced are not quantitative. The wisdom of deviating from the rule to adopt the *ina* termination for the Latin title of the alkaloids, and *ine* for the English name, in this case is also not apparent, for although it is a mixture, the officinal description clearly defines it as a mixture of *alkaloids*, and hence it should have the alkaloidal termination, and not that of the neutral principles. The term chinoidine was first applied to all of the amorphous alkaloids found in and existing naturally in cinchona bark, but it is now used to define a complex body consisting not only of the natural amorphous alkaloids, but those which are artificial and accidental in the derivative products resulting from the application of heat. Upon the evaporation of the mother-liquor left after the crystallization of sulphate of quinine in the preparation of that salt, a dark-colored substance is obtained, having the appearance of an extract. Sertürner supposed that he had discovered a new alkaline principle in this product; but his conclusions were invalidated by the experiments of MM. Henry and Delondre, which went to prove that the alkaline matter contained in it consisted of quinine and cinchonine, obscured by admixture with a yellowish substance that interfered with their crystallization. Nevertheless, under the name of *quinoidine* or *chinoidine*, given to the supposed new alkaloid by Sertürner, there has been long employed in Europe a substance precipitated from the mother-liquor of sulphate of quinine by means of an alkaline carbonate, having a yellowish white or brownish color, and, when moderately heated, agglutinating into a mass of resinous appearance. This substance was found by Dr. F. L. Winckler to contain an uncrystallizable alkaline principle, having the same molecular weight as quinine, and differing from that alkaloid only in the want of the property of crystallization, and in forming uncrystallizable salts with the acids. (*Pharm. Centralb.*, May, 1847, p. 310.) Liebig afterwards proved it to be identical in composition with ordinary quinine, to which he considered it as bearing the same relation that uncrystallizable sugar bears to the crystallizable. Pasteur has found that ordinary quinoidine, or amorphous quinine, consists of two alkaloids, derivatives from quinine and cinchonine, with which they are respectively isomeric, though differing in being uncrystallizable, and named, in view of their origin, *quinicine* and *cinchonicine.* The pure amorphous quinine of Liebig is the former of these alkaloids. The *amorphous quinine*, as Liebig calls it, is entirely soluble in diluted sulphuric acid and in alcohol; and, if its solution in a diluted acid yields upon the addition of ammonia exactly as much precipitate as there was of the original substance dissolved, it may be considered pure. (*A. J. P.*, xviii. 181.) We have been informed that, in an extensive chemical manufacturing establishment in Philadelphia, the loss by quinoidine in the preparation of sulphate of quinine has much diminished since the introduction of steam heat, showing the agency of heat in converting the crystallizable into the uncrystallizable salt.

Properties. The U. S. Pharmacopœia describes chinoidine as "a brownish black, or almost black solid, breaking, when cold, with a resinous, shining fracture, becoming plastic when warmed, odorless, having a bitter taste and an alkaline reaction. Almost insoluble in water, freely soluble in alcohol, chloroform, and diluted acids; partially soluble in ether and in benzol. The solutions have a very bitter taste. If Chinoidin be triturated with boiling water, the liquid, after filtration, should be clear and colorless, and should remain so on the addition of an alkali (abs. of alkaloidal salts). On ignition, Chinoidin should not leave more than 0·7 per cent. of ash." *U. S.*

A simple method of purification consists in dissolving the chinoidine in diluted hydrochloric acid, adding water and precipitating with an alkali, washing and drying.*

Tinctura Chinoidini is made, according to the German Pharmacopœia, by simply dissolving 2 parts of chinoidine in 1 of hydrochloric acid and 17 of alcohol.

Hydrochlorate of Chinoidine is made by heating 1 part of purified chinoidine with 4 parts of distilled water, adding sufficient diluted hydrochloric acid to complete the solution, filtering, evaporating, and powdering the residue.

Medical Properties. Quinoidine is undoubtedly possessed of decided antiperiodic properties, but in these it is inferior to the cinchona alkaloids. It is, moreover, very much more apt to disagree with the stomach, and is uncertain in its dose, so that, notwithstanding its great cheapness, it is but rarely used. From thirty grains to a drachm may be given in the interparoxysmal periods of an intermittent.

* As commercial chinoidine is often very impure, sometimes, according to the observations of M. de Vrij, containing as much as 35 per cent. of foreign matters, a satisfactory method of purifying it becomes important. The following has been proposed by M. de Vrij, founded on the observation of M. Pasteur, that 9 parts of chinoidine, rubbed for a long time in a mortar with a dilute solution of 2 parts of neutral oxalate of ammonium, are at length completely dissolved, with the escape of the ammonia, and entire separation of impurities. M. de Vrij boils in an iron vessel 9 parts of chinoidine with a weak solution of 2 parts of oxalate of ammonium, until ammonia ceases to escape. As the insoluble matter attaches itself in places to the surface of the vessel, he adds from time to time distilled water so as to cover this matter during the boiling. As soon as ammonia is no longer disengaged, he allows the liquor to become quite cool, and ascertains if it is made turbid by the addition of water. In this case he dilutes the solution with water, then filters, and precipitates in a capsule with an excess of solution of caustic soda. The tenacious precipitate which forms may be collected, by means of a gentle heat, in the bottom of the capsule. The clear alkaline liquid is then decanted, and the precipitated chinoidine washed repeatedly with distilled water. Thus purified, being still adhesive, it is exposed for some time to a heat of 100 C. (212° F.) to 110° C. (230° F.), at which it parts with the water it contained, and becomes, after cooling, hard and friable. The oxalate of ammonium is used in order to get rid of lime, which is a frequent impurity in chinoidine. (*Journ. de Pharm.*, 4e sér., iv. 50.)

CHIRATA. *U.S., Br.* *Chirata.*

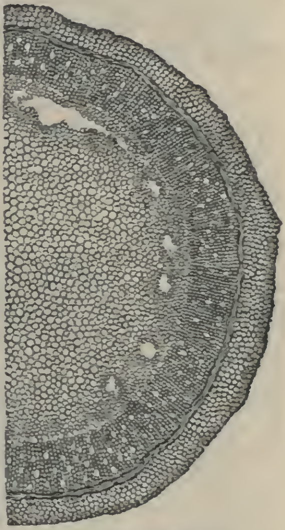
(CHI-RĀ'TA.)

"Ophelia Chirata. Grisebach. (*Nat. Ord.* Gentianaceæ.)" "The entire plant." *Br.*

Chirette, *Fr.;* Chiretta, *G.*

Gen. Ch. Corolla withering, rotate, in æstivation twisted to the right; with glandular hollows protected by a fringed scale upon the segments. *Anthers* not changing. *Stigmas* sessile. *Capsules* conical; one-celled, with spongy placentæ upon the sutures. *Seeds* indefinite, minute. *Lindley.*

Agathotes Chirayta. Don, *Lond. Philos. Mag.* 1836, p. 76.—*Gentiana Chirayta.* Fleming, *Asiat. Research.* xi. 167.—*Ophelia Chirata.* Grisebach. *B. & T.* 183. The *chirayta* or *chiretta* is an annual plant, about three feet high, with a branching root, and an erect, smooth, round stem, branching into an elegant leafy panicle, and furnished with opposite, embracing, lanceolate, very acute, entire, smooth, three or five-nerved leaves. The flowers are numerous, peduncled, yellow, with a four-cleft calyx having linear acute divisions, the limb of the corolla spreading and four-parted, four stamens, a single style, and a two-lobed stigma. The capsules are shorter than the permanent calyx and corolla. The plant is a native of Nepaul, and other parts of Northern India. The whole of it is gathered when the flowers begin to decay.*


Chiretta, transverse section.

The dried plant is imported into Europe in bundles, consisting mainly of the stems, with portions of the root attached. The stems contain a yellowish pith. The drug is officinally described as a "root nearly simple, about three inches (75 mm.) long; stem branched, nearly forty inches (1 m.) long, slightly quadrangular above; leaves opposite, sessile, ovate, entire, five-nerved; flowers numerous, small, with a four-lobed calyx and corolla; the whole plant smooth, pale brown, inodorous and intensely bitter." *U. S.* It imparts its virtues to water and alcohol; and they are retained in the extract. According to Lassaigne and Boissel, the stems contain resin, a yellow bitter substance, brown coloring matter, gum, and various salts. Flückiger and Höhn, who have subsequently examined the stems and roots, have extracted from them sugar, wax, chlorophyll, soft resin, tannin, an acid which they name *ophelic*, possessing the formula $C_{13}H_{20}O_{10}$, and a peculiar bitter substance, denominated *chiratin*, $C_{26}H_{48}O_{15}$. The acid is syrupy, deliquescent, yellowish brown, at first slightly sour, afterwards intensely bitter. It is soluble in water with some turbidness, probably owing to resin mixed with it, and completely soluble in alcohol, or a mixture of this with ether. It decomposes certain salts, and forms amorphous compounds with acids. Chiratin is a yellow, hygroscopic powder, but feebly crystallizable, very bitter, sparingly soluble in cold water, more so in hot water, and readily dissolved by alcohol and ether. It is neutral to test-paper, and yields a copious precipitate with tannic acid. By the action of acids, chiratin is separated into ophelic acid, and a yellowish brown, amorphous substance, bitter, scarcely soluble in water, readily soluble in spirit, and not reducing copper solutions, as the ophelic acid does. Höhn gives it the formula $C_{13}H_{24}O_3$, and names it *chiratogenin.* (*P. J. Tr.*, Aug. 1870, p. 106.)

Medical Properties and Uses. Chiretta has long been used in India. It has been introduced into Europe, and appears to be highly esteemed, but has not been employed to any considerable extent in this country. Its properties are those of the pure bitters, and probably do not differ from those of the other members of the family of Gentianaceæ. (See *Gentiana.*) Like these, in overdoses it nauseates and oppresses the stomach. Some have supposed that, in addition to its tonic properties, it exerts a peculiar influence over the liver, promoting the secretion of bile and correcting it when deranged, and restoring healthy evacuations in cases of habitual costiveness. It has been used in dyspepsia, and in the debility of convalescence, and generally in cases in which corroborant measures are indicated. In India it has been successfully employed in intermittents and remittents, combined with the seeds of *Guilandina Bonduc.* It may be given in powder, infusion, tincture, or extract. The dose in substance is twenty grains (1·3 Gm.). A fluid extract may be made in the same manner as that of gentian.

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* In the Indian bazaars the name chiretta is applied to various dried gentianaceous plants; the only one of them, except the officinal species, so far as we know, which has found its way into Western commerce is *Ophelia angustifolia.* This *Paharee* or *Hill chiretta* is distinguished by its inferior bitterness, and its rectangular, winged stems, whose section presents a thick woody ring and a centre nearly or entirely hollow, with only traces of pith.

Off. Prep. Infusum Chiratæ, *Br.;* Tinctura Chiratæ, *U. S.*, *Br.;* Extractum Chiratæ Fluidum, *U. S.*

CHLORAL. *U. S.* *Chloral.* [*Hydrate of Chloral.*]

C_2HCl_3O, H_2O; 165·2. (CHLŌ'RAL.) $C_4HCl_3O_2, 2HO$; 165·2.

"Chloral should be preserved in glass-stoppered bottles, in a cool and dark place." *U. S.*

Chloral Hydras, *Br. Add.;* Chloralum Hydratum Crystallisatum, *P.G.;* Hydrate de Chloral, *Fr.;* Chloral Hydrat, *G.*

In adopting the name chloral to designate the hydrate of chloral, the U. S. Pharmacopœia has unfortunately perpetuated an inaccuracy which neither the English, the Germans, nor the French follow in their usage, the term *hydrate* being always employed as it should be. The fact that water is absolutely necessary to allow of the crystallization of the preparation, and to give it medicinal character, should be recognized in the name. As custom has sanctioned the usage here in the present article, whenever the term chloral is used, the hydrate is intended; and whenever the uncombined substance is referred to, it is designated *anhydrous chloral.*

Perhaps no medicine has come so rapidly into extensive use as that now under consideration. Though discovered by Liebig so long since as 1832, and afterwards investigated by Dumas, who determined its chemical formula, it was not until 1869 that its remedial properties were first made known by their discoverer, Dr. Otto Liebreich, of Berlin; in 1878 the consumption of chloral was estimated at one ton daily in England and America alone.

Anhydrous Chloral. In preparing anhydrous chloral, the simple method originally employed by Liebig, of acting directly on alcohol by chlorine, is generally preferred, even, we believe, by the larger manufacturers; though a more complex proceeding has been suggested by Stædeler, of distilling together proximate vegetable principles, as fecula, sugar, etc., with black oxide of manganese and hydrochloric acid, whereby the chlorine acts *in statu nascendi.* The following details of the manufacture of chloral hydrate as carried out on a commercial scale have been supplied by E. Schering, of Berlin, who has been for some years the largest manufacturer of it. Absolute alcohol in lots of 50 pounds is placed in large glass flasks and saturated with chlorine, which is passed in a continuous stream for 6 to 8 weeks. The chlorine is led into cold alcohol at first, and when no more is absorbed, the alcohol is heated at first gently and then to 60° C. (140° F.). When saturated, the mixture formed is agitated with sulphuric acid at a temperature of 60° C. (140° F.) for several hours, during which time most of the hydrochloric acid escapes. The separated chloral is then rectified over calcium carbonate. The pure chloral so obtained is then mixed in glass flasks with the necessary amount of water, and the resulting hydrate either cast into cakes or purified by crystallization. As solvents for this purpose certain of the side products of the chloral manufacture after being purified and rectified, are used, for instance, ethylen and ethyliden chlorides. Or in their absence chloroform is used; petroleum benzin, and bisulphide of carbon have also been recommended. (See also *A. J. P.*, 1873, p. 413.) According to Gerhardt, the formula of anhydrous chloral is C_2Cl_3HO; in other words aldehyd C_2H_4O, in which

3 atoms of hydrogen have been replaced by 3 atoms of chlorine. The alcohol C_2H_6O may be supposed to give up 2 atoms of its hydrogen to form aldehyd, which exchanges 3 of its atoms of hydrogen for 3 atoms of the chlorine, the hydrogen forming hydrochloric acid with 3 other atoms of the chlorine. The name of chloral was derived from the *chlor*ine and *al*cohol from which it is formed. The anhydrous chloral thus formed is a colorless liquid, of penetrating disagreeable odor, of little taste, of the sp. gr. 1·502, and boiling at 94° C. (201·2° F.). It is soluble in ether or chloroform without change.

Meta-chloral. By continued contact of anhydrous chloral and concentrated sulphuric acid, a change is effected in the chloral, by which it becomes a solid insoluble in water, which is designated as *insoluble chloral*, or *meta-chloral*. It is tasteless, of a white color resembling porcelain, and insoluble in alcohol and ether. Its formula is $C_6H_3Cl_9O_3$, being formed by the union of three molecules of chloral. Personne has tried its effects on animals, and ascribes to it a value little differing from that of the hydrate. (*Arch. Gén.*, Sept. 1870, p. 332.) It has not hitherto been employed therapeutically.

Alcoholate of Chloral. A compound obtained by M. Roussin, which he announced as pure hydrate of chloral, was found by M. Personne to contain no water, but to be in fact a compound of alcohol and chloral, and is now known by the name of *alcoholate of chloral*, $C_2HCl_3O.C_2H_6O$. It results directly from the action of absolute alcohol on anhydrous chloral, and is now known to be formed as a stage in the manufacture of chloral from alcohol. As it is very likely to be confounded with chloral hydrate, the following points of difference should be noted. It forms white crystals melting at 46° C. (114·8° F.), and boils at 113·5° C. (236° F.), while chloral hydrate crystals melt at 48°–49° C. (118.4°–120·2° F.), and boil at 97·5° C. (207° F.); chloral alcoholate melts without complete solution when warmed with two volumes of water, and, on cooling, congeals below the surface of the water, while chloral hydrate is soluble in one and one-half times its weight of water; chloral alcoholate, gently heated with nitric acid of 1·2 sp. gr., is violently attacked, while chloral hydrate is scarcely acted on; chloral-alcoholate, heated on platinum foil, inflames readily, while chloral hydrate scarcely burns. (Allen, *Commerc. Org. Analysis*, p. 167.)

The three forms of chloral, the *anhydrous*, the polymeric *meta-chloral*, and the *alcoholate*, described above, have been more or less introduced into the European markets, and have required some notice to prevent them from being confounded with the hydrate, which is alone officinal. The following observations will be confined to this compound; and the reader will note that whether the simple term chloral, or the exact designation, hydrate of chloral, is used, the same substance is intended.

Properties of Hydrate of Chloral, or Chloral, *U. S.* This results from simply mixing anhydrous chloral with water. Acicular crystals soon form, which consist of a molecule each of the chloral and water, constituting hydrate of chloral, or officinal chloral. As employed in the United States, this comes, we believe, exclusively from Europe, and chiefly from Germany, with the exception of that produced by Dr. E. R. Squibb, of Brooklyn. It occurs in commerce mainly in two forms, in distinct crystals, which is the officinal form, or in crystalline plates, about three lines in thickness, broken into small, irregular, angular pieces, so as to be readily introduced into broad-mouthed bottles. These pieces, while retaining their tabular form, are somewhat translucent, but usually covered with a white powder, which somewhat conceals that property. This is the more common form and the cheaper; but the crystals are to be preferred, as their purity may be relied on. Chloral is white, of a peculiar pungent odor, and an acrid pungent taste, especially affecting the velum pendulum. The odor has been compared to that of an over-ripe melon. Exposed to the air it very slowly volatilizes, and, like camphor, when enclosed in a bottle, covers the interior surface with numerous minute crystallizations. The boiling point of the pure crystals, obtained from their solution in bisulphide of carbon, is 97·5° C. (207° F.). If the boiling point be under 95° C., it indicates an under-hydrated preparation; if above 98° C., an over-hydrated one. (E. R. Squibb.) The pure hydrate does not take fire when heated in a spoon, but evaporates without residue. With the aid of heat, its solution may be effected readily in chloroform; and the solution, on cooling, deposits it in beautiful crystals, which are generally needle-shaped; but, when deposited from bisulphide of carbon, they are prisms. The watery solution is prone to decomposition, which is ultimately attended with the development of algæ. Chloral should not, therefore, be kept long in this state. (Dr. E. Labbée, *Arch. Gén.*, Sept. 1870, p. 31.) In its relation to acids and alkalies it is neutral, or, according to E. Schering, slightly acid when perfectly pure. When equal parts of chloral in crystals and of camphor in small fragments are shaken together in a bottle, and allowed to stand, they liquefy, forming a clear solution. When chloral and sulphuric acid are mixed, the temperature is greatly reduced. A solution of chloral hydrate dissolves morphine, quinine, and most of the vegetable alkaloids. (R. F. Fairthorne, *A. J. P.*, Oct. 1871, p. 447.) When ammonium sulphide is added to an aqueous solution of chloral hydrate, the mixture rapidly turns yellow, and, after passing through several shades of color, finally becomes dark brown. From this liquid diluted sulphuric acid throws down a bulky brown precipitate. This, purified from precipitated sulphur and dried, is a light brown powder of the composition $C_{18}H_{24}S_{13}N_4O_6$. Hydrogen sulphide gas forms a sulphydrate by its action on chloral. These reactions are important, as the detection of metallic poisons in toxicological cases by hydrogen sulphide has been complicated by the presence of chloral hydrate. A still more important chemical reaction of chloral is that which takes place when the hydrate, or either of its other forms, is placed under the influence of an alkali. Chloroform is developed, and along with it a formate of the alkali employed. Thus, in a strong solution of potassa, put a pinch of powdered chloral, and almost instantly the odor of chloroform becomes sensible, and some oil-like globules of chloroform are visible at the bottom of the vessel. The reaction is as follows:

$$\underset{\text{Chloral hydrate}}{C_2HCl_3O,H_2O} + \underset{\text{potassium hydrate}}{KOH} = \underset{\text{chloroform}}{CHCl_3} + \underset{\text{potassium formate}}{CHO.OK} + \underset{\text{water}}{H_2O}.$$

This relation of chloral to chloroform would serve as a ready test of the former, and may be used also to determine its quality; for pure hydrate of chloral ought by calculation to yield 76·35 per cent. of chloroform, and the best known yields, according to the table of Mason, 71·5 (72·20 Selden) per cent. If, therefore, the product of chloroform should fall much below the latter percentage, the parcel acted on is probably impure. When blood is agitated with chloral, it produces the same change, and the smell of chloroform becomes sensible after a time; and Richardson was able to collect a certain quantity by distillation. (*Labbée.*) Important pathological inferences have been drawn from this result. The following tests of purity are given in the U. S. Pharmacopœia. "Separate, rhomboidal, colorless, and transparent crystals, slowly evaporating when exposed to the air, having an aromatic, penetrating, and slightly acrid odor, a bitterish, caustic taste, and a neutral reaction. Freely soluble in water, alcohol, or ether; also soluble in four parts of chloroform, in glycerin, benzol, benzin, disulphide of carbon, fixed or volatile oils. It liquefies when mixed with carbolic acid or with camphor. Its aqueous solution soon acquires an acid reaction, but its alcoholic solution remains neutral. At about 58° C. (136° F.), it melts to a clear liquid of sp. gr. 1·575, which solidifies to a crystalline mass at a temperature between 35° and 50° C. (95° and 122° F.). At about 78° C. (172° F.) it begins to yield vapors of water and of anhydrous chloral, and it boils at 95° C. (203° F.). When dissolved in water and treated, while hot, with solution of potassa or of soda, or with water of ammonia, a vaporous, milky mixture of chloroform is obtained, with a formate in solution. If the addition of the water of ammonia be made in a test-tube, after adding a few drops of test-solution of nitrate of silver, a silver mirror will be obtained upon the glass. An aqueous solution, treated with test-solution of sulphide of ammonium, gives a reddish-brown precipitate. Chloral should be dry, and should not readily attract moisture in ordinarily dry air; when dissolved in diluted alcohol it should not redden blue litmus paper (abs. of acids), nor be precipitated upon addition of a few drops of nitric acid, and of test-solution of nitrate of silver (abs. of hydrochloric acid). Warmed in contact with an equal volume of sulphuric acid, it liquefies, but should not blacken; and, when vaporized by heat, no residue should remain. It should not dissolve in less than 4 times its weight of chloroform at 15° C. (59° F.), (difference from alcoholate). A portion, in a test-tube, containing a fragment of broken glass, held in water nearly boiling should boil at about 97° C. (206·6° F.) (difference from alcoholate, which boils at 115° C. (239° F.), and evidence of due hydration). If 1 Gm. be dissolved in 2 C.c. of distilled water, the solution warmed, and about 8 C.c. (or a slight excess) of solution of potassa added, the mixture filtered clear through wet filter paper, and the filtrate treated with test-solution of iodine until it is yellowish, no yellow, crystalline precipitate (iodoform) should appear, even after standing half an hour (abs. of alcoholate of chloral)." *U. S.*

Medical Properties and Uses. When chloral is ingested in full therapeutic dose (from 15 to 30 grains), it produces in from ten minutes to half an hour a quiet, placid sleep, which usually continues about three hours, when it ceases, generally without any unpleasant symptom during its progress, or after its termination. In some instances the ordinary doses fail to cause sleep, and in others the sleep is attended with dreams and hallucinations, and followed by unpleasant symptoms, like those which often succeed other hypnotics, especially opium; such as nausea, headache, unpleasant nervous disorder, etc. These diversities may be ascribed in part to peculiarity of constitution; but more frequently, in all probability, they are owing to morbid conditions existing at the time, which oppose themselves to the proper action of the choral. In an individual in health chloral will probably almost always induce a calm sleep, differing little from the natural. Moreover, these unpleasant symptoms are now much more rarely produced than formerly, and there can be but little doubt that they have often been due to impurities in the drug. The pulse is in this degree of action not affected, or is rendered a little slower; the pupil is contracted, but becomes normal so soon as the subject is awakened; the respiration is deep, full, and regular. When larger amounts are given, the sleep is much deeper, and may pass into profound coma; the respirations fall in number; the pulse is weakened and rendered slower, but may become rapid and irregular if the dose has been toxic; the temperature is reduced; the muscular system is relaxed, and both sensibility and reflex action are diminished. If a fatal dose has been given, all these symptoms are intensified: with coma, intense muscular relaxation, weak, thready pulse, and a pupil contracted at first, but afterwards dilated, the victim gradually sinks into death, paralyzed and anæsthetic. The immediate cause of death is generally a paralytic arrest of respiration; but in many cases there appears to be a simultaneous arrest of the cardiac action, and it is very possible that fatal syncope may at times occur. At post-mortem examination, congestion of the meninges and substance of the brain and cord, and of the lungs, is commonly found. The blood is thought by Richardson (*Med. Times and Gaz.*, Sept. 4, 1870) to coagulate less firmly than normal.

After the brain the motor tract of the spinal cord, including the respiratory centre, is most sensitive to the action of chloral. The loss of voluntary muscular power and the lessening of reflex activity which the drug produces, are the result of this spinal influence. Upon the sensory tract of the cord chloral acts with much less vigor, while the nerves and muscles practically escape its influence. Of course any agent which produces sleep in some measure relieves pain, but the anæsthetic influence of chloral is far from pronounced, and often patients on waking will complain bitterly of pain suffered during sleep.

The physiological action of chloral may be summed up as follows. Upon the cerebrum it acts as a most powerful and certain hypnotic; in full doses it acts as an intense depressant upon the centres at the base of the brain, and upon the spinal cord, causing slowing and weakness of the heart's action, probably vaso-motor paralysis, slowing of the respiration, and muscular weakness, lessening of reflex activity, with a certain amount of anæsthesia; in fatal doses it causes death generally by arresting respiration through paralysis of the nerve-centres, and finally stopping the heart in diastole. Its action in very small doses is uncertain, but there is considerable evidence to indicate that it irritates or stimulates the spinal and the cardiac, and even the vaso-motor, centres. On the vagi and on the motor nerve trunks it has no marked influence. Clinical experience indicates that chloral acts as a depressant to the heart-muscle; although some authorities believe the influence of the drug upon the heart is not direct, but exerted through the nerve-centres. Chloral has little effect on the secretions, though it is said somewhat to increase the secretion of urine. In man, it is stated by Bouchut that, in accordance with his observations, this secretion is not only increased, but has been found also augumented in density; at the same time reducing the cupro-potassic liquor, and rendered brown by potassa or subnitrate of bismuth; as if a temporary glycosuria were produced. Formic acid has never been found in the urine as a result of the taking of chloral. (*Arch. Gén.*, Sept. 1870, p. 346.)

Action as Chloral. The conversion of chloral by alkalies in solution into chloroform and formic acid first suggested its use in medicine to Liebreich (*Wiener Medizinische Wochenschrift*, August, 1869); and the theory that its action is really due to chloroform generated by the alkalinity of the blood has been received with favor by Personne and other writers, but there are very many facts which militate against the truth of this supposition. Thus chloroform cannot be detected either in the blood, breath, or excretions of chloralized animals, although chloroform at once manifests itself when it is administered, and in the so-called "salt frogs" of Cohnheim, after substitution of warm salt water for the blood of the animal, chloral acts as upon the normal batrachian.

Chloral, especially when used continuously, is said to produce in some individuals serious disturbances. Such are vaso-motor paralysis, transient skin neurosis, acute purpura, and great prostration of the heart's action, sometimes amounting to paralysis of that organ; and sometimes ending fatally, even though the doses of the chloral used were within the limits ordinarily deemed safe. For a full discussion of these phenomena, see H. C. Wood's *Therapeutics.* Dr. Hawkes, though a strong advocate for the use of chloral, has found it repeatedly prejudicial in the general paralysis of mania and in elderly persons with feeble circulation and impaired nutrition. There can be no doubt that great caution should be practised in administering the drug when the heart is very weak, or the general powers much enfeebled. Dr. Jolly relates two cases in which 5 grammes (about 76 grains), given every night, caused death, in one case after the fifth dose, and, in the second, after the thirteenth, without abnormal symptoms until after the last dose, when the action of the heart and respiration suddenly ceased, and the patient died. (*New York Med. Journ.*, Nov. 1872.) These cases would appear to justify the statement that there is a possible cumulative action of the drug. Although 480 grains have been recovered from, Dr. Fuller has recorded a case in which a single dose of thirty grains proved fatal in a young lady, and two others in which the same quantity caused alarming symptoms in similar circumstances; so that the highest dose to begin with in ordinary diseases, especially in delicate women, should not exceed twenty grains. In poisoning by chloral, if the case be seen early, the stomach should be thoroughly evacuated by an emetic or the stomach-pump, and the system afterwards supported by cardiac and respiratory stimulants, as milk punch, carbonate of ammonium, etc. Atropine, digitalis, and strychnine should be administered freely, and the same general measures taken to sustain the respiration as are usually practised in opium poisoning. Atropine is undoubtedly of value when there is failure of respiration, and care should always be taken to maintain the bodily temperature. Artificial respiration should be practised when necessary. Care also should be exercised to maintain the bodily temperature by external heat. Dr. Liebreich recommends strychnine as an antidote; having found that poisonous doses of the two substances, introduced into the same animal, neutralize each other's operation, and no serious effect ensues.

From what has been said it will be readily perceived that the two great indications for this remedy are to procure sleep and to relax spasm. In pure nervous insomnia, and in the same affection attendant on other diseases, as in acute fevers, active congestion of the brain, cerebral inflammation, mania, delirium tremens, etc., it is superior to opium; fifteen to twenty or twenty-five grains (1–1·3 or 1·565 Gm.) are generally sufficient for a commencing dose, to be repeated in half the quantity in an hour, if the first dose fail. The sleep is usually calm and undisturbed for three or four hours, and may be renewed, if required, by the repetition of the dose. When the sleeplessness is due to pain, opium is much more effective than chloral. The combination of chloral and morphia is often very useful in procuring sleep for the suffering. As an anæsthetic, chloral should never be employed; the intravenous use of it as practised to some extent in France is most dangerous and absolutely unjustifiable. In spasmodic affections chloral is one of the most powerful remedies known. In tetanus it is singularly useful, but must be given in very large doses. In hysteria, severe chorea, and other functional or spinal convulsions, it is no less efficient. In epilepsy and other forms of cerebral convulsions chloral is of less service, although it is frequently employed with benefit in puerperal convulsions. In local spasms it is often of service, and has been used with success in strangulated hernia, spasm of the glottis, spasmodic croup, asthma, hiccough, and even in incontinence of urine. Chloral is possessed of very decided antiseptic properties; a solution of the strength of 30 grains to the ounce will preserve animal tissues for a long time. Locally applied it is narcotic and antiseptic, and has been used in foul sores, irritable ulcers, etc.

Pharmaceutical Preparations. Chloral is best administered in solution with syrup of orange flowers, or in simple solution. The French sometimes employ *chloral cream*, made of chloral hydrate 5 parts, water 15 parts, white sugar finely powdered 100 parts, flavored with mint, orange, or vanilla. One grain of chloral is contained in 24 grains of the cream, and a teaspoonful is equivalent to about 8 grains of chloral. This preparation keeps well, and the dose may be dissolved in a little water. *Chloral liniment* may be made by dissolving 6 parts of chloral in 30 parts oil of sweet almonds. *Chloral ointment*, 6 parts chloral, 3 parts white wax, 27 parts lard; the lard and wax are melted at a gentle heat, the chloral added in powder and dissolved. *Camphorated chloral* is made by rubbing together equal parts of camphor and chloral, forming a thick liquid. *Chloral plaster*, to produce counter-irritant effects, is prepared by spreading powdered chloral on Burgundy pitch plaster.

CHLOROFORMUM PURIFICATUM. *U. S.* *Purified Chloroform.*

$CHCl_3$; 119·2. (CHLŌ-RỌ-FÖR'MŬM PŪ-RỊ-FỊ-CĀ'TŬM.) C_2HCl_3: 119·2.

Chloroformum, *Br.;* Chloroformium, *P.G.;* Formylem Trichloratum; Chloroforme pur, *Fr.;* Reines Chloroform, *G.*

"Commercial Chloroform, *two hundred parts* [or seventy fluidounces]; Sulphuric Acid, *forty parts* [or eleven and a half fluidounces]; Carbonate of Sodium, *ten parts* [or five ounces av.]; Lime, in coarse powder, *one part* [or half an ounce av.]; Alcohol, *two parts* [or two and a quarter fluidounces]; Water, *twenty parts* [or ten fluidounces]. Add the Acid to the Chloroform and shake them together, occasionally, during twenty-four hours. Separate the lighter liquid and add to it the Carbonate of Sodium previously dissolved in the water. Agitate the mixture thoroughly for half an hour and set it aside; then separate the Chloroform from the supernatant layer, mix it with the Alcohol, transfer it to a dry retort, add the Lime, and, taking care that the temperature in the retort does not rise above 67·2° C. (153° F.), distil, by means of a water-bath, into a well-cooled receiver, until the residue in the retort is reduced to *two parts* [or six fluidrachms]. Keep the product in glass-stoppered bottles, in a cool and dark place." *U. S.*

"Take of Chlorinated Lime *ten pounds* [avoirdupois]; Rectified Spirit *thirty fluidounces* [Imperial measure]; Slaked Lime *a sufficiency;* Water *three gallons* [Imp. meas.]; Sulphuric Acid *a sufficiency;* Chloride of Calcium, in small fragments, *two ounces* [av.]; Distilled Water *nine fluidounces* [Imp. meas.]. Place the Water and the Spirit in a capacious still, and raise the mixture to the temperature of 100°. Add the Chlorinated Lime and five pounds [av.] of the Slaked Lime, mixing thoroughly. Connect the still with a condensing worm encompassed by cold water, and terminating in a narrow-necked receiver; and apply heat so as to cause distillation, taking care to withdraw the fire the moment the process is well established. When the distilled product measures fifty ounces, the receiver is to be withdrawn. Pour its contents into a gallon [Imp. meas.] bottle half filled with Water, mix well by shaking, and set at rest for a few minutes, when the mixture will separate into two strata of different densities. Let the lower stratum, which constitutes crude chloroform, be washed by agitating it in a bottle with three [fluid]ounces of the Distilled Water. Allow the Chloroform to subside, withdraw the water, and repeat the washing with the rest of the Distilled Water, in successive quantities of three [fluid]ounces at a time. Agitate the washed Chloroform for five minutes in a bottle with an equal volume of Sulphuric Acid, allow the mixture to settle, and transfer the upper stratum of liquid to a flask containing the Chloride of Calcium mixed with half an ounce of Slaked Lime, which should be perfectly dry. Mix well by agitation. After the lapse of an hour connect the flask with a Liebig's condenser, and distil over the pure Chloroform by means of a water-bath. Preserve the product in a cool place, in a bottle furnished with an accurately ground stopper. The lighter liquid which floats on the crude Chloroform after its agitation with water, and the washings with Distilled Water, should be preserved, and employed in a subsequent operation." *Br.*

In the U. S. Pharmacopœia of 1850 a process was given for preparing chloroform; but as this is never made on a small scale by the apothecary, but purchased of the manufacturer, it was very properly transferred, at the next revision, to the Materia Medica Catalogue. But, as the chloroform of commerce is often impure, and, though fitted for external use, and for various pharmaceutical purposes, is, in this impure state, unfit for use as a respiratory anæsthetic agent, it was deemed advisable to introduce a formula by which its purification, if required, might be readily effected. This process is the first of those above given. The process of the British Pharmacopœia is for the preparation of the chloroform *ab initio*, with directions which secure its purity if complied with. In this process, the reaction by which the chloroform is produced takes place between the chlorinated lime and the alcohol; the slaked lime, which is added in accordance with the directions in the late Dublin Pharmacopœia, being intended probably to lessen the production of the chlorinated pyrogenous oil, the amount of which is greater, according to Soubeiran and Mialhe, in proportion to the relative excess of the chlorine to the lime employed. The use of this earth is stated by some chemists to give rise to Dutch liquid, or ethene chloride, $C_2H_4Cl_2$, and to increase the product at the expense of its purity.* As first distilled, the chloroform is very impure, and is directed to be washed first with ordinary water, and afterwards with distilled water, which separate alcohol, chlorine, and probably other contaminating substances. In consequence of the density of the chloroform and its insolubility in water, it readily subsides, forming a distinct layer which may be easily separated. The crude product, after having been freed from alcohol by the washing with water, is purified from the chlorinated pyrogenous oil, which comes over with the chloroform, by agitation with an equal volume of sulphuric acid, which ought to be *pure* and *colorless*, and at least of the density 1·840. The oil is charred and destroyed by the acid, which becomes yellow or reddish brown, and is partially changed into sulphurous acid. To remove the latter acid, as well as any water present, the chloroform, which floats on the surface of the acid, is removed and agitated well with chloride of calcium and slaked lime, and then again submitted to distillation. According to Gregory and Kemp, of Edinburgh, by whom the use of sulphuric acid for this purpose was proposed, chloroform is effectually purified from the pyrogenous oil by agitation with this acid if strong and pure. So long as a ring, darker than the rest of the acid, appears, after rest, at the line of contact between the acid and the chloroform, the agitation must be repeated; and the oil is known to be fully separated when the acid remains colorless. Black oxide of manganese has been employed to separate the sulphurous acid; but, in this case, the chloroform is apt to become, after the lapse of a few weeks, of a delicate pink color, which sometimes disappears and then returns. This coloration depends upon the presence of manganese, and forms an objection to the use of the black oxide as a purifier.

In the U. S. process the method of purification is somewhat different. Instead of equal measures of the impure chloroform and sulphuric acid and an agitation for only 5 minutes, the commercial chloroform is shaken occasionally for 24 hours with but one-fifth of its weight of the acid. To remove any water and acid that may be present, instead of chloride of calcium and lime, a little stronger alcohol is mixed with the chloroform, and then carbonate of sodium previously heated to redness, and the mixture is distilled to dryness.

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* According to Gehe & Co. (June, 1881), the yield of pure chloroform is nearly 8 per cent. of the amount of chloride of lime used; this being the average product during several months' manufacture of chloroform.

It sometimes happens that the chloroform purified with sulphuric acid, though apparently pure at first, will not keep, but, after some time, becomes so loaded with chlorine and hydrochloric acid as to be altogether unfit for respiration. Dr. Christison ascertained that, if the sulphuric acid employed contain hyponitric acid, the chloroform changes in less than 24 hours. The idea has been entertained that it would be necessary to abandon sulphuric acid as a purifying agent; but experience has shown that, with certain precautions, it may be safely used; and its efficiency in getting rid of the empyreumatic impurity is so great that it is still much employed for the purpose. The British Council endeavors to escape the difficulty by using a large quantity of the acid, and allowing but very brief contact; while in the U. S. process the same end is arrived at by employing a comparatively small quantity of the acid, with a much longer period for its operation. In any case, however, the acid should be strong and pure, and especially free from any of the nitrogen acids; and care should afterwards be taken to remove every particle of the sulphuric or sulphurous acid, as is done in the officinal processes, by lime and carbonate of sodium. Dr. Squibb attributes the fact, that chloroform purified by concentrated sulphuric acid does not keep well, to the very purity attained. He believes that perfectly pure chloroform is prone to decomposition, and is rendered more stable by the addition of a small proportion of alcohol, so as to reduce its density to the officinal standard, 1·49. This he effects by adding alcohol in the proportion of ten drops to each fluidounce of good chloroform of maximum density. This recommendation is carried into effect in the U. S. process, and explains the addition of alcohol before distillation. Dr. Gregory also attributes the tendency to decomposition to its purity, and to the action of sunlight; having found that those portions which he had purified with the greatest care were soonest decomposed under the influence of light.

As chloroform of great purity is often to be purchased in the market, it is not necessary for the pharmacist to apply the officinal process of purification to every parcel that he may meet; but it is in the highest degree incumbent on him to sell none for inhalation which is not so pure as to stand the tests given in the Pharmacopœia, and if he can obtain none so pure, then to purify it himself. All pure specimens, moreover, should be kept distinct, and labelled with the officinal title of Purified Chloroform, for the sake of distinction.

The intermediate formation of chloral as a result of the reaction between alcohol and chlorinated lime suggested the preparation of chloroform from chloral, which has of late years been produced in immense quantities. The advantages which were anticipated by decomposing pure chloral hydrate with alkalies have not altogether been realized, for the product is much more expensive, and the claim of greater stability has not been sustained, as it requires just as much alcohol to preserve it as that made in the usual way.

Chloroform may be made by the action of chlorinated lime on pyroxylic spirit (wood spirit); but when thus prepared it is largely contaminated with a chlorinated pyrogenous oil, analogous to that already mentioned as being found in small proportion in chloroform prepared from alcohol. Chloroform, thus prepared, called *methylic chloroform*, is purified with much more difficulty than is that made with alcohol, called by Soubeiran *normal chloroform*. In Great Britain chloroform is now obtained by the use of methylated spirit; and the preparation, when properly purified, is stated to answer every purpose to which it is applied equally well with that obtained by the use of alcohol. Damoiseau (*Comptes-Rendus*, vol. xcii. p. 42, 1881; *N. R.*, 1881, p. 71) describes a new method of making chloroform, by passing chlorine, mixed with the proper proportion of methyl chloride, through a long tube containing animal charcoal, heated from 250° C. to 350° C. (482° F. to 662° F.). (See *Methylic Alcohol* in Part II.)

Pettenkofer inferred, from numerous experiments on the manufacture of chloroform, that very different quantities are obtained, on different occasions, from the same amount of materials, and the same process. The yield is less, the longer the mixture is allowed to stand before distillation, and is greater when the heat of the mixture is between 57·2° C. (135° F.) and 75° C. (167° F.) than at either a lower or higher temperature. When the latter degree is exceeded, the chloroform contains more chlorine. (*Buchner's Neues Repert.*, x. 103.)

Discovery and History. Chloroform was discovered by Mr. Samuel Guthrie, of Sackett's Harbor, N. Y., in 1831, and about the same time by Soubeiran in France, and Liebig in Germany. Guthrie obtained it by distilling a gallon from a mixture of three pounds of chlorinated lime and two gallons of alcohol of the sp. gr. 0·844, and rectifying the product by redistillation, first from a great excess of chlorinated lime, and afterwards from carbonate of potassium. (*Silliman's Journal*, vol. xxi., Jan. 1832, p. 64.) In a subsequent letter to Professor Silliman, dated Feb. 15, 1832, Mr. Guthrie states that the substance which he had obtained, "distilled off sulphuric acid, has the specific gravity of 1·486, or a little greater, and may then be regarded as free from alcohol; and if a little sulphuric acid which sometimes contaminates it be removed by washing it with a strong solution of carbonate of potassium, it may then be regarded as *absolutely pure*." (*Ibid.*, vol. xxii., July, 1832, p. 105.) It is thus evident that Mr. Guthrie obtained, in a pure state, the substance now called chloroform; but he erroneously supposed his product to be the well-known oily liquid of the Dutch chemists, which it greatly resembles, and for the preparation of which he believed he had fallen on a cheap and easy process. Under this impression, he called the substance, in his communications, *chloric ether*, one of the names by which *Dutch liquid*, or *Ethene dichloride*, is designated. He was induced to make the preparation from noticing, in Professor Silliman's Elements of Chemistry, a reference to the Dutch liquid as a grateful diffusible stimulant, when properly diluted with alcohol and water.

Properties. Chloroform is "a heavy, clear, colorless, diffusive liquid, of a characteristic, pleasant, ethereal odor, a burning, sweet taste, and a neutral reaction. Soluble in about 200 parts of water, and, in all proportions, in alcohol or ether; also in benzol, benzin, fixed or volatile oils. Sp. gr. 1·485–1·490 at 15° C. (59° F.). It boils at 60° to 61° C. (140° to 142° F.), corresponding to the presence of three-fourths (¾) to one (1) per cent. of alcohol." *U. S.* According to Remys (*Archiv der Pharm.*, 3, v. 31), pure chloroform has the sp. gravity of 1·500 at 15° C. (59° F.). Besnou gives the densities of various mixtures of alcohol and the purest commercial chloroform at 4·5° C. (40° F.) as follows:

Specific Gravity.	Chloroform, per cent.	Alcohol, per cent.	Specific Gravity.	Chloroform, per cent.	Alcohol, per cent.
1·4945	100·0	0·0	1·4772	97·5	2·5
1·4908	99·5	0·5	1·4602	95·0	5·0
1·4874	99·0	1·0	1·4262	90·0	10·0
1·4845	98·5	1·5	1·4090	87·5	12·5

When pure, it has no action on potassium, except to cover the surface of the metal with small bubbles of gas. Chloroform is a powerful antiseptic. It does not, like creasote, coagulate albumen. It is scarcely acted on by sulphuric acid in the cold, but dissolves readily in alcohol and ether. The alcoholic solution, when moderately diluted with water, forms an aromatic, saccharine liquid of a very grateful taste. A strong alcoholic solution is decomposed by abundance of water, the chloroform separating and subsiding, and the alcohol uniting with the water. It is liable to decomposition by sunlight, or even diffused daylight; and hence the propriety of keeping it in bottles, covered with dark paper, in a rather dark place. Chloroform has extensive solvent powers, being capable of dissolving caoutchouc, gutta-percha, mastic, elemi, tolu, benzoin, and copal. Amber, sandarac, lac, and wax are only partially soluble. It also dissolves iodine, bromine, the organic alkalies, the fixed and volatile oils, most resins, and fats. It dissolves sulphur and phosphorus sparingly. It possesses the power of dissolving a large quantity of camphor, and furnishes the means of administering that medicine in an elegant form. As a general solvent, it has the advantage over ether of not being inflammable; the inflammability of the latter being the cause of frequent accidents. For an extensive list of substances, soluble, insoluble, and partly soluble in chloroform, see a paper by M. Lepage, of Gisors, France, copied into *A. J. P.*, 1852, p. 147.* It has been found by J. B. Barnes that chloroform has the power of preventing the alcoholic, lactic, and other fermentations, probably by killing the organisms that provoke these processes. Twenty minims preserved sixteen ounces of malt, to which two drachms of yeast had been added, as long as the experiment lasted. The same quantity kept fresh eight fluidounces of milk in a warm place for five days. Mucilage and infusions were preserved for weeks with one minim or even less to the ounce. Similar results were reached by Mr. F. J. Barrett and others. (*P. J. Tr.*, 1874, pp. 441, 442, 455.) The active properties of chloroform forbid its use as a preservative of medicinal infusions, but from milk it could always be removed by boiling. A. Munz (*P. J. Tr.*, 1875, p. 967) proposes the employment of chloroform as a test between chemical and living ferments, since he has found it to have no effect upon the former, though absolutely destructive to the latter.

Composition. Chloroform is composed of one atom of carbon, one of hydrogen, and three of chlorine. Its simplest derivation in theory is from marsh-gas (*methane*), CH_4, whence it is often called "*trichloro-methane*." While it can be thus produced, by the action of chlorine upon marsh-gas, in practice, it is formed either from alcohol by the action of bleaching-powder, or from chloral by an alkaline hydrate.

The reactions are sometimes complex, but if the temperature be carefully kept at from 70° C. (158° F.) to 73° C. (163·4° F.), they are essentially as follows:

$$C_2H_6O + CaOCl_2 = CaCl_2 + C_2H_4O + H_2O;$$

that is, one molecule of bleaching-powder, reacting with one of alcohol, yields one of calcium chloride, one of aldehyd, and one of water. The aldehyd formed is then further decomposed according to the reaction:

$$2(C_2H_4O) + 6(CaOCl_2) = 3CaCl_2 + 3Ca(OH)_2 + 2(C_2HCl_3O_2);$$

that is, two molecules of aldehyd, reacting with six of bleaching-powder, yield three of calcium chloride, three of calcium hydrate, and two of chloral. The chloral is, however, decomposed by the free base calcium hydrate according to the reaction:

$$2(C_2HCl_3O_2) + Ca(OH)_2 = Ca(CHO_2)_2 + 2(CHCl_3);$$

that is, two molecules of chloral, reacting with one of calcium hydrate, yield one of calcium formate and two of chloroform.

Impurities and Tests. Chloroform is liable to contain alcohol and ether, both of which lower its specific gravity. If it have a less density than 1·38, it will float instead of sinking in a mixture of equal weights of concentrated sulphuric acid and water, after it has cooled. M. Mialhe has proposed the following test for the presence of alcohol. Drop into distilled water a small quantity of the chloroform. If pure, it will remain transparent at the bottom of the glass; but, if it contain even a small proportion of alcohol, the globules will acquire a milky appearance. Soubeiran's method was to agitate almond oil and chloroform together in a tube. If the chloroform be pure, it remains clear; if it contain as much as 5 or 6 per cent. of alcohol, it becomes milky. (*Journ. de Pharm.*, Août, 1860, p. 95.) Prof. Procter detected alcohol by adding the suspected chloroform to an oxidizing mixture of bichromate of potassium and sulphuric acid. If alcohol be present, the deep orange color of the chromic mixture will gradually become green; if absent, no change of color will take

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* The following table of the solubility of the several alkaloids and their salts in chloroform, prepared with great care by A. Schlimpert, may be of some practical use. At 17·7° C. (64° F.) 100 parts of chloroform dissolve

Morphine	1·66	Sulphate of cinchonine	3·00	Caffeine	11·00
Acetate of morphine	1·66	Chinoidine	25·30	Digitaline	1·25
Quinine	15·00	Veratrine	11·60	Brucine	14·00
Sulphate of quinine	0·00	Atropine	33·00	Aconitine	22·00
Hydrochlorate of quinine	11·10	Strychnine	14·10	Santonin, pure	23·00
Cinchonine	2·50	Nitrate of strychnine	6·60	Santonin, impure	33·30

(*A. J. P.*, 1860, p. 160; from *Archiv de Pharm.*, Nov. 1859, p. 151.)

place. (*A. J. P.*, 1856, p. 213.) Hoffmann's violet has been recently suggested as a test. If a small portion is added to chloroform containing alcohol, the solution is colored a deep purple. Boettger recommends adding to the chloroform a solution of molybdic acid in pure, strong sulphuric acid, when even a trace of alcohol will cause an intense blue color. (1879.) A. C. Oudemans, Jr., affirms that the percentage of alcohol may be correctly estimated by the power of the suspected liquid to dissolve cinchonine (*A. J. P.*, 1873, p. 223), and gives the table inserted in the note below.[*] The most injurious impurities are the chlorinated pyrogenous oils, already alluded to. These are different as obtained from methylic or normal chloroform. The oil, obtained by Soubeiran and Mialhe from methylic chloroform, is an oleaginous, yellow liquid, lighter than water, and of a peculiar nauseous empyreumatic odor, perceptible in the methylic chloroform itself. In commercial chloroform it is sometimes present to the amount of 6 per cent. It is easily set on fire, and burns with a smoky flame, chlorine being among the products of its combustion. The oil procured from normal chloroform, which contains it in the amount of about one-fifth of 1 per cent. only, is essentially different from the methylic chloroform oil. It is heavier than water, and has an acrid, penetrating odor, unlike that of the other oil. When the vapor of these oils is inspired or even smelt, it causes, according to Dr. Gregory, distressing sickness and headache. These pyrogenous oils are detected and removed by *pure* and *strong* sulphuric acid. Chloroform, when pure, upon being mixed with an equal volume of this acid, does not color it; but, when contaminated with these oils, gives the acid a color, varying from yellow to reddish brown, according to the amount of impurity. Alcohol also is detected and removed by sulphuric acid. In applying this test, several fluidounces of chloroform should be used; as a slight change of color cannot be easily seen in a test-tube, and care must be taken to see that mechanical impurities like cork-dust, dirt, etc., have been filtered out of the specimen, or the acid will be discolored from this cause. A still more delicate test of the oily impurities, according to Dr. Gregory, is the smell which they leave. If chloroform, thus contaminated, be poured upon the hand, it quickly evaporates, leaving the oily impurities, recognizable by their offensive odor, now no longer covered by that of the chloroform. The pure substance, rubbed on the skin, quickly evaporates, and leaves scarcely any smell. Chloroform sometimes contains Dutch liquid, which may be discovered by adding an alcoholic solution of potassa; when the mixture, if this impurity be present, will heat and give off a permanent gas, which is *chloride of acetyl*, C_2H_3OCl. (*Geuther.*)[†] Fuming nitric acid, heated with chloroform to 90° C. (194° F.) for 120 hours, forms a new substance, chloropicrine. (*Journ. de Pharm.*, 4e sér., xv.)

Certain conclusions of Prof. John M. Maisch upon the subject of chloroform, drawn from a series of practical and experimental observations, are worthy of notice. Chloroform may be made of the sp. gr. 1·5, or perhaps somewhat heavier, and this is its density when pure; but it will not keep so well as when of the officinal strength from 1·490 to 1·494. When pure, or even of the sp. gr. of about 1·49, it is quickly decomposed in direct sunlight, and more slowly in diffused daylight; and the presence of water, however small in quantity, favors the decomposition. The prod-

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[*] Percentage of Alcohol.	Percentage of Cinchonine by weight, at 17° C.	Difference between it and pure Chloroform.	Percentage of Alcohol.	Percentage of Cinchonine by weight, at 17° C.	Difference between it and pure Chloroform.
0	0·28	0	6	3·39	40
1	0·90	62	7	3·79	36
2	1·46	56	8	4·15	33
3	1·99	53	9	4·48	28
4	2·49	47	10	4·76	...
5	2·96	43	11	......	...

The cinchonine is best prepared by precipitating a weak alcoholic solution of a pure salt of the alkaloid by ammonia.

[†] In relation to chloroform, see the paper of Soubeiran and Mialhe, *Journ. de Pharm.*, July, 1849, copied into *A. J. P.*, xxi. 313; also the paper of Dr. Gregory, *Chem. Gaz.*, May 15, 1850.

ucts of its decomposition are hydrochloric acid and phosgene gas. If, however, it be perfectly excluded from the light, it will keep indefinitely; Wiggers having preserved some, unaltered, for fifteen years. According to Schacht, moreover, pure chloroform will resist even sunlight, if in a perfect vacuum. To prevent the decomposition of chloroform the most effectual means is the addition of alcohol. If reduced by this to the sp. gr. 1·480 or 1·484, it will keep well in diffused daylight, and, for a time at least, even in the sun's rays, if perfectly free from moisture. At the sp. gr. 1·475 or lower, it remains unaffected whether in diffused light or in the sun, and whether the bottles be damp or dry. The measures, therefore, to secure chloroform from decomposition are two, either of which will answer; first, to keep it perfectly secluded from light, from the moment of rectification; or, secondly, to reduce the sp. gr. to 1·475 by alcohol, as suggested by Dr. Squibb. Sulphuric acid will not decompose chloroform in the dark; in the light it evolves hydrochloric acid. One of the best criteria of its purity is a constant boiling point. When of the sp. gr. 1·496, it boils at 67° C. (152·6° F.). A slight acid reaction in chloroform is not easily detected, as litmus is quite insoluble in that fluid. It is best observed by allowing a few drops of chloroform to evaporate spontaneously with one drop of an aqueous solution of litmus duly neutralized. The color will be changed to reddish. After becoming acid, chloroform may be readily regenerated, by agitating it with solution of carbonate of sodium, and distilling from a little unslaked lime. From what has been said above, chloroform to be kept for use should have the sp. gr. 1·475, and if denser than this, should be brought to it by the addition of alcohol. It is best kept in cork-stoppered bottles. As the cork is not acted on by chloroform, if it become yellow and softened, it will indicate the presence of an acid, and thus act as a test. (*A. J. P.*, 1868, p. 289.)

Boettger states that chloroform altered by the sun's rays, containing hydrochloric acid and having a chlorinous odor, may be restored and made fit for inhalation by agitation with a few fragments of caustic soda, and that the fluid may be kept exposed to light, if protected in the same way. (*Ibid.*, Sept. 1866, p. 473; from *Journ. de Pharm.*, Avril, 1864.) M. Jaillard (*Journ. de Pharm.*, 4, sér. xxii., p. 305) states that he has frequently found both hydrochloric and formic acids in chloroform exposed for sale. He employs nitrate of silver as a test, using an excess of the reagent; he filters out the precipitated chloride, and boils, when, if formic acid be present, black metallic silver is deposited.

Officinal Tests. The U. S. Pharmacopœia directs that "if 5 C.c. of Purified Chloroform be thoroughly agitated with 10 C.c. of distilled water, the latter, when separated, should not affect blue litmus paper (abs. of acids), nor test-solution of nitrate of silver (chloride), nor test-solution of iodide of potassium (free chlorine). If a portion be digested, warm, with solution of potassa, the latter should not become dark colored (abs. of aldehyde). On shaking 10 C.c. of the Chloroform with 5 C.c. of sulphuric acid, in a glass-stoppered bottle, and allowing them to remain in contact for twenty-four hours, no color should be imparted to either liquid. If a few C.c. be permitted to evaporate from blotting-paper, no foreign odor should be perceptible after the odor of Chloroform ceases to be recognized." *U. S.* These tests imply the presence of but a minute proportion of alcohol, and the total absence of chlorine and those volatile and empyreumatic substances which constitute the most injurious impurities of chloroform. A heat that would be felt through the bottle, on the admixture of sulphuric acid with chloroform, would evince the presence of too much alcohol or water. The want of discoloration from the contact of the two liquids shows the absence of empyreumatic oily matter; but a very slight discoloration might proceed from the alcohol present, and would not, therefore, be a material objection. A color bordering on that of madeira wine would imply an objectionable amount of impurities. The volatile impurities are less volatile than chloroform, and would consequently be the last to escape on the evaporation of the liquid. Impure chloroform, therefore, leaves a foreign odor behind it when allowed to evaporate from the hand, and especially when from a porcelain plate, in the amount and manner indicated; and if a specimen stand this test well, it may be considered as free from noxious volatile impurity. The slight foreign aroma without pungency, which is given out under these circumstances, is of no injurious significance. It is stated that chloroform made from chloral may be distinguished from other chloroform by its remaining colorless when the sulphuric acid test is employed, and by its leaving no aromatic residue when evaporated, evidences of its absolute purity. It has been claimed that this chloral chloroform does not undergo decomposition, but this has been proved not to be correct. (*A. J. P.*, xlii. 409.)

Medical Properties and Uses. Chloroform, when applied locally, is very irritant and produces decided pain, which may be followed by some numbness and local anæsthesia. If the chloroform be prevented from evaporating, its prolonged contact with the skin is apt to produce blistering. Taken internally, it is absorbed and acts upon the general system. The rapidity of its absorption, and, to some extent, its general effects, depend upon the method in which it is administered. It is commonly exhibited by the mouth or by inhalation. Taken into the stomach in doses of 15 to 25 drops (0·24–0·38 C.c.), it induces only gastric symptoms, chiefly due to its irritant properties; but when there is excessive flatulence, colic, or gastralgia, it not only causes an increased peristalsis and expulsion of any flatus present, but evinces a distinct local narcotic influence by quieting pain and spasm. Taken in doses of 1 to 2 fluidrachms (3·75–7·5 C.c.), it produces a narcotism similar to that seen when it is administered by inhalation, the narcotism, however, developing and passing off much more slowly than in the latter case. Chloroform, as prepared by Mr. Guthrie, was used internally as early as 1832 by Professor Ives and Dr. Nathan B. Ives, of New Haven, in asthma, spasmodic cough, scarlet fever, and atonic quinsy, with favorable results. (*Silliman's Journ.*, xxi. 406, 407.) It was employed by Dr. Formby, of Liverpool, in hysteria, in 1838; by Mr. Tuson, of London, in cancer and neuralgic affections, in 1843; and by M. Guillot, of Paris, in asthma, in 1844. The first case in which it was employed in inhalation is related by Professor Ives, of New Haven, under date of the 2d of Jan. 1832. The case was one of pulmonic disease, attended with general debility and difficult respiration, and was effectually relieved. (*Silliman's Journ.*, vol. xxi., Jan. 1832, p. 406.) In March, 1847, the action of the pure substance by inhalation was tried on the lower animals, by M. Flourens, and its effects on the spinal marrow described. In November of the same year, Dr. Simpson, of Edinburgh, after experimenting with a number of anæsthetic agents in order to discover a substitute for ether, tried chloroform at the suggestion of Mr. Waldie, and, having found its effects favorable, brought it forward as a new remedy for pain, by inhalation in surgery and midwifery. The advantages which he conceived it to possess over ether were the smallness of the dose, its more prompt action, more agreeable effects, less tenacious odor, greater cheapness, and greater facility of exhibition.

The usual effects produced by a full dose of chloroform, administered by inhalation, are the rapid production of coma, relaxation of the muscles, slow and often stertorous breathing, upturning of the eyes, and total insensibility to agents which ordinarily produce acute pain. The effect on the heart's action is somewhat variable, but the pulse is usually quickened, with a more or less marked loss of volume and firmness. Sometimes frothing of the mouth takes place, and, more rarely, convulsive twitches of the face and limbs. The insensibility is generally produced in one or two minutes, and usually continues for five or ten minutes; but the effect may be kept up for many hours, provided the inhalation be cautiously renewed from time to time. As a general rule, no recollection is retained of anything that occurred during the state of insensibility. In some cases sensibility is distinctly affected before consciousness, but the loss is rarely complete enough to be of any practical value; so that it is almost always necessary to produce unconsciousness before the surgeon can commence his operation.

The dose of chloroform for inhalation is a fluidrachm (3·75 C.c.), equivalent to 250 drops, or more, to be repeated in two minutes, if the desired effect should fail to be produced. The most convenient inhaler is a handkerchief, loosely twisted into the form of a bird's nest, which, after having been imbued with the chloroform, is held to the mouth and nose. The use of this simple inhaler insures a due admixture of atmospheric air with the vapor of the chloroform. The patient should always be in the horizontal posture. The moment insensibility is produced, which should be brought on *gradually*, the inhalation should be suspended; and, if consciousness return too soon, it should be cautiously renewed. In all cases an experienced assistant should attend to the administration of the chloroform and to nothing else, watching the state of the respiration and pulse. The moment there is the least snoring or failure of the pulse, the vapor should be withdrawn. As shown by Claude Bernard, the hypodermic use of morphine greatly prolongs the anæsthesia caused by chloroform. Chloroform should not be administered to persons subject to epilepsy, affected with organic disease of the heart, or predisposed to syncope. Even with the greatest care, there is always danger in the anæsthetic use of this agent. It is estimated (*Med. Times and Gaz.*, 1870; *Pacific Med. Journ.*, June, 1869) that death occurs once in 3000 inhalations on an average. In very many fatal cases the operation has been a very trifling one, and death has occurred in the most robust, and in those who had previously taken the anæsthetic without bad effects. The advantages which chloroform has over ether are in its greater rapidity of action, and in the fact that it is less prone to produce, as an after-effect, much nausea and vomiting. The greater safety of ether, however, more than counterbalances these advantages, so that a large proportion of surgeons believe the use of chloroform unjustifiable, except under especial circumstances. The reason that ether is so much safer than chloroform lies not chiefly in the greater power of the latter agent, but in the fact that it is directly paralyzant to the heart, whilst ether is primarily stimulant to that viscus. Experiments show that in the lower animals the arterial pressure steadily falls during the administration of the chloroform, whilst under ether it rises, and clinical experience abundantly demonstrates that the effects of these agents upon the circulation in man and in the lower animals are identical. As chloroform accidents usually occur very suddenly, the patient should always be closely watched. In most instances a peculiar pallor of the face is the first evidence of danger. The remedies for the accident are placing the patient at an angle of 45°, with the head downward, or even completely inverting the person, cold air fanned upon the face, cold water poured upon the head, sinapisms to the feet, frictions and heat to the body and extremities, and ammonia to the nostrils. If respiration ceases, the tongue should be seized with the artery-forceps, and pulled forward from off the glottis, and artificial respiration vigorously performed. When the patient can swallow, strong alcoholic drinks may be given with advantage. Dr. Halfourd has proposed the injection of liq. ammonia into the veins, and it has been successfully practised in one or two cases; and if circumstances favor it, intravenous injections of the tincture of digitalis may be employed. Faradaic irritation of the body should also be practised, and in some cases faradization of the phrenic nerve has seemed to be of service. Sometimes chloroform produces unpleasant remote effects; such as abolition of smell, perversion of taste, and loss of tonicity in the bladder and rectum.

In midwifery chloroform is believed to be safer than in surgery, and its use is very extensive. It certainly tends to increase the danger of post-partum hemorrhage, but this tendency can be overcome by the administration of ergot after the head has come well down upon the perineum. It is frequently stated that no case of death has occurred from its administration during labor; but this appears to be a mistake. On account of its power of producing muscular relaxation, chloroform is frequently employed in general and local spasms. In setting fractured bones, in reducing dislocations or strangulated hernias, etc., the surgeon frequently employs it, and it is often used by the physician in hiccough, chorea, hooping-cough, hysteria, the paroxysm of asthma, angina pectoris, biliary and nephritic colic, tetanus, poisoning from strychnine, hydrophobia, and the paroxysm of tic douloureux. In these cases it is superior to ether, when a very prompt action is desirable.

As chloroform is powerfully sedative, and ether powerfully stimulant, it was very naturally supposed that, by combining them, the depressing effects of the former might be counteracted by the latter; but experience has not confirmed the suggestion of theory in this case; as fatal effects have several times followed the joint administration of the two anæsthetics. This result may be in part explained by the more rapid volatilization of the chloroform, which may cause it to reach the surface of absorption with comparatively little admixture of the ethereal vapor, as suggested by Mr. Robert Ellis. (*Med. Times and Gaz.*, March 9, 1867.)

Locally, chloroform is employed as a very prompt, active counter-irritant and narcotic in neuralgia, colic, etc., and deep injections of it in the neighborhood of painful nerve trunks have been practised by Dr. Roberts Bartholow with asserted good effects.

M. Fournié has found that the vapor from a mixture of equal measures of glacial acetic acid and chloroform is even more effectual, as a local anæsthetic, than that of pure chloroform; producing complete insensibility of the skin in five minutes, if applied from a bottle heated simply by the hand. (*P. J. Tr.*, 1862, p. 385.)

Chloroform may be gelatinized by agitating it with an equal weight of white of egg in the cold. In three hours it takes the gelatinous form. A stronger preparation may be made by shaking together, in a bottle, four parts of chloroform and one of white of egg, and placing the mixture in water at 60° C. (140° F.). In four minutes the gelatinization is completed. *Gelatinized chloroform* may be applied to the skin, spread on linen, or by friction.

Chloroform, in vapor, may be used as a topical application to the rectum. M. Ehrenreich employed it with success in tenesmus. A drachm may be vaporized by the heat of warm water from a bottle, fitted with a flexible tube, inserted into the bowel. It may be applied to the skin in the form of a vapor douche, according to the method of Dr. Hardy, of Dublin. (See *Ranking's Abstract*, No. 19, p. 287.) Prof. Langenbeck, of Berlin, prefers chloroform to tincture of iodine, as an injection for the radical cure of hydrocele.

When an overdose of chloroform is taken by the mouth, it is essential to empty the stomach by the pump or siphon tube, and then treat the case much as in serious narcosis from inhalation. In a case of suicide by swallowing chloroform, in which death took place in about thirty-four hours, the lining membrane of the larynx and trachea was found inflamed, the bronchi were loaded with a dirty-gray purulent fluid, the lungs were inflamed as in the first stage of pneumonia, and the brain and its membranes congested; but these morbid appearances are not constant.

In relation to the preparations, consisting of chloroform and alcohol, which have been used under the name of "chloric ether," the reader is referred to *Spiritus Chloroformi.*[*]

Off. Prep. Mistura Chloroformi, *U. S.;* Spiritus Chloroformi; Tinctura Chloroformi Composita, *Br.*

CHLOROFORMUM VENALE. *U. S.* *Commercial Chloroform.*

(ÇHLŌ-RỌ-FŌR′MŬM VẸ-NĀ′LĒ.)

"A liquid containing at least 98 per cent. of Chloroform." *U. S.*

Chloroforme vénal, *Fr.;* Käufliches Chloroform, *G.*

The employment of commercial chloroform should be restricted to preparations for external application, or as a solvent. "Commercial Chloroform has nearly the same sensible properties as Purified Chloroform (see *Chloroformum Purificatum*). Its sp. gr. should not be lower than 1·470. If 1 C.c. be agitated with 20 C.c. of distilled water, the latter, when separated, should not render test-solution of nitrate of silver more than slightly turbid (limit of foreign chlorine compounds). When shaken with an equal volume of sulphuric acid, the subsiding, acid layer should not become quite black within twenty-four hours. A portion evaporated should leave no fixed residue." *U. S.*

Off. Prep. Chloroformum Purificatum, *U. S.;* Linimentum Chloroformi, *U. S.*

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[*] *Chlorodyne.* An empirical remedy under this name was first used in London, but is now in some of its imitations very largely employed in various parts of the world. Many formulas are extant. The following has been extensively used in Philadelphia. Hydrochlorate of morphine 8 grains, water fʒss, hydrochloric acid fʒss, chloroform fʒiss, tincture of cannabis Indica fʒi, hydrocyanic acid, U. S. P., ♏xii, alcohol f℥ss, oil of peppermint ♏ij, oleoresin of capsicum ♏i. The hydrochlorate of morphine and water are heated in a flask with the hydrochloric acid until a clear solution is produced, then the other ingredients are mixed together, and when the first solution is cold the mixture added to it. This is a dangerous remedy, and should be used with great care in three to ten drop doses for an adult.

CHONDRUS. *U. S.* *Irish Moss.*

(ꞒHŎN′DRỤS.)

"Chondrus crispus, Lyngbye, and Chondrus mammilosus, Greville. (*Nat. Ord.* Algæ.)" *U. S.*

Carrageen, *P.G.;* **Caragahen, Fucus Crispus; Carragaheen, Mousse marine pertée,** *Fr.;* **Irländisches Moos, Perlmoos, Knorpeltang,** *G.*

Gen. Ch. Frond cartilaginous, dilating upwards into a flat, nerveless, dichotomously divided expansion, of a purplish or livid-red color. *Fructification*, subspherical capsules in the substance of the frond, rarely supported on little stalks, and containing a mass of minute free seeds. *Greville.*

Chondrus crispus. Greville, *Alg. Brit.* 129, t. 15; *B. & T.* 305.—*Sphærococcus crispus.* Agardh.—*Fucus crispus.* Linn. The *Irish moss*, or *carrageen* as it is frequently called, consists of a flat, slender, cartilaginous frond, from two to twelve inches in length, dilated as it ascends until it becomes two or three lines in width, then repeatedly and dichotomously divided, with linear, wedge-shaped segments, and more or less curled up so as to diminish the apparent length. The capsules are somewhat hemispherical, and are imbedded in the disk of the frond. The plant grows upon rocks and stones on the coast of Europe, and is especially abundant on the southern and western coasts of Ireland, where it is collected. It is also a native of the United States, and is said to be gathered largely on the southern sea-coast of Massachusetts, where it is partly torn from the rocks, and partly collected upon the beach, on which it is thrown up during storms. It is prepared for market by spreading it out high on the beach, to dry and bleach in the sun. (Aug. P. Melzar, *Proc. A. P. Ass.*, 1860.) An elaborate account of the plant, its distribution on the sea-coast of Massachusetts, and of the mode of gathering and curing it, is given by Mr. G. Hubert Bates, of Scituate, Mass. (*U. S. Agricultural Report*, 1866; also *A. J. P.*, 1868, p. 417.)

When collected, it is washed and dried. In the fresh state it is of a purplish color, but, as found in the shops, is yellowish or yellowish white, with occasionally purplish portions. It is officinally described as "yellowish or white, horny, translucent; many-forked; when softened in water, cartilaginous; segments flat, wedge-shaped, or linear; at the apex emarginate or two-lobed; it has a slight sea-weed odor, and a mucilaginous, somewhat saline taste. One part of it boiled for ten minutes with 30 parts of water, yields a solution which gelatinizes on cooling." *U. S.* It swells in cold water, but does not dissolve. Boiling water dissolves a large proportion of it, and the solution, if sufficiently concentrated, gelatinizes on cooling. According to Feuchtwanger, it contains starch and pectin, with compounds of sulphur, chlorine, and bromine, and some oxalate of calcium. Herberger found 79·1 per cent. of pectin, and 9·5 of mucus, with fatty matter, free acids, chlorides, etc., but neither iodine nor bromine. M. Dupasquier discovered in it both of these elements, which had generally escaped attention in consequence of their reaction, as soon as liberated, upon the sulphide of sodium resulting from the decomposition of the sulphate of sodium of the moss when charred. (*Journ. de Pharm.*, 3e sér., iii. 113.) The pectin Pereira thought peculiar, and proposed to call *carrageenin.* It is distinguished from gum by affording, when dissolved in water, no precipitate with alcohol; from starch, by not becoming blue with tincture of iodine; from pectin, by yielding no precipitate with acetate of lead, and no mucic acid by the action of nitric acid. M. Ch. Blondeau gives the name of *goëmine* to a substance obtained by boiling carrageen (*goémon*, *Fr.*) for several hours in distilled water, and precipitating the mucilaginous liquid by alcohol. The precipitate, being redissolved in water, yields on evaporation thin, transparent, elastic plates, resembling ichthyocolla, which soften and swell up on contact with cold water. This substance, which is probably complex, is without smell or taste, neutral to test-paper, and dissolves completely in alkaline liquids. Blondeau's analysis gave 21·80 per cent. of carbon, 4·87 of hydrogen, 21·36 of nitrogen, 2·51 of sulphur, and 49·46 of oxygen. Flückiger, who analyzed this mucilage with care, found in it *no* sulphur, and only 0·88 per cent. of nitrogen.

The drug itself yielded not more than 1·012 per cent. of nitrogen. (*Pharmacographia*, 2d ed., p. 748.)*

Carrageen is nutritive and demulcent, and, being easy of digestion and not unpleasant to the taste, forms a useful article of diet in cases in which the farinaceous preparations, such as tapioca, sago, barley, etc., are usually employed. It has been particularly recommended in chronic pectoral affections, scrofulous complaints, dysentery, diarrhœa, and disorders of the kidneys and bladder. It may be used in the form of decoction, made by boiling a pint and a half of water with half an ounce of the moss down to a pint. Sugar and lemon-juice may usually be added to improve the flavor. Milk may be substituted for water, when a more nutritious preparation is required. It is recommended to macerate the moss for about ten minutes in cold water before submitting it to decoction. Any unpleasant flavor that it may have acquired from the contact of foreign substances is thus removed.

CHRYSAROBINUM. *U.S.* *Chrysarobin.*

(ÇHRY̌S-Ạ-RỌ-BĪ'NŬM.)

"A mixture of proximate principles, commonly misnamed Chrysophanic Acid, extracted from Goa-powder, a substance found deposited in the wood of the trunk of Andira Araroba. Aguiar. (*Nat. Ord.* Leguminosæ, Papilionaceæ.)" *U. S.*

Goa Powder, Araroba, Poh di Bahia; Poudre de Goa, *Fr.;* Goa-Pulver, *G.*

Chrysarobin, or Araroba, has long been used as a medicine in Brazil, and exported in considerable quantities to Portugal, whence it found its way through the Portuguese colonies into Eastern commerce. In the East Indies it is usually known as Goa Powder. Indeed, the identity of the two powders was first proved in 1875 by Dr. J. F. Dasilva Lima. (*P. J. Tr.*, v. 724, 801, 806.)

Chrysarobin has been supposed to be yielded by certain lichens, but was shown by Dr. R. A. Monteiro to be obtained from a leguminous tree abundant in the forests of the Brazilian province of Bahia, which was referred by Mr. E. M. Holmes to the genus Cæsalpinia, but which was determined by studies made in its native forests by Dr. J. M. de Aguiar to be an undescribed species of Andira.

Andira Araroba, Aguiar, is a large tree, attaining a height of 100 feet, with a smooth trunk, and a spheroidal, not very bushy head. The wood is yellowish, with numerous longitudinal canals, besides abundant irregular interspaces or lacunæ, in which the chrysarobin is found. (See *P. J. Tr.*, ix. 755; x. 42, 814.) The oldest trees yield the largest amount of the powder; the parts containing it are finely chipped or scraped off. The workmen who procure it often suffer severely from irritation of the eyes and face.

Properties. "A pale orange yellow, crystalline powder, permanent in the air, odorless and tasteless, almost insoluble in water, only slightly soluble in alcohol, readily soluble in ether and in boiling benzol. When heated to about 162° C. (323·6 F.), it melts, and may be partially sublimed. On ignition it is wholly dissipated. In solutions of alkalies it is soluble with a yellowish red or reddish-yellow color, which is changed to red by passing air through the liquid. Sulphuric acid dissolves it with a deep blood-red color; on pouring the solution into water, the substance separates again unchanged." *U. S.* As first obtained, chrysarobin is stated to be of a pale primrose yellow, but it rapidly darkens with age, so that in commerce it varies from a dull ochre color to a dark chocolate or maroon-brown. It is sometimes a rather fine powder, but is usually more or less agglomerated, and not rarely contains fragments of woody tissue. Its taste is bitter. It is insoluble in water and most menstrua, but yields as much as 80 per cent. of its weight to solutions of caustic alkalies and to benzol. Attfield analyzed Goa powder, and found, along with 2 per cent. of resin, 5·5 per cent. of woody fibre, and 7 per cent. of bitter extractive, 80 to 84 per cent. of what he considered to be chrysophanic acid; but Liebermann and Siedler showed that this was not chrysophanic acid at all, but a substance easily convertible into the acid, which substance they called *chrysarobin*, and gave to it the formula $C_{30}H_{26}O_7$. (*A. J. P.*, 1879, p. 80.)

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* Most species of sea-weed contain a mucous substance analogous to, if not identical with, that of carrageen, but are not available for use on account of their disagreeable taste. In France the *Gigartina aciculosus* is said to be extensively sold as carrageen. (Dragendorff, *Jahresb.*, 1874, p. 42.)

Medical Uses. When taken internally in sufficient amount, chrysarobin acts as a decided gastro-intestinal irritant, producing large, very watery, brownish stools, and repeated vomiting, without much nausea. Dr. J. A. Thompson (*N. R.*, 1877, p. 167) states that it acts efficiently in doses of 20 to 25 grains (1·3–1·565 Gm.) for the adult, 10 grains (0·65 Gm.) for children 12 years of age, 6 grains (0·4 Gm.) for babies. He believes it to have practical value as affording a very prompt and efficient means of clearing out the whole primæ viæ, and of causing very large discharges of bile. It is, however, not probable that it will be used to any extent as an internal remedy.

Chrysarobin has been long used in South America and India as a remedy in skin diseases, but the attention of the general profession was first called to it in 1874 by Sir Joseph Fayrer. It is at present used largely for the preparation of chrysophanic acid, in which all of its properties appear to reside, and is itself used to some extent in diseases of the skin.

Off. Prep. Unguentum Chrysarobini.

CIMICIFUGA. *U. S.* *Cimicifuga.* [*Black Snakeroot.*]

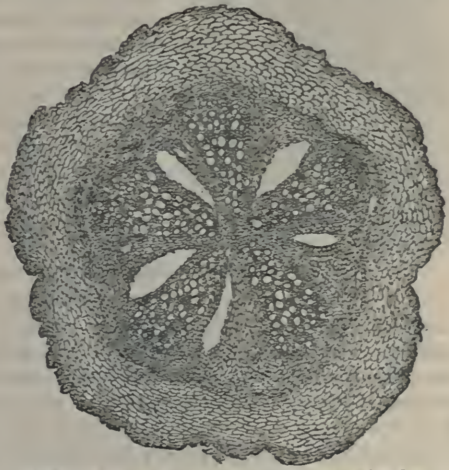
(CĬM-Ị-CĬF'U̇-GẠ.)

"The rhizome and rootlets of Cimicifuga racemosa. Elliott. (*Nat. Ord.* Ranunculaceæ.") *U. S.*

Black Cohosh; Racine d'Actée à Grappes, *Fr.;* Schwarze Schlangenwurzel, *G.*

Gen. Ch. Calyx four or five-leaved. *Petals* four to eight, deformed, thickish, sometimes wanting. *Capsules* one to five, oblong, many-seeded. *Seeds* squamose. *Nuttall.*

Cimicifuga racemosa. Torrey, *Flor.* 219; Carson, *Illust. of Med. Bot.* i. 9, pl. 3. —*C. serpentaria.* Pursh, *Flor. Am. Sept.* p. 372.—*Actæa racemosa.* Willd. *Sp. Plant.* ii. 1139.—*Macrotys racemosa.* Eaton's *Manual*, p. 288; *B. & T.* 8. This is a tall stately plant, having a perennial root, and a simple herbaceous stem, which rises from four to eight feet in height. The leaves are large, and ternately decomposed, having oblong-ovate leaflets, incised and toothed at their edges. The flowers are small, white, and disposed in a long, terminal, wand-like raceme, with occasionally one or two shorter racemes near its base. The calyx is white, four-leaved, and deciduous; the petals are minute, and shorter than the stamens; the pistil consists of an oval germ and sessile stigma. The fruit is an ovate capsule containing numerous flat seeds.

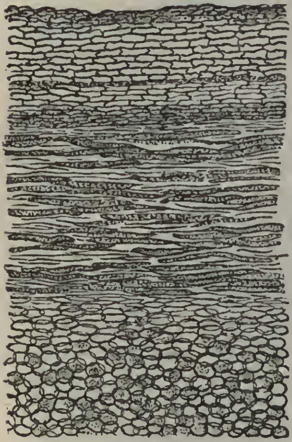


Transverse section of Cimicifuga; rootlet showing five ligneous rays.

The *black snakeroot*, or *cohosh* as this plant is sometimes called, is a native of the United States, growing in shady or rocky woods from Canada to Florida, and flowering in June and July. The root is the part employed.

Properties. The dried root consists of a thick, irregularly bent or contorted body or caudex, from one-third of an inch to an inch in thickness, often several inches in length, furnished with many slender radicles, and rendered exceedingly rough and jagged in appearance by the remains of the stems of successive years, which to the length of an inch or more are frequently attached to the root. It is officinally described as follows. "The rhizome is horizontal, hard, two inches (5 cm.) or more long, about one inch (25 mm.) thick, with numerous stout, upright or curved branches, terminated by a cup-shaped scar, and with numerous, wiry, brittle, obtusely quadrangular rootlets, about one-twelfth of an inch (2 mm.) thick; the whole brownish-black, nearly inodorous, and having a bitter, acrid taste. Rhizome and branches have a smooth fracture, with a large pith, surrounded by numerous, sublinear, whitish wood-rays, and a thin, firm bark. The rootlets break with a short fracture, have a thick bark, and contain a ligneous cord branching into about four rays." *U. S.* The odor, though not strong, is peculiar and rather disagreeable, and is gradually lost by keeping. The root yields its virtues to boiling water. It was found by Mr. Tilghman, of Philadelphia, to contain gum, starch, sugar, resin, wax, fatty matter, tannic and gallic acids, a black coloring matter, a green coloring matter, lignin, and salts of potassa, lime, magnesia, and iron. (*A. J. P.*, vi. 20.) It no doubt also contains, when fresh, a volatile principle, with which its virtues may be in some degree associated; as we are confident that it is more efficacious in the recent state, than when long kept. In fact, Mr. George H. Davis, in a more recent analysis, has separated by distillation a small proportion of volatile oil, having decidedly the peculiar odor of the root. Mr. Davis also found, in addition to the principles above mentioned, albumen and extractive among the organic, and silica among the inorganic constituents. The sugar, moreover, noticed by him was of the uncrystallizable variety, and the resin of two kinds, one soluble in alcohol but not in ether, the other soluble in both these menstrua. (*A. J. P.*, xxxiii. 396.)

A crystallizable principle has been obtained from the root by Mr. T. Elwood Conard. After failing to obtain any volatile principle from the fresh root by distillation, he prepared a strong tincture of the root, treated this with the solution of subacetate of lead, which precipitated resin, tannin, and coloring matters, then filtered, and precipitated the lead by sulphuretted hydrogen in excess, and allowed the tincture to evaporate spontaneously; and, finally, having treated the residuary powder with benzin, afterwards washed it with water, dissolved it to saturation in strong alcohol, and treated the solution with alumina. The mixture was allowed to evaporate to a dry mass, which was nearly exhausted with alcohol. The solution, being allowed to evaporate, left behind a crystalline mass, somewhat resembling alum. This substance has little taste on account of its extreme insolubility in the saliva; but in alcoholic solutions has very strongly the acrid taste characteristic of the fresh root. The crystals are very soluble in cold, and more so in hot alcohol, soluble also in chloroform, and slightly in ether. They are fusible and inflammable. They are neutral, possessing neither acid nor alkaline properties. Their effects on the system were not examined. (*A. J. P.*, 1871, p. 151.)


Longitudinal section, highly magnified.

Medical Properties and Uses. The effects of cimicifuga in health have not been fully investigated. It undoubtedly exercises considerable influence over the nervous system, probably of a sedative character; but this influence, so far as our observation has gone, is shown more in morbid states of that system than in health. Dr. Hildreth, of Ohio, found it, in large doses, to produce vertigo, impaired vision, nausea, and vomiting, and a reduction of the circulation; but from very large quantities he observed no alarming narcotic effects. Dr. N. S. Davis uniformly found it to lessen the force and frequency of the pulse, to soothe pain and allay irritability. (*Trans. of Am. Med. Assoc.*, i. 352.) Large doses of it will certainly produce marked nervous depression, with severe headache and often vertigo. Its common name was probably derived from its supposed power as an antidote to the bite of the rattlesnake. It was originally employed in domestic practice in rheumatism, dropsy, hysteria, and various affections of the lungs, particularly those resembling consumption. The first published notice of its use in phthisis was by Dr. Thomas J. Garden, of Charlotte, Virginia. (*Am. Med. Recorder*, Oct. 1823.)

In ordinary chorea, cimicifuga is an efficient remedy. At one time it was employed to a considerable extent in rheumatism, but at present is never used.

It may be given in substance, decoction, tincture, or extract. The dose of the powder is from a scruple to a drachm (1·3–3·9 Gm.). The *decoction* has been much used, but is thought by some not to contain all the virtues of the root. An ounce of the bruised root may be boiled for a short time in a pint of water, and one or two fluidounces (30–60 C.c.) given for a dose. From half a pint to a pint of the decoction may be taken without inconvenience during the day. The *tincture* is officinally made in the proportion of twenty parts in one hundred of alcohol, and given in the dose of one or two fluidrachms (3·75–7·5 C.c.). The fluid extract when properly made from good root is, however, the best preparation. The dose of it is from a half to one fluidrachm (1·9–3·75 C.c.) three or four times a day in water. The practitioners calling themselves eclectics use, under the name of *cimicifugin*, or *macrotin*, an impure resin obtained by precipitating a saturated tincture of the root with water. It is given in the dose of a grain or two (0·065–0·13 Gm.). The names, however, are inappropriate, as they should be reserved for the pure active principle or principles when discovered. (See *N. J. Med. Reporter*, viii. 247.)

Off. Prep. Extractum Cimicifugæ Fluidum, *U. S.;* Tinctura Cimicifugæ, *U. S.*

CINCHONA. *U. S.* *Cinchona.*

(CĬN-ÇHŌ'NA.)

"The bark of any species of Cinchona (*Nat. Ord.* Rubiaceæ, Cinchoneæ), containing at least 3 per cent. of its peculiar alkaloids." *U. S.*

Syn. Peruvian Bark; Cinchona Bark.

Varieties.

CINCHONA FLAVA. *Yellow Cinchona.* [*Calisaya Bark.*] *U. S.* "The bark of the trunk of Cinchona Calisaya, Weddell. (*Nat. Ord.* Rubiaceæ, Cinchoneæ), containing at least 2 per cent. of quinine." *U. S.* "The bark of Cinchona Calisaya." *Br.*

Cinchonæ Flavæ Cortex, *Br.; Yellow Cinchona Bark.*

CINCHONA RUBRA. *Red Cinchona.* [*Red Bark.*] *U. S.* "The bark of the trunk of Cinchona succirubra, Pavon (*Nat. Ord.* Rubiaceæ, Cinchoneæ), containing at least 2 per cent. of quinine." *U. S.* "The bark of Cinchona succirubra, Pavon." *Br.*

Cinchonæ Rubræ Cortex, *Br.; Red Cinchona Bark.*

CINCHONÆ PALLIDÆ CORTEX. *Br.* *Pale Cinchona Bark.* "The bark of the Cinchona Condaminea, *vars.* chahuarguera, Pavon, and crispa, Tafalla." *Br.*

Quinquina, *Fr.;* China, Peruvianische Rinde, *G.;* China, *It.;* Quina, *Sp.*

Botanical History.

Though the Peruvian bark was introduced into Europe so early as 1640, it was not till the year 1737 that the plant producing it was known to naturalists. In that year La Condamine, on a journey to Lima, through the province of Loxa, had an opportunity of examining the tree, of which, upon his return, he published a description in the Memoirs of the French Academy. Soon afterwards Linnæus gave it the name of *Cinchona officinalis*, in honor of the Countess of Cinchon, who is said to have first taken the bark to Europe; but, in his description of the plant, he united the species discovered by La Condamine with *C. pubescens*, a specimen of which had been sent to him from Santa Fé de Bogota. For a long time it was not known that more than one species existed; and *C. officinalis* continued, till a comparatively recent period, to be recognized by the Pharmacopœias as the only source of the Peruvian bark of commerce. But a vast number of plants belonging to the Linnæan genus Cinchona were in the course of time discovered; and the list became at length so unwieldy and heterogeneous, that botanists were compelled to distribute the species into several groups, each constituting a distinct genus, and all associated in the natural family of Cinchonaceæ. Among these genera, the *Cinchona* is that which embraces the true Peruvian bark trees, characterized by the production of the alkaloids, quinine, çinchonine, etc., as well as by certain botanical peculiarities, among which the most distinctive is probably the dehiscence of the capsule from the base towards the apex, or from below upward. The new genera *Exostemma* and *Buena* embrace species which have been, perhaps, most frequently referred to as Cinchonas; but they are sufficiently characterized, the former by the projection of the stamens beyond the corolla, a peculiarity which has given name to the genus, the latter by the different shape of the corolla, the separation of the calyx from the fruit at maturity, and the opening of the capsule from above downward. More recently Weddell has separated several generally admitted species from Cinchona, and instituted a new genus, which he proposes to name *Cascarilla.* This includes the former *Cinchona magnifolia* of Ruiz and Pavon (*C. oblongifolia* of Mutis), the *C. stenocarpa* of Lambert, the *C. acutifolia* of Ruiz and Pavon, the *C. oblongifolia* of Lambert, the *C. macrocarpa* of Vahl, and the *C. cava* of Pavon, which differ from the true Cinchona in having the dehiscence of the capsules from the apex towards the base, or from above downward, and the barks of which contain neither of the alkaloids above referred to. (Weddell, *Hist. Nat. des Quinquinas*, p. 77.) With this brief preliminary notice, we shall proceed to consider the true Cinchonas. It may be proper, however, first to say, that the botanists who have personally observed these plants, besides La Condamine, of whom we have before spoken, are chiefly Joseph de Jussieu, who in the year 1739 explored the country about Loxa, and gathered specimens still existing in the cabinets of Europe; Mutis, who in 1772 discovered Cinchona trees in New Granada, and afterwards, aided by his pupil, Zea, made further investigations and discoveries in the same region; Ruiz and Pavon, who in 1777 began a course of botanical inquiries in the central portions of Lower Peru, and discovered several new species; Humboldt and Bonpland, who visited several of the Peruvian bark districts, and published the results of their observations after 1792; Pöppig, who travelled in Peru so late as 1832, and published an account of his journey about the year 1835; and finally Weddell, whose researches in Bolivia are so well known, and have been so productive of valuable information in relation to the Calisaya bark.

Gen. Ch. Calyx with a turbinate tube, and a persistent five-toothed limb. *Corolla* with a round tube, a five-parted limb, and oblong lobes valvate in æstivation. *Stamens* with short filaments inserted into the middle of the tube, and linear anthers entirely closed. *Stigma* bifid, subclavate. *Capsule* ovate or oblong, somewhat furrowed on each side, bilocular, crowned with the calyx, septicidal-dehiscent, with the mericarps loosened from the base towards the apex, the introflexed part disjoined. *Placentæ* elongated. *Seeds* numerous, erect, imbricated upward, compressed, winged, with a membranous margin, and a fleshy albumen.—The plants composing this genus are trees or shrubs. The leaves are opposite, upon short petioles with flat margins, and are attended with ovate or oblong, foliaceous, free, deciduous stipules. The flowers are terminal, in corymbose panicles, and of a white or purplish rose color. *De Candolle.*

The genuine Cinchona trees are natives exclusively of South America.* In that

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* *Transplanting of the Cinchona trees, and Cultivation in new Sites.* For a long time after the discovery of the virtues of Peruvian bark, no attempt appears to have been made to transplant to other countries the trees which produced it. In 1737, La Condamine collected a large number of young plants, with a view of conveying them to Europe; but, after having descended the Amazon in safety for more than a thousand leagues, they were washed overboard, near the mouth of that river, from the boat containing them, and were all lost. After this failure, though the idea of transplanting the Cinchonas was occasionally suggested, nothing was done until 1846–7, when Dr. Weddell, now celebrated for his successful exploration of the region of the Calisaya bark, sent some seeds to France, which were planted with success in the Jardin des Plantes, and thus supplied some of the conservatories of Europe with specimens of the plant. But the first successful effort, with a view to great practical results, was made in 1853, by the Dutch government, by whom Mr. Hasskarl, formerly superintendent of the Botanical Garden in Java, was sent to South America on this important mission. A number of young Cinchona plants were sent by him directly across the Pacific to Batavia, which they reached before the close of 1854. From these, and from seeds obtained from other sources, which were planted in the mountains of Java, in sites selected for their supposed conformity in climate with the native locality of the Cinchona, have sprung numerous plantations.

Stimulated by the suggestions of Dr. Royle, and by the partial success of the Dutch, the English government engaged, in 1859, the services of Mr. Clements B. Markham, who proceeded to Bolivia, in South America, and, after almost incredible hardships, arising partly from the nature of the country and partly from the jealousy of the native authorities, succeeded in collecting and transmitting to England upwards of 400 Calisaya plants. Most of these, however, were so much continent, however, they are widely diffused, extending from the 19th degree of south latitude, considerably south of La Paz, in Bolivia, to the mountains of Santa Marta, or, according to Weddell, to the vicinity of Caracas, on the northern coast, in about

injured, on their way from England to India, by the excessive heat of the Red Sea, that very few, on their arrival in Hindostan, had sufficient life remaining to grow when planted. Happily, the deficiency was supplied by seeds of *C. Calisaya* sent from Java, where they were produced, to Calcutta, at the request of the English Governor-General. (De Vrij, *P. J. Tr.*, 1863, p. 440.) Whilst Mr. Markham was in Bolivia, other agents were collecting other species in Peru and Ecuador, whence seeds of the pale and red bark Cinchonas reached India, and, being planted in the selected sites, proved to be very productive.

The sites selected for the Cinchona plantations were in the Neilgherry Hills, in Southern India, in the Presidency of Madras, at the junction of the East and West Ghauts, near the Sanitary Station of Ootacamund, at heights varying from 5000 to 7450 feet above the sea. These positions unite the peculiar characters of the native region of the Cinchonas in the Andes, not only as regards elevation and latitude, but also as to atmospheric moisture, an excess of which, for the greater portion of the year, seems essential to the perfection of these trees. But, though a certain excess of atmospheric moisture is necessary, yet the trees do not grow well in a wet soil, as Mr. Cross, who personally inspected the region in the Andes where the best barks are obtained, found the Cinchona plants only on the dry slopes, and never on wet ground. He remarked, moreover, that constant dampness of the atmosphere is unfavorable, as a certain amount of dry weather is necessary for the ripening of the capsules. In regard to the temperature, which is about the same throughout the year, he observed that during the hottest days the thermometer rose to 59° or 60° F., falling to 46° or 48° F. at night; but at the upper limit it ranged, during the day, from 46° to 48°, and at night fell to 35° or 36° F. (*A. J. P.*, 1867, p. 161.)

Besides the Neilgherry Hills, other sites were selected for experimental plantations; and, since the first introduction of the Cinchona trees, their culture has been extended to various points from Hakgalla, in the island of Ceylon, to the Himalaya Mountains; as in the Wynaad, the Coorg, the hills of Travancore, and especially at Peermede in the Presidency of Madras; in Sikkim and Darjeeling in the Presidency of Bengal; at Lingmulla in the Presidency of Bombay; and in the valley of Kangra in the Punjab; from the southern to the northern extremity of British India. The culture has especially flourished in Ceylon; in 1877, Mr. MacMillan estimated the number of trees at 7,000,000.

Besides the general fact of the success of the culture, other results, as unexpected as they are important, have been obtained within the last few years. It was ascertained at an early period, that the productiveness of these plants in alkaloids had not been diminished by transplanting; it is now known that this productiveness has in fact been very considerably increased. Another highly important result is the discovery by Mr. MacIvor, that the yield in alkaloids is greatly augmented by a certain treatment of the trees. It had been noticed that the cinchona alkaloids, especially in any other form than that of sulphate, were apt, on exposure to the direct light of the sun, to become reddened by the generation of coloring matter, at the expense of the alkaloid. It was a very natural inference that a similar change might take place in the living plant, as a consequence of which the proportion of alkaloids they were capable of producing, might be greatly diminished. To obviate this presumed effect, Mr. MacIvor was induced to make the experiment of covering the stems of the growing trees with a layer of moss, so as completely to protect the bark against the influence of sunlight. The result was favorable beyond all expectation; and the yield of the bark thus protected in alkaloids is said to be doubled, tripled, or increased even in larger proportion. A tree can thus be made continuously productive; for if a slip is removed longitudinally from the trunk, from top to bottom, by covering the decorticated portion with moss, the bark is renewed, at least as rich as previously in the alkaloids, while from time to time other strips may be taken, till the whole of the old bark is removed, and the new ready for removal by a repetition of the same process; and the tree is thus preserved indefinitely, probably for the whole normal length of its life. The practical difficulty with the process is that it requires skilled workmen, not always attainable, and hence the "coppicing system" still largely prevails in India. Under it the trees are cut down, not too close to the ground, when young shoots put up abundantly. It has been experimentally found best to allow only two of these shoots to remain, and that the bark contains the maximum of alkaloid in the eighth year of growth.

A very important result of the culture in India has been the appearance of hybrids. One which has received the name of *C. angustifolia* has been found to contain in its bark 11 per cent. of alkaloids, whilst a second form, believed to be a cross between *C. officinalis* and *C. Calisaya*, has been called *C. pubescens* and yielded a bark containing 12·2 per cent. of alkaloids. The culture of bark in India may be considered as fully established, although Markham affirms that the greed for immediate results has been disastrous and that the plantations are not in as good condition as formerly. The total yield of bark by Ceylon and India for the season of 1879 and 1880 was 1,172,060 pounds. The quality of the bark seems to be superior to that of South America, whilst the financial success has been such that 70 per cent. a year is said to be sometimes returned, and Mr. Markham affirms that the plantations have entirely paid for themselves, principal and interest. (For further information in regard to the culture of Cinchonas in India, see *Peruvian Bark*, by C. R. Markham. London, John Murray, 1880; also *P. J. Tr.*, xi. 244.)

Owing to the worthlessness of many of the species of Cinchona first introduced into Java, the Dutch have reaped success more slowly than the English; but by destroying the progeny of the first imports and introducing from India other more valuable species the Java plantations have at last been made to flourish, and in 1879 and 1880 yielded 70,088 pounds of good bark. Attempts have also been made to introduce the new culture into the West India island of Jamaica. Various special difficulties have environed the attempts at Cinchona culture in Jamaica; thus, in 1874, 60,000 trees were destroyed by a hurricane. Nevertheless, progress has been made, and about the 10th degree of north latitude. They follow, in this distance, the circuitous course of the great mountain ranges, and for the most part occupy the eastern slope of the second range of the Cordilleras. Those which yield the bark of commerce grow at various elevations upon the Andes, seldom less than 4000 feet above the sea, and require a temperature considerably lower than that which usually prevails in tropical countries.

There has been much difficulty in properly arranging the species of Cinchona. One source of the difficulty is the varying shape of the leaves of the same species, according to the degree of elevation upon the mountainous declivities, to the severity or mildness of the climate, the greater or less humidity of the soil, and to various circumstances in the growth of individual plants. Even the same tree often produces foliage of a diversified character; and a person, not aware of this fact, might be led to imagine that he had discovered different species from an examination of the leaves from one and the same branch. The fructification partakes, to a certain extent, of the same varying character. Lambert, in his "*Illustration of the genus Cinchona*," published in 1821, after admitting with Humboldt the identity of several varieties which had received specific names from other botanists, described nineteen species. De Candolle enumerated only sixteen. Lindley admits twenty-one known species, and five doubtful. Weddell describes twenty-one species, including eight new ones of his own, and two doubtful, and excluding several before admitted by other writers, which he joins to his new genus Cascarilla. (For further information, see foot-note p. 430.)

Until recently, it was impossible to decide from which species of Cinchona the several varieties of bark were respectively derived. The former references of the yellow bark to *C. cordifolia*, of the pale to *C. lancifolia*, and of the red to *C. oblongifolia*, have been very properly abandoned in all the Pharmacopœias. It is now universally admitted that the officinal barks, known in the market by these titles, are not the product of the species mentioned. It is stated by Humboldt that the property of curing agues belongs to the barks of all the Cinchonas with hairy and woolly blossoms, and to these alone. All those with smooth corollas belong to the genus Cascarilla of Weddell. Within a few years much light has been thrown upon the botanical history of the different varieties of bark, and at present most if not all of the valuable varieties can be traced to their sources. The following species are acknowledged by the Pharmacopœia of the United States.

1. *Cinchona Calisaya.* Weddell, *Hist. Nat. des Quinquinas*, p. 30, t. 3. This is a lofty tree, with a trunk often two feet or more in diameter, and a summit usually rising above the other trees of the forest. The leaves are petiolate, oblong or lanceolate-obovate, from three to six inches long and one or two in breadth, obtuse, acute or slightly attenuated at the base, softish, above smooth, of a velvety aspect, and obscurely green, beneath smooth and of a pale emerald hue, with scrobiculi at the axils of the veins, but scarcely visible on the upper surface. The stipules are about as long as the petioles, oblong, very obtuse, and very smooth. The flowers are in ovate or subcorymbose panicles. The calyx is pubescent, with a cup-shaped limb, and short triangular teeth; the corolla is rose-colored, with a cylindrical tube about four lines long, and a laciniate limb fringed at the edges; the stamina are concealed in the tube, with anthers more than twice as long as the filaments. The fruit is an ovate capsule scarcely as long as the flower, enclosing elliptical lanceolate seeds, the margin of which is irregularly toothed, with a fimbriated appearance. The tree

21,000 pounds of the bark found its way from Jamaica to the London market in the season of 1879–80.

The French have been less successful than the Dutch and English. The first plants taken by Weddell from Peru to Paris all perished. Subsequently trials have been made in the Isle of Bourbon, and at Guadeloupe, but with what final results we do not know. In Algiers, where situations believed to be suitable were selected for plantations among the mountains, no satisfactory results have yet been attained. The Brazilians have had somewhat better success near Rio Janeiro, and it is said that plants have been introduced into the Azores, which are growing well. (Soubeiran, *Journ. de Pharm.*, Feb. 1868, p. 139.)

In Bolivia the cultivation of Cinchona has also been entered upon extensively, and in 1881 cultivated South American red bark containing nearly 3 per cent. of quinine was offered in the London market, with small amounts of yellow bark of similar origin.

grows in the forests, upon the declivities of the Andes, at the height of 6000 or 7000 feet above the ocean, in Bolivia and the southernmost part of Peru.

A variety of this species, described by Weddell under the name of *Josephiana*, is a mere shrub, not more than twelve feet high, with a slender stem, erect branches, and a strongly adherent bark. This variety is found in some places covering extensive surfaces destitute of forest trees. Weddell supposes that these tracts had once been covered with forests, which, having been destroyed by fires, have been succeeded by this stunted growth springing from the roots, and prevented from receiving its full development by the want of protection from other trees.

Mr. Markham states that the natives recognize three varieties of the Calisaya: 1. *Calisaya amarilla* or *fina* (*a. vera* of Weddell); 2. *C. morada* (*C. Boliviana*, Wedd.); and 3. *C. verde* or *alta*, a very large tree, growing lower in the valley than the other varieties, and distinguished by having the veins of the leaves never purple, but always green.. (*A. J. P.*, 1866, p. 422.) By the discovery of this species, the long unsettled point of the botanical source of Calisaya bark has been determined. The immense consumption of that bark, and the wasteful methods pursued by the bark-gatherers, have caused the rapid destruction of the tree; and many years ago it had disappeared from the neighborhood of inhabited places, except in the form of a shrub. Weddell was compelled to make long journeys on foot through the forests, by paths scarcely opened, before he could get a sight of the tree in its full vigor.

2. *Cinchona Condaminea.* Humb. and Bonpl. *Plant. Equin.* i. p. 33, t. 10; Lindley, *Flor. Med.* 414; Carson, *Illust. of Med. Bot.* i. 53, pl. 45.—*Cinchona officinalis.* Linn.; Hooker, *Bot. Mag.* t. 5364. This tree, when full grown, has a stem about eighteen feet high and a foot in thickness, with opposite branches, of which the lower are horizontal, and the higher rise at their extremities. The bark of the trunk yields when wounded a bitter astringent juice. The leaves are of variable shape, but generally ovate-lanceolate, about four inches in length by less than two in breadth, smooth and scrobiculate at the axils of the veins beneath. The flowers are in axillary, downy, corymbose panicles. The tree grows on the declivities of the mountains, at an elevation of from about a mile to a mile and a half, and in a mean temperature of 67° F. It was seen by Humboldt and Bonpland in the neighborhood of Loxa, and is said also to grow near Guancabamba and Ayavaca in Peru. It is now admitted to be the source of the *crown bark of Loxa*. Weddell considers as varieties of this species, though with some hesitation, as he has never seen them alive, the following: 1, *Candolli* (*C. macrocalyx* of Pavon and De Candolle); 2, *lucumæfolia* (*C. lucumæfolia* of Pavon and Lindley); 3, *lancifolia* (*C. lancifolia* of Mutis), hereafter referred to as a distinct species; and, 4, *Pitayensis*, growing in New Granada.[*] The last mentioned variety has subsequently been raised by Weddell to the rank of a distinct species.

3. *C. micrantha.* Ruiz and Pavon, *Fl. Peruv.* ii. 52. t. 194; Lindley, *Flor. Med.* 412; Carson, *Illust. of Med. Bot.* i. 52, pl. 44. This is a large tree, forty feet high,

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[*] Botanists seem disposed to return to the old Linnæan designation of this species, *Cinchona officinalis*, of which three varieties are recognized, under the names of *Bonplandiana*, *Uritusinga*, and *Crespilla*, all yielding the crown barks. Of these the *Bonplandiana* seems to have been most successfully transplanted, as upwards of 750,000 are now growing in the plantations of British India. (*Broughton.*) The varieties of this species seem to flourish best at a greater elevation than the *C. succirubra*, growing at heights from 5500 or 6000 feet even to 8350 feet above the level of the sea. The effect of the moss in increasing the productiveness of this species in alkaloids has been highly satisfactory. (*Markham.*) Instead, however, of cinchonine being the prominent alkaloid of this species, as in the pale barks of Loxa, the quinine has been found most abundant in the Indian bark, and, though the former alkaloid is generally present, yet it is usually in small proportion. Indeed, Mr. Broughton states that the trees of the variety Bonplandiana yield a bark nearly equal to the fine Calisaya bark of Bolivia, and superior in some respects for manufacturing purposes to the richer red barks, as it yields its alkaloids more readily in a free state, in consequence of the smaller amount of resin and coloring matter contained in it. The following results were obtained by Mr. Broughton in the chemical examination of the bark of this species. The dried bark of the trunk yielded altogether in alkaloids (hydrated) 3·6 per cent., of which 2·8 per cent. was quinine (or of alkaloid soluble in ether), and only 0·8 per cent. was of cinchonine and cinchonidine jointly; and 2·8 per cent. of crystallized sulphate of quinine was obtained. Another specimen was even more productive, yielding 3·0 per cent. of quinine. The bark of the same species, which had been renewed in six months under the mossing process, gave a total of alkaloids (hydrated) 6·8 per cent., of which 4·8 was of quinine, and 2·0 of cinchonine and cinchonidine jointly; and 4·1 per cent. of crystallized sulphate of quinine was obtained. (*P. J. Tr.*, 1867, p. 241.)

with oblong leaves, from four to twelve inches in length and from two to six in breadth, scarcely acute, smooth, shining on the upper surface, and scrobiculate at the axils of the veins beneath. The flowers are in terminal, loose leafless panicles, and are smaller than those of any other species except *C. lancifolia.* (*Lindley.*) The tree grows, according to Ruiz and Pavon, in the mountains near Chicoplaya, Monzon, and Puebla de San Antonio, according to Pöppig, at Cuchero, and, according to Weddell, in the Peruvian province of Carabaya, and in Bolivia. Ruiz states that its bark is always mixed with that sent into the market from the provinces of Panatahuas, Huamilies, and Huanuco. The Edinburgh and Dublin Colleges ascribed to it the *cinchona cinerea*, the *gray* or *silver bark* of the British commerce; and the U. S. Pharmacopœia recognizes it as one of the sources of pale bark, as it undoubtedly is.

Cinchona succirubra, Pavon, which was officinally recognized in the U. S. Pharmacopœia of 1870, and, as the source of the genuine red bark, is scarcely less important than either of the preceding, has, within a few years, acquired additional value from the great success with which it has been propagated in the Highlands of Hindostan.

4. *C. succirubra.* Pavon, *MS.;* Howard, *Pharm. Journ. and Trans.*, Oct. 1856, p. 209, with a figure.—*C. ovata*, var. *erythroderma.* Weddell, *Hist. Nat. des Quinquinas*, p. 60. This species has been satisfactorily ascertained to produce the proper officinal red bark, the origin of which remained so long unknown, or at least undetermined. The name of *C. succirubra* originated with Pavon, having been applied by him, in an unpublished manuscript, to an undescribed species yielding the bark called *cinchona colorada de Huaranda*, which has been shown to be identical with officinal red bark; while a specimen of the plant itself, in the collection of Ruiz and Pavon at Kew, upon examination by Mr. J. E. Howard, of London, proved to correspond exactly with a specimen of the red bark tree which that gentleman had received from South America. The same plant was described by Weddell, in his *Natural History of the Cinchonas*, as a variety of *C. ovata*, under the designation of *Cinchona ovata*, var. *erythroderma*, and was conjectured by him to be the source of red bark, though he did not at the time feel justified in giving a decided opinion. This point, however, having been subsequently determined, and the plant elevated to the dignity of a new species, Mr. Howard proposed at first to name it *Cinchona erythroderma*, not only from courtesy to Dr. Weddell, but also from the appropriateness of the name itself, implying the redness of the bark; but Pavon's name of *succirubra* was afterwards preferred on the ground of priority, being itself also (red-juiced) expressive of a quality of the tree. This species is, when full-grown, of great magnitude; but almost all the older trees have been destroyed, and few now remain with a stem so much as a foot in diameter. The branches have a silvery epidermis, corresponding with that of the red bark in quills as often seen in the market. The leaves are ovate, varying greatly in size, often as much as nine inches by six, narrowing towards the base, somewhat membranaceous, pubescent beneath, and green on both sides. The tree inhabits a region in the present republic of Ecuador, on the western slope of Chimborazo, the seaport of which is the town of Guayaquil.*

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* Botanists at present (1882) are far from being in concord in regard to the species of the genus Cinchona. As previously mentioned, the experiments made in India have shown that the trees have a remarkable tendency to hybridize, and Kuntze, as the result of studies made in the India plantations, has concluded that there are but four true species, namely, *C. Weddelliana*, Kuntze, nearly answering to *C. Calisaya*, Weddell; *C. Paviana*, Kuntze, including *C. micrantha*, Ruiz and Pavon, with various allied forms; *C. Howardiana*, Kuntze, including *C. succirubra*, Pavon, and other species of various authors; and *C. Pahudiana*, Howard. (*Cinchona, Arten, Hybriden, und Cultur der Chininbäume*, Leipzig, 1878.) The conspectus on p. 431 of the principal species of Cinchona is taken from the *Pharmacographia.* It seems to represent more nearly, as well as more concisely, the present state of our knowledge than does much of the matter in previous editions of the United States Dispensatory, and is consequently substituted for the latter.

Markham in his recent work gives the following synopsis of the valuable species.

I. C. officinalis, var. α. Condaminea,
β. Bonplandia, } yielding crown bark.
γ. Crispa,
II. C. succirubra, Pavon, yielding red bark.
III. C. pitayensis,
C. lancifolia, } yielding colombian bark.
C. cordifolia,

IV. C. nitida,
C. micrantha, } yielding gray bark.
C. Peruviana,
V. C. Calisaya, yielding yellow bark.

Conspectus of the Principal Species of Cinchona.

Species (excluding sub-species and varieties) according to Weddell.	Where Figured.	Native Country.	Where Cultivated.	Product.
I. Stirps Cinchonæ officinalis.				
1. Cinchona officinalis, Hook.	Bot. Mag. 5364	Ecuador (Loxa)	India, Ceylon, Java.	Loxa or Crown Bark, Pale Bark.
2. " macrocalyx, Pav.	Howard, N. Q.	Peru		Ashy Crown Bark. The sub-species *C. Palton* affords an important sort called *Palton Bark* much used in the manufacture of quinine.
3. " lucumæfolia, Pav.	Do.	Ecuador, Peru.		
4. " lanceolata, R. et P. (?)	Do.	Peru		Carthagena Bark, confounded with Palton Bark, but is not so good.
5. " lancifolia, Mutis	Karsten tab. 11, 12.	New Granada	India.	Columbian Bark. Imported in large quantities for manufacture of quinine. The soft Columbian Bark is produced by Howard's var. *oblonga*.
6. " amygdalifolia, Wedd.	Wedd. tab. 6	Peru, Bolivia		A poor bark, but not now imported.
II. Stirps Cinchonæ rugosæ.				
7. Cinchona pitayensis, Wedd.	Karst. tab. 22. (*C. Triana*.)	New Granada (Popayan)	India	Pitayo Bark. Very valuable; used by makers of quinine; it is the chief source of quinidine.
8. " rugosa, Pav.	Howard, N. Q.	Peru		Bark unknown, probably valueless.
9. " Mutisii, Lamb.	Do.	Ecuador		Bark not in commerce, contains only aricine.
10. " hirsuta, R. et P.	Wedd. tab. 21	Peru.		
11. " carabayensis, Wedd.	Wedd. tab. 19.	Peru, Bolivia		Bark not collected.
12. " Pahudiana, How.	Howard, N. Q.	Peru	India, Java	A poor bark, yet of handsome appearance; propagation of tree discontinued.
13. " asperifolia, Wedd.	Wedd. tab. 20.	Bolivia		Bark not collected.
14. " umbellulifera, Pav.	Howard, N. Q.	Peru		Bark not known as a distinct sort.
15. " glandulifera, R. et P.	Do.	Peru		Do.
16. " Humboldtiana, Lamb.	Do.	Peru		False Loxa Bark, Jaen Bark. A very bad bark.
III. Stirps Cinchonæ micranthæ.				
17. Cinchona australis, Wedd.	Wedd. tab. 8	South Bolivia		An inferior bark, mixed with Calisaya.
18. " scrobiculata, H. et B.	Do.	Peru		Bark formerly known as *Red Cusco Bark* or *Santa Ana Bark*.
19. " peruviana, How.	Howard, N. Q.	Peru	India	Gray Bark, Huanuco or Lima Bark. Chiefly consumed on the Continent.
20. " nitida, R. et P.	Do.	Peru	India	
21. " micrantha, R. et P.	Do.	Peru	India	
IV. Stirps Cinchonæ Calisayæ.				
22. Cinchona Calisaya, Wedd.	Wedd. tab. 9	Peru, Bolivia	India, Ceylon, Java, Jamaica, Mexico.	Calisaya Bark, Bolivian Bark, Yellow Bark. The tree exists under many varieties, bark also very variable.
23. " elliptica, Wedd.		Peru (Carabaya)		Carabaya Bark. Bark scarcely now imported. *C. euneura*, Miq. (flower and fruit unknown), may perhaps be this species.
V. Stirps Cinchonæ ovatæ.				
24. Cinchona purpurea, R. et P.	Howard, N. Q.	Peru (Huamalies)		Huamalies Bark. Not now imported.
25. " rufinervis, Wedd.	Do.	Peru, Bolivia		Bark, a kind of light Calisaya.
26. " succirubra, Pav.	Do.	Ecuador.	India, Ceylon, Java, Jamaica.	Red Bark. Largely cultivated in British India.
27. " ovata, R. et P.	Do.	Peru, Bolivia	India (?), Java (?)	Inferior Brown and Gray Barks.
28. " cordifolia, Mutis	Karsten tab. 8	New Granada, Peru.		Columbian Bark (in part). Tree exists under many varieties; bark of some used in manufacture of quinine.
29. " tucujensis, Karst.	Karsten tab. 9	Venezuela.		Maracaibo Bark.
30. " pubescens, Vahl	Wedd. tab. 16	Ecuador, Peru, Bolivia.		Arica Bark (Cusco Bark from var. *Pelletieriana*). Some of the varieties contain aricine. *C. caloptera*, Miq., is probably a var. of this species.
31. " purpurascens, Wedd.	Wedd. tab. 18	Bolivia		Bark unknown in commerce.

Commercial History.

For more than a century after Peruvian bark came into use, it was procured almost exclusively from the neighborhood of Loxa. In a memoir published in 1738, La Condamine speaks of the bark of Rhiobambo, Cuença, Ayavaca, and Jaen de Bracomoros. Of these places, the first two, together with Loxa, lie within the ancient kingdom of Quito, at the southern extremity; the others are in the same vicinity, within the borders of Peru. The drug was shipped chiefly at Payta, whence it was carried to Spain, and thence spread over Europe. Beyond the limits above mentioned, the Cinchona was not supposed to exist, till, in the year 1753, a gentleman of Loxa discovered it, while on a journey to Santa Fé de Bogota, in numerous situations along his route, wherever, in fact, the elevation of the country was equal to that of Loxa, or about 6500 feet above the level of the sea. This discovery extended through Quito into New Granada, as far as two degrees and a half north of the equator. But no practical advantage was derived from it; and the information lay buried in the archives of the viceroyalty, till subsequent events brought it to light. To Mutis belongs the credit of making known the existence of the Cinchona in New Granada. He first discovered it in the neighborhood of Bogota, in 1772. A botanical expedition was afterwards organized by the Spanish government, with the view of exploring this part of their dominions, and the direction was given to Mutis. Its researches eventuated in the discovery of several species of Cinchona in New Granada; and a commerce in the bark soon commenced, which was carried on through the ports of Carthagena and Santa Martha.

To these sources another was added about the same time (1776), by the discovery of the Cinchona in the centre of Peru, in the mountainous region about the city of Huanuco, which lies on the eastern declivity of the Andes, northeast of Lima, at least six degrees south of the province of Loxa. To explore this new locality, another botanical expedition was set on foot, at the head of which were Ruiz and Pavon, the distinguished authors of the Flora Peruviana. These botanists spent several years in that region, during which time they discovered numerous species. Lima became the entrepot for the barks collected around Huanuco; and hence probably originated the name of Lima bark, so often conferred, in common language, not only upon the varieties received through that city, but also upon the medicine generally.

Soon after the last-mentioned discovery, two additional localities of the Cinchona were found; one at the northern extremity of the continent near Santa Martha,* the other very far to the south, in the provinces of La Paz and Cochabamba, then within the viceroyalty of Buenos Ayres, now in the republic of Bolivia. These latter places became the source of an abundant supply of excellent bark, which received the name of Calisaya. It was sent partly to the ports on the Pacific, partly to Buenos Ayres.

The consequence of these discoveries was a vast increase in the supply of bark, which was now shipped from the ports of Guayaquil, Payta, Lima, Arica, Buenos Ayres, Carthagena, and Santa Martha. At the same time the average quality was probably deteriorated; for, though many of the new varieties were possessed of excellent properties, yet equal care in superintending the collection and assorting of the bark could scarcely be exercised in a field so much more extended. The varieties now poured into the market soon became so numerous as to burden the memory if not to defy the discrimination of the druggist; and the best pharmacologists found themselves at a loss to discover any permanent peculiarities which might serve as the basis of a proper and useful classification. This perplexity has continued more or less to the present time; though the discovery of the alkaloidal principles has presented a ground of distinction before unknown. The restrictions upon the commerce of South America, by directing the trade into irregular channels, had also a tendency to deteriorate the character of the drug. Little attention was paid to a proper assortment of the several varieties; and not only were the best barks mixed with those of inferior species and less careful preparation, but the products of other trees, bearing no resemblance to the Cinchona, were sometimes added, having been artificially prepared so as to deceive a careless observer. The markets of this country were peculiarly ill-furnished. The supplies, being derived chiefly, by means of a contraband trade, from Carthagena and other ports on the Spanish Main, or indirectly through the Havana, were necessarily of an inferior character; and most of the good bark which reached us was imported by our druggists from London, whither it was sent from Cadiz. A great change, however, in this respect, took place after the ports on the Pacific were opened to our commerce. The best kinds of bark were thus rendered directly accessible to us; and the trash which formerly glutted our markets is now in great measure excluded. Our ships trading to the Pacific run along the American coast from Valparaiso to Guayaquil, stopping at the intermediate ports of Coquimbo, Copiapo, Arica, Callao, Truxillo, etc., from all which they probably receive supplies. Much good bark has of late also been imported from Carthagena, and other ports of the Caribbean Sea, being brought down the Magdalena River from the mountainous regions of New Granada; and, since the completion of the railroad across the Isthmus, large quantities reach this country by way of Panama, to which place they are brought chiefly from the Pacific ports of Buenaventura and Guayaquil. An additional source of supply has recently been opened through the Amazon; a considerable quantity of bark having been taken to the London market from the port of Para, in Brazil, brought down that river, probably, from the Peruvian province of Huanuco. According to Mr. Howard, the bark thus obtained is of inferior quality, yielding but a small proportion of alkaloids. (*P. J. Tr.*, Dec. 1863, p. 248.)*

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* In relation to this locality of the Cinchonas, we are informed that Dr. Ernst, President of a Scientific Society of Caracas, in an excursion from that place, discovered on the slopes of several mountains, groups of the *Cinchona cordifolia*, var. *rotundifolia*, Weddell, *C. rotundifolia* of Pavon, at the height of 4500 feet above the sea. The bark of this tree is said to be the variety known in commerce as the *Ashy Crown bark*, one of the Loxa barks. The bark was found to contain 0·5 per cent. of quinine, and 0·67 of cinchonine. (*A. J. P.*, 1870, p. 449.)

The persons who collect the bark are called in South America *Cascarilleros.* Considerable experience and judgment are requisite to render an individual well qualified for this business. He must not only be able to distinguish the trees which produce good bark from those less esteemed, but must also know the proper season and age at which a branch should be decorticated, and the marks by which the efficiency or inefficiency of any particular product is indicated. The bark gatherers begin their work with the setting in of the dry season in May. Sometimes they first cut down the tree, and afterwards strip off the bark from the branches; in other instances they decorticate the tree while standing. The former plan is said to be the most economical; as, when the tree is cut down, the stump pushes up shoots which in the course of time become fit for decortication, while, if deprived of its bark, the whole plant perishes. The operator separates the bark by making a longitudinal incision with a sharp knife through its whole thickness, and then forcing it off from the branch with the back of the instrument. Other means are resorted to, when the trunk or larger limbs are decorticated. According to Pöppig, the bark is not separated until three or four days after the tree is felled. It must then be speedily dried, as otherwise it becomes deteriorated. For this purpose it is taken out of the woods into some open place, where it is exposed to the sun. In drying it rolls up, or becomes quilled; and the degree to which this effect takes place is proportionate directly to the thinness of the bark, and inversely to the age of the branch from which it was derived. In packing the bark for exportation, it often happens that several different kinds are introduced in the same case. The packages are, in commercial language, called *seroons.* As found in this market they are usually covered with a case of thick and stiff ox-hide, lined within by a very coarse cloth, apparently woven out of some kind of grass.

The Cinchona forests, being in very thinly inhabited districts, do not, for the most part, belong to individuals, but are open to the enterprise of all who choose to engage in the collection of the bark. The consequence is, that the operations are carried on without reference to the future condition of this important interest; and the most wasteful modes of proceeding are often adopted.

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* An interesting history of the commerce in the Cinchona barks, by Dr. H. A. Weddell, will be found in the *A. J. P.* (xxvi. 539, Nov. 1854), originally from his *Voyages dans le Nord de la Bolivie*, Paris, 1853.

The bitterness of the Cinchona is not confined to its bark. The leaves and flowers also have this property, which in the former is associated with acidity, in the latter with a delicious aroma, which renders the air fragrant in neighborhoods where the trees abound. The wood is nearly tasteless; but the bark of the root has the same virtues as that of the trunk.*

It was at one time supposed that the leaves might have sufficient of the active principles of the bark to justify their use in medicine; but, though they have proved useful as a tonic, experiment has not shown them to be possessed of decided anti-periodic powers, and, on chemical examination, they have yielded but a small proportion of the characteristic alkaloids.

Classification.

To form a correct and lucid system of classification is the most difficult part of the subject of bark. An arrangement founded on the botanical basis is liable to the objection, that the product of the same species may vary according to the age of the bark and the situation of the tree; and, besides, is at present scarcely practicable; as, though our knowledge of the source of the several varieties has very much extended, it is still defective on some points.

The Spanish merchants adopted a classification, dependent partly on the place of growth or shipment, and partly on the inherent properties or supposed relative value of the bark. So long as the sources of the drug were very confined, and the varieties few, this plan answered the purposes of trade; but at present it is quite inadequate; and, though some of the names originally conferred upon this principle are still retained, they are often uncertain or misapplied.

Perhaps, on the whole, the best arrangement for pharmaceutical and medicinal purposes is that founded upon difference of color. It is true that dependence cannot be placed upon this property alone; as barks of a similar color have been found to possess very different virtues; and, between the various colors considered characteristic, there is an insensible gradation, so that it is not always possible to decide where one ends and the other begins. Still, it has been found that most of the valuable barks may be arranged, according to their color, in three divisions, which, though mingling at their extremes, are very distinctly characterized, in certain specimens, by peculiarity not only in color, but also in other sensible properties, and even in chemical constitution. The three divisions alluded to are the *pale*, the *yellow*, and the *red*. This arrangement has been adopted in the Br. Pharmacopœia; and the U. S. recognizes the yellow and red, and under Cinchona any colored bark containing at least 3 per cent. of alkaloids. Until recently, as almost all the highly-esteemed barks were brought from the Pacific coast of South America, and those from the northern coast were deemed inferior, it was only the former that were recognized under the three divisions referred to. Of late, however, some of the best barks, and most productive in alkaloids, have been brought from India and Java; so that the restriction of the officinal barks to the Pacific coast was abandoned at the late revision of the U. S. Pharmacopœia; and the much better rule was adopted of recognizing all the Cinchona barks as officinal which might contain three per cent. of their proper alkaloids. Nevertheless, the former officinal varieties have been retained. In describing, therefore, the different kinds of barks, we shall treat first, under the officinal titles of *pale*, *yellow*, and *red*, of those originally brought only from the ports of the Pacific; while those coming to us from the northern ports of New Granada and Venezuela will be subsequently considered under the heading of *Carthagena barks*, by which name they have been generally known in commerce. The commercial name will be given whenever a knowledge of it can be useful. It is proper to state that the different barks are often mingled in the same package, and that, in deciding upon the character of a seroon, the druggist is guided rather by the predominance than the exclusive existence of certain distinctive properties.

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* Dr. De Vrij, on examining a specimen of *C. Pahudiana*, grown in Java, obtained from the bark of the stem 1·274 per cent. of alkaloids (cinchonidine and cinchonicine, without any quinine), and afterwards from the bark of the root, 2·818 per cent. of alkaloids, of which 1·849 was quinine. Another specimen, only two years old, yielded to him from the bark of the stem 0·09 per cent. of alkaloid, without a trace of quinine; while from the root, treated so as to separate all the woody fibres, he obtained 1·941 per cent. of alkaloids, of which more than three-fourths was quinine. Four other species yielded, for the most part, analogous results. *C. Calisaya* of Java gave 3·676 per cent. of alkaloids from bark of the stem, and 4·430 from that of the root; the same species from Hindostan 1·89 to 3·10; *C. lancifolia* of Java 4·13 to 2·94; *C. succirubra*, No. 1, from Ootacamund (East India) 2·10 to 2·00; *C. succirubra* from the same place 2·65 to 7·514; and *C. micrantha* from Ootacamund 2·791 to 4·166. The result of all his experiments justified, he thought, an appeal to his government to devote a small portion of ground to the cultivation of the *C. Pahudiana*, with the view of obtaining quinine from the roots when two years old; as he believed that the alkaloids might then be profitably obtained; but his application was not favorably received; and the correctness of his inference remains still undetermined. (*Journ. de Pharm.*, Janv. 1869, pp. 17–23.)

1. Pale or Gray Bark.

The epithet *pale*, applied to the barks of this division, is derived from the color of the powder. The French call them *quinquinas gris*, or gray barks, from the color of the epidermis. They come into the market in cylindrical pieces, of variable length from a few inches to a foot and a half, sometimes singly, sometimes doubly quilled, from two lines to an inch in diameter, and from half a line to two or three lines in thickness. The kinds which were formerly deemed the finest are about the size of a goose-quill; but experience has shown that the young barks are not the most efficient. Their exterior surface is usually more or less rough, marked with transverse and sometimes with longitudinal fissures, and of a grayish color, owing to adhering lichens. The shade is different in different samples. Sometimes it is a light gray, approaching to white, sometimes dull and brown, sometimes a grayish fawn, and frequently diversified by the intermixture of the proper color of the epidermis with that of the patches of lichens. The interior surface, in the finer kinds, is smooth; in the coarser, occasionally rough and somewhat ligneous. Its color is a brownish orange, sometimes inclining to red, sometimes to yellow, and, in some inferior specimens, of a dusky hue. The fracture is usually smooth, with some short filaments on the internal part only. In the coarser barks it is more fibrous. The color of the powder is a pale fawn, which is of a darker hue in the inferior kinds. The taste is moderately bitter and somewhat astringent, without being disagreeable or nauseous. Authors speak also of an acidulous and aromatic flavor. The better kinds have a feeble odor, which is distinct and agreeably aromatic in powder and decoction. The pale barks are chemically characterized by containing *a much larger proportion of cinchonine and quinidine or cinchonidine than of quinine;* and their infusion does not yield a precipitate with solution of sulphate of sodium. Their appearance generally indicates that they were derived from the smaller branches. They are collected in the provinces about Loxa, or in the country which surrounds the city of Huanuco, northeast of Lima, and are probably derived chiefly from *Cinchona Condaminea*, *C. nitida*, and *C. micrantha*.

There are several commercial varieties of pale bark, obtained from different sources, and differing more or less in properties. The most highly esteemed of these is the *Loxa bark*, the finest specimens of which are sometimes called *crown bark of Loxa*, from the impression that they have the same origin and character with the bark formerly selected with great care for the use of the King of Spain and the royal family. The pale bark collected about Huanuco is named either *Lima bark*, because taken to that city for commercial distribution, or *Huanuco bark*, from its place of collection. The former name has been more common in this country, where, indeed, this commercial variety has not unfrequently been confounded with the Loxa bark. Other pale barks are the *Jaen* and *Huamilies barks*, which are scarcely known as distinct varieties in the United States.*

In this country, the pale bark has fallen into disuse. As it yields little quinine, it is not employed in the manufacture of the sulphate of that alkaloid, which has almost superseded the bark as a remedy in intermittents; and the red or yellow bark is preferred by physicians when it is necessary to resort to the medicine in substance. There is no doubt, however, that *cinchonine*, *quinidine*, and *cinchonidine* possess febrifuge properties little inferior, so that the pale bark may come into more extensive use for the preparation of the other alkaloids.

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* For an elaborate description of numerous varieties of Pale Bark, see fourteenth edition of the United States Dispensatory. This is omitted here as unnecessary, because barks are no longer purchased by their physical appearance, but by their yield of alkaloids on analysis.

2. YELLOW BARK.

The officinal term yellow bark is applicable only to the valuable variety of the drug called commercially *Calisaya*, a name which has been said, though erroneously, to be derived from a province in Bolivia, near the city of La Paz, where the bark is collected.* By the druggists *Calisaya bark* is arranged in two sub-varieties, the quilled and the flat, which sometimes come mixed together in the same seroon, sometimes separate. It is called by the French *quinquina jaune royal* (royal yellow bark), from its resemblance to a variety formerly collected for the Spanish king.

The *quilled Calisaya* (*Calisaya arrolada* of the Spanish Americans) is in pieces from three inches to two feet long, from a quarter of an inch to two or three inches in diameter, and of equally variable thickness. The epidermis is of a brownish color, diversified or concealed by silvery white, whitish, or yellowish lichens, is marked by longitudinal wrinkles and transverse fissures, and is often partially separated, and generally easily separable from the proper bark. In the larger kinds, it is thick, rough, deeply indented by the transverse fissures, which often surround the quills, and is composed of several layers, separated from each other by a reddish brown membrane. The epidermis yields a dark red powder, and is tasteless and inert. It is desirable, therefore, to get rid of it before the bark is powdered, as the medicine is thus procured of greater strength. The bark itself, without the epidermis, is from one to two lines in thickness, compact, of a short fibrous texture, and when broken presents shining points, apparently the termination of small fibres running longitudinally, which, examined by the microscope, are found, when freed from a salmon-colored powder that surrounds them, to be yellow and transparent. When the bark is powdered, they readily separate, in the form of spicula, which, like those of cowhage, insinuate themselves into the skin, and produce a disagreeable itching and irritation. The color of the bark is brownish yellow with a tinge of orange, the taste less astringent than that of the pale bark, but much more bitter; and the bitterness is somewhat peculiar. The external part of the proper bark is more bitter and astringent, and consequently stronger in medicinal power, than the internal. The odor is faint, but when the bark is boiled, resembles that of the pale varieties. The small quills closely resemble some of the pale barks, but may be distinguished by their very bitter taste. The U. S. Pharmacopœia thus describes quilled Calisaya bark. "The quills are either single or double, varying in length from one-half to two inches (1 to 5 cm.) in diameter; the bark is from one-sixteenth to one-eighth of an inch (1·5 to 3 mm.) in thickness; it is covered with a grayish cork marked by longitudinal and transverse fissures, about one inch (25 mm.) apart and forming irregular meshes with raised edges. The inner surface is cinnamon-brown and finely striate from the bast-fibres." *U. S.*

The *flat Calisaya* (*Calisaya plancha* of the Spaniards), which is derived from the large branches and trunk, is in pieces of various lengths, either quite flat, or but slightly curved, and generally destitute of the epidermis, which has been obviously removed through its own want of adhesiveness to the proper bark, and not by a knife, as is the case with some inferior barks in other respects resembling the Calisaya. "The flat pieces vary in length and width; are from one-sixth to two-fifths of an inch (4 to 10 mm.) in thickness, almost entirely deprived of the brown, corky layer, compact, of a tawny-yellow color; outer surface marked with shallow, conchoidal depressions and intervening, rather sharp ridges; inner surface closely and finely striate; the transverse fracture showing numerous, very short and rigid, glistening fibres, which are radially arranged, and rarely in small groups. The powder has a light cinnamon-brown color, and a slightly aromatic but persistently bitter taste." *U. S.* The inner surface is like that of the quilled pieces; the outer is irregular, marked with confluent longitudinal furrows and ridges, and somewhat darker colored than the inner, being of a brownish fawn, frequently diversified with darker stains. The bark is of uniform fracture throughout, generally thicker than the quilled, more fibrous in its texture, less compact, less bitter, and possessed of less medicinal power. Though weaker than the proper bark of the quills, it is usually, in equal weight, more valuable than that variety, because free from the useless epidermis. This variety of yellow bark is now (1882) practically out of the American market.

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* No such province exists in Bolivia. According to M. Laubert, the name is a corruption of *collisalla*, said to be derived from *colla*, a remedy, and *salla*, a rocky country. (*Journ. de Pharm.*, xxii. 614.) Weddell refers the origin of the name to the words *colli* and *saya*, which in the Quichua language signify *red* and *sort*, and have probably been applied from the redness which the outer denuded surface of the bark assumes in drying, or from the red color which the leaves sometimes exhibit.

The officinal yellow bark is characterized by its strongly bitter taste, with little astringency; by its fine brownish yellow, somewhat orange color, which is still brighter in the powder; and by *containing a large proportion of quinine with very little cinchonine.* The salts of quinine and lime are so abundant, that a strong infusion of it instantly affords a precipitate when crystals of sulphate of sodium are added. (Guibourt, *Hist. des Drogues*, 4éme ed., iii. 131.)* "The true yellow Cinchona Bark should not be confounded with other Cinchona barks of a similar color, but having the bast-fibres in bundles or radial rows, and breaking with a splintery or coarsely fibrous fracture." *U. S.*

Until the recent most valuable researches of Weddell, nothing was known with certainty as to the particular species which yields Calisaya bark. At present there is no variety of which, in this respect, we have more accurate knowledge. The genuine bark is derived from the newly described species, named *C. Calisaya;* but the bark of *C. Boliviana*, another of the species discovered by Weddell, is sometimes mixed with it in the same seroons. It is produced exclusively in Bolivia, formerly upper Peru, and in the southern portion of the adjoining Peruvian province of Carabaya. Before these countries were separated from Spain, it was shipped as well from Buenos Ayres as from the ports on the Pacific; but at present it comes only from the latter. As first announced in this work, from information derived from merchants long personally engaged in commercial transactions on the Pacific coast of South America, the bark is brought from the interior to the port of Arica, whence it is sent to various other ports on the coast. The interior commerce in the drug has its centre chiefly in the town of La Paz. The trade in this bark has been much diminished, in consequence partly of its greater scarcity, partly of restrictions by the Bolivian government.

It is generally supposed to have been first introduced into commerce towards the end of the last century, and it was probably not known by its present name till that period; but La Condamine states that the Jesuits of La Paz, at a period anterior to the discovery of the febrifuge of Loxa, sent to Rome a very bitter bark by the name of *quinaquina*, which, though supposed by that traveller to have been derived from the Peruvian balsam tree, was very probably, as conjectured by Guibourt, the true cinchona. Besides, Pomet, in his *History of Drugs*, published in 1694, speaks of a bark more bitter than that of Loxa, obtained from the province of Potosi, which borders upon that of La Paz; and Chomal also states that the cinchona tree inhabited the mountains of Potosi, and produced a bark more esteemed than that which grew in the province of Quito. (Guibourt, *Journ. de Pharm.*, xvi. 235.) It is possible that, though known at this early period, it may have gone out of use; and its reintroduction into notice, towards the end of the last century, may have been mistaken for an original discovery.

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* For descriptions of varieties of yellow bark, see 14th edition U. S. Dispensatory. A *false bark* has been sometimes mixed with the genuine Calisaya, which it resembles so closely as not to be easily distinguished by the eye. According to Weddell, it is the bark of *Gomphosia chlorantha*, a lofty tree, growing in the same forests where the *Calisaya* is found. It is distinguished by a peculiar odor, and by exhibiting in its transverse section, under the microscope, "a peculiar fasciculate disposition of the cortical fibres, and some vessels gorged with a ruby-colored juice." It does not contain a particle of alkaloid, but yields a volatile oil on which its odor depends. (Howard, *P. J. Tr.*, xiv. 318.)

3. Red Bark.

The name of this variety is very appropriately applied; as the color is usually distinct both in the bark and the powder. In South America it is called *cascarilla roxa* and *colorada.* Some writers have divided it into several sub-varieties; but, in relation to the true red bark, there does not seem to be ground for such division in any essential difference of properties. Like the *Calisaya*, it comes in quills and flat pieces, which are probably derived from different parts of the same tree. It is imported in chests.

Some of the pieces are entirely rolled, some partially so, as if they had been taken from half the circumference of the branch; others are nearly or quite flat. They vary greatly in size, the quill being sometimes less than half an inch in diameter, sometimes as much as two inches; while the flat pieces are occasionally very large and thick, as if derived from the trunk of a tree. They are covered with a reddish brown or gray, sometimes whitish epidermis, which is rugged, wrinkled longitudinally, and in the thicker pieces marked with furrows, which in some places penetrate to the surface of the proper bark. In many specimens, numerous small roundish or oblong eminences, called warts, may be observed upon the outer surface. Beneath the epidermis is a layer, dark red, brittle and compact, which possesses some bitterness and astringency, but much less than the interior parts. These are woody and fibrous, of a more or less lively brownish red color, which is usually very distinct, but in some specimens passes into orange and even yellowish brown; so that it is not always possible to distinguish the variety by this property alone. The taste is bitter and astringent, and the odor similar to that of other good barks. Red bark is chemically distinguished by *containing considerable quantities of both quinine and cinchonine.* It yields a turbid salmon-colored decoction with water. Mr. Howard, in examining slender sections of a fine specimen of red bark under the microscope, noticed numerous stellate groups of crystals diffused irregularly throughout its substance, which he believed to consist of quinovate of quinine, formed during the drying of the bark. He also noticed other crystalline forms which he ascribed to the quinovates severally of cinchonine, quinidine, and cinchonidine. (*P. J. Tr.*, May, 1865, p. 584.)* The U. S. Pharmacopœia thus describes red bark. "In quills and in flat or inflexed pieces, varying in length and width, and from one-eighth to one-half of an inch (3 to 12 mm.) in thickness; compact; of a deep brown-red color; outer surface covered with numerous, suberous warts and ridges, or longitudinally and somewhat transversely fissured; inner surface rather coarsely striate; transverse fracture short-fibrous; the bast-fibres in interrupted, radial lines; the powder deep brown-red, slightly odorous, astringent and bitter. Red Cinchona should not be confounded with other Cinchona barks, having an orange-red color, and breaking with a coarse, splintery fracture. Thin, quilled Red Cinchona of a light red-brown color should be rejected." *U. S.*

Non-officinal or Carthagena Barks.

Under this head may be classed all the Cinchona barks brought from the northern Atlantic ports of South America. In commerce, they are variously called *Pitaya*, *Bogota*, *Carthagena*, *Maracaybo*, and *Santa Martha barks*, according to the place in the vicinity of which they are collected, or the particular port at which they may be shipped. Formerly these barks were for the most part of inferior quality, and were therefore not recognized in the Pharmacopœias; but the deficient supply and consequent high price of Calisaya have directed enterprise into other quarters; and large quantities of very good bark were thrown into commerce from New Granada, derived chiefly from the neighborhood of Bogota and Popayan, and brought down the river Magdalena. Since the completion of the railroad across the Isthmus of Panama, considerable quantities have been brought to us by that route, being shipped from the port of Buenaventura, on the Pacific coast. There can be little doubt that the commerce in these barks will continue and increase; as some of them are inferior in their yield of alkaloids only to the Calisaya, if even to that variety, and the region from which they are procured is almost virgin soil. It has appeared to us, from an examination of such of them as have come under our notice, that they may all, at least with one exception, be referred without violence to some one or another of the varieties of Carthagena bark already recognized; but these better kinds formerly seldom reached the market; because, partaking of the general reputation of the inferior barks from the same region, it was feared that they might not pay the cost of importation. Most of the Carthagena barks are characterized by a soft, whitish or yellowish white epidermis, which may be easily scraped by the nail, and which, though often more or less completely removed, almost always leaves behind traces sufficient to indicate its character. Those of them which may, in other respects, bear some resemblance to Calisaya, are in general readily distinguishable by this character of the epidermis when it remains, and, when it is wanting, by the peculiar appearance of the outer surface, showing that the exterior coating has been scraped off, or shaved off with a knife. They all contain the alkaloids in greater or less proportion, though they differ much in this respect. In reference to the relative proportion of the different alkaloids, they have nothing in common, except perhaps that they yield proportionately more cinchonine, cinchonidine, and quinidine than the Calisaya, resembling, in this respect, the pale and red barks. Inferior barks, with the soft, white epidermis, are found on the western coast of South America, where they are known as *white barks;** but they seldom reach us. In the state of powder, the inferior Carthagena barks were formerly, and are still, to a certain extent, kept in the shops, and sold for tooth-powder, etc., under the name of *common bark.* They have not unfrequently been substituted, either fraudulently or by mistake, for the better kinds.

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* For description of varieties of Red Bark, see fourteenth edition of U. S. Dispensatory.

The Carthagena barks were formerly classified, according to their color, into the *yellow*, *orange*, *red*, and *brown;* but this mode of distinction must now be abandoned; for these varieties of color may be found in the barks identical in other respects, and derived from the same species of Cinchona. The well characterized Carthagena barks may all be referred to one of the three following varieties.

1. *Hard Carthagena Bark. Hard Yellow Carthagena Bark. Yellow Bark of Santa Fé. Common Yellow Carthagena Bark.—China flava dura.* Von Bergen. *Quinquina de Carthagène jaune pâle.* Guibourt. This is in pieces of various size and form, sometimes wholly or partially quilled, and sometimes flat; and the flat pieces present the appearance of having been warped in drying, being frequently curved longitudinally backward, and sometimes also in the transverse direction or spirally. The quills are from three to eight lines in diameter, from half a line to a line and a half thick, and from five to nine and rarely fifteen inches long. The flat pieces are thicker, from half an inch to two inches broad, and from four to eight and sometimes twelve inches in length. As found in this market, the bark is some-

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* *Paytine* or *Paytina.* Having been requested by a merchant to examine for quinine a *white bark* from the Pacific port of *Payta*, Dr. O. Hesse, in the year 1870, discovered that the bark contained alkaloids, but not one of those proved to exist in the proper Cinchona barks. The alkaloid specially noticed by him, may be prepared from the alcoholic extract, by treating this with soda, and agitating with ether, which dissolves the alkaloid with some coloring matter. The ethereal liquid, agitated with dilute sulphuric acid, furnishes a solution of the sulphate. This is decolorized by a little animal charcoal, almost neutralized with heat by ammonia, then, after cooling, is treated with iodide of potassium, until this ceases to produce a precipitate. The salt thus formed is entirely deposited in 24 hours. Separated from the mother-water, it is treated with dilute solution of soda, and shaken with ether. This, holding the alkaloid in solution, is separated from the heavier liquid; and, having been washed with water, yields, on spontaneous evaporation, the alkaloid in fine colorless crystals. Dr. Hesse gives the new alkaloid the name of *paytine*, after the port whence the bark was obtained. Paytine is in well-defined prismatic crystals. It has a bitter taste. It melts at 156° C., and distils partially at a higher temperature, leaving a carbonaceous residue. It is very soluble in alcohol, ether, benzin, and chloroform, but little soluble in water and alkaline solution. According to the analysis of Hesse it is represented by the formula $C_{21}H_{24}N_2O$ for the pure anhydrous alkaloid, with the addition of one mol. of water in the crystals. It seems to be without poisonous properties, as dogs have taken it freely without evil results. It has not been tried on man; but is a good subject for therapeutical experiment, especially in miasmatic fevers. According to Dr. Hesse, the bark which yields it, though bearing a superficial resemblance to the Calisaya, cannot, from its interior structure, have been the product of a Cinchona. The bark is in pieces about one foot long, two inches broad, and two or three lines thick; and consists mainly of greenish yellow cells, between which is lodged, in large quantities, a white pulverulent matter. It has so little firmness that its fibres are crushed under the pressure of the finger-nail. It has been found to contain another alkaloid besides paytine; but this has not been examined. For further particulars about the alkaloid see the *Journ. de Pharm.*, Nov.-Dec. 1870, p. 389.

times in small, irregularly square or oblong, flattish, and variously warped pieces, from one to four inches long, and from one to three lines in thickness, mixed with small quills or fragments of quills; the former appearing as if chipped from the trunk or larger branches, the latter evidently derived from the small branches. In this shape it was treated of in some former editions of this work, as a distinct variety, under the name of *Santa Martha Bark*, which it at one time held in the market; but a closer examination has convinced us that it is the same bark as the one above described, though collected in a different manner. The quills are generally more covered with the whitish epidermis than the flat pieces, in which it is often nearly or quite removed. The inner surface of the latter, though sometimes smooth, is often rough and splintery, as if forcibly separated from the wood. The color of the proper bark is a pale, dull, brownish yellow, darker in parcels which have been long kept; and the surface often appears as if rubbed over with powdered bark. The texture is rather firm and compact, and the fracture abrupt, without being smooth or presenting long splinters. The taste is bitter and nauseous. This variety of bark is now universally ascribed to *C. cordifolia.*

2. *Fibrous Carthagena Bark. Fibrous Yellow Carthagena Bark. Spongy Carthagena Bark. Bogota Bark. Coquetta Bark.—Quinia naranjanda.* Mutis.—*Quinquina orangé.* Humboldt.—*China flava fibrosa.* Von Bergen.—*Quinquina. Carthegène spongieux.* Guibourt. This is in quills or half-quills, or is slightly rolled; and there are comparatively few pieces which are quite flat, even among the largest barks. The quills are from half an inch to an inch and a half in diameter, and of extremely variable length, with a yellowish brown epidermis, often covered with crustaceous lichens so as to render the surface of the bark whitish and smooth, and exhibiting not unfrequently longitudinal and transverse fissures. The larger barks, which are much the most frequent in commerce, are usually from six to twelve inches long, from one to two inches broad, and from two to five lines in thickness; but they often vary much from these dimensions, being sometimes in the smallest fragments, and sometimes forming semi-cylinders four or five inches in diameter, a foot and a half long, and nine lines thick. They are usually without epidermis, which has been scraped off, or pared off with a knife, leaving the surface smooth and uniform in the former case, and somewhat angular in the latter. Sometimes, however, the epidermis either partially or wholly remains, when it generally exhibits the soft whitish surface characteristic of most of the Carthagena barks. The bark is very fibrous, presenting generally, when broken, long, sometimes stringy splinters, though the outer edge of the fracture is occasionally short from the cellular, or remains of the suberous coat. Its texture is loose, soft, and spongy under the teeth, and the bark itself is usually light. The color both of the trimmed outer surface, and the inner, and of the bark itself, varies from an ochreous or light brownish yellow, to orange, and red; but, for the most part, it presents more or less of the orange tint, which induced Mutis to give it the title of *orange bark.* The red color is found especially in the largest barks. The larger pieces are sometimes marked on the outside with a deep spiral impression, produced probably by a climbing plant winding around the stem of the tree. The color of the powder is yellowish, with not unfrequently an orange tint. The taste is more or less bitter, but varies in this respect extremely; some barks being almost insipid, while others have a very decided taste. There can be little doubt that these barks are all derived from the *Cinchona lancifolia* of Mutis. It is asserted that the red variety of the bark is obtained from trees which grow side by side with those which yield the yellow or orange.

The productiveness of the fibrous bark in alkaloids varies greatly in the different specimens. Thus, while some have yielded scarcely any product, others have been found to afford more than three per cent. They probably contain all the cinchona alkaloids; but some have been found more abundant in one, and others in another. Thus, the red is said to be especially rich in quinidine (cinchonidine); a Pitaya bark, which we believe to belong to the fibrous Carthagena, has yielded a very large product of quinine; while, in not a few specimens which have been examined, the cinchonine predominates. (*A. J. P.*, xxv. 308.) It is probable that the richness in these principles depends in some degree on the natural position of the plants;

those growing in low situations being less productive than those higher on the mountains.*

A specimen labelled *yellow bark of Loxa*, brought from South America several years since by Dr. Dillard, of the U. S. Navy, and said to be used in Loxa for making extract of bark, presents characteristics closely analogous to those of fibrous Carthagena bark, sufficiently so to justify the supposition that it was derived from the same species of Cinchona; and we have seen a specimen sent hither from Guayaquil, which has the same character, and is so rich in alkaloids as to be worked with advantage.†

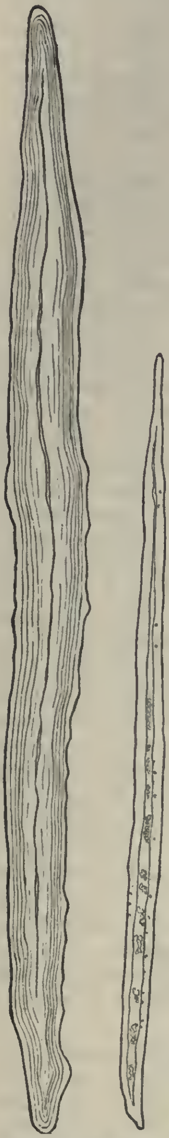
3. *Hard Pitaya Bark.—Pitaya Condaminea Bark.* Pereira.—*Quinquina brun de Carthagène. Quinquina Pitaya, ou de la Colombia, ou d'Antioquia.* Guibourt. This bark, though seen by Guibourt so long since as 1830, did not come into general notice until some years afterwards. Much of it has been imported into Philadelphia, coming sometimes through Carthagena, and sometimes over the Isthmus of Panama, whither it is brought from Buenaventura. The following description is drawn from an examination of the bark contained in several seroons that have come under our notice. It is in small irregular pieces, from less than an inch to about four inches long, which are obviously the fragments of larger pieces both quilled and flat. Dr. Pereira states that he had pieces more than a foot in length. In thickness it varies from less than a line to four or five lines. Most of the fragments are covered with the whitish, soft epidermis, characteristic of the Carthagena barks; but some of them have a dark brown epidermis, rugose with innumerable cracks in all directions; and others are partially or wholly destitute of the outer covering, presenting generally, in the denuded part, a dark uniform or somewhat wrinkled surface. The inner surface is finely and compactly fibrous, and of a dull yellowish brown color with a reddish tinge; and the whole of the liber or true bark has the same color and texture. But outside of the liber there is in many pieces a very distinct resinous layer, which is sometimes of considerable thickness, and, when cut across by a knife, exhibits a dark reddish brown, shining surface. The resinous layer is the most striking peculiarity of the bark, though not present in all of the pieces, which sometimes consist of the liber alone. The fracture is towards the interior shortly fibrous, towards the exterior often smooth, in consequence of the layer just referred to. The whole bark is rather hard, compact, and heavy; differing in this respect very decidedly from the last mentioned variety. It has more resemblance to the hard Carthagena, from which, however, it differs by its deeper and redder color, its much more developed resinous coat, and its occasional grater-like epidermis. The taste is very bitter, and the yield in alkaloids considerable. Mr. Weightman informed us that he had obtained from it an average product of 1·6 per cent. of sulphate of quinine, and 0·34 of sulphate of cinchonine, independently of the amorphous or uncrystallizable alkaloidal matter. It must, therefore, be ranked among the efficient barks, though not so productive as the fine variety of fibrous bark denominated soft Pitaya. It contains also a large proportion of resin.

This bark comes from the mountain of Pitaya near Popayan, and the particular

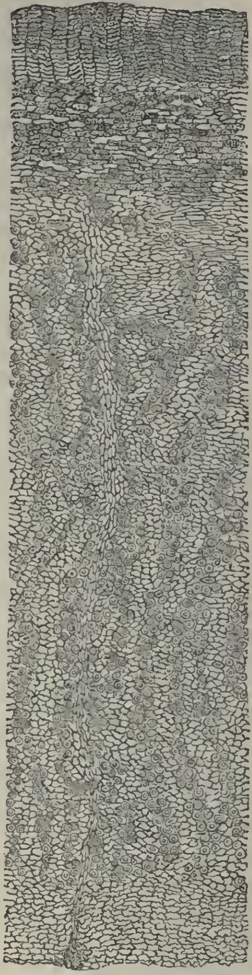
* Karsten states that the bark of *C. lancifolia,* which on the average yields 2·5 per cent. of sulphate of quinine and from 1·0 to 1·5 per cent. of sulphate of cinchonine, often yields neither, and sometimes 4·5 per cent. of the two. The bark of the young branches yields much less than that of the trunk. (*A. J. P.*, xxx. 534.)

† *Fibrous Carthagena Bark.* The following is an abbreviation of Von Bergen's description of this variety. In shape and dimensions it does not materially differ from the preceding; but the flatter pieces are almost always a little rolled, or curved laterally. The epidermis is in general either in part or wholly rubbed off. When it is present, the outer surface is nearly smooth, only marked here and there with faint irregular transverse fissures and longitudinal furrows. Its color varies from a dirty whitish gray to yellowish, but is sometimes more or less dark. When the outer surface is rubbed off, as is almost always the case in the flat pieces, the color is nearly pure ochre yellow. Where the whole thickness of the outer coat is wanting, as happens here and there in spots, the surface is dark cinnamon, or dark ochre yellow, and commonly dull or powdery. The inner surface is usually even, but sometimes irregular and splintery, and always harsh to the fingers, leaving small splinters sticking in the skin when drawn over it. It is of a nearly pure ochre yellow color, and is very powdery. The fracture distinguishes this variety from the preceding, and from all others. The longitudinal fracture is strikingly fibrous, and in the flat pieces the fragments still hang together by connecting fibres.

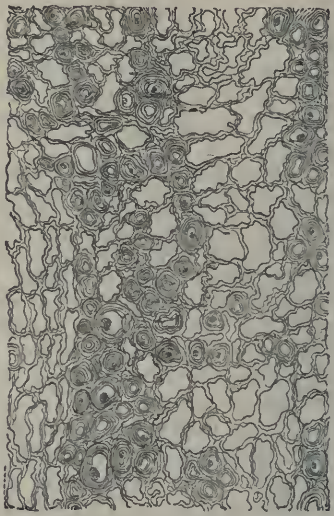
seroons examined by ourselves were said to have been brought down the Magdalena river from the town of Honda. It is referred by Dr. Pereira and Mr. Howard to the *Cinchona Condaminea*, var. *Pitayensis* of Weddell, of which that author has made a distinct species, under the name of *Cinchona Pitayensis.* (*Ann. des Sci. Nat.*, May, 1849.)*



Bast-cells from Carthagena and Cuprea barks.



Transverse section of Cuprea bark.



Highly magnified section of Cuprea bark, showing bast-cells.

CUPREA BARK.—As early as 1820, a Brazilian surgeon, by the name of Remijio, pointed out to his countrymen that the bark of certain small trees or shrubs growing in Brazil were as effective as the Peruvian bark in malarial fevers, and ever since in Brazil these plants have been known by the names of *Quinia de Sera*, or *Quinia de Remijio.* St. Hilaire (*Plantes Us. Bras.*) placed these shrubs in the genus Cinchona, as *C. Remijiana*, *ferruginea*, and *Vellozii;* but De Candolle (*Prodromus*, iv. 357) erected for them a new genus, Remijia, which has since been universally recognized by botanists. It is distinguished from Cinchona by the fruit capsules opening semi-loculicidally, by its peltate seeds, and by its inflorescence in elongated axillary racemes with opposite fascicles of flowers. In 1857 a new bark appeared in the London market, but only within the last few years has this so-called *Cuprea bark* appeared in large quantities. After its value became known the search for it in South America became very active; indeed, in Colombia a "fever" is said to have broken out, which has caused agriculture to be neglected and deranged the business of the country, whilst in London the supply has been so great as to break the whole cinchona market. Mr. S. G. Rosengarten informs us that the bark reaches this country from London, and also directly from

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* More minute descriptions of the Carthagena barks may be found in the foot-notes to the fourteenth edition of the U. S. Dispensatory.

Colombia. There are two distinct regions which yield it: one is the lower part of the basin of the Magdalena River, in the province of Santander, the trees growing in the mountain chain of La Paz, and the port of export being Bucaramanga; the other the basin of the Orinoco, among the mountains which constitute the eastern branch of the Cordillera of the Andes.

Bentham states that the genus Remijia comprises 13 species; according to the researches of José Triana, but two of these, *R. Purdieana*, Wedd. (*Ann. Sci. Nat.*, 3e sér., xi. p. 272), and *R. pedunculata*, Triana (*Cinchona pedunculata*, Karsten), yield the Cuprea bark of commerce. (*P. J. Tr.*, April, 1882.) An exceedingly important fact connected with these trees is that they grow in a dry climate, and in position a little above the level of the sea, and hence without doubt could be cultivated in many intertropical countries where the Cinchonas will not grow. They would in all probability flourish within the limits of the United States.

The specimens of Cuprea bark which have been furnished us as typical by the Messrs. Rosengarten are composed of pieces varying from half an inch to 3 or 4 inches in length, from a quarter to a twelfth of an inch in thickness, strong and hard, varying from a yellowish to a red cinnamon color, and having a somewhat cupreous tint, distinctly curled, *very smooth* upon their inner surface, on their outer surface smoothish, or in the larger specimens rough, with the epidermis usually adherent; marked, except in the very large pieces, with fine wrinkles, and sometimes with transverse or spiral grooves, which are sometimes quite shallow, but often are deeply and sharply cut. The texture is dense and hard, the fracture is short, not fibrous, and free from spicules. The microscopic characters differ from that of the true Cinchonas in the bast-cells being small and with their cavity widely open, not obliterated by secondary layers. The figure represents a bast-cell obtained from a Carthagena bark, and one from Cuprea bark equally magnified.

Cuprea bark varies in the percentage of quinine it contains. The Messrs. Rosengarten state that the yield in their laboratories has been from 1 to 2 per cent., and that usually the bark is remarkably free from inferior alkaloids. The complete absence of cinchonidine is said to be characteristic of them. Messrs. D. Howard and I. Hodgkin, Dr. B. H. Paul, and Mr. Cownley and Mr. T. G. Whiffen almost simultaneously announced the discovery of a new alkaloid, *homoquinine* or *ultraquinine*, which there is some reason for believing is a double salt of quinine and quinidine. (*Chem. News*, xlv. 6.) The characteristic chemical product is the alkaloid *cinchonamine*, whose right to a separate existence seems to be well established. (See page 448.)

FALSE BARKS.

Before dismissing the subject of the varieties of Cinchona, it is proper to observe that numerous barks have at various times been introduced into the market, and sold as closely resembling or identical with the febrifuge of Peru, which experience has proved to differ from it materially, both in chemical composition and in medical virtues. These barks are generally procured from trees formerly ranked among the Cinchonas, but now arranged in other genera. They are distinguished from the true Peruvian bark by the absence of its peculiar alkaloids. Hence they are readily distinguished by means of *Grahe's test.* This depends upon the fact that the cinchona alkaloids and barks containing them yield, when heated, beautiful purplish vapors, condensing into a similarly colored tar. (See p. 451, note.) Hesse's method of testing is probably the best: it consists in extracting the bark by slightly acidulated water, solidifying the liquid with the powdered bark, and heating in a large test-tube. If the bark be a true Cinchona, the vapors will be unmistakable. The microscopic character of the false barks also distinguish them from the genuine. Among them are—1, a bark known to the French pharmaceutists by the name of *quinquina nova*, or *new bark*, the product of *Cascarilla oblongifolia*,* which, though at one time thought to be possessed of some virtues, has been proved to be worthless; 2, the *Caribæan bark*, from *Exostemma Caribæa;* 3, the *St. Lucia bark*, or *quinquina piton* of the French, derived from *Exostemma floribunda;* and, 4, a bark of uncertain botanical origin, called in France

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* For minute description of this bark, see fourteenth edition U. S. Dispensatory.

quinquina bicolore, and in Italy *china bicolorata*, and sometimes erroneously named *Pitaya bark.* Of these the last only is known in this country. A considerable quantity of it was some time since imported into New Orleans, whence a portion reached this city. The specimen in our possession is in quills, for the most part singly, but in some instances doubly rolled, from eight or ten inches to more than two feet in length, and from a quarter of an inch to an inch or more in diameter. The outer surface is of a dull grayish olive color, with numerous large oval or irregular spots, much lighter colored, sometimes even whitish and slightly depressed beneath the general surface, as if a layer of the epidermis had fallen off within their limits. It is to this appearance that the bark owes the name of *bicolorata.* The color of the internal surface is deep brown or almost blackish; that of the fresh fracture, brownish red. The bark is hard, compact, and thin, seldom as much as a line thick, and breaks with a short rough fracture. It is inodorous, and has a very bitter taste, not unlike that of some of the inferior kinds of Cinchona.*

The inner bark of an Indian species of *Hymenodictyon*, formerly considered as a Cinchona, and named *C. excelsa*, has been supposed to possess properties analogous to those of genuine cinchona. It has been chemically examined by Mr. Broughton, who succeeded in obtaining from it a pure crystalline principle, ascertained to be identical with *æsculin*, the characteristic principle of *Æsculus Hippocastanum*, or common horse chestnut. He could find no trace of any of the cinchona alkaloids. (*P. J. Tr.*, March, 1868, p. 418.)

Bark Structure. The general structure of Cinchona barks does not differ from that of other barks, though in some of their microscopical details they are peculiar. The true epidermis is found only upon the growing twigs, and is never present in the commercial cinchona; the so-called epidermis of the various Cinchona barks of commerce being really the outer corky layer, the *exophlæum*, or *outer bark* of botanists. Within it is the *mesophlæum*, or *middle bark;* and innermost of all, the *endophlæum*, *inner bark*, or *liber*. The tuberous outer bark is composed of flat, thick-walled cells, and in some Cinchonas, instead of forming a distinct outer coating, sends processes into the mesophlæum, or it may occur in scattered islets through the middle bark. Under these circumstances, the middle bark may finally altogether be supplanted; if now the exophlæum be shed or rubbed off, a bark is finally left composed entirely of liber, as is the case, for example, with the large, flat pieces of true Calisaya. The middle bark, when present, is formed out of irregular parenchymatous cells, among which may, in some species, be seen the so-called latex vessels, composed of soft, elongated, unbranched cells, more or less completely fused together into channels. In old bark these latex vessels are often entirely obliterated. The parenchymatous cells sometimes contain minute starch granules, and occasionally single cells may be found, having crystals of oxalate of lime, or a softish, reddish, resinoid mass, in their interiors. These constitute the so-called *crystal* and *resin cells* of authors.

The endophlæum is divided by distinct medullary rays into wedge-like masses of parenchymatous tissue, containing the liber, or bast-cells, which, on section, are seen to be thick-walled, with a faint yellowish tint. The liber-cells are the most distinctive feature of Cinchona barks. (See Fig.) "They are elongated and bluntly pointed at their ends, but never branched, mostly spindle-shaped, straight, or slightly curved, and not exceeding in length 3 mm. They are consequently of a simpler structure than the analogous cells of most other officinal barks. They are about ¼ to ⅓ mm. thick, their transverse section exhibiting a quadrangular rather than a circular outline. Their walls are strongly thickened by numerous secondary deposits, the cavity being reduced to a narrow cleft, a structure which explains the brittleness of the fibres. The liber fibres are either irregularly scattered in the liber rays, or they form radial lines transversely intersected by narrow strips of parenchyma, or they are densely packed in short bundles. It is a peculiarity of Cinchona barks that these bundles consist always of a few fibres (3 to 5 or 7), whereas in many other barks (as cinnamon) analogous bundles are made up of a large number of fibres."* (*Pharmacographia*, p. 356.)

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* In previous editions of this work, it was stated that this bark had been employed in Italy successfully in intermittents, and that Folchi and Peretti had discovered in it a new alkaloid, which they named *pitaynine*. But there is reason to believe that this was a mistake, caused by the confused use of the name Pitaya bark; and that the bark employed in Italy, and analyzed by the chemists mentioned, was that described as *hard pitaya* in a preceding page. It is conjectured that the alkaloid *pitaynine* may have been either quinidine or cinchonidine, or a mixture of the two.

It has been asserted that crystals of salts of the alkaloids can be seen with the microscope in Cinchona bark, but this is an error. These crystals are only to be found in sections which have been boiled in a dilute solution of caustic alkali, and then washed with water, and are probably alkaloids that have been set free by the decomposition of the quinovates by the potash or soda.

Various attempts have been made to identify the different species of Cinchona by the structure of their barks, and we append in a foot-note† the analyses of Prof.

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[*] Any one desirous of studying these bast-cells can easily separate them by boiling fragments of the bark in dilute nitric acid until thoroughly pulpified and then teasing out with needles.

[†] PROF. MAISCH'S ANALYSIS.

1.—*Bast fibres single, sometimes in groups of 2, or rarely more; medium-sized.*

C. Calisaya. Laticiferous ducts in young bark; no resin-cells; old bark with prominent secondary cork; medullary rays narrow.

C. glandulifera. Laticiferous ducts in 1 or 2 rows; resin-cells few; bast rays narrow; medullary rays large-celled.

2. *Bast fibres single, or oftener in groups; not in distinct radial lines.*

C. micrantha. No laticiferous ducts; resin-cells few or none; bast fibres medium; medullary rays narrow.

C. purpurea. Laticiferous ducts in 1 or 2 rows; resin-cells numerous; bast fibres thin, with some incomplete fibres; medullary rays broadly wedge-shaped at end.

C. pubescens. Laticiferous ducts in 1 row; resin-cells numerous; bast fibres large, variable, with incomplete fibres; medullary rays broad.

3. *Bast fibres in interrupted single or double radial lines.*

C. succirubra. Laticiferous ducts in 1 row, in old bark often filled with cells; bast and medullary rays narrow; bast fibres medium.

C. officinalis. Laticiferous ducts thin, soon obliterated; resin-cells none; bast fibres medium; medullary rays narrow.

C. Pitoyensis. Laticiferous ducts none; resin-cells few or none; bast fibres thin; medullary rays mostly narrow, wedge-shaped at end.

C. cordifolia. Laticiferous ducts none; resin-cells few; bast fibres small, with some incomplete fibres; medullary rays large-celled.

C. lancifolia. Laticiferous ducts none; resin-cells many; bast fibres medium, with some incomplete fibres; medullary rays large-celled.

C. nitida. Laticiferous ducts none; resin-cells few or none; bast fibres mostly thin, but many thick or medium; medullary rays narrow.

C. Peruviana. Laticiferous ducts (in 1 row) and resin-cells small; bast fibres small, many incompletely filled.

4. *Bast fibres in nearly uninterrupted radial lines.*

C. scrobiculata. Laticiferous ducts in 1 or 2 rows; resin-cells and bast fibres numerous; medullary rays large-celled.

MR. REEVE'S ANALYSIS.

1. *Resin-cells absent.*

Laticiferous ducts present (in young bark); thickest fibres observed average ·095 mm. in diameter; fibres mostly separate. *C. Calisaya.*

Laticiferous ducts present (sometimes obscured in old bark); thickest fibres average ·085 mm. in diameter; fibres in lines, and occasionally groups of 2 to 8. *C. succiruba.*

Laticiferous ducts present (soon obliterated). *C. officinalis.*

2. *Resin-cells few or none* (i.e., *they vary*).

Laticiferous ducts absent; thickest fibres ·10 mm. in diameter; fibres in groups of 2 or 3, in older barks of more; medullary rays thin and indistinct. *C. micrantha.*

Laticiferous ducts absent; thickest observed fibres average ·075 mm.; thin fibres, mostly in single lines; section in places or sometimes entirely light gray. *C. Pitayensis.*

3. *Resin-cells present.*

Laticiferous ducts absent; thickest fibres average ·084 mm.; numerous resin-cells; fibres in line or groups of 2 to 4, with some staff-cells; medullary rays large-celled. *C. lancifolia.*

Laticiferous ducts absent; thickest fibres average ·078 mm.; resin-cells few; medullary rays large-celled; fibres small (sometimes few), in mostly single lines of 2 to 4. with some staff-cells; in some regions the fibres are dark red-brown. becoming bright rose-red with KOH. *C. cordifolia.*

Laticiferous ducts present; thickest observed fibres average ·106 mm.; numerous resin-cells; medullary rays broadly wedge-shaped; fibres in groups of 3 to 5, with some staff-cells. *C. purpurea.*

Laticiferous ducts present: numerous resin-cells; medullary rays broad; fibres large, in groups of 2 to 3, with staff-cells. *C. pubescens.*

Laticiferous ducts present; numerous resin-cells; fibres very numerous, in uninterrupted, usually single lines. *C. scrobiculata.*

Same as last, but few resin-cells. *C. glandulifera.*

Resin-cells, laticiferous ducts, and fibres small, many fibres incompletely filled in lines of 2 to 6. *C. Peruviana.*

Maisch and Mr. J. C. Reeve. The constancy of the characters is, however, very doubtful, and in some studies of commercial barks, owing to the contradictory characters presented, we have found it impossible to apply the asserted facts, so as to determine by the microscope from what species the bark had been procured.

Chemical History.

In the analysis of Peruvian bark, the attention of chemists was at first directed exclusively to the action of water and alcohol upon it, and to the determination of the relative proportions of its gummy or extractive and resinous matter. The presence of tannin and of various alkaline or earthy salts in minute quantities was afterwards demonstrated. Fourcroy made an elaborate analysis, which proved the existence of other principles in the bark besides those previously ascertained. Dr. Westring was the first who attempted the discovery of an active principle in the bark, on which its febrifuge virtues might depend; but he was not successful. Seguin afterwards pursued the same track, and endeavored, by observing the effects of various reagents, to discover the relative value of different varieties of the drug; but his conclusions have not been supported by subsequent experiment. M. Deschamps, an apothecary of Lyons, obtained from bark a crystallizable salt of lime, the acid of which Vauquelin afterwards separated, and called *kinic acid.* The latter chemist also pushed to a much further extent the researches of Seguin as to the influence of reagents, and arrived at the conclusion that those barks were most efficient which gave precipitates with tannin or the infusion of galls. Reuss, of Moscow, succeeded in isolating a peculiar coloring matter from red bark, which he designated by the name of *cinchonic red*, and obtained a bitter substance which probably consisted in part of the peculiar alkaline principles subsequently discovered. The first step, however, towards the discovery of cinchonine and quinine appears to have been taken by the late Dr. Duncan, of Edinburgh, so early as 1803. He believed the precipitate, afforded by the infusion of cinchona with that of galls, to be a peculiar vegetable principle, and accordingly denominated it *cinchonine.* Dr. Gomez, a Portuguese physician, convinced that the active principle of bark resided in this cinchonine, but mixed with impurities, instituted experiments upon some pale bark, which resulted in the separation of a white crystalline substance, considered by him to be the pure *cinchonine* of Dr. Duncan. It was obtained by the action of potassa upon an aqueous infusion of the alcoholic extract of the bark, and was undoubtedly the principle now universally known by the name of *cinchonine* or *cinchonia.* But Dr. Gomez was ignorant of its precise nature, considering it to be analogous to resin. M. Laubert afterwards obtained the same principle by a different process, and described it under the name of *white matter*, or *pure white resin.* To Pelletier and Caventou was reserved the honor of crowning all these experiments, and applying the results which they obtained to important practical purposes. In 1820, they demonstrated the alkaline character of the principle discovered by Gomez and Laubert, and gave it definitively the name of *cinchonine.* They discovered in the yellow or Calisaya bark another alkaline principle, which they denominated *quinine.* Both these bases they proved to exist in the barks, combined with *kinic* or *quinic acid*, in the state of *kinate of cinchonine and of quinine.* It was, moreover, established by their labors that the febrifuge property of bark depends upon the presence of these two principles. In 1833, MM. O. Henry and Delondre discovered a new alkaloid, but afterwards, finding its composition in its anhydrous state the same as that of quinine, concluded that it was a hydrate of that base. About 1844, Winckler announced anew the existence of the same principle which he considered distinct, and named *chinidine;* and, under the similar title of *quinidine*, it has now taken its place among the cinchona alkaloids. In 1853, M. Pasteur found that what had been considered as quinidine consisted in fact of two alkaloids, for one of which he retained the name of quinidine, and called the other *cinchonidine;* and, on pushing his investigations further, he ascertained that no less than six alkaloids may be obtained from different varieties of Peruvian bark; namely, *quinine* and *quinidine* isomeric with each other, *cinchonine* and *cinchonidine* also isomeric, and two others, derivatives from the preceding through the agency of heat, viz, *quinicine* from quinine, and *cinchonicine* from cinchonine, each being isomeric with the alkaloid from which it is derived.* The termination *a* or *ia* has heretofore been adopted by American and English chemists to distinguish the organic alkaloids from other organic proximate principles, the names of which terminate in *in* or *ine*, the terms quinine and cinchonine becoming *quinia* and *cinchonia*. On the same principle, *quinidine*, *quinicine*, *cinchonidine*, and *cinchonicine* were called respectively *quinidia*, *quinicia*, *cinchonidia*, and *cinchonicia*. The Committee of Revision of the Pharmacopœia, 1880, have, however, accepted the custom of continental writers, and the *a* and *ia* termination has been dropped and *ine* substituted.

At the present time, 1882, the following alkaloids are recognized, as either existing naturally, or produced artificially, from the Cinchona barks.

Natural Alkaloids. 1. QUININE, $C_{20}H_{24}N_2O_2$. 2. QUINIDINE (*Conchinine of Hesse*), $C_{20}H_{24}N_2O_2$. 3. CINCHONINE, $C_{20}H_{24}N_2O$. 4. CINCHONIDINE, $C_{20}H_{24}N_2O$. (These four alkaloids are the most important, and the only ones used medicinally, or to be found in the market.) 5. *Quinamine*, $C_{19}H_{24}N_2O_2$. 6. *Quinidamine* (*Conchinamine of Hesse*), $C_{19}H_{24}N_2O_2$. 7. *Homoquinine* or *Ultra-quinine*. 8. *Cinchonamine*. 9. *Paytine*, $C_{21}H_{24}N_2OH_2O$. 10. *Homocinchonine*, $C_{19}H_{22}N_2O$. 11. *Homocinchonidine*, $C_{19}H_{22}N_2O$. 12. *Cusconine*, $C_{23}H_{26}N_2O_42H_2O$. 13. *Cusconidine*. 14. *Aricine* (*Cinchovatine of Manzini*), $C_{23}H_{26}N_2O_4$. 15. *Paricine*, $C_{16}H_{15}N_2O$. 16. *Paytamine*. 17. *Dihomocinchonine*. 18. *Dicinchonine*, $C_{40}H_{48}N_4O_2$? 19. *Diquinidine* (*Diconchinine of Hesse*), $C_{40}H_{46}N_4O_3$. 20. *Javanine*. 21. *Cincholine*.

The Artificial Alkaloids at present known are: 1. *Quinicine*, $C_{20}H_{24}N_2O_2$. 2. *Cinchonicine*, $C_{20}H_{24}N_2O$. 3. *Quinamicine*, $C_{19}H_{24}N_2O_2$. 4. *Quinamidine*, $C_{19}H_{24}N_2O_2$. 5. *Protoquinamicine*, $C_{17}H_{20}N_2O_2$. 6. *Apoquinamine*, $C_{19}H_{22}N_2O$. 7. *Homocinchonicine*, $C_{19}H_{22}N_2O$. 8. *Hydrocinchonine*, $C_{20}H_{26}N_2O$.

Chinoidine or *Quinoidine* is a term now applied to the resinous substance, consisting not only of the *amorphous* natural alkaloids, but to those which are produced artificially, through the action of heat and acids upon the crystalline alkaloids. It is now officinal. The other constituents of Cinchona bark are *Kinic* or *Quinic*, *Kinovic* or *Quinovic*, *Cinchotannic* or *Quinotannic* acids, *Kinovin* or *Quinovin*, *Cinchonic red*, volatile butyraceous oil in small quantity, red and yellow coloring matter. These constituents will now be considered in detail.

Quinine, *Quinidine*, *Cinchonine*, *Cinchonidine*, or their sulphates, having been made officinal, will be treated of under separate heads (see Index). *Quinicine* and *Cinchonicine*, being derivatives of quinine and cinchonine, will be considered under their respective sources.

QUINAMINE, *Quinamia*, $C_{19}H_{24}N_2O_2$. Dr. O. Hesse discovered this cinchona alkaloid in the bark of *C. succirubra* from Darjeeling in 1872. He has since found it in all of the East Indian succirubra barks, as well as in the barks of *C. nitida*, *C. Calisaya*, var. *Schuhkrafft*, *C. erythrantha*, *C. erythroderma*, *C rosulenta*, and *C. Calisaya* (Para bark). De Vrij (*L'Union Pharm.*, 1877, p. 204; *N. R.*, 1877, p. 300) has published a process for its preparation. It crystallizes in very long, asbestos-like, white prisms, without water of crystallization. It is insoluble in water, and solution of potassa or ammonia; is readily dissolved by hot alcohol, which deposits it in crystals, and less readily by diluted alcohol. Ether dissolves it rather easily at ordinary temperature, more readily when boiling hot, and gives it up crystallized on cooling and evaporation. In alcoholic solution it has an alkaline reaction. It neutralizes sulphuric and hydrochloric acids, forming with the latter an amorphous salt, but with the former one that crystallizes with difficulty in hexagonal scales and short prisms. Its solution is dextrogyrate. Its reaction with chloride of gold is very characteristic; the solution of the chloride producing with it a yellowish white precipitate, which soon becomes purple, and separates gold; the supernatant liquid assuming a purplish red, and afterwards a brown color. (For other characters, see *A. J. P.*, 1872, p. 302.)

QUINIDAMINE, *Quinidamia* (*Conchinamine of Hesse*), $C_{19}H_{24}N_2O_2$, is found in *C. rosulenta* and *C. succirubra*, and probably exists in other species of red bark.

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* It is unfortunate that in Germany some confusion yet exists in the names adopted for the cinchona alkaloids. Cinchonidine is frequently called *chinidine*, and Hesse insists on calling quinidine *conchinine*.

It crystallizes in long, brilliant prisms, which melt at 123° C. (253·4° F.). A crystalline hydriodide has been produced. Like quinamine, its gold salt soon decomposes.

HOMOQUININE, $C_{19}H_{22}N_2O_2$, was discovered in 1881 simultaneously, by D. Howard and J. Hodgkin, B. H. Paul, A. J. Cownley and T. G. Whiffen (*P. J. Tr.*, 1881, p. 497; 1882, p. 905). It was named by Howard, and Hesse states that J. A. Tod observed the alkaloid in 1880. It is obtained from the Cuprea bark, and was first noticed by Paul and Cownley on account of the readiness with which it crystallized from its ethereal solution. It exists in the bark sometimes to the extent of 0·3 per cent. *Ultraquinine* is the name suggested for *Homoquinine* by Whiffen, on account of its extreme lævogyrate properties. It is freely soluble in alcohol and chloroform, sparingly in ether, from which it crystallizes in proportion as it can take up water. (*Hesse.*) It is also soluble in diluted sulphuric acid, producing fluorescence, and gives, with chlorine water and ammonia, a green coloration (thalleioquin). The sulphate coincides exactly in properties with sulphate of quinine except in its behavior with ether. Its tartrate closely resembles tartrate of cinchonidine. Homoquinine and its salts behave towards polarized light like quinine.

CINCHONAMINE, $C_{19}H_{24}N_2O$. This alkaloid was discovered in 1881 by M. Arnaud in Cuprea bark. It exists in the proportion of 0·2 per cent., and is usually associated with cinchonine. His process is to treat the bark with milk of lime, dry the mixture, exhaust with boiling alcohol, distil off the alcohol, and take up the residue with diluted hydrochloric acid; hydrochlorate of cinchonamine crystallizes out, hydrochlorate of cinchonine remaining in solution. Cinchonamine is insoluble in cold water, soluble in 30 parts of alcohol, more soluble in hot alcohol, in 100 parts of ether. It is dextrogyrate.

PAYTINE, $C_{21}H_{24}N_2O,H_2O$, was discovered by Hesse in the white Payta bark. PAYTAMINE is an amorphous alkaloid accompanying *Paytine.*

HOMOCINCHONINE, $C_{19}H_{22}N_2O$, *the Cinchonodine of Koch*, is obtained from the bark of *C. rosulenta;* it is lævogyrate, and crystallizes from its alcoholic solution in large prisms. It has been mistaken for *aricine.*

DIHOMOCINCHONINE, $C_{38}H_{44}N_4O_2$, is an amorphous alkaloid obtained from *C. rosulenta.* It is dextrogyrate.

HOMOCINCHONIDINE, $C_{19}H_{22}N_2O$, is also obtained from *C. rosulenta.* It crystallizes in large prisms, and forms a neutral sulphate containing six molecules of water, which may be had in commerce.

CUSCONINE, $C_{23}H_{26}N_2O_4.2H_2O$, was discovered by Leverköhn. It is a constituent of the cusco bark, *C. pubescens* var. *Pelletieriana*, and Hesse has recently found it in Cuprea bark. It is nearly insoluble in water, soluble in 35 parts of ether, more easily in alcohol, very soluble in chloroform. It may be distinguished from other cinchona alkaloids by forming with sulphuric acid a neutral sulphate, which is amorphous, gelatinous, and yellow, and insoluble in an excess of the acid.

CUSCONIDINE is an amorphous alkaloid found in cusco bark, accompanying cusconine.

ARICINE, $C_{23}H_{26}N_2O_4$. *Cinchovatine.* This alkaloid, found in cusco bark, and quite recently in Cuprea bark, was formerly believed by Hesse to be identical with cinchonidine. Pelletier and Cariol obtained *aricine* as far back as 1829 (see note, p. 308, 14th ed. U. S. D.). Its separate existence is now (1882) not doubted. It crystallizes in prisms, and its salts are of sparing solubility.

PARICINE, $C_{16}H_{18}N_2O$, is found with quinamine in the bark of *C. succirubra* of Darjeeling, and, according to Hesse, it may be separated from all the cinchona alkaloids with which it may be associated in solution by treating with carbonate of sodium, which precipitates paricine first.

DICINCHONINE is found in chinoidine. It is amorphous.

DIQUINIDINE, *Diconchinine of Hesse*, $C_{40}H_{46}N_4O_3$, is found principally in chinoidine which has been obtained from barks containing quinine and quinidine. It is dextrogyrate, produces a fluorescent solution with diluted sulphuric acid, and gives the thalleioquin reaction.

JAVANINE, obtained by Hesse from *C. Calisaya* var. *Javanica.*

CINCHOLINE, a pale yellow, liquid alkaloid, having an odor recalling that of chinoline, discovered by Hesse in 1882. (See *P. J. Tr.*, May 6, 1882.)

Of the artificial bases, QUINAMICINE and QUINAMIDINE are isomeric; they are both amorphous, and are produced by heating quinamine in contact with diluted sulphuric acid. If the action of sulphuric acid be continued at 120° C. (248° F.) to 130° C. (266° F.), an amorphous brownish substance is formed which may be precipitated by carbonate of sodium, and is insoluble in ether. Hesse has named this PROTO-QUINAMICINE.

APOQUINAMINE is isomeric with homocinchonine, and is prepared by boiling quinamine or quinamidine with hydrochloric acid for a short time. It is white, amorphous, soluble in ether, alcohol, and diluted hydrochloric acid. HOMOCINCHONICINE is prepared from homocinchonidine just as cinchonicine and quinicine are from cinchonine and quinine,—*i.e.*, by heating their sulphates.

HYDROCINCHONINE, $C_{20}H_{26}N_2O$, discovered by Caventou, is obtained by treating cinchonine with potassium permanganate. It is soluble in 1300 parts of water, more soluble in alcohol and ether. The statement that it may be found in commercial cinchonine has not been confirmed.

The other constituents of Cinchona bark are of less importance.

Kinic Acid (*Cinchonic* or *Quinic Acid*), $C_7H_{12}O_6$. This acid was isolated as early as 1785 by Hofmann, an apothecary of Leer, who obtained it from the calcium salt from cinchona. It exists in a number of important plants,—ivy, oak, elm, ash, coffee, etc. It may be desirable to procure the alkaloids in the state of saline combination in which they exist in the bark; since it is possible that they may exert an influence over the system in this state, somewhat different from that produced by their combinations with the sulphuric or other mineral acid. As it is impossible to procure the kinates immediately from the bark in a pure state, it becomes necessary first to obtain the kinic acid separately, which may thus become of some practical importance. We shall, therefore, briefly describe the mode of procuring it, and its characteristic properties. It is most usually prepared from the kinate of calcium, the residue obtained in the manufacture of sulphate of quinine (see *Quininæ Sulphas*) by decomposing an aqueous solution of kinate of calcium with oxalic acid, filtering out the precipitated oxalate of calcium, and evaporating the filtrate to the crystallizing point; or by evaporating the infusion of bark to a solid consistence, and treating the extract with alcohol, we have in the residue a viscid matter consisting chiefly of mucilage with kinate of calcium, which is insoluble in alcohol. If an aqueous solution of this substance be formed, and allowed to evaporate at a gentle heat, crystals of the kinate will be deposited, which may be purified by a second crystallization. The salt thus obtained, being dissolved in water, is decomposed by means of oxalic acid, which precipitates the lime, and leaves the *kinic acid* in solution. This may be procured in the crystalline state by spontaneous evaporation, though as usually prepared it is in the form of a thick syrupy liquid. The crystals are transparent and colorless, sour to the taste, and readily soluble in alcohol and in water. By heating kinic acid or a kinate with manganese dioxide and sulphuric acid, we get yellow crystals of *kinone*, better known as *quinone*, $C_6H_4O_2$; a reaction which may be used for ascertaining the presence of kinic acid. The kinates of cinchonine and quinine may be obtained either by the direct combination of their constituents, or by the mutual decomposition of the sulphates of those alkaloids and kinate of calcium. *Kinate of cinchonine* has a bitter and astringent taste, is very soluble in water, is soluble also in alcohol, and is crystallized with difficulty. *Kinate of quinine* is also very soluble in water, but less so in rectified alcohol. Its taste is very bitter, resembling that of yellow bark. It crystallizes in beautiful stellate groups, which are opaque or semi-transparent. The salt is with difficulty obtained free from color, and only by employing the ingredients in a state of extreme purity. (*Ann. de Chim. et de Phys.*, Juillet, 1829.) Lautemann found, in experiments upon himself, that kinic acid, when taken into the system, undergoes a conversion into hippuric acid, and in this state escapes with the urine. (*Ann. der Chem. und Pharm.*, cxxv. 9.) M. Rabuteau has investigated the physiological properties of kinic acid, and has found it closely to resemble the ordinary vegetable acids, being harmless in its effects on the system, and forming with water a refreshing drink like lemonade. Like other vegetable acids, also, it is decomposed in the system, forming, when taken in the state of an alkaline salt, a carbonate of the alkali in the blood, and rendering that fluid alkaline. (*Am. Journ. of Med. Sci.*, Oct. 1872, p. 524.) Kinic acid is said by Zwenger to have been found in the leaves of *Vaccinium Myrtillus.* (*A. J. P.*, March, 1861, p. 128.)

Quinovin or *Kinovin. Kinovic Bitter*, $C_{30}H_{48}O_8$. Originally discovered in the false bark called quinquina nova or new bark, this substance has since been found in the Calisaya bark, and probably exists, in greater or less proportion, in all the Cinchona barks. It was detected by De Vrij not only in the bark, but also in the wood and leaves of *C. Calisaya* and *C. lucumæfolia.* (*Journ. de Pharm.*, Avril, 1860, pp. 225 and 258.) It is white, uncrystallizable, almost insoluble in water, but readily dissolved by alcohol and ether. It is very bitter, and, as it is asserted to have no febrifuge virtues, may on this account mislead the judgment in relation to the activity of the bark in which it may be found. Some barks are said to owe their bitterness mainly to this ingredient. Winckler gives, as a certain test of its presence in any bark, the sulphate of copper, which is indifferent to infusion of bark containing none of this principle, but detects the smallest proportion of it by producing a dirty green color, soon followed by the deposition of a fine similarly colored powder. This is a salt of copper, and has a very bitter and metallic taste. (See *A. J. P.*, xxv. 343.)

Kinovin in alcoholic solution was shown in 1859 by Hlasiwetz to be resolved by means of hydrochloric acid gas into kinovic acid, $C_{24}H_{38}O_4$, and an uncrystallizable sugar *mannitan*, $C_6H_{12}O_5$, by assimilation of H_2O. The formation of kinovic acid takes place more easily if kinovin is placed in contact with sodium amalgam and spirit of wine, when after 12 hours mannitan and kinovate of sodium are formed. (*Pharmacographia*, 2d ed., p. 364.)

Kinovic or *Quinovic Acid*, resulting as before stated from the decomposition of kinovin, and possessing the formula $C_{24}H_{38}O_4$, is white, in rhomboidal crystals, insoluble in water, but slightly soluble in ether, somewhat more so in boiling alcohol, but very soluble in ammonia and the fixed alkalies. All its solutions are decidedly bitter. Its acid properties are feeble, yet it is capable of decomposing the alkaline carbonates. (*Journ. de Pharm.*, Nov. 1859, p. 386.) De Vrij proposes the following method of isolating kinovin. Macerate powdered cinchona with a very weak solution of caustic potassa or soda, precipitate the filtered liquid with an acid, redissolve the precipitate in milk of lime to separate the cinchonic red, filter and precipitate the solution boiling hot with hydrochloric acid, separate the precipitate, wash it, express as much as possible, and lastly dry it on porous stones, and powder it. Thus prepared, the kinovic bitter forms soluble compounds with magnesia and lime, and has been employed, in this mode of combination, as a tonic in the hospital of Batavia, with encouraging success. (*Ibid.*, Avril, 1860, p. 258.) Dr. Kerner (*Deutsche Klin.*, xx. p. 81) speaks very favorably of kinovic acid, as an excellent and at the same time perfectly safe tonic, which produces no narcotic symptoms, and given to adults, in the quantity of half or three-quarters of an ounce, causes not the slightest ill effect. He prefers it in the form of kinovate of calcium, of which 40 grains (2·6 Gm.) is the average dose. (*Am. Journ. of Med. Sci.*, Oct. 1869, p. 543.)

A bitter principle was extracted from Calisaya bark by Winckler. He named it *kinovic bitter;* but, having been supposed to possess acid properties, it was afterwards denominated *quinovic* or *kinovic acid.* The compounds are, however, distinct, although associated.

By the experiments of Henry, Jr., and Plisson, it may be considered as established that the alkaloids of the different varieties of bark are combined at the same time with kinic acid, and with one or more of the coloring matters, which, in relation to these substances, appear to act the part of acids. This idea was originally suggested by Robiquet. (*Journ. de Pharm.*, xii. 282, 369.) The compounds of quinine, cinchonine, etc., with the coloring matter, are scarcely soluble in water, while their kinates are very soluble.

The odor of bark appears to depend on a *volatile oil*, which Fabroni and Trommsdorff obtained by distillation with water. The oil floated on the surface of the water, was of a thick consistence, and had a bitterish, acrid taste, with the odor of bark.

The *fatty matter*, which was first obtained pure by M. Laubert, is of a greenish color as obtained from the pale bark, orange yellow from the yellow. It is insoluble in water, soluble in boiling alcohol, which deposits a part of it on cooling, very soluble in ether even cold, and saponifiable with the alkalies.

The *cinchonic red* of Reuss, the *insoluble red coloring matter* of Pelletier and Caventou, is reddish brown, insipid, inodorous, largely soluble in alcohol especially when hot, and almost insoluble in ether or water, though the latter dissolves a little at the boiling temperature. The acids promote its solubility in water. It precipitates tartar emetic, but not gelatin; but if treated with a cold solution of potassa or soda, or by ammonia, lime, or baryta, with heat, and then precipitated by an acid, it acquires the property of forming an insoluble compound with gelatin. It is most abundant in the red bark (over 10 per cent.), and least so in the pale.

The *yellow coloring matter* has little taste, is soluble in water, alcohol, and ether, precipitates neither gelatin nor tartar emetic, and is itself precipitated by subacetate of lead.

CINCHOTANNIC ACID. *Tannic acid, tannin*, or *soluble red coloring matter* of Pelletier and Caventou, has been considered as possessing all the properties which characterize the proximate vegetable principles associated together under the name cinchotannic acid. It has a brownish red color and an austere taste, is soluble in water and alcohol, combines with metallic oxides, and produces precipitates with the salts of iron, which vary in color according to the variety of bark, being deep green with the pale bark, blackish brown with the yellow, and reddish brown with the red. It also forms white precipitates with tartar emetic and gelatin, and readily combines with atmospheric oxygen, becoming insoluble. It must, however, differ materially from the tannic acid of galls, which could not exist in aqueous solutions containing cinchonine and quinine without forming insoluble compounds with them. Rembold has shown that when cinchotannic acid is boiled with diluted sulphuric acid cinchonic red is produced, sugar being formed at the same time by fusing cinchona red with caustic potash, protocatechuic acid, $C_7H_6O_4$, is formed.

Incompatibles. Of the relations of bark to the several solvents employed in pharmacy we shall speak hereafter, under the heads of its infusion, decoction, and tincture; where we shall also have an opportunity of mentioning some of the more prominent substances which afford precipitates with its liquid preparations. It is sufficient at present to state that all the substances which precipitate the infusion of bark do not by any means necessarily affect its virtues; as it contains several inert ingredients which form insoluble compounds with bodies that do not disturb its active principles. As *tannic acid* forms with the alkaloids compounds insoluble in water, it is desirable that substances containing this acid in a free state should not be prescribed in connection with the infusion or decoction of bark; for, though these insoluble tannates might be found efficacious if administered, yet, being precipitated from the liquid, they would be apt to be thrown away as dregs, or at any rate would communicate, if agitated, an unpleasant turbidness. The same may be said of the *tincture* and *compound solution of iodine*, which form insoluble compounds with all the cinchona alkaloids, and of the *alkalies*, *alkaline carbonates*, and *alkaline earths*, which precipitate these alkaloids from their aqueous solution.

Estimation of Value. It is evident, from what has been said, that an infusion of bark, on account of the tannin-like principle which it contains, may precipitate gelatin, tartar emetic, and the salts of iron, without having a particle of cinchonine, quinine, or other alkaloid in its composition; and that consequently any inference as to its value, drawn from these chemical properties, would be fallacious; but, as the active principles are thrown down by the tannic acid of galls, no bark can be considered good which does not afford a precipitate with the infusion of this substance.*

* *Grahe's test.* A test of the Cinchona barks, containing one or more of their characteristic alkaloids, has been proposed by Grahe. It is founded on the fact, that, when these barks are exposed to destructive distillation, a product is obtained of a bright carmine color, which is yielded by no other bark under the same circumstances, and not by cinchona unless it contain one or more of its peculiar alkaloids. Nor do the pure alkaloids afford it; but, if mixed with a little acetic, kinic, tannic, citric, or tartaric acid, they exhibit the reaction, showing that in the bark it takes place between the alkaloids and organic acids contained in it. Grahe applies the test by heating a piece

It is impossible to determine, with accuracy, the relative proportion of the active ingredients in the different varieties of cinchona; as the quantity is by no means uniform in different specimens of the same variety. The results of the most recent experiments have been already stated under the head of the several varieties of bark described. But it is highly important, in relation to any particular sample of bark, to be able to ascertain its medicinal efficiency, which is measured by the quantity of the peculiar cinchona alkaloids it may contain. The U. S. Pharmacopœia for the first time in its history gives a process for assaying Cinchona bark; this is deemed necessary because of the impossibility of judging of the quality of the bark by its physical appearances. The manufacturing chemist never trusts to anything short of a careful chemical assay, and Cinchona bark should never be dispensed or used without having its quality tested or certified to by a competent authority. The following process of assay was contributed to the Committee of Revision by Prof. A. B. Prescott, of Ann Arbor, Mich., who acknowledges valuable assistance from Dr. W. M. Mew, Chemical Service U.S.A., Medical Museum, Washington, D. C. It is based upon De Vrij's method, and will give sufficiently accurate results for the uses of the pharmacist. Each manufacturer and quinologist usually has a process of his own, which he carefully keeps secret, and a method which will accurately differentiate the quantities of the alkaloids is usually difficult and unreliable in the hands of the inexperienced.

"ASSAY OF CINCHONA BARK. I. *For Total Alkaloids.* Cinchona, in No. 80 powder, and fully dried at 100° C. (212° F.), *twenty grammes;* Lime, *five grammes;* Diluted Sulphuric Acid, Solution of Soda, Alcohol, Distilled Water, each, *a sufficient quantity.* Make the Lime into a milk with 50 C.c. of Distilled Water, thoroughly mix therewith the Cinchona, and dry the mixture completely at a temperature not above 80° C. (176° F.). Digest the dried mixture with 200 C.c. of Alcohol, in a flask, near the temperature of boiling, for an hour. When cool, pour the mixture upon a filter of about six inches (15 cm.) diameter. Rinse the flask and wash the filter with 200 C.c. of Alcohol, used in several portions, letting the filter drain after use of each portion. To the filtered liquid add enough Diluted Sulphuric Acid to render the liquid acid to test-paper. Let any resulting precipitate (sulphate of calcium) subside; then decant the liquid, in portions, upon a very small filter, and wash the residue and filter with small portions of Alcohol. Distil or evaporate the filtrate to expel all the Alcohol, cool, pass through a small filter, and wash the latter with Distilled Water slightly acidulated with Diluted Sulphuric Acid, until the washings are no longer made turbid by Solution of Soda. To the filtered liquid, concentrated to the volume of about 50 C.c., when nearly cool, add enough Solution of Soda to render it strongly alkaline. Collect the precipitate on a wetted filter, let it drain, and wash it with small portions of Distilled Water (using as little as possible), until the washings give but a slight turbidity with test-solution of chloride of barium. Drain the filter by laying it upon blotting or filter papers until it is nearly dry. Detach the precipitate carefully from the filter and transfer it to a weighed capsule, wash the filter with Distilled Water acidulated with Diluted Sulphuric Acid, make the filtrate alkaline by Solution of Soda, and, if a precipitate result, wash it on a very small filter, let it drain well and transfer it to the capsule. Dry the contents of the latter at 100° C. (212° F.) to a constant weight, cool it in a desiccator and weigh. The number of grammes multiplied by *five* (5), equals the percentage of total alkaloids in the Cinchona.

"II. *For Quinine.* To the total alkaloids from 20 grammes of Cinchona, previously weighed, add Distilled Water acidulated with Diluted Sulphuric Acid, until the mixture remains for ten or fifteen minutes after digestion, just distinctly acid to test-paper. Transfer to a weighed beaker, rinsing with Distilled Water, and adding of this enough to make the whole weigh *seventy* (70) *times* the weight of the alka-

of the bark weighing from five to ten grains in an ordinary test-tube, and gradually increasing the heat to redness. Whitish smoke, and watery vapor condensing on the surface of the tube, are first given off, which are soon followed by the appearance of redness in the fumes, and by the deposition, an inch above the heated part, of a red pulverulent film, which is gradually changed into a thick, oily liquid, running down the glass in drops or streaks of a fine carmine color. (*Chemisches Centralblatt,* Feb. 17, 1858, p. 97.) For further information see p. 443.

loids. Add now, in drops, Solution of Soda previously well diluted with Distilled Water, until the mixture is exactly neutral to test-paper. Digest at 60° C. (140° F.) for five minutes, then cool to 15° C. (59° F.) and maintain at this temperature for half an hour. If crystals do not appear in the glass vessel, the total alkaloids do not contain quinine in quantity over *eight* (8) *per cent.* of their weight (corresponding *to nine* (9) *per cent.* of sulphate of quinine crystallized). If crystals appear in the mixture, pass the latter through a filter not larger than necessary, prepared by drying two filter papers of two to three and a half inches (5 to 9 cm.) diameter, trimming them to an equal weight, folding them separately, and placing one within the other so as to make a plain filter four-fold on each side. When the liquid has drained away, wash the filter and contents with Distilled Water of a temperature of 15° C. (59° F.), added in small portions, until the entire filtered liquid weighs *ninety* (90) *times* the weight of the alkaloids taken. Dry the filter, without separating its folds, at 60° C. (140 F.), to a constant weight, cool, and weigh the inner filter and contents, taking the outer filter for a counter-weight. To the weight of effloresced sulphate of quinine so obtained, add 11·5 per cent. of its amount (for water of crystallization), and add 0·12 per cent. of the weight of the entire filtered liquid (for solubility of the crystals at 15° C.) 59° F. The sum in grammes, multiplied by *five* (5), equals the percentage of crystallized sulphate of quinine equivalent to the quinine in the Cinchona." *U. S.*

The British Pharmacopœia gives the following methods of testing Cinchona barks.

1. "*Test for Yellow Cinchona.* Boil 100 grains of the bark, reduced to very fine powder, for a quarter of an hour, in a fluidounce of distilled water acidulated with ten minims of hydrochloric acid; and allow it to macerate for twenty-four hours. Transfer the whole to a small percolator, and, after the fluid has ceased to drop, add at intervals about an ounce and a half of similarly acidulated water, or until the fluid which passes through is free from color. Add to the percolated fluid solution of subacetate of lead until the whole of the coloring matter has been removed, taking care that the fluid remains acid in reaction. Filter, and wash with a little distilled water. To the filtrate add about thirty-five grains of caustic potash, or as much as will cause the precipitate which is at first formed to be nearly redissolved, and afterwards six fluidrachms of pure ether. Then shake briskly, and, having removed the ether, repeat the process twice with three fluidrachms of ether, or until a drop of the ether employed leaves on evaporation scarcely any perceptible residue. Lastly, evaporate the mixed ethereal solutions in a capsule. The residue, which consists of nearly pure Quinia, when dry, should weigh not less than two grains, and should be readily soluble in diluted sulphuric acid.

2. "*Test for Pale Cinchona.* Two hundred grains of the bark, treated in the manner directed in the test for yellow cinchona bark, with the substitution of chloroform for ether, should yield not less than one grain of alkaloids.

3. "*Test for Red Cinchona.* One hundred grains of the bark, treated in the manner directed in the test for yellow cinchona, with the substitution of chloroform for ether, should yield not less than 1·5 grain of alkaloids." *Br.*

It is usually sufficient to ascertain the quantity of total alkaloids in bark, for this is really a test of the efficacy of the bark for pharmaceutical purposes; for all the organic alkaline principles contained in it are efficient as medicines, and in all probability in a nearly equal degree. But, for manufacturing purposes, it is necessary to push the investigation further, and ascertain the proportion of the several alkaloids in the mixture. This is most conveniently done by means of ether. Cinchonine is scarcely soluble in ether, quinidine is soluble in small proportion, quinine is freely soluble. When, therefore, a mixture of these alkaloids is treated with that menstruum, quinine and quinidine are dissolved, and cinchonine left. The two former may be separated by allowing the ethereal solution to evaporate. Quinidine crystallizes from the solution, and quinine is obtained uncrystallized, as the last product of the evaporation of the ether. These remarks apply to quinidine, as it was understood before the investigations of Pasteur.*

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* Mr. Robert Howard employs the following method of ascertaining the presence or absence of these alkaloids, severally, in any mixture of their sulphates, founded on the fact that ten grains

From the most recent and carefully conducted assays, it appears that the best officinal yellow Calisaya bark, the finest red bark, and the finest fibrous Carthagena bark (*soft Pitaya*) are about equal in their amount of alkaloids, each containing from 3 to 4 per cent, and the Indian and Java barks frequently exceed these yields; De Vrij obtained from bark of *C. officinalis* grown at Ootacamund total alkaloids as high as 11·96 per cent. (9·1 per cent. of which was quinine). The highest yield yet recorded was obtained by De Vrij from Ootacamund bark, 13·5 per cent., the greater part of which was quinine. Between these and the barks of lowest

of sulphate of quinine dissolve in sixty drops of ether, but only one grain of sulphate of quinidine. Ten grains of the salt are put into a strong test-tube, ten drops of dilute sulphuric acid (one of acid and five of water) with fifteen drops of water are added, and a moderate heat applied till the salt is dissolved. When the solution has quite cooled, sixty drops of officinal ether with twenty of spirit of ammonia are added, and the mixture is well shaken, the tube being closed by the thumb. After this the tube is closely stopped with a well-fitting cork, and gently shaken from time to time. If the salt contain only quinine, or not more than 10 per cent. of quinidine, it will be completely dissolved, while, at the surface of contact of the two clear liquids, only mechanical impurities will be seen. After some time the layer of ether becomes gelatinous, and then no further observation can be made. Ten grains of the salt examined may contain one grain of quinidine, and yet be completely dissolved by the ether and ammonia; but in this case the quinidine will soon begin to crystallize in the layer of ether. The least trace of quinidine may be detected by employing, instead of ordinary ether, the same fluid previously saturated with quinidine, in which case all the quinidine must remain undissolved. It is necessary, in the last experiment, to observe, after the shaking, whether or not all has dissolved; for, owing to the great tendency of quinidine to crystallize, it may again separate, and thus become a source of error. If more than a tenth of quinidine, or if cinchonine be present in the salt, an insoluble precipitate will be seen between the layers of the two fluids. If it be quinidine, it will be dissolved on the addition of proportionately more ether; while, if it be cinchonine, it will remain unaffected. (*P. J. Tr.*, xi. 394.)

De Vrij uses the following method of ascertaining the alkaloid strength of cinchona, and of obtaining the several alkaloids separate. Having dried a portion of powdered bark at 100° C., and weighed it, mix with it one-fourth of slaked lime, and boil for five minutes with ten times its weight of alcohol of sp. gr. 0·85. Put the whole on a filter, and exhaust by adding successively portions of boiling alcohol, until the whole weight of the spirit used equals twenty times that of the bark. Acidulate the tincture with diluted acetic acid so that it shall redden litmus, and then evaporate on a water-bath till all the alcohol is expelled. Treat the residue separately with water till the filtered liquid is no longer made turbid by an alkali. The solution thus obtained contains all the alkaloids; the kinovic acid, resin, fat, and other impurities remaining on the filter. If the filter and its contents be treated with milk of lime, the quantity of kinovic acid can be determined. The watery solution is now to be reduced by evaporation on a water-bath to a small bulk, and then mixed with an excess of slaked lime, by which the alkaloids are precipitated. Now throw the whole on the smallest possible filter, and wash with the minimum of cold water. If proper care be taken, the amount of water necessary to remove the coloring matter is so small, that the loss of alkaloids through their slight solubility in lime-water may be disregarded. After the filter has been duly washed, and dried, boil it repeatedly with alcohol of 0·82, till this will dissolve nothing more; then filter, evaporate the slightly colored alcoholic solution in a weighed platinum vessel, and heat the residue on a water-bath till it ceases to lose weight. The amount of alkaloids is now known. Sometimes a trace of coloring matter is left undissolved. If this is sufficient to be weighed, it must be deducted from the amount of the alkaloids; but generally the quantity is insufficient to merit notice.

To ascertain their character, dissolve in the smallest quantity of very dilute acetic acid. Put the solution in a closed funnel, provided with a cork, agitate with a slight excess of caustic soda, and a quantity of ether equal to fifteen times the weight of the alkaloids, and let the mixture stand for six hours; for, though cinchonidine and quinidine are sparingly soluble in ether, a considerable amount is dissolved on the first agitation, which separates in crystals in a few hours. Now evaporate the ethereal solution, and dry the residue on a water-bath till the weight remains constant. The residue is quinine, with traces of cinchonidine, quinidine, and cinchonine; and in many cases a large amount of a still unknown fusible alkaloid. By the known reactions of chlorine and ammonia, and by the preparation of Herapathite, the nature of this residue can be ascertained.

The alkaloids which have not been dissolved by the ether are now again to be dissolved in the smallest quantity of diluted acetic acid, and the solution mixed with a few drops of a concentrated solution of iodide of potassium. After stirring with a glass rod, a sandy crystalline precipitate will occur if quinidine be present. In such a case, the hydriodate of quinidine is collected on a filter, dried at 100° C. (212° F.), and weighed, and the quantity of quinidine ascertained by calculation; 100 grains of the hydriodate being equivalent to 71·68 of quinidine, according to the formula $C_{20}H_{24}N_2O_2,HI$.

The liquid separated by filtration from the hydriodate is precipitated by caustic soda, and the precipitate will be either cinchonine, or a mixture of this with cinchonidine.

The presence of cinchonine or quinidine among the alkaloids may be conjectured at the time of the treatment with ether; for, if one of these is present, it is partially deposited in a crystalline state after some time.

While the presence of quinidine can easily be ascertained by iodide of potassium even in small quantities, that of cinchonidine can be determined with certainty only by the polarizing apparatus, by which De Vrij has detected the cinchonidine of Pasteur even in the bark of the *C. Pahudiana* of Java. (*P. J. Tr.*, vi. 51.)

value there is every grade of productiveness, down to a mere trace of alkaloidal matter.*

Medical Properties and Uses. This valuable remedy was unknown to the civilized world till about the middle of the seventeenth century, though the natives of Peru are generally supposed to have been long previously acquainted with its febrifuge powers. Humboldt, however, is of a different opinion. In his Memoir on the Cinchona forests, he states that it is unknown as a remedy to the Indians inhabiting the country where it grows; and, as these people adhere pertinaciously to the habits of their ancestors, he concludes that it never was employed by them. They have generally the most violent prejudices against it, considering it poisonous, and in the treatment of fever prefer the milder indigenous remedies. Ruiz and Pavon, however, ascribe the discovery to the Indians; and Tschudi states, in his Travels in Peru (*Am. ed.*, ii. 280), that the inhabitants of the Peruvian forests drink an infusion of the green bark as a remedy in intermittent fever.† On the other hand, the statements of Humboldt have recently been confirmed by the travellers Markham and Spence, the former remarking that the native Indian doctors do not use the bark, and the latter that the Cascarilleros of Ecuador believe that their red bark is used solely for dyeing. It is uncertain whether, as Jussieu stated in 1739, the Jesuit fathers received their knowledge from the Indians, or, as Humboldt believes, discovered the virtues of the drug for themselves, having been led to make trial of it by its extreme bitterness. The Countess of Cinchon, wife of the Viceroy of Peru, having in her own person experienced the beneficial effects of the bark, is said, on her return to Spain in the year 1640, to have first introduced the remedy into Europe. Hence the name of *pulvis Comitissæ*, by which it was first known. After its introduction, it was distributed and sold by the Jesuits, who are said to have obtained for it the price of its weight in silver. From this circumstance it was called *Jesuit's powder*, a title which it long retained. In 1653, Dr. Chifflet, physician to the Archduke Leopold, directed the attention of all Europe to the bark by his work entitled *Pulvis Febrifugus Orbis Americani.* This gave rise to a very active controversy; the high price of the drug aiding very greatly those who opposed its introduction. According to Sturm, twenty doses in 1658 cost sixty florins. It seems first to have been advertised in England for sale in 1658 by a James Thomson, and by 1660 it was much employed. It still, however, encountered much prejudice and ignorance, and was not made officinal in the London Pharmacopœia until 1677. Sir Robert Talbot (or Talbor) used it as a secret remedy with so much address and success that in 1679 he cured Charles II. of a tertian, and subsequently sold his secret to Louis XIV. of France, who published it in 1681.

When taken into the stomach, bark usually excites in a short time a sense of warmth in the epigastrium, which often diffuses itself over the abdomen and even the breast, and is sometimes attended with considerable gastric and intestinal irritation. Nausea and vomiting are sometimes produced, especially if the stomach was previously in an inflamed or irritated state. Purging, moreover, is not an unfrequent attendant upon its action. After some time has elapsed, the circulation often experiences its influence, as exhibited in the somewhat increased frequency of pulse; and, if the dose be repeated, the whole system becomes more or less affected, and all the functions undergo a moderate degree of excitement. Its action upon the nervous system is often evinced by a sense of tension, or fulness, or slight pain in the head, singing in the ears, and partial deafness, which are always experienced by many individuals when brought completely under its influence. The effects above mentioned entitle bark to a place among the tonics, and it is usually ranked at the very head of this class of medicines. It has, however, certain, at present inscrutable, powers, which enable it to combat the action of malaria. It is, therefore, *antiperiodic*, but why it is so is at present entirely unknown. At present it is never itself employed in intermittents, and for the details of its action upon the system the reader is referred to the article upon the sulphate of quinine. As a tonic, bark is advantageously employed in chronic diseases connected with debility; as, for example, in scrofula, dropsy, passive hemorrhages, certain forms of dyspepsia, obstinate cutaneous affections, amenorrhœa, chorea, hysteria; in fact, whenever a corroborant influence is desired, and no contraindicating symptoms exist. But in all these cases it greatly behooves the physician to examine well the condition of the system, and, before resorting to the tonic, to ascertain the real existence of an enfeebled condition of the functions, and the absence of such local irritations or inflammations, especially of the stomach or bowels, as might be aggravated by its use. In doubtful cases, we have been in the habit of considering the occurrence of profuse sweating during sleep as an indication for its use, and, under these circumstances, have prescribed it very advantageously, in the form of sulphate of quinine, in acute rheumatism, and in the advanced stages of protracted fevers. Cinchona bark was formerly used in doses of 10 grains to a drachm (0·65 Gm. to 3·9 Gm.), but at present is never exhibited in its crude state.

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* To obviate the disadvantages arising from the variable strength of bark, M. Guillermond recommends to fix on an appropriate strength, as indicated by the percentage of quinine, below the highest yet much above the lowest, and either to select bark of this strength, or to bring that employed to the medium strength, by adding a stronger or weaker bark, as the case may require, in due proportion. He recommends as this standard the yield of 3·2 per cent. of sulphate of quinine. This is to be treated by alcohol till entirely exhausted, and the tincture evaporated so as to yield an extract which shall exactly represent the virtues of the bark, and shall always have the same strength. From this extract all the preparations of bark are to be made, which will thus always be uniform in strength. (*Journ. de Pharm.*, Août, 1863, p. 124.)

† Tschudi also observes that he has found the fresh bark more efficacious than the dried; as, in less than half the usual dose, it not only effects cures in a short time, but insures the patient against the return of the disease.

Off. Prep. of Yellow Bark. Extractum Cinchonæ, *U. S.;* Extractum Cinchonæ Fluidum, *U. S.;* Extractum Cinchonæ Flavæ Liquidum, *Br.;* Infusum Cinchonæ; Tinctura Cinchonæ, *U. S.;* Tinctura Cinchonæ Flavæ, *Br.*

Off. Prep. of Pale Bark. Mistura Ferri Aromatica, *Br.;* Tinctura Cinchonæ Composita, *Br.*

Off. Prep. of Red Bark. Tinctura Cinchonæ Composita, *U. S.*

CINCHONIDINÆ SULPHAS. *U. S.* *Sulphate of Cinchonidine.*

(CĬN-ÇHO̤-NI̤-DĪ′NÆ SŬL′PHĂS.)

$(C_{20}H_{24}N_2O)_2H_2SO_4.3H_2O$; 768. $(C_{20}H_{12}NO)_2, HO, SO_3.3HO$; 384.

"The neutral sulphate of an alkaloid prepared from certain species of Cinchona, chiefly Red Cinchona." *U. S.*

Sulphate of Cinchonidia; Schwefelsaures Cinchonidin, *G.;* Sulfate de Cinchonidine, *Fr.*

This is a new officinal, which has largely come into use lately. It is prepared from the mother-liquors obtained in the manufacture of sulphate of quinine, and is separated from the sulphates of the other alkaloids by fractional crystallization. The British-India and Javanese cultivated red barks usually contain large quantities of cinchonidine. Of the South American barks, probably the Colombian varieties yield the largest proportion of cinchonidine. Owing to some confusion in naming cinchonidine and quinidine, this alkaloid is sometimes incorrectly called in Germany *chinidine.* Skraup's researches on the composition of cinchonine and cinchonidine have not been endorsed by the Committee of Revision, and his partially accepted formula $C_{19}H_{22}N_2O$ is therefore not adopted.

Properties. Sulphate of cinchonidine occurs in "white, silky, lustrous needles, or thin quadratic prisms, odorless, having a very bitter taste, and a neutral or faintly alkaline reaction. Soluble in 100 parts of water and in 71 parts of alcohol at 15° C. (59° F.), in 4 parts of boiling water, in 12 parts of boiling alcohol, freely in acidulated water and in 1000 parts of chloroform (the undissolved portions becoming gelatinous); very sparingly soluble in ether or benzol. At 100° C. (212° F.) the salt loses its water of crystallization. From a dilute aqueous solution the salt crystallizes with 13·13 per cent. (6 to 7 mol.) of water of crystallization; from a concentrated aqueous solution with 7·03 per cent. (3 to 4 mol.). On ignition, the salt is dissipated without leaving a residue. The aqueous solution of the salt yields, on addition of water of ammonia, a white precipitate (Cinchonidine) which requires a large excess of ammonia to dissolve it, and which is soluble in about 75 times its weight of ether. With test-solution of iodide of mercury and potassium, the aqueous solution yields a curdy precipitate, and with test-solution of chloride of barium a white precipitate insoluble in hydrochloric acid. The moderately dilute aqueous solution of the salt, acidulated with sulphuric acid, should not show more than a slight blue fluorescence (abs. of more than traces of sulphate of quinine or of quinidine). The salt should not be colored by the addition of sulphuric acid (abs. of foreign organic matters). If 1 Gm. be dried at 100° C. (212° F.) until it ceases to lose weight, the residue, cooled in a desiccator, should weigh not less than 0·92 Gm. If 0·5 Gm. of the salt be digested with 20 C.c. of cold distilled water, 0·5 Gm. of tartrate of potassium and sodium added, the mixture macerated, with frequent agitation, for one hour at 15° C. (59° F.), then filtered, and a drop of water of ammonia added to the filtrate, not more than a slight turbidity should appear (abs. of more than 0 5 per cent. of sulphate of cinchonine, or of more than 1·5 per cent. of sulphate of quinidine)." *U. S.*

Cinchonidine. The alkaloid itself is not officinal; as usually seen it is in white, light, pulverulent masses. It is crystallizable, soluble in 1680 parts of cold and in a somewhat smaller quantity of hot water, in about 20 parts of alcohol and 70 parts of ether. It melts at 206·5° C. (404° F.), and becomes a solid mass of crystals at 190° C. (374° F.). The *acid sulphate* (sometimes called *bisulphate*) is much more soluble in water than the officinal sulphate. The *salicylate of cinchonidine* is neutral and crystalline, insoluble in cold water, sparingly in hot water, easily soluble in alcohol and diluted alcohol. It may be prepared by the direct combination of salicylic acid with the alkaloid. (Rosengarten, *A. J. P.*, 1879, p. 616.) The *hydrobromate* has been employed by Prof. Gubler hypodermically. (*N. R.*, 1879, p. 366.)

Medical Properties. So far as our knowledge goes, this alkaloid influences the system similarly to quinine; the only difference being seemingly that it is less powerful. It may be given in a dose one-third greater than those of quinine, but should not be relied on in very severe cases.

CINCHONINA. *U. S.* *Cinchonine.* [*Cinchonia.*]

$C_{20}H_{24}N_2O$; 308. (CĬN-ꞒHỌ-NĪ'NẠ.) $C_{20}H_{12}NO$; 154.

"An alkaloid prepared from different species of Cinchona." *U. S.*

This alkaloid is introduced for the first time into the U. S. Pharmacopœia. The sulphate has had an extensive use, is again officinal, and is the source from whence this alkaloid is usually prepared. Cinchonine is most conveniently precipitated from an aqueous solution of sulphate of cinchonine by water of ammonia. Several processes have been employed for the preparation of cinchonine. One of the simplest is the following. Powdered pale bark is submitted to the action of sulphuric or hydrochloric acid very much diluted, and the solution obtained is precipitated by an excess of lime. The precipitate is collected on a filter, washed with water, and treated with boiling alcohol. The alcoholic solution is filtered while hot, and deposits the cinchonine when it cools. A further quantity is obtained by evaporation. If not perfectly white, it may be made so, by converting it into a sulphate with dilute sulphuric acid, then treating the solution with animal charcoal, filtering, precipitating by an alkali, and redissolving by alcohol in the manner already mentioned. It may also be obtained from the mother-waters of sulphate of quinine by diluting them with water, precipitating with ammonia, collecting the precipitate on a filter, washing and drying it, and then dissolving it in boiling alcohol, which deposits the cinchonine in a crystalline form upon cooling. It may be still further purified by a second solution and crystallization. Its formula is generally accepted as $C_{20}H_{24}N_2O$, the molecular weight of which is 308. Skraup (1878) proposes, instead of this, the formula $C_{19}H_{22}N_2O$.

Properties. This alkaloid occurs in "white, somewhat lustrous prisms or needles, permanent in the air, odorless, at first nearly tasteless, but developing a bitter after-taste, and having an alkaline reaction. Almost insoluble in cold or hot water, soluble in 110 parts of alcohol at 15° C. (59° F.), in 28 parts of boiling alcohol, 371 parts of ether, 350 parts of chloroform, and readily soluble in diluted acids, forming salts of a very bitter taste. At about 250° C. (482° F.) it melts and turns brown with partial sublimation. On ignition, the alkaloid is dissipated without leaving a residue. A solution of the alkaloid in diluted sulphuric acid, should not exhibit more than a faint blue fluorescence (abs. of more than traces of quinine or quinidine). On precipitating the alkaloid from this solution by water of ammonia, it is very sparingly dissolved by the latter (difference from and abs. of quinine), and requires at least 300 parts of ether for solution (difference from quinine, quinidine, and cinchonidine). The salt should not be colored, or but very slightly colored, by the addition of sulphuric acid (abs. of foreign organic matter)." *U. S.* Waddington found it to sublime readily, without change, in perfectly characteristic crystals. (*P. J. Tr.*, March, 1868, p. 414.)* Its alkaline character is very decided, as it neutralizes the strongest acids. Of the salts of cinchonine, the sulphate, nitrate, hydrochlorate, phosphate, and acetate are soluble in water. The neutral tartrate, oxalate, and gallate are insoluble in cold water, but soluble in hot water, alcohol, or an excess of acid. Winkler has shown that cinchonine is rendered uncrystallizable or amorphous by sulphuric acid in excess, aided by heat; a fact of importance in the preparation of the sulphate of this alkaloid. (*Chem. Gaz.*, March 15, 1848.) Cinchonine is but little more soluble in carbonic acid water than in pure water, and does not, like quinine, yield crystals of the carbonate on exposure of its carbonic acid solution. (*Comptes-Rendus*, Nov. 7, 1853, p. 727.) It differs from quinine by its rotating the plane of polarization to the right, by the want of fluorescence in its solutions, and by its failing to give the *thalleioquin* test.

Exposed to the air, cinchonine does not suffer decomposition, but very slowly absorbs carbonic acid gas, and acquires the property of effervescing slightly with acids. It is precipitated sulphur yellow by the terchloride of gold. Chlorine water dissolves it or any of its salts without change; but if ammonia be now added, a white precipitate is produced. It is thus distinguishable from quinine. (See *Quinine.*) Dr. J. W. Bill, U.S.A., proposes ferrocyanide of potassium as a very delicate test of cinchonine. If added to the solution of a salt of this alkaloid, it produces a yellowish white curdy precipitate, which is dissolved upon the application of a gentle heat, but is again deposited, when the liquid cools, as an abundant crop of golden yellow crystals. No other alkaloid exhibits the same reaction. A cloudy precipitate is produced by the same reagent with a salt of quinine; but this does not happen when the ferrocyanide is in excess; and, if the precipitate be dissolved by heat, no subsidence takes place on cooling. Hence, in the application of this test to cinchonine, a slight excess of the ferrocyanide should be added. (*Am. Journ. of Science and Arts*, July, 1858, p. 108.)

By the action of permanganate of potassium cinchonine is decomposed, with the effect of producing, besides other products, a distinct neutral principle, named *cinchotenine*, $C_{18}H_{20}N_2O_3 + 3H_2O$, a crystallizable acid, the *carbocinchonic*, $C_{20}H_{14}N_2O_4$, and an alkaloid, which the authors name *hydrocinchonine*, $C_{20}H_{26}N_2O$, as it differs from cinchonine (cinchonia) only in having two additional atoms of hydrogen. For a special account of these principles the reader can consult *P. J. Tr.*, 1869, p. 291; from a paper by Messrs. Caventou and Willm, presented to the Chemical Society of Paris.

Medical Properties. The physiological action of cinchonine is similar to but less powerful than that of quinine. Thus, Conzen (quoted by Husemann) has found that its action on infusoria and on fermentation is similar to but weaker than that of its sister alkaloid, and that on the movements of the white blood-corpuscles its influence seems transient. Upon dogs, according to Bernatzik's experiments, the lethal dose of cinchonine is to that of quinine as 5 is to 4. As an antiperiodic or tonic, cinchonine exerts an influence similar to that of quinine, but is probably about one-third weaker than that alkaloid, and must be used in correspondingly larger dose.

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* It is asserted that the hydrochlorates of quinine, cinchonine, and quinidine, heated on a slip of platinum, short of combustion, emit a purple vapor like iodine. Neither the alkaloids nor their sulphates have this property; but the addition of one-tenth of hydrochlorate will cause the evolution of the colored vapor. (*Journ. de Pharm. et de Chim.*, 4e sér., iii. 397.)

CINCHONINÆ SULPHAS. *U.S.* *Sulphate of Cinchonine.*

(CĬN-ȻHỌ-NĪ′NÆ SŬL′PHĂS.)

$(C_{20}H_{24}N_2O)_2H_2SO_4.2H_2O$; 750. $(C_{20}H_{12}NO)_2.HO,SO_3.2HO$; 375.

Cinchoniæ Sulphas, *Pharm.* 1870; **Cinchoninum Sulfuricum**, *P.G.;* **Sulfate de Cinchonine**, *Fr.;* **Schwefelsaures Cinchonin**, *G.*

The process officinal in U. S. P. 1870 is as follows. "Take of the mother-water, remaining after the crystallization of Sulphate of Quinine, in the process for preparing that salt, *a convenient quantity ;* Solution of Soda, Alcohol, Diluted Sulphuric Acid, Animal Charcoal, in fine powder, each, *a sufficient quantity.* To the mother-water add gradually, with constant stirring, Solution of Soda, until the liquid becomes alkaline. Collect on a filter the precipitate formed, wash it with water, and dry it. Then wash it with successive small portions of alcohol, to remove other alkaloids which may be present. Mix the residue with eight times its weight of water, and, having heated the mixture, add gradually Diluted Sulphuric Acid until it is saturated and becomes clear. Then boil the liquid with Animal Charcoal, filter it while hot, and set it aside to crystallize. Lastly, drain the crystals, and dry them on bibulous paper. By evaporating the mother-liquid, more crystals may be obtained." *U. S.*

In consequence of its greater solubility, Sulphate of Cinchonine remains behind in the mother-waters, when sulphate of quinine crystallizes, in the process for preparing the latter salt. To separate it from other substances contained in the mother-waters, it is decomposed by solution of soda, which is preferable to potassa, as it forms a very soluble salt, with sulphuric acid, whereas the sulphate of potassium, being of difficult solubility, might fall with the precipitated cinchonine. The precipitate may be safely washed with small portions of alcohol, as the alkaloid is almost insoluble in that liquid when cold. It is next reconverted into the sulphate; and the solution, having been boiled with *unpurified* animal charcoal to decolorize it, and at the same time neutralize any possible excess of sulphuric acid which might interfere with the crystallization of the salt, is filtered while hot, and then allowed to stand. It is peculiarly important that there should be no excess of sulphuric acid while the solution is exposed to heat, as, under this influence, the alkaloid is much disposed to become uncrystallizable. Hence the advantage of using unpurified animal charcoal or bone-black, as the carbonate of calcium contained in it neutralizes any excess of the acid. The sulphate of cinchonine, held in solution by the liquid while hot, is deposited by it upon cooling in crystals.

It may be prepared also by first obtaining cinchonine from one of the pale barks; treating this with water acidulated with sulphuric acid, added gradually till the alkaloid is dissolved; then boiling with purified animal charcoal, filtering the solution while hot, and setting it aside to crystallize.

There are two sulphates of cinchonine, the neutral and the acid-sulphate. The officinal salt is the neutral sulphate. It is in "hard, white, shining prisms of the clino-rhombic system, permanent in the air, odorless, having a very bitter taste and a neutral or faintly alkaline reaction. Soluble in about 70 parts of water and in 6 parts of alcohol at 15° C. (59° F.), in 14 parts of boiling water, 1·5 parts of boiling alcohol, 60 parts of chloroform, and easily so in diluted acids; insoluble in ether or benzol. At 100° C. (212° F.) the salt loses its water of crystallization, and at about 240° C. (464° F.) it melts with partial sublimation. On ignition, the salt is dissipated without leaving a residue. The aqueous solution of the salt yields a curdy precipitate with test-solution of iodide of mercury and potassium. With water of ammonia it yields a white precipitate (Cinchonine) which is very sparingly soluble in an excess of ammonia (difference from quinine), and not soluble in less than 300 parts of ether (difference from quinine, quinidine, and cinchonidine).*

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* A test, distinguishing between the sulphates of quinine and of cinchonine, has been announced by M. Palm, of Russia, in the polysulphide of potassium prepared by boiling solution of potassa with an excess of sulphur. When a solution of this sulphide is added to a boiling solution of sulphate of quinine, the latter, however small the quantity present, is thrown down as a red terebinthinate mass, which hardens on cooling, and then assumes the appearance of a resin; while with sulphate of cinchonine a white powder is precipitated containing sulphur. (*Journ. de Pharm.*, Mai, 1864.)

With test-solution of chloride of barium it yields a white precipitate insoluble in hydrochloric acid. A moderately dilute solution of the salt, acidulated with sulphuric acid, should not show more than a faint blue fluorescence (abs. of more than traces of sulphate of quinine or of quinidine). If 1 Gm. be dried at 100° C. (212° F.), until it ceases to lose weight, the residue, cooled in a desiccator, should weigh not less than 0·952 Gm. If the salt, dried at a gentle heat, be macerated, for half an hour, with frequent agitation, with 70 times its weight of chloroform at 15° C. (59° F.), it should wholly, or almost wholly, dissolve (any more than traces of sulphate of quinine or sulphate of cinchonidine remaining undissolved). It should not be colored by contact with sulphuric acid (abs. of foreign organic matters)." *U S.* The *acid sulphate*, or *bisulphate*, $C_{20}H_{24}N_2OH_2SO_4,3H_2O$, is prepared by adding sulphuric acid to the neutral sulphate. According to Baup, 100 parts are soluble in 45 parts of water and in 100 parts of absolute alcohol; it is insoluble in ether. It crystallizes in rhombic octahedrons.

Medical Properties and Uses. It is now determined that sulphate of cinchonine has the same remedial properties as sulphate of quinine, but must be given in somewhat larger dose. As a tonic it may be given in the dose of a grain or two (0·065–0·13 Gm.) three or four times a day; as an antiperiodic, 15 grains to 40 grains (1·0–2·6 Gm.) may be given between the paroxysms. It may be taken in pill or solution made by the addition of dilute sulphuric acid, in the proportion of a minim or two drops for each grain of the salt.

CINNAMOMUM. *U. S.* *Cinnamon.*

(CĬN-NA̤-MŌ'MŬM.)

"The inner bark of the shoots of Cinnamomum Zeylanicum, Breyne (Ceylon Cinnamon); or the bark of the shoots of one or more undetermined species of Cinnamomum grown in China (Chinese Cinnamon). (*Nat. Ord.* Lauraceæ.)" *U. S.* "The inner bark of shoots from the truncated stocks of Cinnamomum Zeylanicum." *Br.*

Cinnamomi Cortex, *Br.;* Cinnamon Bark; Cortex Cinnamonii Zeylonici, *P.G.;* Cinnamomum Acutum, s. Verum; Cannelle de Ceylon, Cannelle. *Fr.;* Brauner Canel, Zeylonzimmt, Zimmt, *G.;* Canella, *It.;* Canela, *Sp.;* Kurundu, *Cingalese;* Karua puttay, *Tamil.*

Cassia.—Cortex Cinnamomi Cassiæ, *P.G.;* Cinnamomum Chinense, Cassia Cinnamomea; Cassia Lignea; Cassia Bark; Casse, Cannelle de Chine, *Fr.;* Cassienzimmt, Zimmtkassie, Chinesischer (Gemeiner) Zimmt, *G.;* Canellina, *It.:* Casia, *Sp.*

The U. S. Pharmacopœia embraces, under the title of Cinnamon, not only the bark of that name obtained from the island of Ceylon, which is the only variety recognized in the British Pharmacopœia, but also the commercial cassia, which is imported from China; and, as the two products, though very different in price, and somewhat in flavor, possess identical medical properties and are used for the same

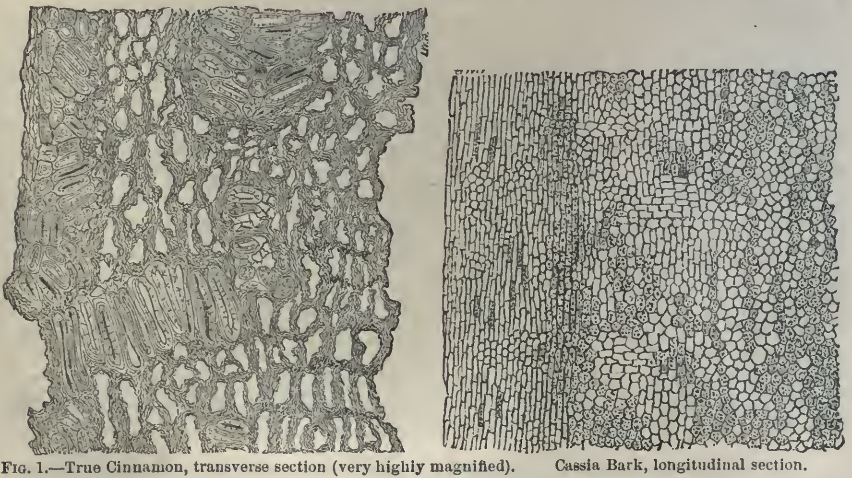
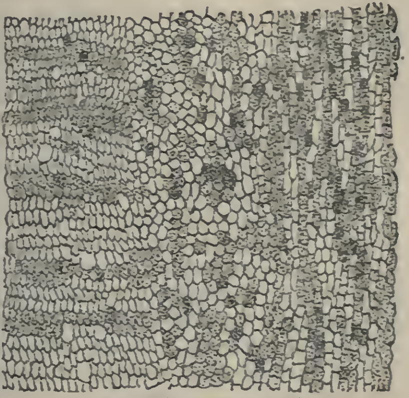


Fig. 1.—True Cinnamon, transverse section (very highly magnified). Cassia Bark, longitudinal section.

purposes, there seems to be no necessity for giving them distinct officinal designations. Indeed, the barks of all the species of the genus Cinnamomum, possessing analogous properties, are as much entitled to the common name of cinnamon, as the barks of the Cinchonas are to the name of cinchona, and the juice of different species of Aloe to that of aloes. Both *cinnamomum* and *cassia* were terms employed by the ancients, but whether exactly as now understood it is impossible to determine. The term *cassia*, or *cassia lignea*, has been generally used in modern times to designate the coarser barks analogous to cinnamon. It was probably first applied to the barks from Malabar, and afterwards extended to those of China and other parts of Eastern Asia. It has been customary to ascribe *cassia lignea* to the *Laurus Cassia* of Linnæus; but the specific character given by that botanist was so indefinite, and based on such imperfect information, that the species has been almost unanimously abandoned by botanists. The barks sold as cinnamon and cassia in different parts of the world are derived from various species of Cinnamomum. We shall describe only the two species recognized in the U. S. Pharmacopœia.



Cassia Bark, transverse section.

Gen. Ch. Flowers hermaphrodite or polygamous. *Perianth* six-cleft, the upper half of each segment deciduous. *Stamens* nine, with four-celled anthers, six (opposite the perianth-segments) opening inwards without glands, three (opposite three of the above) opening outwards and bearing a gland on each side at the base. *Staminodia* three (opposite the three other outer stamens), with capitate or cordate abortive anthers. *Berry* resting on the enlarged six-lobed base of the perianth." (Bentham, *Flora Hongkongensis.*) As thus defined, the genus Cinnamomum does not include the genus Camphora; for the modification of character necessary to do this, see *Camphora.*

1. *Cinnamomum Zeylanicum.* Nees, *Laurineæ*, 52; Lindley, *Flor. Med.* 329; Hayne, *Darstel. und Beschreib., etc.* xii. 263.—*Laurus Cinnamomum.* Linn. This is a tree about 20 or 30 feet high, with a trunk from 12 to 18 inches in diameter, and covered with a thick, scabrous bark. The branches are numerous, strong, horizontal, and declining; and the young shoots are beautifully speckled with dark green and light orange colors. The leaves are opposite for the most part, coriaceous, entire, ovate, or ovate-oblong, obtusely pointed, and three-nerved, with the lateral nerves vanishing as they approach the point. There are also two less obvious nerves, one on each side arising from the base, proceeding towards the border of the leaf, and then quickly vanishing. The footstalks are short and slightly channelled, and, together with the extreme twigs, are smooth and without the least appearance of down. In one variety, the leaves are very broad and somewhat cordate. When mature, they are of a shining green upon their upper surface, and lighter colored beneath. The flowers are small, white, and arranged in axillary and terminal panicles. The fruit is an oval berry, which adheres like the acorn to the receptacle, is larger than the black currant, and when ripe has a bluish brown surface, diversified with numerous white spots.

The tree emits no smell perceptible at any distance. The bark of the root has the odor of cinnamon with the pungency of camphor, and yields this principle upon distillation. The leaves have a spicy odor when rubbed, and a hot taste. A volatile oil distilled from them has been introduced into commerce.* The petiole has the flavor of cinnamon. It is a singular fact that the odor of the flowers is to people in general disagreeable, being compared by some to the scent exhaled from newly-sawn bones. The fruit has a terebinthinate odor when opened, and a taste in some degree like that of Juniper berries. A fatty substance, called *cinnamon-suet*, is obtained from it when ripe, by bruising and then boiling it in water, and removing the oleaginous matter which rises to the surface, and concretes upon cooling. It is the prepared bark that constitutes the genuine cinnamon.

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* The *cinnamon leaf oil*, as imported into Great Britain, is of two kinds, one containing a considerable quantity of a fatty fixed oil, perhaps cinnamon-suet from the fruit, the other a pure volatile oil. The oil is said to be obtained by distilling the leaves after maceration in sea-water. It resembles the oil of cloves and pimento in sensible properties, having a brownish color, a penetrating, fragrant odor, and a very pungent taste. According to Stenhouse, it is of the sp. gr. 1·053, has an acid reaction, and consists of eugenic acid, a neutral substance with the formula $C_{10}H_{16}$, and a minute proportion of benzoic acid. (*P. J. Tr.*, xiv. 319.)

This species is a native of Ceylon, where it has long been cultivated. It is said also to be a native of the Malabar Coast, and has at various periods been introduced into Java, the Isle of France, Bourbon, the Cape Verds, Brazil, Cayenne, several of the West India islands, and Egypt, and in some of these places is at this time highly productive, especially in Cayenne, where the plant was flourishing so early as 1755. It is exceedingly influenced, as regards the aromatic character of its bark, by the circumstances of soil, climate, and mode of culture. Thus, we are told by Marshall that in Ceylon, beyond the limits of Negombo and Matura, in the western and southern parts of the island, the bark is never of good quality, being greatly deficient in the aromatic flavor of the cinnamon; and that even within these limits it is of unequal value, from the various influence of exposure, soil, shade, and other circumstances.

2. *C. aromaticum.* Nees, *Laurineæ*, 52; Lindley, *Flor. Med.* 330.—*C. Cassia.* Blume, Ed. Ph.; Hayne, *Darstel. und Beschreib., etc.* xii. 23.—*Laurus Cassia.* Aiton, *Hort. Kew.* ii. 427.—Not *Laurus Cassia* of Linn. This is of about the same magnitude as the former species, and, like it, has nearly opposite, shortly petiolate, coriaceous, entire leaves, of a shining green upon the upper surface, lighter colored beneath, and furnished with three nerves, of which the two latter vanish towards the point. The leaves, however, differ in being oblong-lanceolate and pointed, and in exhibiting, under the microscope, a very fine down upon the under surface. The footstalks and extreme twigs are also downy. The flowers are in narrow, silky panicles. The plant grows in China, Sumatra, and other parts of Eastern Asia, and is said to be cultivated in Java. It is believed to be the species which furnishes, wholly or in part, the Chinese cinnamon or cassia brought from Canton, and is supposed to be the source of the *cassia buds.*

Besides the two species above described, others have been thought to contribute to the cinnamon and cassia of commerce. In 1839 (*Madras Journ. Lit. & Sci.*, No. 22), Dr. Wight stated that in his belief cinnamon was derived from 12 to 18 specially distinct trees. *C. inners*, Reinw., is distinguished from *C. Zeylanicum* by the nervation of its leaves, which are also paler and thinner than those of the officinal plant, of which, however, it is probably only a variety. It yields the so-called *wild cinnamon* of Japan. *C. Loureirii* of Nees, growing in the mountains of Cochin-China, near Laos, and in Japan, affords, according to Loureiro, a cinnamon of which the finest kind is superior to that of Ceylon. *C. nitidum*, growing in Ceylon, Java, and on the continent of India, is said to have been the chief source of the drug known formerly by the name of *Folia Malabathri*, and consisting of the leaves of different species of Cinnamomum mixed together. *C. Culilawan* of the Moluccas yields the aromatic bark called culilawan, noticed in Part II. of this work; and similar barks are obtained from another species of the same region, named *C. rubrum*, and from *C. Sintoc* of Java. *Massoy-bark*, from which an aromatic volatile oil is obtained called *oil of massoy*, is the product of *C. Kiamis.* (Gmelin, *Handbook*, xiv. 380.) In the mountains of Eastern Bengal, at a height of 1000 to 4000 feet, flourish *C. obtusifolium*, Nees, *C. pauciflorum*, Nees, and *C. Tamala*, W., and these afford quantities of a bark which is brought to Calcutta for shipment under the name of *cassia lignea*, or *cassia.*

Culture, Collection, Commerce, etc. Our remarks under this head will first be directed to the cinnamon of Ceylon, in relation to which we have more precise information than concerning that obtained from other sources. The bark was originally collected exclusively from the tree in a wild state; but the Dutch introduced the practice of cultivating it, which has been continued since the British came into possession of the island. The principal cinnamon gardens are in the vicinity of Columbo. The seeds are planted in a prepared soil at certain distances; and, as four or five are placed in a spot, the plants usually grow in clusters like the hazel-bush. In favorable situations they attain the height of five or six feet in six or seven years; and a healthy bush will then afford two or three shoots fit for peeling, and every second year afterwards from four to seven shoots in a good soil. The cinnamon harvest commences in May, and continues till late in October. The first object is to select shoots proper for decortication, and those are seldom cut which are less than half an inch or more than two or three inches in diameter. The bark is divided by longitudinal incisions, of which two are made in the smaller shoots, several in the larger, and is then removed in strips by means of a suitable instrument. The pieces are next collected in bundles, and allowed to remain in this state for a short time, so as to undergo a degree of fermentation, which facilitates the separation of the epidermis. This, with the green matter beneath it, is removed by placing the strip of bark upon a convex piece of wood, and scraping its external surface with a curved knife. The bark now dries and contracts, assuming the appearance of a quill. The peeler introduces the smaller tubes into the larger, and connects them also endwise, thus forming a congeries of quills which is about forty inches long. When sufficiently dry, these cylinders are collected into bundles weighing about thirty pounds, and bound together by pieces of split bamboo. The commerce in Ceylon cinnamon was formerly monopolized by the East India Company; but the cultivation is now unrestricted, and the bark may be freely exported upon the payment of a fixed duty. It is assorted in the island into three qualities, distinguished by the designations of *first*, *second*, and *third*. The inferior kinds, which are of insufficient value to pay the duty, are used for the preparation of oil of cinnamon.

Immense quantities of cinnamon are exported from China, the finest of which is little inferior to that of Ceylon, though the mass of it is much coarser. It passes in commerce under the name of *cassia*, and is said by Mr. Reeves to be brought to Canton from the province of Kwangse, where the tree producing it grows very abundantly. (*Trans. Medico-Bot. Soc.*, 1828, p. 26.) It has already been stated that this tree is supposed to be the *Cinnamomum aromaticum;* but we have no positive proof of the fact. Travellers inform us that cinnamon is also collected in Cochin-China; but that the best of it is monopolized by the sovereign of the country. It is supposed to be obtained from the *Cinnamomum Loureirii* of Nees, the *Laurus Cinnamomum* of Loureiro. According to Siebold, the bark of the large branches is of inferior quality and is rejected; that from the smallest branches resembles the Ceylon cinnamon in thickness, but has a very pungent taste and smell, and is little esteemed; while the intermediate branches yield an excellent bark, about a line in thickness, which is even more highly valued than the cinnamon of Ceylon, and yields a sweeter and less pungent oil. (*Annal. der Pharm.*, xx. 280.) Cinnamon of good quality is said to be collected in Java; and considerable quantities of inferior quality have been thrown into commerce, as *cassia lignea*, from the Malabar Coast. Manilla and the Isle of France are also mentioned as sources whence this drug is supplied. Little, however reaches the United States from these places. The island of Martinique, Cayenne, and several of the West India islands, yield to commerce considerable quantities of cinnamon of various qualities. That of Cayenne is of two kinds, one of which closely resembles, though it does not quite equal, the aromatic of Ceylon, the other resembles the Chinese. The former is supposed to be derived from plants propagated from a Ceylonese stock, the latter from those which have sprung from a tree introduced from Sumatra.

By far the greater proportion of cinnamon brought to this country is imported from China. It is entered as *cassia* at the custom-house, while the same article brought from other sources is almost uniformly entered as cinnamon. Much of it is afterwards exported.

From what source the ancients derived their cinnamon and cassia is not certainly known. Neither the plants nor their localities, as described by Dioscorides, Pliny, and Theophrastus, correspond precisely with our present knowledge; but in this respect much allowance must be made for the inaccurate geography of the ancients. It is not improbable that the Arabian navigators, at a very early period, conveyed this spice within the limits of Phœnician and Grecian, and subsequently of Roman commerce.

Properties. *Ceylon cinnamon* is in long cylindrical fasciculi, composed of numerous quills, the larger enclosing the smaller. In the original sticks, which are somewhat more than three feet in length, two or three fasciculi are neatly joined at the end, so as to appear as if the whole were one continuous piece. The finest is of a light brownish yellow color, almost as thin as paper, smooth, often somewhat shining, pliable to a considerable extent, with a splintery fracture when broken. It has a pleasant fragrant odor, and a warm, aromatic, pungent, sweetish, slightly astringent, and highly agreeable taste. When distilled it affords but a small quantity of essential oil, which, however, has an exceedingly grateful flavor. It is brought to this country from England; but it is costly. The inferior sorts are browner, thicker, less splintery, and of a less agreeable flavor, and are little if at all superior to the best Chinese. The finer variety of *Cayenne cinnamon* approaches in character that above described, but is paler and in thicker pieces, being usually collected from older branches. That which is gathered very young is scarcely distinguishable from the cinnamon of Ceylon. "*Ceylon Cinnamon* is in long, closely-rolled quills, composed of eight or more layers of bark of the thickness of paper; pale yellowish-brown; outer surface smooth, marked with wavy lines; inner surface scarcely striate; fracture splintery; odor fragrant; taste sweet and warmly aromatic." *U. S.**

Chinese cinnamon, or *Cassia*, is in tubes from one-eighth of an inch to an inch in diameter, usually single, sometimes double, but very rarely more than double. In some instances the bark is rolled very much upon itself, in others is not even completely quilled, forming segments more or less extensive of a hollow cylinder. It is of a redder or darker color than the finest Ceylon cinnamon, thicker, rougher, denser, and breaks with a shorter fracture. It has a stronger, more pungent and astringent, but less sweet and grateful taste, and, though of a similar odor, is less agreeably fragrant. It is the kind almost universally kept in our shops. Of a similar character is the cinnamon imported directly from various parts of the East Indies. But under the name of cassia have also been brought to us very inferior kinds of cinnamon, collected from the trunks or large branches of the trees, or injured by want of care in keeping, or perhaps derived from inferior species. It is said that cinnamon from which the oil has been distilled is sometimes fraudulently mixed with the genuine. These inferior kinds are detected, independently of their greater thickness and coarseness of fracture, by their deficiency in the peculiar sensible properties of the spice. "*Chinese Cinnamon* (Cassia Bark) is in quills about one twenty-fifth of an inch (1 mm.) or more in thickness; nearly deprived of the corky layer; brown, outer surface somewhat rough; fracture nearly smooth; odor and taste analogous to that [*sic*] of Ceylon Cinnamon, but less delicate." *U. S.*

The *Pharmacographia* gives the following tests for distinguishing powdered cassia from powdered cinnamon, and for recognizing the inferior varieties of cassia. Make a decoction of powdered cinnamon of known genuineness, and one of similar strength of the suspected powder; when cool and strained, test a fluidounce of each with one or two drops of tincture of iodine. A decoction of cinnamon is but little affected, but in that of cassia a deep blue-black tint is immediately produced. The cheap kinds of cassia known as *cassia vera* may be distinguished from the more valuable Chinese cassia as well as from cinnamon by their richness in mucilage; this can be extracted by cold water as a thick glairy liquid, giving dense ropy precipitates with corrosive sublimate or neutral acetate of lead, but not with alcohol.

Microscopic Structure. Ceylon cinnamon usually consists simply of liber, the outer coatings having been stripped off during its preparation for market. Three layers are distinguishable in the liber. "1. The external surface, which is composed of one to three rows of large thick-walled cells (Fig. 1), forming a coherent ring; it is only interrupted by bundles of liber fibres, which are obvious even to the unaided eye. 2. The middle layer is built up of about 10 rows of parenchymatous thin-walled cells, interrupted by much larger cells containing deposits of mucilage, while other cells not larger than those of the parenchyme itself are loaded with essential oil.

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* For an account of the cultivation of *C. Zeylanicum*, see *P. J. Tr.*, xi. 261.

3. The innermost layer exhibits the same thin-walled but smaller cells, yet intersected by narrow somewhat darker medullary rays, and likewise interrupted by cells containing either mucilage or essential oil, instead of bundles of liber fibres. Fibres mostly isolated are scattered through the two inner layers, the parenchyme of which abounds in small starch granules accompanied by tannic matter. On a longitudinal section the length of the liber fibres becomes more evident, as well as oil-ducts and gum-ducts." (*Pharmacographia.*)

The coarser cassia bark, or cassia lignea, usually has some of the external or corky layer adherent to it, and always the parenchymatous mesophlæum or middle bark, but the liber constitutes the chief mass. Isolated liber fibres and thick-walled cells (stone-cells) are scattered even through the outer layers of a transverse section. In the middle zone they are numerous, but do not form a coherent sclerenchymatous ring as in Ceylon cinnamon. The innermost part of the liber shares the structural character of cinnamon, with difference due to age, as, for instance, the greater development of the medullary rays. Oil-cells and gum-ducts are likewise distributed in the parenchyme of the former. The finest cassia or Chinese cinnamon has the three layers described in Ceylon cinnamon, but is readily distinguished by the adherent outer parenchymatous and suberous layer.

Chemical Composition. According to the analysis of Vauquelin, cinnamon contains a peculiar volatile oil, tannin, mucilage, a coloring matter, an acid, and lignin. The tannin is of the variety which yields a greenish black precipitate with the salts of iron. The oil obtained from the Cayenne cinnamon he found to be more biting than that from the Ceylonese, and at the same time to be somewhat peppery. Bucholz found in 100 parts of *cassia lignea*, 0·8 of volatile oil, 4·0 of resin, 14·6 of gummy extractive (probably including tannin), 64·3 of lignin and bassorin, and 16·3 of water including loss. This aromatic yields its virtues wholly to alcohol, and less readily to water. At the temperature of boiling alcohol very little of the oil rises, and an extract prepared from the tincture retains, therefore, the aromatic properties. For an account of the volatile oil, see *Oleum Cinnamomi.*

Medical Properties and Uses. Cinnamon is among the most grateful and efficient of the aromatics. It is warm and cordial to the stomach, carminative, astringent, and, like most other substances of this class, more powerful as a local than as a general stimulant. It is seldom prescribed alone, though, when given in powder or infusion, it will sometimes allay nausea, check vomiting, and relieve flatulence. It is chiefly used as an adjuvant to other less pleasant medicines, and enters into a great number of officinal preparations. It is often employed in diarrhœa, in connection with chalk and astringents, and has recently been recommended as peculiarly efficacious in uterine hemorrhage. The dose of the powder is from ten grains to a scruple (0·65–1·3 Gm.).

CASSIA BUDS. This spice consists of the calyx of one or more species of Cinnamomum, surrounding the young germ, and, as stated by Dr. Martius, on the authority of the elder Nees, about one-quarter of the normal size. It is produced in China; and Mr. Reeves states that great quantities of it are brought to Canton from the province which affords cassia. The species which yields it is in all probability the same with that which yields the bark, though it has been ascribed by Nees to *Cinnamomum Loureirii.* In favor of the former opinion is the statement of Dr. Christison, that *C. aromaticum*, cultivated in the hot-houses of Europe, bears a flower-bud which closely resembles the cassia bud when at the same period of advancement. Cassia buds have some resemblance to cloves, and are compared to small nails with round heads. The enclosed germen is sometimes removed, and they are then cup-shaped at top. They have a brown color, with the flavor of cinnamon, and yield an essential oil upon distillation. They may be used for the same purposes as the bark.

Off. Prep. Aqua Cinnamomi, *Br.;* Decoctum Hæmatoxyli, *Br.;* Infusum Catechu, *Br.;* Pulvis Aromaticus, *U. S.;* Pulvis Catechu Compositus, *Br.;* Pulvis Cinnamomi Comp., *Br.;* Pulvis Cretæ Aromaticus, *Br.;* Pulvis Kino Comp., *Br.;* Syrupus Rhei Aromaticus, *U. S.;* Tinctura Cardamomi Comp.; Tinct. Catechu; Tinct. Cinnamomi; Tinct. Lavandulæ Comp., *U. S., Br.;* Vinum Opii, *U. S.*

COCCUS. *U.S., Br.* *Cochineal.*

(cŏc'cụs.)

"The dried female of Coccus cacti. Linné. (*Class* Insecta; *Order* Hemiptera.)" *U.S.* "The dried female insect, Coccus Cacti." *Br.*

Coccionella, *P. G.;* Cochenille, *Fr., G.;* Scharlachwurm, *G.;* Cocciniglia, *It.;* Cochinilla, *Sp.*

The coccus is a genus of hemipterous insects, having the snout or rostrum in the breast, the antennæ filiform, and the posterior part of the abdomen furnished with bristles. The male has two erect wings, the female is wingless. The *C. Cacti* is characterized by its depressed, downy, transversely wrinkled body, its purplish abdomen, its short and black legs, and its subulate antennæ, which are about one-third of the length of the body. (*Rees's Cyclopædia.*) Another species, *C. Ilicis*, which inhabits a species of oak, is collected in the mountainous parts of the Morea, in Greece, and used as a dye-stuff in the East, under the name of *kermes*, *chermes*, or *alkermes*. The dried insects are nearly globular, smooth, about the size of a pea, and of a reddish brown color. They yield a carmine-colored powder, and with a salt of tin, a fine scarlet-red dye. They probably contain carminic acid, though we have met with no analysis of them. The Coccus Cacti is found wild in Mexico and Central America, inhabiting different species of Cactus and allied genera of plants, and is said to have been discovered also in some of the West India islands, and the southern parts of the United States. In Mexico, particularly in the provinces of Oaxaca and Guerrero, it is an important object of culture. The Indians form plantations of the *nopal* (*Opuntia cochinillifera*), upon which the insect feeds and propagates. During the rainy season, a number of the females are preserved under cover, upon the branches of the plant, and, after the cessation of the rains, are distributed upon the plants without. They perish quickly, after having deposited their eggs. These, hatched by the heat of the sun, give origin to innumerable minute insects, which spread themselves over the plant. The males, of which, according to Mr. Ellis, the proportion is not greater than one to one hundred or two hundred females, being provided with wings and very active, approach and fecundate the latter. After this period, the females, which before moved about, attach themselves to the leaves, and increase rapidly in size; so that, in the end, their legs, antennæ, and probosces are scarcely discoverable; and they appear more like excrescences on the plant than distinct animated beings. They are now gathered for use, by detaching them by means of a blunt knife, a quill, or a feather; a few being left to continue the race. They are destroyed either by dipping them enclosed in a bag into boiling water, or by the heat of a stove. In the former case they are subsequently dried in the sun. The males, which are much smaller than the full-grown females, are not collected. It is said that of the wild insect there are six generations every year, furnishing an equal number of crops; but the domestic is collected only three times annually, the propagation being suspended during the rainy season, in consequence of the inability of the insect to support the inclemency of the weather. The insect has been taken from Mexico to the Canary Islands; and very large quantities of cochineal have been delivered to commerce from the island of Teneriffe.* Its culture is said to have proved successful in Java and Algeria, but unprofitable in Spain.†

Cochineal is defined in the U. S. Pharmacopœia as follows: "About one-fifth of an inch (5 mm.) long; of a purplish-gray or purplish-black color; nearly hemispherical; somewhat oblong and angular in outline; flat or concave beneath; convex above; transversely wrinkled; easily pulverizable, yielding a dark-red powder. Odor faint; taste slightly bitterish. It contains a red coloring matter soluble in water, alcohol, or water of ammonia, slightly soluble in ether, insoluble in fixed and volatile oils. On macerating Cochineal in water, the insect swells up, but no insoluble powder should be separated." *U. S.*

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* Various species of Opuntia are adapted to the support of the cochineal insect, especially those which are very juicy, with few thorns and a thick skin. It is the *O. Ficus Indica* which is chiefly cultivated in Teneriffe, the dry but hot climate of which is peculiarly adapted to the growth both of the plant and the insect. For an account of the mode of rearing the cochineal insect in the Canary Islands, see *P. J. Tr.*, Sept. 1871; in Central America, see *A. J. P.*, 1873, p. 30; *N. R.*, 1880, p. 175.

† In Asia Minor, in the vicinity of Oushak, are great quantities of an insect, closely resembling the Coccus Cacti, which feed on a species of Cistus: but it is unknown whether any portion has been introduced into general commerce. (*A. J. P.*, xxxv. 455.)

As kept in the shops, the finer cochineal, *grana fina* of Spanish commerce, is in irregularly circular or oval, somewhat angular grains, about one-eighth of an inch in diameter, convex on one side, concave or flat on the other, and marked with several transverse wrinkles. Two varieties of this kind of cochineal are known to the druggist, distinguished by their external appearance. One is of a reddish gray color, formed by an intermixture of the dark color of the insect with the whiteness of a powder by which it is almost covered, and with patches of a rosy tinge irregularly interspersed. From its diversified appearance, it is called by the Spaniards *cochinilla jaspeada*. It is the variety commonly kept in our shops. The other, *cochinilla renegrida*, or *grana nigra*, is dark-colored, almost black, with only a minute quantity of the whitish powder between the wrinkles. The two are distinguished in our markets by the names of *silver grains* and *black grains*. Some suppose the difference to arise from the mode of preparation; the gray cochineal consisting of the insects destroyed by a dry heat; the black, of those destroyed by hot water, which removes the external whitish powder. According to Mr. Faber, who derived his information from a merchant residing in the neighborhood where the cochineal is collected, the silver grains consist of the impregnated female just before she has laid her eggs; the black, of the female after the eggs have been laid and hatched. (*A. J. P.*, xviii. 47.) There is little or no difference in their quality.* Another and much inferior variety is the *grana sylvestra*, or wild cochineal, consisting partly of very small separate insects, partly of roundish or oval masses, which exhibit, under the microscope, minute and apparently new-born insects, enclosed in a white or reddish cotton-like substance. It is scarcely known in our drug market.

Cochineal has a faint heavy odor, and a bitter slightly acidulous taste. Its powder is of a purplish carmine color, tinging the saliva intensely red. According to Pelletier and Caventou, it consists of a peculiar coloring principle, a peculiar animal matter constituting the skeleton of the insect, stearin, olein, an odorous fatty acid, and various salts. Tyrosin, a crystallizable animal principle, has been found by De la Rue. (*Gmelin*, xiii. 358.) It was also analyzed by John, who called the coloring principle *cochinilin*. It is, however, universally known now as *carminic acid*, and has the composition $C_{17}H_{18}O_{10}$. Hlasiwetz and Grabowski (*Ann. Chem. und. Ph.*, 141, p. 329) have shown that it is a glucoside, and is decomposed by boiling with diluted sulphuric acid into a non-fermentable sugar and *carmine red*, $C_{11}H_{12}O_7$. Carminic acid is of a brilliant purple-red color, unalterable in dry air, is decomposed at temperatures over 136° C. (276·8° F.), is very soluble in water, soluble in cold, and more so in boiling alcohol, insoluble in ether, and without nitrogen. It is obtained by macerating cochineal in ether, and treating the residue with successive portions of boiling alcohol, which on cooling deposits a part of the carminic acid, and yields the remainder by spontaneous evaporation. It may be freed from a small proportion of adhering fatty matter by dissolving it in alcohol of 40° Baumé, and then adding an equal quantity of ether. The pure carminic acid is deposited in the course of a few days. The watery infusion of cochineal is of a violet-crimson color, which is brightened by the acids and deepened by the alkalies. The coloring matter is readily precipitated. The salts of zinc, bismuth, and nickel produce a lilac precipitate, and those of iron a dark purple approaching to black. The salts of tin, especially the nitrate and chloride, precipitate the coloring matter of a brilliant scarlet, and form the basis of those splendid scarlet and crimson dyes, which have rendered cochineal so valuable in the arts. With alumina the coloring matter forms the pigment called *lake*. The finest *lakes* are obtained by mixing the decoction of cochineal with freshly prepared gelatinous alumina. The pigment called *carmine* is the coloring matter of cochineal precipitated from the decoction by acids, the salts of tin, etc., or by animal gelatin, and when properly made is of the most intense and brilliant scarlet. J. J. Hess proved that if fatty matters found in cochineal were removed by treatment with alcohol, a much more brilliant carmine could be produced. He found in Guatemala cochineal 17 per cent. of a crystalline stearopten, in Java cochineal 7 per cent., and in Canary cochineal 18 per cent. (Dingler, *P. J. Tr.*, 235, 88; *N. R.*, 1880, p. 338.) The degree of coloring power in cochineal may be approximately measured by the decolorizing effect produced by solution of permanganate of potassium. For a method of applying this process, the reader is referred to a paper by J. M. Merrick, of Boston, in *A. J. P.*, 1871, p. 263; from *Amer. Chem.* (April, 1871).

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* *Cake cochineal* is the name given to a variety of the drug, produced in the Argentine Republic. A specimen, examined by Dr. Stark, was in flat cakes about a quarter of an inch thick, and, under the microscope, was seen to consist chiefly of the cochineal insect, mixed with small portions of the thorns and epidermis of the cactus, in consequence of careless gathering. It is inferior for dyeing purposes to the ordinary variety. (*P. J. Tr.*, xiv. 346.)

Cochineal has been adulterated by causing certain heavy substances, such as powdered talc, carbonate of lead, and sulphate of barium, by shaking in a bag or otherwise, to adhere, by means of some glutinous material, to the surface of the insects, and thus increase their weight. Cochineal yields 1·5 per cent. of ashes. Five specimens of the drug have been examined, which left in their ashes respectively 8, 12, 16, 18, and 25 per cent. of the salt of baryta. (*A. J. P.*, 1870, p. 220.) The fraud may be detected by the absence, under the microscope, of a woolly appearance, which characterizes the white powder upon the surface of the unadulterated insect. Metallic lead, which is said frequently to exist in fine particles in the artificial coating, may be discovered by powdering the cochineal, and suspending it in water, when the metal will remain behind. Grains of a substance artificially prepared to imitate the dried insect have been mixed with the genuine in France. A close inspection will serve to detect the difference. (*Journ. de Pharm.*, 3e sér., ix. 110.) Vermilion and chrome-red (dichromate of lead) are said also to have been largely used in the adulteration of carmine, to the extent sometimes of 60 or even 70 per cent. (*P. J. Tr.*, 1860, p. 547.) There can be no difficulty in detecting them by the appropriate tests. Starch has been used, according to Prof. Maisch, for the same purpose in the United States, and in one specimen he found 57·14 per cent. (*A. J. P.*, xxxiii. 18.)

Medical Properties, etc. Cochineal is supposed by some to possess anodyne properties, and has been highly recommended in hooping-cough and neuralgic affections, but is probably useless. In pharmacy it is employed to color tinctures and ointments. To infants with hooping-cough, cochineal in substance is given in the dose of about one-third of a grain (0·02 Gm.) three times a day. The dose of a tincture, prepared by macerating one part of the medicine in eight parts of diluted alcohol, is for an adult from twenty to thirty drops (1·25–1·9 C.c.), twice a day. In neuralgic paroxysms, Sauter gave half a tablespoonful (7·5 C.c.), with the asserted effect of curing the disease.

Off. Prep. Tinctura Cardamomi Composita; Tinct. Cinchonæ Comp., *Br.;* Tinct. Cocci, *Br.*

CODEINA. *U. S.* *Codeine.* [*Codeia.*]

$C_{18} H_{21} NO_3 . H_2 O$; 317. (CŌ-DẸ-Ī'NẠ.) $C_{36} H_{21} NO_6 . 2HO$; 317.

"An alkaloid prepared from Opium." *U. S.*

Codeinum, *P.G.;* Codeine, *Fr.;* Codein, *G.*

Codeine was discovered in 1832 by Robiquet in the hydrochlorate of morphine prepared according to the process of Gregory. It exists in opium combined like morphine with meconic acid, and is extracted along with that alkaloid in the preparation of the hydrochlorate. (See *Morphina.*) When the solution of the mixed hydrochlorates of morphine and codeine is treated with ammonia, the former alkaloid is precipitated, and the codeine, remaining in solution, may be obtained by evaporation and crystallization. It may be purified by treating the crystals with hot ether, which dissolves them, and yields the codeine in colorless crystals on spontaneous evaporation. Codeine occurs in "white, or yellowish-white, more or less translucent, rhombic prisms, somewhat efflorescent in warm air, odorless, having a slightly bitter taste and an alkaline reaction. Soluble in 80 parts of water at 15° C. (59° F.) and in 17 parts of boiling water; very soluble in alcohol and in chloroform; also soluble in 6 parts of ether and in 10 parts of benzol, but almost insoluble in benzin. When heated to 120° C. (248° F.), Codeine loses its water of crystallization. At about 150° C. (302° F.) it melts, and, on ignition, it is completely dissipated. Codeine is dissolved by sulphuric acid containing 1 per cent. of molybdate of sodium, to a liquid having, at first, a dirty green color, which, after a while, becomes pure blue and gradually fades, within a few hours, to pale yellow. On dissolving Codeine in sulphuric acid, a colorless liquid results, which, on the addition of a trace of ferric chloride, and gentle warming, becomes deep blue. An aqueous solution of Codeine, added to test-solution of mercuric chloride, should produce no precipitate; and if Codeine be added to nitric acid of sp. gr. 1·200, it will dissolve to a yellow liquid which should not become red (difference from and abs. of morphine)." *U. S.* When added in excess to boiling water, the undissolved portion melts and sinks to the bottom, having the appearance of an oil. It may be separated from morphine by a solution of potassa or soda, which dissolves the morphine, and leaves the codeine. It has an alkaline reaction on test-paper, and combines with acids to form salts, some of which are crystallizable, particularly the nitrate. Its capacity of saturation is almost identical with that of morphine. According to Robiquet, 1 part of hydrochloric acid is saturated by 7·837 of codeine, and by 7·88 of morphine. It is distinguishable, however from the latter principle by the different form of its crystals, which are octohedral, by its solubility in boiling ether, greater solubility in water, and insolubility in alkaline solutions, and by not assuming a red color with nitric acid, or a blue one with ferric salts. Tincture of galls precipitates from its solutions a tannate of codeine. Crystallized from a watery solution, it contains about 6 per cent. of water, which is driven off at 100° C. (212° F.). The crystals obtained from a solution in ether contain no water.

Medical Properties. It is probable that pure codeine is a very feeble alkaloid, tolerated by the human system in very large doses. On the other hand, cases of severe poisoning have been published, and experimenters have claimed for it a very powerful influence upon the lower animals. As late as 1874, Dr. Myrtle reported the instance of a man who was almost killed by four grains of codeine, prepared by Messrs. Smith, of Edinburgh. (*Br. Med. Journ.*, 1874, i. 478.) The symptoms were first vascular excitement and exhilaration, then depression, with great anxiety, nausea and vomiting, cold pale, moist skin, slight contraction of the pupil, and delirious sleeplessness. On the other hand, Dr. S. Weir Mitchell took five grains of codeine without effect, save some nausea, slight giddiness, and cerebral heaviness, and a trifling acceleration of the pulse; whilst we have given codeine prepared by Powers & Weightman, of Philadelphia, in doses of eight grains a day without distinct effect. It is very evident that commercial codeine has been and probably still is of varying composition, and the results frequently obtained have been produced by coherent alkaloids. Mr. Wm. Weightman informs us that nearly the whole product of their laboratory goes to France, where it appears to be largely used as a calmative drug, free from many of the objections to opium, but in no way comparing with it in power. Within the last year or two it has been highly lauded in the treatment of diabetes mellitus, and cases of recovery under its use reported. In the grave form of this disorder we have seen it fail to exert any perceptible influence, but the evidence is sufficient to demand a fair trial of the remedy in any individual case. On account of its frequent contamination, care should be exercised as to the commencing dose, but no effect at all is to be expected from less than one grain (0·06 Gm.), and this dose may be rapidly increased until some symptoms are produced. It may be given in pill or in syrupy solution.

COLCHICI RADIX. *U. S.* *Colchicum Root.*

(CŎL′ÇHI̩-CĪ RĀ′DĬX—kŏl′ki̩-sī.)

"The Corm of Colchicum autumnale. Linné. (*Nat. Ord.* Melanthaceæ.)" *U. S.* "The fresh corm of Colchicum autumnale, collected about the end of June; and the same stripped of its coats, sliced transversely, and dried at a temperature not exceeding 150°." *Br.*

Colchici Cormus, *Br.:* Colchicum Corm; Bulbus s. Tuber Colchici; Meadow-Saffron Root, Bulbe de Colchique, de Safran bâtard, *Fr.;* Zeitlosenknollen, *G.*

COLCHICI SEMEN. *U.S.* *Colchicum Seed.*

(CŎL′ÇHI̤-CĪ SĒ′MĔN—kŏl′kį-sī.)

"The seed of Colchicum autumnale. Linné. (*Nat. Ord.* Melanthaceæ.)" *U. S.* "The fully ripe seeds of Colchicum autumnale." *Br.*

Colchici Semina, *Br.;* Colchicum Seeds; Semen Colchici, *P.G.;* Semences de Colchique, Colchique, *Fr.;* Zeitlose, Herbst-Zeitlose, Zeitlosensamen, *G.;* Colchico, *It.*, *Sp.*

Gen. Ch. A *spathe. Corolla* six-parted, with a tube proceeding directly from the root. *Capsules* three, connected, inflated. *Willd.*

Colchicum autumnale. Willd. *Sp. Plant.* ii. 272; Woodv. *Med. Bot.* p. 759, t. 258. This species of Colchicum, often called *meadow-saffron*, is a perennial bulbous plant, the leaves of which appear in spring, and the flowers in autumn. Its manner of growth is peculiar, and deserves notice as connected in some measure with its medicinal efficacy. In the latter part of summer, a new bulb, or *cormus* as the part is now called, begins to form at the lateral inferior portion of the old one, which receives the young offshoot in its bosom, and embraces it half round. The new plant sends out fibres from its base, and is furnished with a radical spathe, which is cylindrical, tubular, cloven at top on one side, and half under ground. In September, from two to six flowers, of a lilac or pale-purple color, emerge from the spathe, unaccompanied with leaves. The corolla consists of a tube five inches long, concealed for two-thirds of its length in the ground, and of a limb divided into six segments. The flowers perish by the end of October, and the rudiments of the fruit remain under ground till the following spring, when they rise upon a stem above the surface, in the form of a three-lobed, three-celled capsule. The leaves of the new plant appear at the same time; so that in fact they follow the flower instead of preceding it, as might be inferred from the order of the seasons in which they respectively show themselves. The leaves are radical, spear-shaped, erect, numerous, about five inches long, and one inch broad at the base. In the mean time, the new bulb has been increasing at the expense of the old one, which, having performed its appointed office, perishes; while the former, after attaining its full growth, sends forth shoots, and in its turn decays. The old bulb, in its second spring, and a little before it perishes, sometimes puts forth one or more small bulbs, which are the sources of new plants.

C. autumnale is a native of the temperate parts of Europe and of Northern Africa, growing in moist pastures and meadows. Attempts have been made to introduce its culture into this country, but with no great success; though small quantities of the bulb, of apparently good quality, have been brought into the market. The flowers possess virtues similar to the bulb and seeds.

Colchici Radix. The medicinal virtue of the bulb depends much upon the season at which it is collected. Early in the spring, it is too young to have fully developed its peculiar properties; and, late in the fall, it has become exhausted by the nourishment afforded to the new plant. The proper period for its collection is from the early part of June, when it has usually attained perfection, to the middle of August, when the offset appears.* It may be owing, in part, to this inequality at different seasons, that entirely opposite reports have been given of its powers. Krapf ate whole bulbs without inconvenience; Haller found the bulbs entirely void of taste and acrimony; and we are told that in Carniola the peasants use it as food with impunity in the autumn. On the other hand, there can be no doubt of its highly irritating and poisonous nature, when fully developed, under ordinary circumstances. Perhaps soil and climate may have some influence in modifying its character.

The bulb is often used in the fresh state in the countries where it grows; as it is apt to be injured in drying, unless the process is carefully conducted. The usual plan is to cut the bulb, as soon after it has been dug up as possible, into thin transverse slices, which are spread out separately upon paper or perforated trays, and dried with a moderate heat. The reason for drying it quickly, after removal from the ground, is that it otherwise begins to vegetate, and a change in its chemical nature takes place; and such is its retentiveness of life, that, if not cut in slices, it is liable to undergo a partial vegetation even during the drying process. Dr. Houlton recommends that the bulb be stripped of its dry coating, carefully deprived of the bud or young bulb, and then dried whole. It is owing to the high vitality of the bud that the bulb is so apt to vegetate. During desiccation there is great loss of weight, 70 per cent. being the average for a number of years in the laboratory of Messrs. Allen & Hanburys, in London.

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* Dr. Christison, however, has found the roots collected in April to be more bitter than those gathered in July, and conjectures that the common opinion of their superior efficacy at the latter season may not be well founded. Prof. Schroff states, as the result of his observation, that the autumn root is much stronger than that dug in summer. (See *A. J. P.*, xxix. 324.)

Properties. The recent bulb or cormus of *C. autumnale* resembles that of the tulip in shape and size, and is covered with a brown membranous coat. Internally it is solid, white and fleshy, and, when cut transversely, yields, if mature, an acrid milky juice. There is often a small lateral projection from its base, which is the bud for the development of a new plant: this bud is frequently broken off in drying. When dried, and deprived of its external membranous covering, the corm is of an ash-brown color, convex on one side, and somewhat flattened on the other, where it is marked by a deep groove, extending from the base to the summit. As found in our shops it is always in the dried state, sometimes in segments made by vertical sections of the bulb, but generally in transverse circular slices, about the eighth or tenth of an inch in thickness, with a notch at one part of their circumference. "About one inch (25 mm.) long, ovoid, flattish and with a groove on one side; externally brownish and wrinkled; internally white and solid; often in transverse slices, reniform in shape, and breaking with a short, mealy fracture; inodorous; taste sweetish, bitter and acrid. Colchicum root which is very dark colored internally, or breaks with a horny fracture, should be rejected." *U. S.* The cut surface is white, and of an amylaceous aspect. Examined with the microscope, the corm is seen to be composed of large irregular cells, full of ovoid, angular, sometimes compound, starch grains, and interspersed with spiral vessels in vascular bundles. The odor of the recent bulb is said to be hircine. It is diminished but not lost by drying. The taste is bitter, hot, and acrid. Its constituents, according to Pelletier and Caventou, are a vegetable alkali combined with an excess of gallic acid; a fatty matter composed of olein, stearin, and a peculiar volatile acid analogous to cevadic acid; a yellow coloring matter; gum; starch; inulin in large quantity; and lignin. The active properties are ascribed to the alkaline principle, which was believed by its discoverers to be identical with *veratrine*, but has been subsequently found to be peculiar, and has received the appropriate name of *colchicine*, or *colchicia*.* Wine and vinegar extract all the virtues of the bulb. Dr. A. T. Thomson states that the milky juice of fresh colchicum produces a fine blue color, if rubbed with the tincture of guaiac, and that the same effect is obtained from an acetic solution of the dried bulb. He considers

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* *Colchicia* or *Colchicine,* and *Colchiceine.* The alkaloid of colchicum has been a subject of some controversy. According to Geiger and Hesse, to whom has been ascribed the credit of determining its precise nature, *colchicine* (*colchicia*) is crystallizable, and has a very bitter and sharp taste, but is destitute of the extreme acrimony of veratrine, and does not, like that principle, excite violent sneezing when applied to the nostrils. It differs also in being more soluble in water, and less poisonous. To a kitten eight weeks old, one-tenth of a grain was given dissolved in dilute alcohol. Violent purging and vomiting were produced, with apparently severe pain and convulsions, and the animal died at the end of twelve hours. The stomach and bowels were found violently inflamed, with effusion of blood through their whole extent. A kitten somewhat younger was destroyed in ten minutes by only the twentieth of a grain of veratrine; and, on examination after death, marks of inflammation were found only in the upper part of the œsophagus. The alkaloid was obtained from the seeds by a process similar to that employed in the preparation of hyoscyamine from hyoscyamus. (See *Hyoscyamus.*) A simpler process is to digest the seeds of meadow-saffron in boiling alcohol, precipitate with magnesia, treat the precipitated matter with boiling alcohol, and finally filter and evaporate.

The nature of the active principle of colchicum subsequently engaged the attention of L. Oberlin. Upon repeating the process of Geiger and Hesse, he was unable to obtain a crystallizable product, and came to the conclusion that the substance obtained by them was complex. By acidifying its watery solution by sulphuric or hydrochloric acid, and concentrating until the liquid became intensely yellow, he obtained, upon the addition of water, a yellowish white precipitate, which, when well washed and freed from coloring matter, dissolved readily in alcohol or ether, and crystallized with facility. The crystalline product thus obtained he proposed to call *colchiceine.* It is a neutral substance, contains no acid, crystallizes in pearly lamellæ, is almost insoluble in cold water, to which, however, it imparts a slight bitterness, is more soluble in boiling water, and readily dissolves in alcohol, ether, methylic alcohol, and chloroform. It is dissolved by concentrated sulphuric, hydrochloric, and nitric acids, becoming yellow, by acetic acid without change of color, and by ammonia and potassa. It is not altered or precipitated by acetate or subacetate of lead, nitrate of silver, mercuric chloride, or infusion of galls, but is rendered green by sesquichloride of iron. It consists of carbon, hydrogen, nitrogen, and oxygen. It was found to be very poisonous to rabbits, killing an animal in 12 hours in the dose of about one-seventh of a grain, and in a few minutes in five times that quantity. (*Comptes-Rendus*, Dec. 1856, p. 1199. See also *A. J. P.*, xxxi. 235.)

Subsequently Mr. J. E. Carter, of Philadelphia, has made some experiments which appear to invalidate the conclusions of Oberlin as to the nature of colchicine, and to confirm the previous opinion of its alkaloid character. Mr. Carter used the bulb, instead of the seeds, which had previously in general been made the subject of experiment. He employed two processes for the extraction of the alkaloid, but found the following most productive. The dried and powdered bulb was exhausted by alcohol of 0·835 by means of percolation; the tincture thus obtained was evaporated to the consistence of syrup; water acidulated with acetic acid was added, and the liquor, after filtration, was nearly neutralized with ammonia, and then precipitated by solution of tannic acid; the precipitated tannate, after being well washed, was rubbed with five times its weight of freshly prepared hydrated oxide of lead, small quantities of alcohol being added from time to time during the trituration; the whole was then filtered, and the filtered liquid evaporated at a gentle heat. Twenty grains were thus obtained from three pounds of the dried root. Thus obtained, *colchicine* was yellowish in mass, nearly white in powder, inodorous, bitter without being acrid, not sternutatory, soluble in water hot or cold, still more so in dilute acids and alkaline solutions, very soluble in alcohol and chloroform, sparingly so in pure ether, and insoluble in benzol. Mr. Carter did not succeed in crystallizing it. It was alkaline to test-paper, neutralized the acids, and with sulphuric acid formed a crystallizable salt. The most delicate test appeared to be that of sulphuric acid and nitre. A piece of nitre, added to its solution in sulphuric acid, produced a beautiful blue color, changing to green, dark brown or purple, and finally reddish yellow. (For a further account of Mr. Carter's experiments, see *A. J. P.*, 1858, p. 209.)

Since Mr. Carter's experiments, others have engaged in the same inquiry. Ludwig confirms the statements of Oberlin. Hubler, operating on the unbruised seeds by a process similar to that of Mr. Carter with the cormus, for the details of which we refer to *A. J. P.* (1866, p. 105), obtained an amorphous substance, soluble without residue in water and in alcohol, of an odor like that of hay, and very bitter. It had no effect on test-paper; its solution was precipitated yellow by chloride of gold, and white by corrosive sublimate; mineral acids and alkalies turned it yellow; at 140° C. (284° F.) it melted, with no other observable change except in color, which became brown; and its composition was represented by the formula $C_{17}H_{19}NO_5$. When treated with acids it yielded crystallizable bodies, but these, instead of salts, were a new product, isomeric with colchicine, but in character resembling if not identical with the colchiceine of Oberlin, which is therefore a result of change in the colchicine. Both these substances are poisonous. Between the substance obtained by Hubler and the one by Carter, there is this apparently irreconcilable difference, that the latter is decidedly though feebly alkaline, while the former is entirely neutral. Either there is some error on the part of one of these experimenters, or the alkaloid obtained from the cormus is different from the active principle of the seeds.

That Mr. Carter's statement was correct has been fully confirmed by Prof. J. M. Maisch, who made a very careful examination of a portion of the colchicine obtained by Mr. Carter, and kept as a specimen, with the following results. It was an amorphous powder; of a light yellow color, a faint odor, and intense bitterness; sparingly soluble in ether, and readily in water and alcohol. The aqueous solution was slightly turbid, probably from the decomposition by time and exposure of a portion of the colchicine into resin and colchiceine. Heated on platinum foil, it melted, and at a higher temperature took fire, and burned without residue. It restored the blue color of reddened litmus, and even neutralized sulphuric acid in very minute proportion. It answered to the best tests of colchicine, namely, 1, the effect on its solution of both acids and alkalies, which cause it to assume a yellow color, and, 2, the violet and blue color produced by oxidizing agents on the dry colchicine. When treated first with concentrated sulphuric acid, and then with nitric acid or a fragment of a nitrate, it went through a series of changes of color, ending in yellow. The same effect resulted from sulphuric acid with a trace of chromate or bichromate of potassium, sesquichloride of iron, or binoxide of lead; the first two causing a green color with the solution, through the intermixture of their yellowishness with the blue developed. The colchicine also answered to the following tests of the alkaloids, giving precipitates with iodohydrargyrate of potassium, phosphomolybdic acid, and tannic acid.

Colchiceine was produced by treating colchicine with diluted sulphuric and hydrochloric acids, evaporating the solution to dryness, repeating this operation once and again, then dissolving the residue in water, filtering the solution to separate the resin formed, evaporating with an excess of carbonate of lead to remove acid, treating with strong alcohol, and slowly evaporating. Colchiceine was deposited in yellow crystals, the solution of which precipitated, like colchicine, tannic and phosphomolybdic acids, and iodohydrargyrate of mercury, but exercised no reaction on litmus paper whether red or blue.

The inference from these experiments is that the active principle of colchicum, known by the name of colchicine, is an alkaloid, but that its salts in solution, on being kept, or evaporated, especially if heat is used, are decomposed, and converted into resin and colchiceine, the latter of which crystallizes; and, as this is isomeric with colchicine, the probability is that the resin has the same composition. In preparing colchicum pharmaceutically, if it be desired to retain the colchicine unchanged, both acids and alkalies should be avoided, especially when heat is employed. Of the officinal preparations, the two fluid extracts contain the colchicine as in nature; the acetic extract has a portion at least of colchiceine in its composition. In the wines, when kept, the colchicine probably passes gradually into colchiceine. (*A. J. P.*, 1867, p. 97.) But it has not been proved that these latter preparations are in any degree less efficacious remedially; and in the absence of all experience to the contrary, the inference is that colchiceine may have all the powers of colchicine; for the acetic extract, and the wines after being long kept, have often been used in practice, without having been found less effectual than other preparations of colchicum.

the appearance of this color, when the slices are rubbed with a little distilled vinegar and tincture of guaiac, as a proof that the drug is good and has been well dried. Dr. J. M. Maclagan has shown that this change of color is produced with the albumen, which is not affected if previously coagulated; so that the value of the test consists simply in proving that the drying has not been effected at a heat above 180°, or the temperature at which albumen coagulates. A very deep or large notch in the circumference of the slices is considered an unfavorable sign; as it indicates that the bulb has been somewhat exhausted in the nourishment of the offset. The decoction yields a deep blue precipitate with solution of iodine, white precipitates with acetate and subacetate of lead, mercurous nitrate, and nitrate of silver, and a slight precipitate with tincture of galls. The value of colchicum is best tested by its bitterness.

Medical Properties and Uses. When taken internally in therapeutic dose, colchicum usually produces no other symptoms than intestinal pains and looseness of the bowels. In some rare cases it is said to give rise to copious diuresis or diaphoresis instead of purging. When larger amounts are exhibited, the purging is more pronounced, and there may be also vomiting. With these symptoms there may be some depression, which seems to be due to the gastro-intestinal irritation rather than to the direct action of the poison. In an overdose, it may produce dangerous and even fatal effects. Excessive nausea and vomiting, abdominal pains, purging and tenesmus, great thirst, sinking of the pulse, coldness of the extremities, and general prostration, with occasional symptoms of nervous derangement, such as headache, delirium, and stupor, are among the results of its poisonous action. A peculiarity of its influence is that when its dose is increased beyond a certain point there is not a corresponding increase in the rapidity of the fatal issue. This is probably because it kills not by a direct influence upon the heart or nervous system, but by causing gastro-enteritis. On post-mortem examination the alimentary mucous membrane is found much inflamed.

Colchicum was well known to the ancients as a poison, and is said to have been employed by them as a remedy in gout and other diseases. Störck revived its use among the moderns. He gave it as a diuretic and expectorant in dropsy and humoral asthma; and on the continent of Europe it acquired considerable reputation in these complaints; but the uncertainty of its operation led to its general abandonment, and it had fallen into almost entire neglect, when Dr. Want, of London, again brought it into notice by attempting to prove its identity with the active ingredient of the *eau médicinale d'Husson*, so highly celebrated as a cure for gout. In James's Dispensatory, printed in 1747, it is said to be used in gout as an external application. The chief employment of the meadow-saffron is at present in the treatment of gout and rheumatism, in which experience has abundantly proved it to be a highly valuable remedy. We have, within our own observation, found it especially useful in these affections, when of a shifting or neuralgic character. It sometimes produces relief without obviously affecting the system; but it is more efficient when it evinces its influence upon the skin or alimentary canal. Professor Chelius states that it changes the chemical constitution of the urine in arthritic patients, producing an evident increase of the uric acid. Dr. Maclagan has found it greatly to increase the proportion both of urea and uric acid in the urine, and, where these previously existed in the blood, to separate them from it. (*Ed. Monthly Journ. of Med. Sci.*, N. S., v. 23.) But Graves and Gardner affirm that the urates diminish under its influence, and in a very careful and extended research Dr. A. B. Garrod found that its action upon the uric acid elimination is very irregular and uncertain. Dr. Elliotson successfully treated a case of prurigo with the wine of colchicum, given in the dose of half a drachm (1·9 C.c.) three times a day, and continued for three weeks; and it has been found useful in urticaria and other cutaneous affections, probably of a gouty nature. At various times colchicum has been used in various diseases, but in modern practice is employed almost solely in gout. Even in rheumatism it is at present rarely administered. It is generally given in the state of vinous tincture (see *Vinum Colchici Radicis*); but there are various other officinal preparations, any one of which may be used efficiently. The dose of the dried bulb is from two to eight grains (0·13–0·52 Gm.), which may be repeated every four or six hours till its effects are obtained.

Colchici Semen.—The seeds of the meadow-saffron ripen in summer, and should be collected about the end of July or beginning of August. They never arrive at maturity in plants cultivated in a dry soil, or in confined gardens. (*Williams.*) They are nearly spherical, about the eighth of an inch in diameter, of a reddish brown color externally, white within, and of a bitter acrid taste. "Sub-globular, about one-twelfth of an inch (2 mm.) thick, very slightly pointed at the hilum; reddish-brown, pitted, internally whitish; very hard and tough; inodorous; bitter and somewhat acrid." *U. S.* They are chiefly composed of a gray horny albumen, constituted of very thick-walled cells, and surrounded by a closely adherent testa. The leafless embryo is very small, and is situated close to the surface opposite the strophiole. Dr. Williams, of Ipswich, England, first brought them into notice in 1820 as superior to the bulb. Prof. Schroff, however, has found that their activity is inferior to that of the dried bulb, dug in autumn (*A. J. P.*, xxix. 324); and recent studies indicate that they contain only a very small percentage of alkaloid. A wine, fluid extract, and tincture of the seeds are directed in the U. S. Pharmacopœia. Their dose is about the same as that of the bulb.

Off. Prep. of the Root. Extractum Colchici, *Br.;* Extractum Colchici Aceticum; Extractum Colchici Radicis Fluidum, *U. S.;* Vinum Colchici, *Br.;* Vinum Colchici Radicis, *U. S.*

Off. Prep. of the Seed. Extractum Colchici Seminis Fluidum, *U. S.;* Tinctura Colchici Seminis, *U. S.;* Tinct. Colchici Seminum, *Br.;* Vinum Colchici Seminis, *U. S.*

COLLODIUM. *U. S., Br.* *Collodion.*

(CỌL-LŌ'DỊ-ŬM.)

Collodion, *Fr.;* Collodium, *G.*

"Pyroxylin, *four parts* [or half an ounce av.]; Stronger Ether, *seventy parts* [or 11 fluidounces 5 fluidrachms]; Alcohol, *twenty-six parts* [or 3 fluidounces 7 fluidrachms], To make *one hundred parts* [or about one pint]. To the Pyroxylin, contained in a tared bottle, add the Alcohol and let it stand for fifteen minutes; then add the Ether, and shake the mixture until the Pyroxylin is dissolved. Cork the bottle well, and set it aside until the liquid has become clear. Then decant it from any sediment which may have formed, and transfer it to bottles, which should be securely corked. Keep the Collodion in a cool place, remote from lights or fire." *U. S.*

"Take of Pyroxylin *one ounce* [avoirdupois]; Ether *thirty-six fluidounces* [Imperial measure]; Rectified Spirit *twelve fluidounces* [Imp. meas.]. Mix the Ether and the Spirit, and add the Pyroxylin. Set aside for a few days, and, should there be any sediment, decant the clear solution. Keep it in a well-corked bottle." *Br.*

Collodion is a solution of gun cotton. On account of the facility with which ether evaporates, it is the better menstruum for remedial purposes; but gun cotton will not dissolve in that liquid when quite pure, and the addition of a little alcohol is necessary. Formerly the U. S. Pharmacopœia directed that the gun cotton be prepared at the time of making the collodion, giving directions for the purpose, but at the revision of 1870 the process of the British Pharmacopœia was substantially adopted, a formula for the preparation of pyroxylin being given separately in the Pharmacopœia. The present formula differs very slightly from that of 1870, containing a little more pyroxylin and alcohol. (See *Pyroxylin.*) A change has been made, however, in directing the collodion to be decanted from the sediment. In the Pharm. 1870 the sediment was directed to be re-incorporated with the clear collodion, and the result was the making of a tougher film. This sediment consists of undecomposed filaments of cotton, and these become partially felted, as the ethereal liquid evaporates, and the film is forming; this direction of the former Pharmacopœia was usually disregarded.

Collodion is a transparent, colorless liquid, of a syrupy consistence, and ethereal smell. When applied to a dry surface, the ether quickly evaporates, and a transparent film is left, having remarkable adhesiveness and contractility. On account of the great volatility of ether, collodion must be kept in bottles well stopped. When insecurely kept, the liquid thickens and becomes less fit for the use of the surgeon. The thickened liquid sometimes contains acicular crystals, as was first observed by Mr. Higginson of London, and afterwards by Prof. Leidy, of this city.

Collodion was first applied to the purposes of surgery by Dr. J. Parker Maynard,[*] of Boston, when a student of medicine, in January, 1847. It is employed for holding together the edges of incised wounds, for covering ulcers or abraded or diseased surfaces, chilblains, chapped nipples, etc., with an impervious film not acted upon by water, and for encasing parts which require to be kept without relative motion. It is applied, brushed over the part, or by means of strips of muslin. In whatever way applied, the solvent quickly evaporates, and leaves the solid adhesive material. The rigid film thus formed contracts with a good deal of force. This property adapts collodion for certain purposes, such as drawing together the edges of wounds, exciting pressure on buboes, etc. When, however, the surgeon desires simply to protect a surface, a flexible, non-contracting film is preferable, and the officinal *Collodion flexile* should be used.

Collodion has been variously medicated, and thus made the vehicle of several important medicines for external application. *Iodized collodion* has been proposed by Dr. C. Fleming, for the purpose of obtaining the specific effects of iodine in a rapid manner, especially on tumors. It is made by dissolving from ten to twenty grains of iodine in a fluidounce of collodion. M. Aran has proposed a *ferruginous collodion*, made of equal parts of collodion and tincture of chloride of iron, as a remedy in erysipelas.[†] A *caustic collodion* may be prepared by dissolving 4 parts of corrosive sublimate in 30 of collodion. Dr. Macke, of Sorau, has used this preparation for destroying nævi materni. The eschar formed is one or two lines in thickness, and separates in from three to six days, leaving but a trifling cicatrix. (See *A. J. P.*, May, 1858, for formulas in which collodion is made the vehicle of iodine, belladonna, sulphur, etc.) All these medicated collodions are most conveniently applied by means of a camel's-hair brush. Collodion is also much used in photography.[‡]

Off. Prep. Collodium Flexile, *U. S.;* Collodium Stypticum, *U. S.*

COLLODIUM CUM CANTHARIDE. *U. S.* *Collodion with Cantharides.* [*Cantharidal Collodion.*]

(CỌL-LŌ′DỊ-ŬM CŬM CẠN-THĂR′Ị-DĒ.)

Collodium Cantharidatum, *P.G.;* Collodium Cantharidale, s. Vesicans; Collodion vésicant (cantharidé), *Fr.;* Blasenziehendes Collodium, *G.*

"Cantharides, in No. 60 powder, *sixty parts;*[§] Flexible Collodion, *eighty-five parts;* Commercial Chloroform, *a sufficient quantity.* Pack the powder firmly in a cylindrical percolator, and gradually pour Commercial Chloroform upon it, until *two hundred and fifty* (250) *parts* of tincture are obtained, or until the Cantharides are exhausted. Recover, by distillation on a water-bath, about *two hundred* (200) *parts* of the Chloroform, and evaporate the residue in a capsule, by means of a water-bath, until it weighs *fifteen* (15) *parts.* Dissolve this in the Flexible Collodion, and let it stand at rest for forty-eight hours. Finally, pour off the clear portion from any sediment which may have been deposited, and transfer it to bottles, which should be securely corked. Keep the Cantharidal Collodion in a cool place, remote from lights or fire." *U. S.*

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[*] Dr. Maynard recommended the following formula. Take of sulphuric acid of sp. gr. 1·850 *two parts*, and of nitric acid of sp. gr. 1·450 *one part.* Mix them, and, having permitted the heat to fall to about 100° F., add raw cotton to saturation. Let it macerate for one or two hours; then pour off the acids, wash the cotton till the washings cease to affect litmus paper, and dry thoroughly. The gummy matter thus formed is now to be dissolved in ether of the sp. gr. about ·750, or in a mixture of three parts of pure ether and one part of alcohol of 95 per cent. Two ounces of cotton will make about a pint of collodion. (*Bost. Med. and Surg. Journ.*, 1866, p. 39.)

[†] *Paresi's Styptic Collodion.* Collodion, 100 parts; Carbolic acid, 10 parts; Pure tannin, 5 parts; Benzoic acid, 3 parts. Agitate till thoroughly mixed. On evaporation it leaves a brown pellicle, adhering strongly to tissues, and effecting instant coagulation of the blood and albumen.

Iodoform Collodion is made, according to Moleschott, by dissolving 1 part of iodoform, in fine powder, in 15 parts of flexible collodion. It is recommended for relieving pain caused by gout, and for orchitis, pericarditis, etc.

[‡] *Silk Collodion.* M. Persoz, the younger, prepares a collodion by bringing silk to the condition of the material from which the worm spins its thread. This he does by dissolving it in a solution of chloride of zinc, and then separating the solvent by means of dialysis. The chloride passes through the parchment of a dialyzer, leaving the silk substance in a soft fibreless state. The material thus obtained is said to be applicable to photographic purposes. Before it could be used as collodion, it would be necessary to dissolve it in a volatile liquid, which would evaporate spontaneously on application to the surface. (See *A. J. P.*, 1867, p. 182.)

[§] As the liquid ingredients in this preparation are more conveniently weighed than measured, the equivalent measures have been omitted.

The officinal process differs considerably in the manipulation from that of the U. S. P. 1870, although the finished preparation is not essentially different. Chloroform is used to extract the cantharidin from the powdered cantharides, by percolation; the chloroform is afterwards recovered by distillation, and the oily residue containing the vesicant is dissolved in the flexible collodion. The practical objection to the process is its costliness, for, notwithstanding the greatest care, considerable chloroform would be wasted through volatilization in the process of percolation and distillation in the hands of the pharmacist. The efficiency of chloroform as a solvent of cantharidin has been shown by Professor Procter. The original process of M. Ilisch was to exhaust, by percolation, a pound of cantharides, with a mixture consisting of a pound of ether and three ounces of acetic ether; and in two ounces of this liquid to dissolve 25 grains of gun cotton. Professor Procter states that it has been found more advantageous to exhaust the flies with ether, distil off the ether, and mix the oily residue with collodion already prepared of the proper consistence (*A. J. P.*, xxiv. 303); and this is probably a better formula than the officinal, if care is used in recovering the ether to avoid contact with flame. Mr. Charles S. Rand (*A. J. P.*, xxii. 18) states that Ilisch's preparation, made with double the proportion of ether, vesicates equally well, and proposes the addition of about 1 per cent. of Venice turpentine, which he has found to prevent the disagreeable and sometimes painful contraction of the collodion upon drying. The preparation may be kept indefinitely, in an opaque glass-stoppered bottle, without change; but, on exposure to the light, the greenish coloring matter of the flies bleaches, and the liquid becomes yellowish.*

Cantharidal collodion is a very convenient epispastic remedy. It may be applied to the surface by means of a camel's-hair brush, and, after the evaporation of the ether, which takes place in less than a minute, may be reapplied if the surface should not be well covered. It produces a blister in about the same time as the ordinary cerate, and has the advantages that it is applied with greater facility, is better adapted to cover uneven surfaces, and retains its place more certainly. According to Mr. Rand, if the evaporation of the ether be restrained by a piece of oiled silk immediately after its application, it will act much more speedily.

COLLODIUM FLEXILE. *U. S., Br.* *Flexible Collodion.*

(CǪL-LŌ'DỊ-ŬM FLĔX'Ị-LĒ.)

Collodium Elasticum, *P.G.;* Collodion élastique, *Fr.;* Elastisches Collodium, *G.*

"Collodion, *ninety-two parts;*† Canada Turpentine, *five parts;* Castor Oil, *three parts*, To make *one hundred parts.* Mix them, and keep the mixture in a well-corked bottle, in a cool place, remote from lights or fire." *U. S.*

"Take of Collodion *six fluidounces* [Imperial measure]; Canada Balsam *one hundred and twenty grains;* Castor Oil *one fluidrachm* [Imp. meas.]. Mix, and keep in a well-corked bottle." *Br.*

The contractility of the collodion film has long been felt as a drawback to its use simply for the purposes of protection. Mr. C. S. Rand, of Philadelphia, proposed to obviate this by dissolving one part of gun cotton and three of Venice turpentine in twenty parts of ether. To give more flexibility to the film, M. Sourisseau, of Kaiserberg, suggested the addition of one part of elemi to twelve of collodion. According to Mr. Startin, of London, opacity and elasticity may be imparted at the same time, by adding from half a drachm to a drachm of lard, or some similar fatty matter, previously dissolved in ether, to an ounce of collodion. The qualities of softness and elasticity may also be given by combining collodion with castor oil, in the proportion of thirty parts to two, agreeably to the plan of M. Guersant, who found it useful, thus modified, in erysipelas; and the proportion of castor oil may be increased if thought desirable. This is the method preferred by the French Codex. An elastic collodion, somewhat similar, in which, besides castor oil, Venice turpentine and white wax are ingredients, has been proposed by E. Lauras. (*P. J. Tr.*, xii. 303.) According to MM. Cap and Garot, the most successful way for obtaining an elastic collodion is to mix two parts of glycerin with one hundred of collodion. *Glycerized collodion* is exceedingly supple, does not crack and scale off from the skin, and accommodates itself to the motions of the part. In order to imitate the color of the skin, an ethereal tincture of turmeric or saffron may be added, so as to produce the desired tint. Dr. Meller has proposed a solution of shellac in highly rectified alcohol, so as to have a gelatinous consistence, as a substitute for collodion. Of all these plans, probably that followed in the officinal directions is the best. Dr. Tournie recommends, in superficial cervical adenitis with redness, painting the part with several layers of flexible collodion every two days. (*Med. Times and Gaz.*, 1874, p. 540.)

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* *Croton Oil Collodion* is made by mixing equal weights of croton oil and flexible collodion. (*Report on Revision of U. S. Pharm., A. P. A.*, 1880.)

† As the liquid ingredients in this preparation are more conveniently weighed than measured, the equivalent measures have been omitted.

COLLODIUM STYPTICUM. *U.S.* *Styptic Collodion.*

(CỌL-LŌ'DỊ-ŬM STY̆P'TỊ-CŬM.)

Styptic Colloid, Xylostyptic Ether; Collodion styptiqne, *Fr.*

"Tannic Acid, *twenty parts* [or eighty grains av.]; Alcohol, *five parts* [or twenty-six minims]; Stronger Ether, *twenty parts* [or one hundred and ten minims]; Collodion, *fifty-five parts* [or four and a half fluidrachms], To make *one hundred parts* [or about one fluidounce]. Place the Tannic Acid in a tared bottle, add the Alcohol, Ether, and Collodion, and agitate until the Tannic Acid is dissolved. Keep the product in well corked bottles, in a cool place, remote from lights or fire." *U. S.*

This new officinal is a modification of the *styptic colloid* of Dr. B. W. Richardson, of London (*P. J. Tr.*, 1867, p. 29), a preparation which has had considerable use, particularly in hospitals. Experience has shown, however, that Dr. Richardson's formula contained too little tannin; and the original quantity has been increased in the U. S. process from a little over four to twenty per cent. The manipulation in the officinal formula might be improved by directing the tannic acid to be rubbed into a smooth paste in a mortar with sufficient alcohol, before introducing into the bottle. This would enable the pharmacist to prepare it extemporaneously. When applied on wounded or abraded surfaces, it soon loses the ether and alcohol, and a firm coating is left, in which, besides the tannin and colloidal substance, are the coagulated blood and secretions from the surface, forming a covering for the part by which the air is excluded. The liquid is applied with a camel's-hair brush, or by means of cotton saturated with it, to the edges of wounds closed by stitches, to ulcerated surfaces and bleeding parts. If it be desired to make a special impression on the diseased surface, carbolic acid, creasote, iodine, morphine, etc., may be incorporated with the styptic fluid.

COLOCYNTHIS. *U.S.* *Colocynth.*

(CŎL-Ọ-CY̆N'THỊS.)

"The fruit of Citrullus Colocynthis, Schrader (*Nat. Ord.* Cucurbitaceæ), deprived of its rind." *U. S.* "The dried decorticated fruit, freed from seeds, of Citrullus Colocynthis." *Br.*

Colocynthidis Pulpa, *Br.;* Colocynth Pulp; Fructus Colocynthidis, *P.G.:* Poma Colocynthidis; Pulpe de Coloquinte; Coloquinte, *Fr.;* Coloquintenapfel, Koloquintenmark, Koloquinten, *G.;* Coloquintida, *It.*, *Sp.*

Gen. Ch. MALE. *Calyx* five-toothed. *Corolla* five-parted. *Filaments* three. FEMALE. *Calyx* five-toothed. *Corolla* five-parted. *Pistil* three-cleft. *Seeds* of the *gourd* with a sharp edge. *Willd.*

Cucumis Colocynthis. Willd. *Sp. Plant.* iv. 611; Woodv. *Med. Bot.* p. 189, t. 71.—*Citrullus Colocynthis*, Royle's Mat. Med. The *bitter cucumber* is an annual plant, bearing considerable resemblance to the common watermelon. The stems, which are herbaceous and beset with rough hairs, trail upon the ground, or rise upon neighboring bodies, to which they attach themselves by their numerous tendrils. The leaves, which stand alternately on long petioles, are triangular, many-cleft, variously sinuated, obtuse, hairy, of a fine green color on the upper surface, rough and pale on the under. The flowers are yellow, and appear singly at the axils of the leaves. The fruit is a globular pepo, of the size of a small orange, yellow and smooth when ripe; and contains, within a hard, coriaceous rind, a white, spongy, medullary matter, enclosing numerous ovate, compressed, white or brownish seeds.

The plant is a native of Turkey, and abounds in the islands of the Archipelago. It grows also in various parts of Africa and Asia. Burckhardt, in his travels across Nubia, found the country covered with it; Thunberg met with it at the Cape of Good Hope; and Ainslie says that it grows in many parts of Lower India, particularly in sandy places near the sea. It is said to be cultivated in Spain, to abound in Morocco and in the neighboring countries, and even to have been collected in Japan. The fruit is gathered in autumn, when it begins to become yellow, and, having been peeled, is dried quickly in a stove or by the sun. Thus prepared, it is imported from the Levant. Small quantities are said to be imported into England from Mogador in the form of brown, unpeeled globular gourds.*

Properties. As kept in the shops, colocynth is in the shape of whitish balls about the size of an orange, very light and spongy, and abounding in seeds which constitute three-fourths of their weight. The seeds are somewhat bitter, but possess little activity, and, according to Captain Lyon, are even used as food in the north of Africa.† When the medicine is prepared for use, they are separated and rejected, the pulpy or medullary matter only being employed. This has a very feeble odor, but a nauseous and intensely bitter taste. The U. S. Pharm. thus describes colocynth. "From two to four inches (5 to 10 cm.) in diameter; globular; white or yellowish-white; light; spongy; readily breaking into three wedge-shaped pieces, each containing, near the rounded surface, many flat, ovate, brown seeds; inodorous; taste intensely bitter. Hard and dark colored Colocynth should be rejected. The pulp, when used, should be deprived of the seeds." *U. S.* Water and alcohol extract the virtues of colocynth. It is a matter of importance to be able to determine whether the drug miller who usually powders colocynth is careful to reject the seeds. If the seeds have been ground with the mass, the microscope will show the presence of numerous albuminous granules derived from the cotyledons. (W. T. Clark, *P. J. Tr.*, vii. 509.) These are best found by putting a small amount of the powder on the glass slide, adding a drop of water, and gently rubbing the cover glass over it: fragments of the double-walled embryo sac showing on the outer side, elongated, more or less hexagonal, thin-walled cells, and on the inner side irregular, tabular, thick-walled cells. Powdered colocynth containing a large number of starch granules has suffered adulteration. Vauquelin obtained the bitter principle of colocynth in a separate state, and called it *colocynthin.* According to Meissner, 100 parts of the dry pulp of colocynth contain 14·4 parts of colocynthin, 10·0 of extractive, 4·2 of fixed oil, 13·2 of a resinous substance insoluble in ether, 9·5 of gum, 3·0 of pectic acid (pectin), 17·6 of gummy extract derived from the lignin by means of potassa, 2·7 of phosphate of calcium, 3·0 of phosphate of magnesium, and 19·0 of lignin, besides water.‡ Colocynthin is obtained by boiling the pulp in water, evaporating the decoction, treating the extract thus procured with alcohol, evaporating the alcoholic solution, and submitting the residue, which consists of the bitter principle and acetate of potassium, to the action of a little cold water, which dissolves the latter, and leaves the greater part of the former untouched. Mr. Bastick obtained it by exhausting the pulp with cold water, heating the solution to ebullition, adding subacetate of lead so long as a precipitate was produced, filtering the liquor when cold, adding dilute sulphuric acid gradually until it no longer occasioned a precipitate, boiling to expel free acetic acid, filtering to separate sulphate of lead, evaporating cautiously nearly to dryness, extracting the colocynthin from the residuum by strong alcohol, which left the salts, and finally evaporating the alcoholic solution. The following process, employed by Dr. Waltz, probably yields it in a purer state. Colocynth is exhausted by alcohol of 0·84, the tincture evaporated to dryness, the residue treated with water, and the solution precipitated first with acetate and afterwards with subacetate of lead. The yellow filtered liquor is then treated with sulphuretted hydrogen to separate the lead, and, after filtration, with solution of tannic acid, which throws down a compound of tannic acid and colocynthin. This is dissolved in alcohol, the tannin thrown down by subacetate of lead, the excess of lead separated, and the liquid digested with animal charcoal, filtered, and evaporated. The residue, washed with anhydrous ether, is pure colocynthin. This is yellowish, somewhat translucent, brittle and friable, fusible by a heat below 100° C. (212° F.), inflammable, more soluble in alcohol than in water, but capable of rendering the latter intensely bitter. M. Mouchon states that it is insoluble in ether. It is neither acid nor alkaline; but its aqueous solution gives with infusion of galls a copious white precipitate. Its formula, according to Dr. Waltz, is $C_{56}H_{84}O_{23}$. Upon the same authority it is a glucoside, being resolved, by the action of sulphuric acid, into sugar and a peculiar resinous substance termed *colocyntheïn*. An infusion of colocynth, made with boiling water, gelatinizes upon cooling. Neumann obtained from 768 parts of the pulp, treated first with alcohol and then with water, 168 parts of alcoholic and 216 of aqueous extract.

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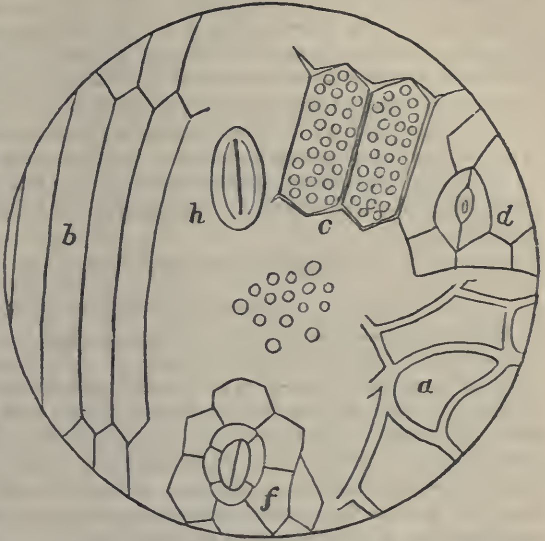
* In Union Village, Lebanon, Ohio, the Shakers formerly prepared an extract from a hybrid between the colocynth and the watermelon. The two plants were placed close to each other, and the hybrid resulting yielded the second year a gourd resembling a watermelon, but very bitter, and affording an abundant extract. This is stated to be equal in purgative properties to that of colocynth, but at present it is not manufactured.

† Dr. Nachtigal confirms this statement of Captain Lyon; but with the qualification, that, before being eaten, the seeds are deprived of their coating by some mechanical means, and the kernels are heated to the boiling point, then washed with cold water, dried, and powdered. Professor Flückiger found a bitter principle in the testa, which accounts for its rejection as food, though rendering improper the rejection of the seed in preparing the extract. He found in the kernels about 45 per cent. of fixed oil and 18 per cent. of albumen. (*A. J. P.*, 1872, p. 538.)

‡ Dr. Waltz supposes that he has found another peculiar principle, *colocynthitin.* It was obtained by treating with ether the alcoholic extract previously exhausted by water, decolorizing the ethereal solution with animal charcoal, evaporating to dryness, and dissolving the residue in anhydrous alcohol, which deposited it in crystals on spontaneous evaporation. It is white and tasteless, and is probably a resin. (*N. Jahrbuch der Pharm.*, xvi. 10.)



470 Diameters.

a, inner layer of embryo sac; *b*, outer layer of ditto; *c*, cells of palisaded layer with granules; *d*, stomata from cotyledon; *e*, granules from cotyledons; *f*, epidermis of rind; *h*, starch granule (side view).

Medical Properties and Uses. The pulp of colocynth is a powerful drastic, hydragogue cathartic, producing, when given in large doses, violent griping, and sometimes bloody discharges, with dangerous inflammation of the bowels. Death has resulted from a teaspoonful and a half of the powder. (*Christison.*) Even in moderate doses it sometimes acts with much harshness, and is, therefore, seldom prescribed alone. By some writers it is said to be diuretic. It was frequently employed by the ancient Greeks and the Arabians, though its drastic nature was not unknown to them. Among the moderns it is occasionally used in obstinate dropsy, and in various affections depending on disordered action of the brain. In combination with other cathartics it loses much of its violence, but retains its purgative energy, and in this state is extensively employed. The compound extract of colocynth is a favorite preparation with many practitioners; and, combined with calomel, extract of jalap, and gamboge, it forms a highly efficient and safe cathartic, especially useful in congestion of the portal circle and torpidity of the liver. (See

Pilulæ Catharticæ Compositæ.) The dose of colocynth is from five to ten grains (0·33–0·65 Gm.). It is best administered in minute division, effected by trituration with gum or farinaceous matter. The active principle has sometimes been employed, and, in the impure state in which it is prepared by the process of M. Emile Mouchon, may be given in the dose of a grain (·065 Gm.).*

Thunberg states that the fruit of *C. Colocynthis*, at the Cape of Good Hope, is rendered so mild by being properly pickled, that it is eaten both by the natives and the colonists; but, as it is thus employed before attaining perfect maturity, it is possible that the drastic principle may not have been developed.

Off. Prep. Extractum Colocynthidis, *U. S.;* Extractum Colocynthidis Compositum, *Br.;* Pilula Colocynthidis Composita, *Br.;* Pilula Colocynthidis et Hyoscyami, *Br.*

CONFECTIONES. *U. S., Br.* *Confections.*

(CO̧N-FĔC-TI̧-Ō'NĒŞ—ko̧n-fĕk-shç-ō'nēz.)

Electuaries; Conserves, Electuaires, Saccharolés mous, *Fr.;* Conserven, Latwergen, *G.*

Under the general title of Confections, the Pharmacopœias include all those preparations having the form of a soft solid, in which one or more medicinal substances are incorporated with saccharine matter, with a view either to their preservation or more convenient administration. But two confections have been retained in the present revision of the U. S. Pharmacopœia. The old division into Conserves and Electuaries has been abandoned; but, as there is some ground for the distinction, we shall make a few general remarks upon each division, before proceeding to the consideration of the individual preparations.

Conserves consist of recent vegetable substances and refined sugar beaten into a uniform mass. By means of the sugar, the vegetable matter is enabled to resist for some time the decomposition to which it would otherwise be exposed in the undried state, and the properties of the recent plant are thus retained to a certain extent unaltered. But, as active medicines even thus treated undergo some change, and those which lose their virtues by desiccation cannot be long preserved, the few conserves now retained are intended rather as convenient vehicles of other substances than for separate exhibition. The sugar used in their preparation should be reduced to a fine powder by pounding and sifting, as otherwise it will not mix uniformly with the other ingredients.

Electuaries are mixtures consisting of medicinal substances, especially dry powders, combined with syrup or honey, in order to render them less unpleasant to the taste, and more convenient for internal use. They are usually prepared extemporaneously; and it is only when their complex nature renders it convenient to keep them ready made in the shops, or some peculiarity in the mode of mixing the ingredients requires attention, that they become proper objects for officinal direction. Their consistence should not be so soft, on the one hand, as to allow the ingredients to separate, nor so firm, on the other, as to prevent them from being swallowed without mastication. Different substances require different proportions of syrup. Light vegetable powders usually require twice their weight, gum-resins two-thirds of their weight, resins somewhat less, mineral substances about half their weight, and deliquescent salts not more than one-tenth. Should the electuary be found, after having been kept for a short time, to swell up and emit gas, it should be beaten over again in a mortar, so that any portion of the sugar which may have crystallized may be again accurately incorporated with the other ingredients. Should it, on the contrary, become dry and hard from the mutual reaction of its constituents, more syrup should be added, so as to give it the requisite consistence. If the dryness result from the mere evaporation of the aqueous part, water should be added instead of syrup, and the same remark is applicable to the conserves. To prevent the hardening of electuaries, the French writers recommend the use of syrup prepared from brown sugar, which is less apt to crystallize than that made from the refined. Molasses would answer the same purpose; but its taste might be objectionable. Some employ honey, but this is not always acceptable to the stomach. Glycerin might sometimes be used with advantage.*

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* For further processes for preparing colocynthin, see U. S. D., fourteenth edition, or *A. J. P.*, xxviii. 166; 1863, 116.

CONFECTIO OPII. *Br.* *Confection of Opium.*

(CỌN-FĔC′TỊ-Ō Ō′PỊ-Ī—kọn-fĕk′shẹ-ō.)

Electuarium Theriaca, *P. G.;* Confection (Electuaire) opiacé, Thériaque, *Fr.;* Opiumlatwerge, Theriak, *G.*

"Take of Compound Powder of Opium *one hundred and ninety-two grains;* Syrup *one fluidounce* [Imperial measure]. Mix." *Br.*

This preparation was dropped in the last revision of the U. S. Pharm. It was intended as a substitute for those exceedingly complex and unscientific preparations, formerly known by the names of *theriaca* and *mithridate*, which have been expelled from modern pharmacy. It was an officinal of the London and Edinburgh Colleges, and, after having been discarded in the first British Pharmacopœia, was adopted in the last edition. The preparation is a combination of opium with spices, which render it more stimulant, and more grateful to a debilitated stomach. It may be given in atonic gout, flatulent colic, diarrhœa unattended with inflammation, and other diseases requiring the use of a stimulant narcotic. Added to Peruvian bark or sulphate of quinine, it increases the efficacy of this remedy in obstinate cases of intermittent fever. One grain of opium is contained in about thirty-six grains of the U. S. confection of 1870,† and in about forty grains of the British.

CONFECTIO PIPERIS. *Br.* *Confection of Black Pepper.*

(CỌN-FĔC′TỊ-Ō PĪ′PẸR-ĬS.)

Electuarium Piperis; Electuaire de Poivre, *Fr.;* Pfefferlatwerge, *G.*

"Take of Black Pepper, in fine powder, *two ounces;* Caraway Fruit, in fine powder, *three ounces;* Clarified Honey *fifteen ounces.* Rub them well together in a mortar." *Br.* This preparation was intended as a substitute for *Ward's paste*, which acquired some reputation in Great Britain as a remedy in piles and ulcers of the rectum. To do good, it must be continued, according to Mr. Brodie, for two, three, or four months. The dose is from one to two drachms repeated two or three times a day. Its stimulating properties render it inapplicable to cases attended with much inflammation.

CONFECTIO ROSÆ. *U. S.* *Confection of Rose.*

(CỌN-FĔC′TỊ-Ō RŌ′ṢÆ.)

Confectio Rosæ Gallicæ, *Br.;* Confection of Roses; Conserva Rosarum; Conserve de Rose rouge, *Fr.;* Rosen-Conserve, *G.*

"Red Rose, in No. 60 powder, *eight parts* [or one ounce av.]; Sugar, in fine powder, *sixty-four parts* [or eight ounces av.]; Clarified Honey, *twelve parts* [or one and a half ounces av.]; Rose Water, *sixteen parts* [or two fluidounces], To make *one hundred parts* [or twelve and a half ounces]. Rub the Red Rose with the Rose Water heated to 65° C. (149° F.), then gradually add the Sugar and Honey, and beat the whole together until thoroughly mixed." *U. S.*

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* *Confectio Aromatica. Aromatic Confection.* (Electuarium Aromaticum; Électuaire, Confection aromatique, *Fr.;* Aromatische Latwerge, Gewürzlatwerge, *G.*) "Take of Aromatic Powder *four troyounces;* Clarified Honey *four troyounces*, or *a sufficient quantity.* Rub the Aromatic Powder with Clarified Honey until a uniform mass of the proper consistence is obtained." *U. S.* 1870. The aromatic confection has been abandoned in the U. S. and Br. Pharmacopœias, probably because readily prepared extemporaneously. It affords, nevertheless, a convenient means of administering the spices contained in it, and an agreeable vehicle for other medicines. The 1870 U. S. formula differed favorably from that of 1850 in the omission of the saffron; and the place of the syrup of orange peel has been economically supplied by using a larger proportion of honey. The confection is given in debilitated states of the stomach. The dose is from ten to sixty grains (0·65–3·9 Gm.)."

Confectio Aurantii Corticis. Confection of Orange Peel. (Conserva Aurantii; Conserve d'Ecorce d'Orange, *Fr.;* Apfelsinenschalen-Conserve, *G.*) "Take of Sweet Orange Peel, recently separated from the fruit by grating, *twelve troyounces;* Sugar [refined] *thirty-six troyounces.* Beat the Orange Peel with the Sugar, gradually added, until they are thoroughly mixed." *U. S.* 1870. This confection, like the preceding, has been dropped in the U. S. and Br. Pharmacopœias. It is not used as frequently as it deserves to be. It is, when well made, a grateful aromatic vehicle or adjunct for tonic and purgative powders.

† "Take of Opium, in fine powder, *two hundred and seventy grains;* Aromatic Powder *six troyounces;* Clarified Honey *fourteen troyounces.* Rub the Opium with the Aromatic Powder, then add the Honey, and beat the whole together until thoroughly mixed." *U. S.* 1870.

"Take of Fresh Red-Rose Petals *one pound;* Refined Sugar *three pounds.* Beat the Petals to a pulp in a stone mortar; add the Sugar, and rub them well together." *Br.*

This preparation differs from that formerly officinal only in a slight increase, 4 per cent., in the quantity of sugar; this is rather an improvement.

In the British process the unblown petals only are used, and these should be deprived of their claws; in other words, the rose-buds should be cut off a short distance above their base, and the lower portion rejected. In the last three editions of the U. S. Pharmacopœia, dried roses have been substituted for the fresh, as the latter are not brought to our market. The process is very similar to that of the French Codex. We have been informed, however, that much of the confection of roses made in Philadelphia on the large scale is prepared from the fresh petals of the hundred-leaved rose and others, by beating them into a pulp with sugar, as in the British process. An excuse for this deviation from the officinal formula is, that the confection thus made has greater adhesiveness than the officinal, and is therefore better fitted for the formation of pills.

This confection is slightly astringent, but is almost exclusively used as a vehicle of other medicines, or to impart consistence to the pilular mass.

Off. Prep. Pilula Aloes Barbadensis, *Br.;* Pil. Aloes et Assafœtidæ, *Br.;* Pil. Aloes et Ferri, *Br.;* Pil. Aloes et Myrrhæ, *Br.;* Pil. Aloes Socotrinæ, *Br.;* Pil. Ferri Carbonatis, *Br.;* Pilulæ Hydrargyri; Pil. Plumbi cum Opio, *Br.*

CONFECTIO ROSÆ CANINÆ. *Br.* *Confection of Hips.*

(CO̩N-FĔC′TI̩-Ō CA̩-NĪ′NÆ)

Confectio Cynosbati, Conserva Cynorrhodi; Conserve de Cynorrhodon, *Fr.;* Hainbutten-Conserve, *G.*

"Take of Hips deprived of their seeds *one pound;* Refined Sugar *two pounds.* Beat the Hips to a pulp in a stone mortar, and rub the pulp through a sieve, then add the Sugar, and rub them well together." *Br.*

This preparation is acidulous and refrigerant, and is used in Europe for forming more active medicines into pills and electuaries. On standing it is apt to develop saccharine crystals, and is therefore not so eligible as confection of rose.

Off. Prep. Pilula Quiniæ, *Br.*

CONFECTIO SCAMMONII. *Br.* *Confection of Scammony.*

(CO̩N-FĔC′TI̩-Ō SCA̩M-MŌ′NI̩-Ī.)

Électuaire ou Confection de Scammonée, *Fr.;* Scammonium-Latwerge, *G.*

"Take of Scammony, in fine powder, *three ounces;* Ginger, in fine powder, *one ounce and a half;* Oil of Caraway *one fluidrachm;* Oil of Cloves *half a fluidrachm;* Syrup *three fluidounces;* Clarified Honey *one ounce and a half.* Rub the powders with the Syrup and the Honey into a uniform mass, then add the Oils and mix." *Br.* The ounce used in this process is the avoirdupois ounce.

The confection is actively cathartic in the dose of half a drachm or a drachm, but is very little used. The British Pharmacopœia now directs scammony alone in its formula without the alternative of the resin given in the first edition. This is a decided improvement. As this drug is generally found in the market, it has but little more than half the strength of the resin. It is true that the purest and best scammony is much stronger than this, yet it is decidedly weaker than its resin, and the Pharmacopœia itself describes it as containing only from 80 to 90 per cent. of this ingredient. It appears to have been a strange want of precision thus to confound the two, as if they were to be given in the same dose.

CONFECTIO SENNÆ. *U. S.* *Confection of Senna.*

(CO̩N-FĔC′TI̩-Ō SĔN′NÆ.)

Electuarium e Senna, *P.G.;* Electuarium de Senna Compositum, Electuarium Lenitivum; Électuaire de Séné composé, Électuaire lénitif, *Fr.;* Sennalatwerge, *G.*

"Senna, in No. 60 powder, *ten parts;* Coriander, in No. 40 powder, *six parts;*

Cassia Fistula, bruised, *sixteen parts;* Tamarind, *ten parts;* Prune, sliced, *seven parts;* Fig, bruised, *twelve parts;* Sugar, in fine powder, *fifty parts;* Water, *sixty parts*, To make *one hundred parts.* Place the Cassia Fistula, Tamarind, Prune, and Fig in a close vessel with *forty-five* (45) *parts* of the Water, and digest for three hours, by means of a water-bath. Separate the coarser portions with the hand, and rub the pulpy mass, first through a coarse hair sieve, and then through a fine one, or through a muslin cloth. Mix the residue with the remainder of the Water, and, having digested the mixture for a short time, treat it as before, and add the product to the pulpy liquid first obtained. Then, by means of a water-bath; dissolve the Sugar in the pulpy liquid, and evaporate the whole until it weighs *eighty-four* (84) *parts.* Lastly, add the Senna and Coriander, and incorporate them thoroughly with the other ingredients while yet warm." *U. S.*

"Take of Senna, in fine powder, *seven ounces;* Coriander Fruit, in fine powder, *three ounces;* Figs *twelve ounces;* Tamarind *nine ounces;* Cassia Pulp *nine ounces;* Prunes *six ounces;* Extract of Liquorice *three-quarters of an ounce;* Refined Sugar *thirty ounces;* Distilled Water *a sufficiency.* Boil the Figs and Prunes gently with twenty-four [fluid]ounces of Distilled Water in a covered vessel for four hours; then, having added more Distilled Water to make up the quantity to its original volume, mix the Tamarind and Cassia Pulp, digest for two hours, and rub the softened pulp of the fruits through a hair sieve, rejecting the seeds and other hard parts. To the pulped product add the Sugar and Extract of Liquorice and dissolve them with a gentle heat; while the mixture is still warm, add to it gradually the mixed Senna and Coriander powders, and mix the whole thoroughly, making the weight of the resulting Confection seventy-five ounces either by evaporation or by the addition of more Distilled Water." *Br.* The ounce employed in the British process is the avoirdupois ounce.

The Confection of Senna, when correctly made, is an elegant preparation, and keeps well if properly secured. The present U. S. process differs from that of 1860 in preparing the pulps, as suggested in former editions of this Dispensatory, instead of taking them already prepared. There may be difficulty, however, in the evaporation to 84 parts, particularly if the pulpy drugs are of good quality. The present preparation contains nearly 20 per cent. more sugar than that officinal in 1870, and nearly 2 per cent. more senna. It is not uncommon to omit the cassia pulp in the preparation of the confection, as the pods are not always to be found in the market. But, as this is next to senna the most active ingredient, the omission is to be regretted. Cassia fistula is now readily procured in commerce, and there can be no excuse for its omission. It has also been proposed to substitute the fluid extract of senna for the crude drug (*A. J. P.*, xliii. 123); but, as the fluid extract is of such uncertain quality, the leaves themselves are certainly preferable.

This is one of our best and most pleasant laxatives, being admirably adapted to cases of habitual costiveness, especially in pregnant women and persons affected with piles. It is also very useful in constipation during convalescence from acute disease. The dose is two drachms (7·8 Gm.), to be taken at bedtime.

CONFECTIO SULPHURIS. *Br.* *Confection of Sulphur.*

(CỌN-FĔC'TỊ-Ō SŬL'PHŮ-RĬS.)

Electuarium Sulphuris; Électuaire de Soufre, *Fr.;* Schwefel-Latwerge, *G.*

"Take of Sublimed Sulphur *four ounces* [avoirdupois]; Acid Tartrate of Potash *one ounce* [av.]; Syrup of Orange Peel *four fluidounces.* Rub them well together." *Br.*

This is merely a mode of administering the two laxatives, sulphur and bitartrate of potassium; and the relative proportion of the latter is so small that it can have little effect. The dose is from one to two drachms or more.

CONFECTIO TEREBINTHINÆ. *Br.* *Confection of Turpentine.*

(CỌN-FĔC'TỊ-Ō TĔR-Ẹ-BĬN'THỊ-NÆ.)

Electuarium Terebinthinatum; Électuaire térébinthiné, *Fr.;* Terpentinol-Latwerge, *G.*

"Take of Oil of Turpentine *one fluidounce;* Liquorice Root, in powder, *one* *ounce* [avoirdupois]; Clarified Honey *two ounces* [av.]. Rub the Oil of Turpentine with the Liquorice, add the Honey, and mix to a uniform consistence." *Br.*

Confections might be multiplied indefinitely upon the principle which appears to have been adopted here, that, namely, of giving a convenient formula for the administration of medicines. The effects of this confection are those only of the oil of turpentine. The dose may be from a scruple to a drachm.

CONII FOLIA. *Br.* *Conium Leaves.*

(CO̤-NĪ′Ī FŌ′LI̤-A̤.)

Hemlock Leaves; Herba Conii, *P.G.;* Herba Cicutæ Majoris; Feuilles de grande Ciguë (de Ciguë officinale), *Fr.;* Schierlingskraut, Schierlings-Blätter, *G.*

"The fresh leaves and young branches of Spotted Hemlock, Conium maculatum; also the leaves separated from the branches and carefully dried; gathered from wild British plants when the fruit begins to form." *Br.*

CONIUM. *U.S., Br.* *Conium.* [*Hemlock.*]

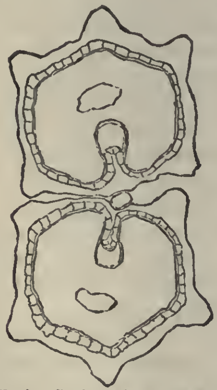
(CO̤-NĪ′ŬM.)

"The full-grown fruit of Conium maculatum. Linné. (*Nat. Ord.* Umbelliferæ, Campylospermæ), gathered while yet green." *U. S.* "The dried ripe fruit of Conium maculatum, Spotted Hemlock." *Br.*

Conii Fructus, *Br.;* Hemlock Fruit; Fruits de grande Ciguë, Ciguë ordinaire, Grand Ciguë, *Fr.;* Gefleckter Schierling, Schierlingsfrüchte, *G.;* Cicuta, *It., Sp.*

Gen. Ch. Partial involucre halved, usually three-leaved. *Fruit* nearly globular, five-streaked, notched on both sides. *Willd.*

Conium maculatum. Willd. *Sp. Plant.* i. 1395; Bigelow, *Am. Med. Bot.* i. 113; Woodv. *Med. Bot.* p. 104, t. 42. This is an umbelliferous plant, having a biennial spindle-shaped whitish root, and an herbaceous branching stem, from three to six feet high, round, hollow, smooth, shining, slightly striated, and marked with brownish purple spots. The lower leaves are tripinnate, more than a foot in length, shining, and attached to the joints of the stem by sheathing petioles; the upper are smaller, bipinnate, and inserted at the division of the branches; both have channelled footstalks, and incised leaflets, which are deep green on their upper surface and paler beneath. The flowers are very small, white, and disposed in compound terminal umbels. The general involucre consists of from three to seven lanceolate, reflected leaflets, whitish at their edges; the partial involucre, of three or four, oval, pointed, spreading, and on one side only. There are five petals, cordate, with their points inflected, and nearly equal. The stamens are spreading, and about as long as the corolla; the styles diverging. The fruit, commonly called seeds, is roundish-ovate, a line and a half or rather less in length by a line in breadth, striated, and composed of two plano-convex, easily separable parts, which have on their outer surface five crenated ribs separated by slightly wrinkled furrows. On cross-section the absence of oil-ducts becomes apparent, and a deep furrow upon the commissural face of the albumen gives a reniform appearance. As kept in the shops, the mericarps are usually separated. They are thus described in the U. S. Pharmacopœia. "About one-eighth of an inch (3 mm.) long; broadly ovate; laterally compressed; gray-green; often divided into the two mericarps, each with five crenate ribs, without oil-tubes, and containing a seed which is grooved on the face; odor and taste slight. When triturated with solution of potassa, Conium gives off a strong, disagreeable odor." *U. S.*



Unripe Conium Fruit, transverse section.

Conium is a native of Europe, and has become naturalized in the United States, where it is also cultivated for medicinal purposes. It grows usually in clusters along the roadsides, or in waste grounds, and is found most abundantly near old settlements. It flowers in June and July. The whole plant, especially at this period, exhales a fetid odor, compared by some to that of mice, by others to that of the urine of cats; and narcotic effects result from breathing for a long time air loaded with the effluvia. The plant varies in narcotic power according to the weather and climate, being most active in hot and dry seasons and in warm countries. The hemlock of Greece, Italy, and Spain is said to be much more energetic than that of the north of Europe. As a general rule, those plants are most active which grow in a sunny exposure. The term *cicuta*, which has often been applied to this plant, belongs to a different genus. The leaves and fruit are officinal.

The proper season for gathering the leaves is when the plant is in flower; and Dr. Fothergill asserts, from experiment, that they are most active about the time when the flowers begin to fade. The footstalks* should be rejected, and the leaflets quickly dried, either in the hot sun, on tin plates before a fire, or by a stove-heat not exceeding 120° F. They should be kept in boxes or tin cases, excluded from the air and light, by exposure to which they lose their fine green color, and become deteriorated. The same end is answered by pulverizing them, and preserving the powder in opaque and well-stopped bottles. But little reliance can be placed on the dried leaves; as, even when possessed of a strong odor and a fine green color, they may be destitute of the narcotic principle. When rubbed with caustic potassa they should exhale the odor of conine. The fruit retains its activity much longer than the leaves. Dr. Christison found them to have sustained no diminution of power after having been kept eight years. Hirtz inferred from experiment that extract of the seeds was ten times stronger than that of the leaves.

Properties. The dried leaves of the hemlock have a strong, heavy, narcotic odor, less disagreeable than that of the recent plant. Their taste is bitterish and nauseous; their color a dark green, which is retained in the powder. A slight degree of acrimony possessed by the fresh leaves is said to be dissipated by drying. The seeds have a yellowish gray color, a feeble odor, and a bitterish taste. Their form has already been described. Water distilled from the fresh leaves has the odor of hemlock, and a nauseous taste, but does not produce narcotic effects. The decoction has little taste, and the extract resulting from its evaporation is nearly inert. From these facts it is inferable that the active principle, as it exists in the plant, is not volatile at 100° C. (212° F.), and, if soluble in water, is injured by a boiling heat. Alcohol and ether take up the narcotic properties of the leaves; and the ethereal extract, which is of a rich dark green color, is stated by Dr. A. T. Thomson to have the smell and taste of the plant in perfection, and in the dose of half a grain to produce headache and vertigo. Upon destructive distillation, the leaves yield a very poisonous empyreumatic oil. Schrader found in the juice of the leaves, resin, extractive, gum, albumen, a green fecula, and various saline substances. Brandes obtained from the plant a very odorous oil, albumen, resin, coloring matter, and salts.

So long ago as 1827, Giseke obtained an alkaline liquid by distilling hemlock leaves with water and caustic lime; but he did not succeed in isolating the substance in which the alkalinity resided. Geiger was the first who obtained the active principle in a separate state, and proved it to be alkaline. It appears that there are two volatile substances in hemlock; one of them an *oil*, which is in very small quantity, and has never been chemically studied; it is obtained by simple distillation. The volatile alkaloid, *conine*, is the active principle. As it exists in the plant in combination with an acid, it is not readily volatilized; but when alkali is previously added, it freely comes over with the distillate. The acid of conium Peschier believed to be peculiar, and named *coniic acid*. Other observers claim that it is *malic acid*. Geiger obtained conine by the following process. He distilled fresh hemlock with caustic potassa and water, neutralized with sulphuric acid the alkaline liquid which came over, evaporated this liquid to the consistence of syrup, added anhydrous alcohol so long as a precipitate of sulphate of ammonium was afforded, separated this salt by filtration, distilled off the alcohol, mixed the residue with a strong solution of caustic potassa, and distilled anew. The conine passed over with the water, from which it separated, floating on the surface in the form of a yellowish oil. According to Dr. Christison, an easier process is to distil cautiously a mixture of a strong solution of potassa and the alcoholic extract of the unripe fruit. As obtained by the above process, conine is in the state of a hydrate, containing one-fourth of its weight of water and a little ammonia. From the former, it may be freed by chloride of calcium; from the latter, by exposing it under an exhausted receiver, till it ceases to emit bubbles of gas.

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* Dr. Manlius Smith, of Manlius, N. Y., has demonstrated that the footstalks are almost destitute of the active alkaline principle. (*Ann. de Thérap.*, 1873, p. 39.)

The fresh leaves or seeds should be employed in the preparation of conine; as the alkaloid undergoes decomposition by time and exposure. The seeds contain most of this principle; but even in these it exists in very small proportion. From 6 pounds of the fresh and 9 of the dried seeds, Geiger obtained about an ounce of conine; while from 100 pounds of the fresh herb he got only a drachm, and from the dried leaves none. Christison recommends the full-grown fruit while yet green, and states that 8 pounds will yield half an ounce of hydrate of conine, and contains much more. In relation to the relative strength of different parts of the plant, Dr. Manlius Smith, of New York, gives, as the result of a series of carefully conducted experiments, that the unripe fruit of the conium is far preferable to the dried leaves, and is even stronger than the full-grown fruit, that it may be dried without serious injury, and that a very active preparation may be made from it. He also found that full-grown fruit, collected in August, and dried in the dark, retained its activity unimpaired for several years. This would appear to contradict in some measure previous opinions of the injurious effects of time. (*P. J. Tr.*, Feb. 1869, pp. 491–2.)

CONINE is in the form of a yellowish oily liquid, of sp. gr. 0·87 to 0·89, of a very acrid taste, and a strong penetrating odor, compared to that of the urine of mice, and recalling the smell of fresh hemlock, though not identical with it. In volatility it resembles the essential oils, readily rising with the vapor of boiling water, but when unmixed, requiring for ebullition a temperature of 170° C. (338° F.). It is freely soluble in alcohol, ether, the fixed and volatile oils, and slightly so in water. It unites with about one-fourth of its weight of water to form a hydrate. It reddens turmeric, and neutralizes the acids, forming with them soluble salts, some of which are crystallizable. With tannic acid it forms an insoluble compound. Like ammonia, it occasions a white cloud when approached by a rod moistened with hydrochloric acid; and the resulting hydrochlorate, contrary to previous statements, is asserted by Prof. Wertheim to be crystallizable, and not in the least deliquescent. The statement of Wertheim as to the crystallization of the hydrochlorate has been confirmed by Geo. C. Close, who prepared it by directly uniting its constituents and evaporating its solution by means of a water-bath. The salt crystallized from the solution. He did not succeed in obtaining crystallizable salts with sulphuric, citric, or oxalic acids. (*A. J. P.*, 1869, p. 62.) It coagulates albumen, and precipitates the salts of aluminium, copper, zinc, manganese, and iron. It also precipitates nitrate of silver, but in excess redissolves the precipitate. Most of its salts are decomposed by evaporation. When exposed to the air, it speedily assumes a deep brown color, and is ultimately converted into a resinous matter, and into ammonia which escapes. Under the influence of heat this change takes place with much greater rapidity. The presence of conine may be detected in an extract, or other preparation of hemlock, by rubbing it with potassa, which instantly develops its peculiar odor. Its formula is $C_8H_{15}N$.* In its effects on the system it closely resembles hemlock itself. Dr. Christison found it, contrary to the experience of Geiger, more active in the saline state than when uncombined. It is a most energetic poison; one drop of it injected into the eye of a rabbit killing the animal in nine minutes, and three drops killing a stout cat in a minute and a half when similarly applied. A recently prepared extract of hemlock acted precisely as conine. Locally the alkaloid appears to act as an irritant.

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* Orfila gives the following additional chemical characters of conine. Heated in a capsule, it forms white vapors, *having a strong smell of celery and of the urine of mice.* Weak tincture of iodine gives a white precipitate, becoming olive with excess of the tincture. *Pure concentrated sulphuric acid does not alter it;* but when the mixture is heated, it becomes first brown, then blood-red, and finally black. *Nitric acid imparts a topaz color,* not changed by heat. The chlorides of platinum and of gold give yellow precipitates, and corrosive sublimate a white one. Permanganate of potassium is immediately decolorized. *Neutral acetate of lead gives no precipitate,* nor does the subacetate. The parts of this note in italics indicate the means of distinguishing this alkaloid from nicotine. (See *P. J. Tr.*, xi. 89.)

Methylconine. From a communication by Drs. A. von Planta and Aug. Kekulé to the *Annal. der Chem. und Pharm.* (lxxxix., s. 129–156), it would appear that commercial conine consists most commonly of at least two homologous bases; one being the proper *conine* ($C_8H_{15}N$), which contains one atom of hydrogen capable of being replaced by radicals, and the other, named *methylconine*, $C_8H_{14}NCH_3$, in which the methyl group CH_3 has been substituted for the replaceable H atom of conine. In relation to the modes of separating these alkaloids and their distinctive properties, we must content ourselves with referring to the original paper.

Conhydrine. Prof. T. Wertheim has also found a new alkaloid mixed with the conine obtained by distillation from fresh hemlock flowers. It is crystallizable, fusible below 100° C. (212° F.), and volatilizable at a higher temperature, diffusing the peculiar odor of conine, or one very much like it. Water dissolves it considerably, ether and alcohol freely; and the solution has a strong alkaline reaction. Its formula is given as $C_8H_{17}NO$. When distilled with anhydrous phosphoric oxide it splits into conine and one molecule of water. (*A. J. P.*, xxix. 321.) It may be separated from conine by exposing the mixed alkaloids to a freezing mixture, expressing, and then repeatedly crystallizing from ether. (*Gmelin*, xiii. 169.)

Artificial Conine, Paraconine. Conine is said to have been artificially produced by Hugo Schiff. From the reaction of *butyric aldehyd* with an alcoholic solution of ammonia, he obtained two bases, one of which, *dibutyraldine*, yielded on distillation, first a neutral oily substance, and afterwards a strong alkaline base, which proved to be conine, having all the physiological properties of natural conine. The amount, however, hitherto produced is small and costly. (*A. J. P.*, April, 1871, p. 161.) Subsequently, however, the same chemist found the artificial product to be not chemically identical with the native alkaloid, though isomeric with it, and he proposes to name it *paraconine.* (*Ibid.*, Dec. 1872, p. 539.)

Medical Properties and Uses. Hemlock is supposed to be the narcotic used by the Athenians to destroy the life of condemned individuals, and by which Socrates and Phocion died. It was also used by the ancients as a medicine, but fell into entire neglect, and did not again come into notice till the time of Störck, by whom it was much employed and extravagantly praised. Anodyne, soporific, antispasmodic, antaphrodisiac, deobstruent, and diuretic properties have been abscribed to it. It was highly recommended by Störck as a remedy in schirrus and cancerous ulcers, and has since been employed in all kinds of chronic enlargements, and in diseases most numerous and most diverse.

Modern research has, however, greatly limited the use of the medicine, rendering its possession of alterative properties more than doubtful. When taken internally in sufficient dose it produces very profound muscular weakness, associated it may be with vertigo and disordered vision. After toxic doses the muscular prostration is extreme, the eyelids droop from weakness, the voice is suppressed, the pupils dilated, the light almost lost, consciousness is usually preserved to the last; and life finally is extinguished without struggle. In some cases there have been convulsive movements, and violent cardiac palpitation has been noted. The chief action of the poison is upon the motor nerves, which it paralyzes; the efferent or sensitive nerves are also affected, but to a much less extent. Conium probably exerts no direct influence upon the cerebral centres, but there is some reason for believing that it is a spinal depressant. At present conium is rarely employed by the general practitioner, except in spasmodic affections, such as chorea and hooping-cough. Probably the most frequent use of it is by alienists for the production of calm in maniacal excitement.

The powdered leaves, and the inspissated juice (the extract of the Pharmacopœias), are the forms in which conium has been usually administered; but the juice of the fresh leaves, prepared with the addition of a small proportion of alcohol, has been adopted in the Br. Pharmacopœia. Either the leaves or the extract may be given in the dose of three or four grains (0·20–0·26 Gm.) twice a day, gradually increased till the occurrence of slight vertigo or nausea indicates that it has taken effect. To maintain a given impression, it is necessary to increase the dose even more rapidly than is customary with most other narcotics; as the system becomes very speedily habituated to its influence. In some instances, the quantity administered in one day has been augmented to more than two ounces. The strength of the preparations of hemlock is exceedingly unequal; and caution is therefore necessary, when the medicine is given in very large quantities, to employ the same parcel, or, if a change be made, to commence with the new parcel in small doses, so as to obviate any danger which might result from its greater power. Unpleasant consequences have followed a neglect of this precaution. There are also an officinal tincture, a fluid extract, an abstract, and an alcoholic extract, all of which, when properly made, are considered efficient preparations. The fresh juice of the plant has been recommended by Hufeland in the dose of from twelve to forty drops (0·72–2·5 C.c.). The expressed juice of the fresh plant, with a little alcohol for its preservation, recently introduced into the Pharmacopœias, is one of the most reliable forms in which the leaves can be used. The powdered seeds should be given in a dose considerably smaller than that of the leaves.* The fresh leaves are sometimes used externally as an anodyne cataplasm; and the extract, and an ointment prepared from the leaves, are applied to the same purpose. A plaster made from the extract has also been employed.†

Conine has been occasionally employed, both internally and externally, with asserted advantage, for the same purposes as hemlock itself, or the extract. It has been particularly recommended in hooping-cough. Dr. Spengler, of Herborn, gave it to an infant a year old in the dose of one-sixteenth of a grain every six hours, with the effect of curing the disease in ten days. (*Ann. de Thérap.*, 1853, p. 73.) According to the formula of Fronmüller, two drops are dissolved in twenty-four drops of alcohol, and three drops of the solution are given each on a piece of sugar. (*Arch. Gén.*, 4e sér., xxiii. 226.) From one-quarter to three-quarters of a drop (0·15–0·45 C.c.) may be given to an adult, and one drop (0·06 C.c.) by enema in emulsion of starch. Dr. Harley has prepared an acid benzoate of conine by adding two mols. of the acid to one of the base, and found the resulting salt effectual in the dose of half a grain. (*P. J. Tr.*, Jan. 1871, p. 585.) A solution of one part in one hundred of very dilute alcohol has been used with advantage in certain cases of scrofulous ophthalmia with photophobia, applied several times daily by friction about the eyelids. (*Journ. de Pharm.*, 3e sér., xix. 219.) Prof. Mauthner, of Vienna, recommends it especially in the spasmodic contraction of the orbicularis in scrofulous children, using a solution containing half a grain of conine in a drachm of almond oil, which he applies by a pencil to the eyelids twice or thrice daily. As a collyrium, from one to three drops may be added to six drachms of pure water, and two drachms of mucilage of quince seeds. Introduced into the cavity of a carious tooth, it is said to be very effectual in toothache. For this purpose it should be diluted with ten parts of tincture of cinnamon, and applied by means of a camel's-hair pencil. In diseases of the skin it may be used as an ointment, made with three drops to a drachm of simple ointment. In neuralgia, three or four drops (0·18–0·24 C.c.) may be applied on linen to the skin, and confined by oiled silk.

The hydrochlorate of conine has been recommended for exhibition by Mr. G. C. Close, as preferable to the uncombined alkaloid. From half a grain he experienced no sensible effects; but a grain produced the characteristic symptoms of conine in an even unpleasant degree. These doses are probably dangerous, and not more than a fourth of a grain (0 015 Gm.) should be given as a commencing dose. (*A. J. P.*, 1869, p. 62.) According to Mourrut, one of the best crystallizable salts of conine is the *bromhydrate*. Most of the conine of the market, however, is somewhat impure; it is accompanied by a brown oily body, which adheres to the crystals with great persistence. A variety of conine prepared in Germany, however, is almost colorless, and gives much better results. The alkaloid is treated with aqueous bromhydric acid, which causes, especially with the brown variety of conine, an elevation of temperature, and a disengagement of white fumes of the odor of conine; the mixture then turns green, and finally blackish red. The crystals, which form after some time, may be obtained quite colorless by repeated crystallizations. They are colorless prismatic needles, soluble in water and alcohol, less so in ether and chloroform, inodorous and almost tasteless, and are not deliquescent. They should be kept in the dark, otherwise they assume a red tint. The salt has been used by various practitioners with great success, in the treatment of hooping-cough, in doses of about one-twelfth of a grain (·005 Gm.), if necessary, every hour, for a child three years of age; or one-thirtieth of a grain (·002 Gm.) for a child of one year; or one-sixth of a grain (·01 Gm.) for adults. In sciatica it has been employed hypodermically in quantities of one-twelfth of a grain (·005 Gm.) with good results. (*Répert. de Pharm.*, 1876, p. 369; *N. R.*, 1876, 1879, pp. 18, 178.)

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* The root, while containing a small proportion of conine, is too feeble, according to the experiments of Dr. John Harley, of London, to be used practically with advantage. Dr. Harley has found in the root three new proximate principles, one a very bitter resin which he names *conamarine*, and the two others, crystallizable bodies, named, respectively, *rhizoconin* and *rhizoconolein*. They are all neutral, and so far as known medicinally inert. (See *P. J. Tr.*, Aug. 1867.)

† The following formula of Planche has been approved by the Society of Pharmacy, of Paris. Take of extract of hemlock 90 parts, of purified elemi 20 parts, of white wax 10 parts. Melt the resin and wax with a gentle heat, and incorporate the extract with the mixture. (*Journ. de Pharm.*, Juillet, 1862, p. 46.)

Though fatal to some animals, hemlock is eaten with impunity by others, as horses, goats, and sheep. The best method of relieving its poisonous effects is the speedy evacuation of the stomach.*

Off. Prep. Abstractum Conii, Extractum Conii Alcoholicum, Extractum Conii Fluidum, *U. S.;* Tinctura Conii, *U. S.*, *Br.*

Off. Prep. of the Leaves. Cataplasma Conii, *Br.;* Extractum Conii, *Br.*

COPAIBA. *U. S., Br.* *Copaiba.* [*Balsam of Copaiba.*]

(CỌ-PĀ′Ị-BẠ.)

"The oleoresin of Copaifera Langsdorffii, Desfontaines, and of other species of *Copaifera.* (*Nat. Ord.* Leguminosæ, Papilionaceæ.)" *U. S.* "The oleo-resin obtained from incisions made in the trunk of Copaifera multijuga and other species of Copaifera." *Br.*

Balsamum Copaiva, *P.G.;* Balsam Copaiba, Balsam Capivi; Copahu, Oleo-résine (Baume) de Copahu, *Fr.;* Copaiva; Copaiva-Balsam, *G.;* Balsamo di Copaiba, *It.;* Balsamo de Copayva, *Sp.*

Gen. Ch. Calyx none. *Petals* four. *Legume* ovate. *Seed* one, with an ovate arillus. *Willd.*

Copaiba was first noticed in a work published by Purchas, in England, in 1625. The next reference to it was by Cristoval d'Acuña, in 1638. In 1648, Marcgrav and Piso gave a detailed account of the tree which produces it, and the methods of gathering it. Jacquin in 1763 described a species of Copaifera, growing in Martinique, which he named *C. officinalis.* As this was believed to be the same plant with the one observed by Marcgrav in Brazil, it was adopted in the Pharmacopœias; but their identity was denied; and Desfontaines proposed for Jacquin's species the title of *C. Jacquini*, in honor of that botanist. It is now known that many species of Copaifera exist in Brazil and other parts of South America; and all of them, according to Martius, yield copaiba. Besides *C. officinalis* or *C. Jacquini*, the following are described by Hayne:—*C. Guianensis*, *C. Langsdorffii*, *C. coriacea*, *C. Beyrichii*, *C.*

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* Dr. Harley's experiments on the relative value of the different preparations of conium are based upon their physiological effects. The results obtained were as follows. 1. The Extractum Conii, *B. P.*, and Succus Conii, *B. P.*—20 grains of the extract equalled 2 fluidrachms of the juice (10 gr. to fʒj). 4. Succus Conii, *B. P.;* Tincture of the green fruit (London ℥v in ℥xx);—four drachms of the juice equalled fifty minims of the tincture (ʒiv to ♏50). 11. Different preparations of Succus, *B. P.*, prepared by different persons,—Buckle's (the plant yielding 75 per cent. of juice) and Hanbury's (the plant yielding 35 per cent. of juice);—nine drachms of Buckle's equalled three drachms of Hanbury's—(ʒix to ʒiij). 12. Extract of green fruit, Tincture of green fruit, and Succus, *B. P.*—Three grains of the extract equalled four fluidrachms of the Tincture, and four drachms of Succus (gr. iij of extract=fʒiv of Tincture, and ʒiv of Succus). 14. Of *Squibb's fluid extract* 50 minims equal of the *Tinct.* of the *green fruit*, London, ʒiss; of the Succus Conii, *B. P.*, ʒv; of the Tincture of the fresh plant, ʒiiiss to ʒiv; and of the Tincture of the dry plant, f℥j. 15. Of Squibb's fluid extract ʒj equals of pale Succus ʒvi, of dark Succus ʒij; of Tincture of the green fruit ʒiss; of Tincture of the fresh plant ʒiv; Neutral Benzoate of Conine, gr. ¾. 18. Of Succus Conii, *B. P.* (Buckle's), ʒvj=Benzoate of Conine, gr. ½. The author draws the following conclusions from his experiments. The green fruit, as the basis of Tinctures and Extracts, is decidedly superior to any other part of the plant; and the spirituous extract of the green fruit should be substituted for the almost worthless Extract of the Br. Pharm. The variable strength of the Succus is an objection. (*P. J. Tr.*, Jan. 1871, p. 585.)

Martii, *C. bijuga*, *C. nitida*, *C. laxa*, *C. cordifolia*, *C. Jussieui*, *C. Sellowii*, *C. oblongifolia*, and *C. multijuga*. Hayne believed that *C. bijuga* was the plant seen by Marcgrav and Piso. The four species to which in the Pharmacographia the production of copaiba is especially attributed are *C. officinalis*, L., *C. Guianensis*, Desf., *C. coriacea*, Mart., and the *C. Langsdorffii*.

C. officinalis is a native of Venezuela, and grows in the province of Carthagena, mingled with the trees which afford the balsam of Tolu. It grows also in some of the West India islands, particularly Trinidad and Martinique. Though recognized in former editions of the U. S. Pharmacopœia as a source of copaiba, it probably yields little of that now in use. According to Hayne (x. t. 17 f. c.), the species from which most of the copaiba of commerce is derived is *C. multijuga*, growing in the province of Para. It was recognized by the U. S. P. 1870; but Bentham, after examining the only specimens extant, asserts it not to be a Copaifera at all. It is probable that *C. Guianensis*, which inhabits the neighboring territory of Guiana, especially in the vicinity of the Rio Negro, affords also considerable quantities; and *C. Langsdorffii* and *C. coriacea*, which are natives of São Paulo, are thought to yield most of the juice collected in the latter province. *C. nitida*, inhabiting the province of Minas-Geraes, probably also contributes to the commercial supplies, through Rio Janeiro.

The juice is obtained by making a square chamber in the stems of the trees reaching to the very centre; and the operation is said to be repeated several times in the same season. A single tree is said to yield about eighty-four English Imperial pints. As it flows from the wound, it is clear, colorless, and very thin, but soon acquires a thicker consistence, and a yellowish tinge. It is most largely collected in the provinces of Para and Maranham, in Brazil, and is brought to this country from the port of Para, in small casks or barrels. Large quantities of it come from Maracaybo, in Venezuela, and from other ports on the Caribbean Sea, whence it is brought in casks, demijohns, cans, jugs, etc. The drug is also exported from Angostura, Cayenne, Rio Janeiro, and some of the West India islands.

Properties. Copaiba is a clear, transparent liquid, usually of the consistence of olive oil, of a pale yellow color, a peculiar not unpleasant odor, and a bitterish, hot, nauseous taste. Its sp. gr. varies ordinarily from 0·950 to 1·000, but has been known to be as low as 0·916. (Procter, *A. J. P.*, xxii. 292.)* It is insoluble in water, but entirely soluble in absolute alcohol, ether, and the fixed and volatile oils. Strong alkaline solutions dissolve it perfectly; but the resulting solution becomes turbid when largely diluted with water. With the alkalies and alkaline earths it forms saponaceous compounds, in which the resin of the copaiba acts the part of an acid. It dissolves magnesia, especially with the aid of heat, and even disengages carbonic acid from the carbonate of that earth. If triturated with a sixteenth of its weight of magnesia and set aside, it gradually assumes a solid consistence; and a similar change is produced with hydrate of lime. (See *Pilulæ Copaibæ.*) Its essential constituents are volatile oil and resin, with a minute proportion of an acid which appears to be acetic. (*Durand.*) As it contains no benzoic acid, it cannot with propriety retain its old title of *balsam of copaiva*. The substances which it most closely resembles, both in composition and properties, are the turpentines. (See *Oleum Copaibæ.*)

" A transparent or translucent, more or less viscid liquid, of a color varying from pale yellow to brownish-yellow; having a peculiar, aromatic odor and a persistently bitter and acrid taste. Sp. gr. 0·940–0·993. It is readily soluble in absolute alcohol. It is not fluorescent, and when heated to 130° C. (266° F.), does not become gelatinous. When subjected to heat, it does not evolve the odor of turpentine, and after distilling off the volatile oil the residue, when cool, should be hard and friable (abs. of fixed oils). The essential oil distilled off from the oleoresin, when rectified, should not begin to boil below 200° C. (392° F.). On adding 1 drop of Copaiba to 19 drops of disulphide of carbon and shaking the mixture with 1 drop of a cold mixture of equal parts of sulphuric and nitric acids, it should not acquire a purplish-red or violet color (abs. of gurjun balsam)." *U. S.*

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* The variety of copaiba found by Prof. Procter to have this low sp. gr. was supposed to be from Para. It was of a light straw color, very fluid, and possessed of the pure copaiba odor. It contained 80 per cent. of volatile oil and 20 of resin, and was not affected by recently calcined magnesia. It appears to be the same with a variety described by Dr. L. Posselt in the *Chemical Gazette* for May 1, 1849. The view of Prof. Procter that it is the product of young trees, in which the juice has not become fully elaborated, is highly probable. As the virtues of copaiba depend mainly on the oil, this variety should be more efficacious than the copaiba in common use.

The *resinous* mass which remains after the distillation of the oil is hard, brittle, translucent, greenish brown, and nearly destitute of smell and taste. By mixing it with the oil in proper proportion, we may obtain a liquid identical or nearly so with the original juice. This resinous mass is of an acid character, and yields a series of amorphous salts. It may be obtained pure by exposing a mixture of 9 parts of copaiba and 2 parts of aqueous ammonia (sp. gr. 0·95) to a temperature of 10° C. In this way crystals of *copaivic acid*, $C_{20}H_{30}O_2$, are obtained. This acid agrees with the *abietic acid* of colophony in composition, but not in properties.

Copaivic acid is readily soluble in alcohol, and especially in warmed copaiba itself; much less in ether. When recrystallized from alcohol, copaivic acid fuses at 116°–117° C. (241°–242·6° F.). (*A. J. P.*, 1879, p. 305.) An analogous substance, *oxycopaivic acid*, $C_{20}H_{28}O_3$, was found in 1841 by H. von Fehling in Para copaiba; and Strauss in 1865 extracted *metacopaivic acid*, $C_{22}H_{34}O_4$, from Maracaybo copaiba.

Copaivic acid forms crystallizable salt with alkalies, and the *copaiviate of sodium*, $NaC_{20}H_{29}O_2$, made by combining equivalent quantities of the acid and soda, is claimed by Zlamál and Roquette to be more efficient than any other preparation of copaiba, A *miscible copaiba* proposed by Groves was made by treating copaiba with a saturated solution of carbonate of potassium. It resembled ordinary copaiba in appearance and consistence, but was alkaline, and when shaken with water, instead of floating on the surface readily formed a white emulsion, more or less stable according to the degree of dilution. (*P. J. Tr.*, ix. 195.)

Copaiba, upon exposure to the air, acquires a deeper color, a thicker consistence, and greater density, and, if spread out upon an extended surface, ultimately becomes dry and brittle. This change is owing partly to the volatilization, partly to the oxidation of the essential oil. As it is the soft resin that results from the oxidation of the oil, it follows that the proportion of this resin increases with age. Considerable diversity must, therefore, exist in the drug, both in physical properties and the properties of its ingredients, according to its age and degree of exposure. Similar differences also exist in the copaiba procured from different sources. Thus, that of the *West Indies*, when compared with the *Brazilian*, which is the variety above described, and in common use, is of a thicker consistence, of a deeper or darker yellow color, less transparent, and of a less agreeable, more terebinthinate odor; and specimens obtained from the ports of Venezuela or Colombia were found, upon examination by M. Vigne, to differ from each other not only in physical properties, but also in their chemical relations. (*Journ. de Pharm.*, N. S., i. 52.). The same is true, as observed by M. Buignet, in their action on polarized light, in which they differ not only in degree, but sometimes also even in direction. (*Journ. de Pharm.*, Oct. 1861, pp. 266–7.) It is not impossible that differences may exist in the juice according to the circumstances of its collection. The species of Copaifera from which the juice is collected, as well as the age of the tree, its position, and the season of collection, must also have influence over the product. It is highly probable that the resinous matter results from oxidation of the oil in the cells of the plant, and that the less elaborated the juice may be, the larger proportion it will contain of the oil. It is said that a volatile oil flows abundantly from a tree near Bogota, which is employed to adulterate the copaiba collected in that vicinity and shipped from Maracaybo and other neighboring ports.

Adulterations. Copaiba is said to be frequently adulterated.* The fixed oils are the most frequent addition, especially castor oil, which, in consequence of its solubility in alcohol, cannot, like the others, be detected by the agency of that fluid.

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* Some years since a substance was imported into New York, under the name of *red copaiba*, which had not a single character of the genuine drug. It was of a thick, semifluid consistence, not unlike that of balsam of Tolu, as it often reaches us, a brown color similar to that of the same balsam, though darker, and an unpleasant yet somewhat aromatic odor, recalling that of liquidambar, but less agreeable. Its origin is unknown.

Various plans have been proposed for detecting the presence of castor oil. The simplest is to boil a drachm of the copaiba in a pint of water, till the liquid is wholly evaporated. If the copaiba contain a fixed oil, the residue will be more or less soft, according to the quantity present; otherwise it will be hard. Another mode, proposed by M. Planche, consists in shaking together in a bottle one part of solution of ammonia of the sp. gr. 0·9212 (22° Baumé) with two and a half parts of copaiba, at a temperature of from 50° to 60° F. The mixture, at first cloudy, quickly becomes transparent if the copaiba is pure, but remains more or less opaque if it is adulterated with castor oil. According to J. E. Simon, however, a variety of genuine copaiba occurs in commerce in which this test fails (*A. J. P.*, xvi. 236); and it does not apply to the variety containing 80 per cent. of volatile oil, described by Prof. Procter. (See note, p. 499.) Carbonate of magnesium, caustic potassa, and sulphuric acid have also been proposed as tests. In the late Edinburgh Pharmacopœia, it was stated that copaiba "dissolves a fourth part of its weight of carbonate of magnesium, with the aid of a gentle heat, and continues translucent." The presence of a small proportion of any fixed oil renders the mixture opaque. One part of potassa dissolved in two of water forms a clear solution with nine parts of pure copaiba, and the liquid continues clear when moderately diluted with water or alcohol; but the presence of one-sixth of fixed oil in the copaiba occasions more or less opacity in the liquid, and half the quantity causes the precipitation of white flakes in a few hours. (*Stolze.*) Turpentine, which is said to be sometimes added to copaiba, may be detected by its smell, especially if the copaiba be heated. According to Mr. Redwood, most of the proposed tests of the purity of copaiba are liable to fallacy; and the best measure of its activity is the quantity of volatile oil it affords by distillation. Castor oil, Venice turpentine, linseed oil, or Gurjun Balsam may be detected by means of petroleum benzin, which makes a clear solution with pure copaiba, but if either of the substances mentioned be present a milky mixture, which soon settles into two layers, is formed, the copaiba solution being on top (*A. J. P.*, July, 1873; *Proc. A. P. A.*, xxiv. 191; xxvi. 286). Prof. Maisch has found that *ten* volumes of benzin, instead of *three* as proposed by Prof. Wayne, must be added to one of copaiba to get the best results from this test. Indeed, it has been shown that pure copaiba will sometimes show turbidity when mixed with benzin. (*A. J. P.*, 1877, p. 131.) Hager recommends the use of absolute alcohol, which he says completely dissolves, without turbidity, all the varieties of copaiba except the Para, whose solution on standing clears itself by the deposition of a few white flakes. J. M. Fulton asserts that some pure copaibas are not entirely dissolved by absolute alcohol. (*A. J. P.*, 1877.)

Medical Properties and Uses. Copaiba is gently stimulant, diuretic, laxative, and in very large doses often actively purgative. It produces, when swallowed, a sense of heat in the throat and stomach, and extends an irritant action, not only throughout the alimentary canal, but also to the urinary passages, and in fact, in a greater or less degree, to all the mucous membranes, for which it appears to have a strong affinity. The urine acquires a peculiar odor during its use, and its smell may be detected in the breath. It sometimes occasions an eruption upon the skin, resembling that of measles, and attended with disagreeable itching and tingling. A case has been recently recorded, in which an acute attack of pemphigus over the whole body attended its use. (*N. Y. Med. Journ.*, Jan. 1873, p. 416.) Nausea and vomiting, painful purgation, strangury, and bloody urine, and a general state of fever are caused by excessive doses. As a remedy it has been found most efficient in diseases of the mucous membranes, particularly those of a chronic character. Thus, it is given with occasional advantage in leucorrhœa, gleet, chronic dysentery, and diarrhœa, painful hemorrhoidal affections, and chronic bronchitis, and has even been used in diphtheria and pseudo-membranous croup. By the late Dr. La Roche, of Philadelphia, it was highly recommended in catarrh and chronic irritation of the bladder. (*Am. Journ. of Med. Sci.*, xiv. 13.) It has been given in psoriasis and dropsy, and is said to be used as a vermifuge in Brazil. The complaint, however, in which it is most employed is gonorrhœa. It should not be administered in the first stages, when the inflammation is severe and acute, nor is it applicable to very chronic, indolent forms of the disorder, such as gleet. It was formerly much esteemed as a vulnerary, and as an application to ulcers; but it is now seldom used externally. Dr. Ruschenberger recommends it locally in chilblains. (*Med. Examiner*, i. 77.) Prof. Marchal, of Strasburg, has employed it with great success in gonorrhœa and leucorrhœa, injecting an emulsion made with 5 parts of copaiba, 8 of gum arabic, and 100 of water, or applying it smeared on catheters or tampons.

The dose of copaiba is from twenty drops to a fluidrachm (1·25–3·75 C.c.) three times a day, or a smaller quantity repeated more frequently. It may be given dropped on sugar, but in this form is often so exceedingly offensive as to render some concealment of its nauseous qualities necessary. A less disagreeable form is that of emulsion, prepared by rubbing the copaiba first with mucilage or the yolk of an egg, and sugar, and afterwards with some aromatic water, as that of mint or cinnamon. The *volatile oil*, which is officinal, may be given in the dose of ten or fifteen drops, in emulsion, or, as is almost universally preferred, in capsules.

Both the volatile oil and resin are eliminated by the kidneys in an altered condition: if to the urine of a person taking the drug nitric acid be added, a precipitate is thrown down, which may be mistaken for albumen. The volatile oil is more active than is the resin, which is not, however, inert. Dr. Wilks, of Guy's Hospital, London, speaks of the resin with great confidence as a hydragogue diuretic in obstinate dropsy, given in the dose of fifteen or twenty grains three or four times a day. (*Lancet*, March 22, 1873.)

Velpeau has found the best effects from copaiba in the form of enema. He gives two drachms made into an emulsion with the yolk of an egg, twenty or thirty drops of laudanum, and eight fluidounces of water. Dr. E. Langlebert recommends a distilled water of copaiba internally, in the dose of one or two fluidounces (30–60 C.c.) three or four times a day, and as a vehicle in urethral injections.

Off. Prep. Massa Copaibæ, *U. S.*

CORIANDRUM. *U. S. Coriander.*

(CŌ-RI-ĂN′DRUM.)

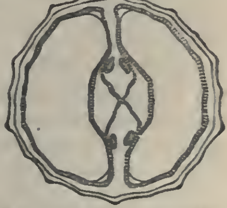
"The fruit of Coriandrum sativum. Linné. (*Nat. Ord.* Umbelliferæ, Cœlospermæ.)" *U. S.* "The dried ripe fruit of Coriandrum sativum, cultivated in Britain." *Br.*

Coriandri Fructus, *Br.;* **Coriander Fruit; Fructus Coriandri,** *P.G.;* **Coriandre,** *Fr.;* **Koriander,** *G.;* **Coriandro,** *It.;* **Cilantro,** *Sp.*

Gen. Ch. Corolla radiate. *Petals* inflex-emarginate. *Universal involucre* oneleafed. *Partial involucres* halved. *Fruit* spherical. *Willd.*

Coriandrum sativum. Willd. *Sp. Plant.* i. 1448; Woodv. *Med. Bot.* p. 137, t. 53. This is an annual plant, with an erect, round, smooth, branching stem, rising about two feet, and furnished with compound leaves, of which the upper are thrice ternate, with linear pointed leaflets, the lower pinnate, with the pinnæ cut into irregular serrated lobes like those of parsley. The flowers are white or rose-colored, and in compound terminal umbels; the fruit globular, and composed of two concave hemispherical portions.

C. sativum is a native of Italy, but at present grows wild in most parts of Europe, having become naturalized in consequence of its extended cultivation. The flowers appear in June, and the fruit ripens in August. It is a singular fact, that all parts of the fresh plant are extremely fetid when bruised, while the fruit becomes fragrant by drying. This is the officinal portion. It is brought to us from Europe.


Transverse section, magnified.

The fruit of the coriander is globular, about an eighth of an inch in diameter, obscurely ten-ribbed, with minute indications of secondary ribs in the furrows, of a grayish or brownish yellow color, and separable into the two mericarps (half-fruits), which are only bound together by the membranous pericarp. Each half-fruit is provided with two oil-tubes on the conjoining face. The whole fruit has the persistent calyx at its base, and is sometimes surmounted by the adhering conical style. Coriander is thus described by the U. S. Pharm. "Globular; about one-sixth of an inch (4 mm.) in diameter; crowned with the calyx-teeth; brownish-yellow, with slight, longitudinal ridges; the two mericarps cohering, enclosing a lenticular cavity, and each furnished on the face with two oil-tubes; odor and taste agreeably aromatic." *U. S.* The aromatic smell and taste depend on a *volatile oil*, which may be obtained separate by distillation, and is said to belong to the camphene family. One pound of the seeds yields forty-two grains of the oil. (*Zeller.*) It is colorless or pale yellow, with an agreeable odor of coriander, a mild aromatic taste, and a sp. gr. varying from 0·859 to 0·871. It has the composition $C_{10}H_{18}O$, and is therefore isomeric with borneol. It is one of the most permanent of the volatile oils, resisting oxidation for a long time. The virtues of the fruit are imparted to alcohol by maceration, and less readily to water.

Medical Properties and Uses. Coriander has, in a moderate degree, the ordinary medicinal virtues of the aromatics. It is almost exclusively employed in combination with other medicines, either to cover their taste, to render them acceptable to the stomach, or to correct their griping qualities. It was well known to the ancients. The dose is from a scruple to a drachm (1·3–3·9 Gm.).

Off. Prep. Confectio Sennæ, *U. S.;* Oleum Coriandri, *Br.;* Syrupus Rhei, *Br.;* Syrupus Sennæ, *Br.;* Tinctura Rhei, *Br.;* Tinctura Sennæ, *Br.*

CORNUS. *U. S.* Cornus. [*Dogwood.*]

(CŎR′NŬS.)

"The bark of the root of Cornus Florida. Linné. (*Nat. Ord.* Cornaceæ.)" *U. S.*
Écorce de Cornouiller à grandes Fleurs, *Fr.;* Grossblüthige Cornelrinde, *G.*

Gen. Ch. Flowers perfect or diœcious. *Calyx* minutely four-toothed. *Petals* four, oblong, spreading. *Stamens* four. *Filaments* slender. *Style* slender. *Stigma* terminal, flat, or capitate. *Drupe* small, with a two-celled and two-seeded stone. *Gray's Manual.*

Cornus Florida. Willd. *Sp. Plant.* i. 661; Bigelow, *Am. Med. Bot.* ii. 73; Barton, *Med. Bot.* i. 44. This is a small indigenous tree, usually about fifteen or twenty feet in height, though sometimes not less than thirty or thirty-five feet. It is of slow growth; and the stem, which generally attains a diameter of four or five inches, is compact, and covered with a brownish bark, the epidermis of which is minutely divided by numerous superficial cracks or fissures. The branches are spreading, and regularly disposed, sometimes opposite, sometimes in fours nearly in the form of crosses. The leaves are opposite, oval, about three inches long, pointed, dark green and sulcated on the upper surface, glaucous or whitish beneath, and marked with strong parallel veins. Towards the close of summer they are speckled with black spots, and on the approach of cold weather become red. The proper flowers are small, yellowish, and collected in heads, which are surrounded by a large conspicuous involucre, consisting of four white obcordate leaves, having the notch at their summit tinged with red or purple. This involucre constitutes the chief beauty of the tree, and is commonly called the flower. The calyx is four-toothed, and the corolla composed of four obtuse reflexed petals. The fruit is an oval drupe, of a vivid glossy redness, containing a two-celled and two-seeded nucleus. The drupes are usually associated together to the number of three or four, and remain on the tree till after the early frosts. They ripen in September. The dogwood is found in all parts of the United States, from Massachusetts to the Mississippi and the Gulf of Mexico, but is most abundant in the Middle States. In the month of May it is clothed with a profusion of large white blossom-clusters, which render it one of the most conspicuous ornaments of the American forests. The bark is the officinal portion, and is derived for use both from the stem and the branches, and from the root. That from the root is preferred.

As brought into market, the bark is in pieces of various size, usually more or less rolled, sometimes invested with a fawn-colored epidermis, sometimes partially or wholly deprived of it, of a reddish gray color, very brittle, and affording, when pulverized, a grayish powder tinged with red. "In curved pieces of various sizes, about one-eighth of an inch (3 mm.) thick; deprived of the furrowed, brown-gray, corky layer; outer and inner surface pale-reddish, or light reddish-brown, striate; transverse and longitudinal fracture short, whitish, with brown, yellow striæ; inodorous; astringent and bitter." *U. S.* The odor of dogwood is feeble, its taste bitter, astringent, and slightly aromatic. Water and alcohol extract its virtues. From the experiments of Dr. Walker and Mr. James Cockburn (*A. J. P.*, vii. 109), it appears to contain bitter extractive, gum, resin, tannin, gallic acid, fixed oil, wax, red coloring matter, lignin, and salts of potassa and iron. Mr. Cockburn also obtained a crystallized substance, without taste, the characters of which, however, were not sufficiently investigated to authorize an opinion as to its nature. A peculiar bitter principle, for which the name of *cornine* was proposed, was announced as an ingredient by Mr. Carpenter; but his results have not been confirmed. Prof. John M. Maisch appears subsequently to have obtained the bitter principle pure in solution, but, in consequence of its extreme facility of decomposition, did not succeed in isolating it. Geiger (*Ann. Ch. und Pharm.*, xiv. 206) first obtained the bitter principle *cornin*, or *cornic acid*, in white, silky, bitter needles, readily soluble in water and alcohol, little in ether, colored dark by alkalies. It is neutral and is not precipitated by infusion of nutgalls, but is precipitated by acetate of lead and by silver solutions. A. G. Frey (*A. J. P*, 1879, p. 390) also obtained *cornin* in pure white crystals out of alcohol. The flowers of *C. Florida* have the same bitter taste as the bark, and, though not officinal, are sometimes employed for the same purposes.*

Medical Properties and Uses. *Cornus Florida* is tonic and astringent. By Dr. Walker it was found, when taken internally, to increase the force and frequency of the pulse, and the heat of the body. It is thought to possess remedial properties analogous to those of Peruvian bark, for which it has occasionally been successfully substituted in the treatment of intermittent fevers; but the introduction of sulphate of quinine into use has nearly banished this, as well as many other substitutes for cinchona, from regular practice. The dogwood has also been employed in low fevers, and other complaints for which Peruvian bark is usually prescribed.

It may be given in powder, decoction, or extract. The dose of the powder is from a scruple to a drachm (1·3–3·9 Gm.), repeated, in cases of intermittent fever, so that from one to two ounces may be taken in the interval between the paroxysms. The decoction was officinal in 1870. The dried bark is said to be preferable to the fresh; as it possesses all the activity of the latter, without being so liable to offend the stomach and bowels. An extract might probably be used with advantage in intermittents in large doses.

Off. Prep. Extractum Cornûs Fluidum, *U. S.*

CREASOTUM. *U. S., Br.* *Creasote.*

(CRĒ-Ạ-SŌ'TŬM.)

"A product of the distillation of wood-tar." *U. S., Br.*

Kreosotum, *P.G.;* Créosote, *Fr.;* Kreosot, *G.*

This is a substance discovered in 1830 by Reichenbach in the products of the distillation of wood. This distillation of wood yields products very analogous to one fraction of the coal-tar obtained by the destructive distillation of bituminous coal. This fraction is the heavy oil of coal-tar, which comes over between 165° C. (329° F.) and 200° C. (392° F.): it is often called "*coal-tar creasote*," and contains a group of phenols, including carbolic acid, or common *phenol*, C_6H_6O, boiling at 182° C. (359·6 F.), *cresylic acid*, or *cresol*, C_7H_8O, boiling at 198° C. (388·4 F.), and *xylenol*, or *dimethyl phenol*, $C_8H_{10}O$, boiling at 211° C. (411·8° F.).

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* Two other indigenous dogwoods were formerly recognized in the U. S. secondary list. *C. circinata* is a shrub from six to ten feet high, with warty branches, large, roundish, pointed leaves, waved on their edges and downy beneath, and white flowers disposed in depressed cymes. The fruit is blue. The plant is a native of the United States, extending from Canada to Virginia, and growing on hill-sides and the banks of rivers. It flowers in June and July. The bark, when dried, is in quills of a whitish or ash color, and affords a powder resembling that of ipecacuanha. Its taste is bitter, astringent, and aromatic. In chemical composition, so far as this has been ascertained, it is analogous to *Cornus Florida*.

C. sericea is usually six or eight feet in height, with numerous erect stems, which are covered with a shining reddish bark, and send out opposite spreading branches. The young shoots are more or less pubescent. The leaves are opposite, petiolate, ovate, pointed, entire, and on the under surface covered with soft brownish hairs. The flowers are small, white, and disposed in terminal cymes, which are depressed and woolly. The fruit consists of globular, berry-formed drupes, of a cerulean blue color, and collected in bunches. The bark of both of these species is said to be of equal medical value with that of *C. Florida*.

"Wood-tar creasote," on the other hand, is chiefly composed of the following phenols. *Guiacol*, or *oxycresol*, $C_7H_8O_2$, boiling at 200° C. (392 F.), *creasol*, $C_8H_{10}O_2$, boiling at 217° C. (422·6° F.), *methyl-creasol*, $C_9H_{12}O_2$, boiling at 214° C. (417° F.) to 218° C. (424·4° F.), and *phlorol*, $C_8H_{10}O_1$, boiling at 219° C. (426·2 F.). (See also *Allen's Commerc. Org. Analysis*, p. 306.)

Preparation. Creasote is obtained either from wood-tar or from crude pyroligneous acid. When wood-tar is used, it is distilled until it has attained the consistence of pitch. The distilled liquid divides itself into three layers, an aqueous between two oily layers. The inferior oily layer, which alone contains the creasote, is separated, and saturated with carbonate of potassium to remove acetic acid. The liquid is allowed to rest, and the new oil which separates is decanted from it. This oil is distilled, and yields products lighter than water, and a liquid heavier. The latter alone is preserved, and, after having been agitated repeatedly with weak phosphoric acid to neutralize ammonia, is allowed to remain at rest for some time. It is next washed as long as acidity is removed, and then distilled with a fresh portion of weak phosphoric acid; care being taken to cohobate from time to time. The oily liquid thus rectified is colorless, and contains much creasote, but also a portion of *eupion*, or light oil distillate. To separate the latter, the liquid is mixed with a solution of caustic potassa of the density 1·12, which dissolves the creasote, but not the eupion. The eupion, which floats above from its levity, is then separated; and the alkaline solution of the creasote is exposed to the air, until it becomes brown in consequence of the decomposition of a foreign matter, and is then saturated with sulphuric acid. This sets free the creasote, which is decanted, and again distilled. The treatment by solution of potassa, sulphuric acid, etc., is to be repeated until the creasote no longer becomes brown by exposure to the air, but only slightly reddish. It is then dissolved in a stronger solution of potassa and distilled again, and finally redistilled for the last time, rejecting the first portion which comes over on account of its containing much water, collecting the next portion, and avoiding to push the distillation too far. The product collected in this distillation is creasote.

When creasote is extracted from pyroligneous acid, the first step is to dissolve sulphate of sodium in it to saturation. The oil which separates and floats above is decanted, and, having been allowed to remain at rest for a few days, is saturated by carbonate of potassium with the assistance of heat, and distilled with water. The oleaginous liquid obtained is of a pale yellow color, and is to be treated with phosphoric acid, etc., as above detailed, in relation to the treatment of the corresponding oil obtained from wood-tar.

Properties. Creasote, when pure, is a colorless oleaginous liquid, of the consistence of oil of almonds, slightly greasy to the touch, volatilizable by heat, and having a caustic, burning taste, and a penetrating, disagreeable odor, like that of smoked meat, and analogous to, yet different from, that of phenol. As met with in the shops, it has frequently a brownish tinge. It burns with a sooty flame. Applied in a concentrated state to the skin, it corrugates and then destroys the cuticle, causing a white spot. On paper it leaves a greasy stain, which disappears in a few hours, or in ten minutes if heated to 100° C. (212° F.). Its sp. gr. is 1·057 at 55° (*Gorup-Besanez*), 1·035–1·085 (*U. S.*), 1·071 (*Br.*). It boils at about 203° C. (397° F.), and remains fluid at —27° C. (—17°F.). It is a non-conductor of electricity, and refracts light strongly. It is devoid of acid or alkaline reaction. Mixed with water, it forms two solutions; one consisting of one part of creasote and about eighty of water, the other, of one part of water and ten of creasote. (*Berzelius.*) It dissolves a large proportion of iodine and phosphorus, and a considerable amount of sulphur, especially when assisted by heat.

The Pharmacopœia describes creasote as "an almost colorless or yellowish, strongly refractive, oily liquid, turning to reddish-yellow or brown by exposure to light, having a penetrating, smoky odor, a burning, caustic taste and a neutral reaction. Sp. gr. 1·035–1·085. It begins to boil near 200° C. (392° F.), and most of it distils over between 205° and 220° C. (401°–428° F.). When cooled to —20° C. (—4°F.) it becomes thick, but does not solidify. It is inflammable, burning with a luminous, smoky flame. Creasote is soluble in about 80 parts of water at 15° C. (59° F.) to a somewhat turbid liquid, and in 12 parts of boiling water; it dissolves, in all proportions, in absolute alcohol, ether, chloroform, benzin, disulphide of carbon, or acetic acid. When applied to the skin, it produces a white stain. Creasote does not coagulate albumen or collodion (difference from carbolic acid). If 1 volume of Creasote be mixed with 1 volume of glycerin, a nearly clear mixture will result, from which the Creasote will be separated by the addition of 1 or more volumes of water. On adding to 10 C.c. of a 1 per cent. aqueous solution of Creasote, 1 drop of test-solution of ferric chloride, the liquid acquires a violet-blue tint, which rapidly changes to greenish and brown, with formation, usually, of a brown precipitate (diff. from carbolic acid)." *U. S.*

Creasote instantly dissolves ammonia, and retains it with great force. Strong nitric and sulphuric acids decompose it; the former giving rise to reddish vapors, the latter to a red color, which becomes black on the addition of more of the acid. Dilute nitric acid converts it into a brown resin, which, treated with ammonia, and then dissolved in boiling alcohol, gives, by evaporation, certain salts of ammonia, two of which contain new acids, discovered by Laurent. Hydrochloric acid produces no change in it. The British Pharmacopœia gives, as one of the characters of its creasote, that a "slip of deal dipped into it, and afterwards into hydrochloric acid, and then allowed to dry in the air, acquires a greenish blue color;" and consequently does not consider the presence of carbolic acid as a contamination. The probability is that the creasote upon which the description in the British Pharmacopœia was prepared was not really derived from wood, but from coal-tar. The true creasote differs from carbolic acid in not coagulating collodion. M. Gorup-Besanez states that with a neutral solution of perchloride of iron, beech-wood creasote, dissolved in alcohol, gives a green color, whilst a similar solution of the product of coal-tar causes a brown color; but, dissolved in water, the true creasote produces no change, while coal-tar creasote produces a blue. (*A. J. P.*, 1868, p. 257.) Mr. T. N. R. Morson, of London, who has long been a manufacturer of creasote, complains of the discredit into which it has fallen in consequence of the substitution for it in commerce, of carbolic acid; while he says that the directions of the Pharmacopœia for the distinction of the two are insufficient, and gives a test, discovered by his son Mr. Thos. Morson, which is at once simple and satisfactory. It consists in the solvent power of glycerin over carbolic acid, which is dissolved by it in all proportions, while pure creasote is insoluble or nearly so; and, consequently, if any liquid, assumed to be creasote, dissolves largely in glycerin, it probably consists in the whole, or in large part, of carbolic acid. (*P. J. Tr.*, May, 1872, p. 921.) Subsequent experiments appear to show that this test succeeds best with Morson's creasote; and beech-wood creasote, although pure, sometimes mixes with glycerin without turbidity. A still better test, according to Mr. John A. Clark, is an alcoholic solution of perchloride of iron (*Tr. Ferri Perchlor.* B. Ph.), which with an alcoholic solution of creasote produces a deep greenish blue color, but with carbolic acid a light brown. (*A. J. P.*, June, 1873, p. 269.) Creasote dissolves a large number of metallic salts, and reduces a few to the metallic state; as, for example, nitrate and acetate of silver. It powerfully coagulates albumen, and in this way is supposed to act as a hæmostatic. Froehde's reagent (a solution of 1 part of molybdic acid in 100 parts of sulphuric acid) is recommended by E. W. Davy as a distinguishing test for carbolic acid. (*P. J. Tr.*, 1878, p. 1022.) A drop or two of the doubtful liquid is to be agitated with two fluidrachms of distilled water, the whole filtered, and a drop or two of the test-solution added. Pure creasote gives a brown or reddish brown reaction on standing or slight warming, passing to a light yellowish brown; with carbolic acid, the brown passing to a maroon soon develops a more or less intense purple.

Of all the properties of creasote, the most remarkable is its power of preserving meat. It is this property which has suggested its name, derived from *κρεάς*, *flesh*, and *σώζω*, *I preserve.*

Impurities and Adulterations. Creasote is apt to contain eupion, and is sometimes adulterated with rectified oil of tar, and the fixed and volatile oils. All these substances are detected by strong acetic acid, which dissolves the creasote, and leaves them behind, floating above the creasote solution. Creasote, however, from beechwood tar, is only partially dissolved by hot acetic acid of ordinary strength. Fixed oils are also discovered by a stain on paper not discharged by heat. Any trace of the matter which produces the brownish tinge is detected by the liquid becoming discolored by exposure to sunshine.

Commercial creasote almost always contains carbolic and cresylic acids, from coal-tar; and indeed, much of what is sold for creasote is nothing more than impure carbolic acid. (See *Acidum Carbolicum.*) It has been already stated that this acid strongly resembles creasote; and this resemblance probably extends also to their therapeutical effects; so that the substitution is less to be regretted than might otherwise be the case. But, as the effects of the two on the system may not be identical, it is highly desirable to be able to distinguish between them. Tests for this purpose have been given above, and, with those quoted from the Pharmacopœia, are sufficient for the purpose.

Medical Properties, etc. The influence of creasote upon the animal economy has never been carefully studied, but is probably identical with that of carbolic acid. It is never used in medicine except for its local action. Applied in this way it is a powerful paralyzant of nerve-tissue, and hence is frequently employed with great advantage in cases of nausea, vomiting, or diarrhœa dependent upon excessive irritability, without acute inflammation, of the gastric or intestinal mucous membrane; it has also been successfully used in nausea and vomiting of pregnancy or hysteria, in cholera morbus, cholera infantum, lienteric diarrhœa, typhoid fever, and even in dysentery. When in these cases there is a tendency to fermentation of the contents of the stomach or bowels, creasote is especially valuable, and may often be combined advantageously with an alkali or chalk. Externally creasote has been employed for exactly the same diseases as has carbolic acid. Indeed, the latter remedy, on account of its superior cheapness, has almost entirely supplanted it.

The skin diseases to the treatment of which creasote has been supposed to be best suited are those of a scaly character. In burns its efficacy has been insisted on, especially in those attended with excessive suppuration and fungous granulations. In chilblains also it is stated to be a useful application. Mixed with four parts of lard, it is said to have proved very serviceable in erysipelas. When applied to wounds it acts as a hæmostatic, stopping the capillary hemorrhage, but possessing no power to arrest the bleeding from large vessels. Accordingly, creasote water has been applied locally in menorrhagia, and to arrest uterine hemorrhage and the bleeding from leech-bites. The ulcers, in the treatment of which it has been found most useful, are those of an indolent and gangrenous character, in which its several properties of escharotic, stimulant, and antiseptic are usefully brought into play. In all these cases, should the remedy cause irritation, it must be suspended, or alternated with emollient and soothing applications. Injected into fistulous ulcers, it proves a useful resource, by exciting the callous surfaces and disposing them to unite.

Wherever there are foul ulcers, gangrenous surfaces, or inflamed serous, mucous, or glandular tissues giving rise to fetid discharges, creasote may be substituted for carbolic acid; as examples, may be mentioned fetid leucorrhœa, puerperal metritis, fetid otorrhœa, putrid or diphtheritic sore throat, chronic empyema. The strength of the application may vary from that of pure creasote to a single drop to the fluidounce of water, according to the delicacy of the part and the severity of the disease. On account of its local anæsthetic and antiseptic influence, it is much employed by dentists for the obtunding of sensitive dentine and as an ingredient of pastes for the destruction of nerves. One or two drops of the pure substance must be carefully introduced into the hollow of the tooth, on a little cotton, avoiding contact with the tongue or cheek. To render it effectual, the hollow of the tooth must be well cleansed before it is applied. A mixture of 15 parts of creasote and 10 of collodion is said to have a jelly-like consistence, and to be usefully applied to carious teeth, which it protects from the air; but, as pure creasote does not coagulate collodion, this remark applies properly to the impure carbolic acid, before stated to be commonly sold under the same name.

Under the name of VAPOR CREASOTI (*Inhalation of Creasote*), the British Pharmacopœia directs a preparation consisting of 12 minims of creasote and 8 fluidounces of boiling water, which are to be mixed in an inhaling apparatus, so arranged that the air shall be made to pass through the solution and then inhaled. It may be used in chronic inflammation of the air-passages.

The internal dose of creasote is one to three minims (0·6–0·18 C.c.), administered in pill, mixture, or solution. In an overdose, it acts as a poison, producing giddiness, obscurity of vision, depressed action of the heart, convulsions, and coma. Whether the soluble sulphates would be antidotal to it, as to carbolic acid, is uncertain, but there is no other available antidote. The medical treatment consists in the evacuation of the poison, and the administration of ammonia and other stimulants.

The addition of three or four drops of creasote to a pint of ink effectually prevents it from becoming mouldy. Dr. Christison finds that creasote water is as good a preservative of some anatomical preparations as spirit, with the advantage of not hardening the parts. It is probably to creasote that the antiseptic properties of wood-smoke and of pyroligneous acid are owing.

Off. Prep. Aqua Creasoti, *U. S.;* Mistura Creasoti, *Br.;* Unguentum Creasoti; Vapor Creasoti, *Br.*

CRETA. *Br.* *Chalk.*

$CaCO_3$; 100. (CRĒ'TA.) CaO, CO_2; 50.

"Native friable carbonate of lime." *Br.*

Craie, *Fr.;* Kreide, *G.;* Creta, *It.;* Greda, *Sp., Port.*

Carbonate of calcium, in the extended meaning of the term, is the most abundant of simple minerals, constituting, according to its state of aggregation and other peculiarities, the different varieties of calcareous spar, common and shell limestone, marble, marl, and chalk. It occurs also in the animal kingdom, forming the principal part of shells, and a small proportion of the bones of the higher orders of animals. It is present in small quantity in most natural waters, being held in solution by the carbonic acid which they contain. In the waters of limestone districts it is a very common impregnation, and causes purging in those not accustomed to their use. In all such cases, boiling the water, by expelling the carbonic acid, causes the carbonate to be deposited. It has been shown, however, that carbonate of calcium is itself in a slight degree soluble in water; so that a small proportion remains in limestone water which has been long exposed to boiling. Hofmann estimated the quantity remaining in solution at thirty-four milligrammes in a litre. That the carbonate is not held in solution by free carbonic acid is shown by the fact that lime-water causes no precipitation. (*Journ. de Pharm. et de Chim.*, 4e sér., iii. 147.) Besides being officinal in the state of chalk, carbonate of calcium is also ordered as it exists in marble and oyster-shell, and as obtained by precipitation. (See *Marmor*, *Testa*, and *Calcii Carbonas Præcipitata.*) In the present article we shall confine our observations to chalk. This occurs abundantly in the south of England and the north of France. It exists massive in beds, and very frequently contains nodules of flint, and fossil remains of land and marine animals. Until recently it was not known to exist in the United States; but Prof. F. V. Hayden states that chalk-beds identical with those of Europe extend for 400 miles along the Missouri River in Dakota.

Properties. Chalk is an insipid, inodorous, insoluble, opaque, soft solid, generally white, but grayish white when impure. It is rough to the touch, easily pulverized, and breaks with an earthy fracture. It soils the fingers, yields a white trace when drawn across an unyielding surface, and when applied to the tongue adheres slightly. Its sp. gr. varies from 2·3 to 2·6. It is never a perfectly pure carbonate of calcium, but contains, besides gritty silicious particles, small portions of alumina and ferric oxide. If pure, it is entirely soluble in hydrochloric acid; but usually a little silica is left. If this solution is not precipitated by ammonia, it is free from alumina and iron. Like all carbonates, it effervesces with acids. Though insoluble in water, it dissolves in an excess of carbonic acid.

Chalk, on account of the gritty particles which it contains, is unfit for medicinal use until it has undergone levigation, when it is called *prepared chalk.* (See *Creta Præparata.*)

Pharm. Use. In preparing carbonic acid gas, *Br.*

Off. Prep. Creta Præparata, *U. S.*, *Br.*

CRETA PRÆPARATA. *U. S., Br.* *Prepared Chalk.*

(CRĒ′TẠ PRÆ-PẠ-RĀ′TẠ—prē-pạ-rā′tạ.)

"Native, friable Carbonate of Calcium [$\mathbf{CaCO_3}$; **100.**—CaO,CO_2; 50], freed from most of its impurities by elutriation." *U. S.*

Craie préparée, *Fr.;* Präparirte Kreide, *G.*

Below will be found the process officinal in the Pharmacopœia of 1870.*

The Br. Pharmacopœia has abandoned its former process, and is now content with defining the medicine to be "chalk freed from most of its impurities by elutriation, and afterwards dried in small masses, which are usually of a conical form."

The object of the above process is to reduce chalk to a very fine powder. The mineral, previously pulverized, should be rubbed with a little water upon a porphyry slab, by means of a muller of the same material. Having been thus very minutely divided, it is agitated with water, which upon standing a short time deposits the coarser particles, and, being then poured off, slowly lets fall the remainder in an impalpable state. The former part of the process is called *levigation,* the latter *elutriation.* The soft mass which remains after the decanting of the clear liquor is made to fall upon an absorbent surface in small portions, which when dried have a conical shape.† Practically, prepared chalk is generally made on the large scale from *whiting* by the manufacturer. (See *P. J. Tr.*, vii. 146.)

No directions are given now in the Pharmacopœia for its preparation; it is thus described. "A white, amorphous powder, generally agglutinated in form of small cones, permanent in the air, odorless and tasteless, and insoluble in water or alcohol. It is soluble in hydrochloric, nitric or acetic acid with copious effervescence, and without leaving more than a trifling residue. By exposure to a red heat, the salt loses carbonic acid gas, and the residue has an alkaline reaction. A neutral solution of the salt in acetic acid yields, with test-solution of oxalate of ammonium, a white precipitate soluble in hydrochloric, but insoluble in acetic acid. Another portion of the same solution should yield no precipitate with test-solution of sulphate of calcium (abs. of barium, strontium). On adding to another portion of the solution, first, chloride of ammonium, then carbonate of ammonium and water of ammonia in slight excess, and gently warming, the filtrate separated from the resulting precipitate should not be rendered more than faintly turbid by test-solution of phosphate

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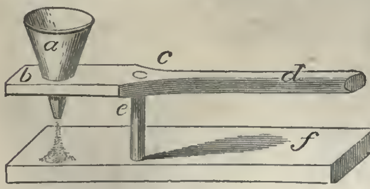
* "Take of Chalk *a convenient quantity.* Add a little water to the chalk, and rub it into fine powder. Throw this into a large vessel nearly full of water, stir briskly, and, after a short interval, decant the supernatant liquor, while yet turbid, into another vessel. Treat the coarser particles of the Chalk, remaining in the first vessel, in a similar manner, and add the turbid liquid to that previously decanted. Lastly, set the liquor by that the powder may subside, and, having poured off the water, dry the powder." *U. S.* 1870.

† Several insoluble substances, besides chalk, are brought habitually into the form of small cones, such as prepared oyster-shell, phosphate of calcium, rust of iron, subnitrate of bismuth, oxide of zinc, etc. This is usually effected by the use of a simple implement, consisting of a funnel of tinned iron, with the neck removed (*a*), fixed at the expanded extremity (*b*) of a piece of wood about a foot long (*c*), having its other end in the form of a handle (*d*), with a stout piece of wood about 4 inches long (*e*) attached perpendicularly to the lower side of it, so as to serve as a support when fixed in a socket. The material to be shaped is introduced in a very soft, almost diffluent state into the funnel, and the instrument, then raised in the hand by the handle, is brought down so that its support shall strike with a gentle shock against a flat surface of chalk stone (*f*), and these little shocks are rapidly repeated. At each one of them a small portion of the soft mass escapes from the mouth of the funnel, and falls on the stone, where it hardens into the shape of a cone; the chalk serving to absorb the moisture rapidly, and thus enabling it quickly to solidify.



of sodium (limit of magnesium). Another portion of the solution should not assume more than a slightly bluish tint with a few drops of test-solution of ferrocyanide of potassium (limit of iron)." *U. S.*

Medical Properties and Uses. This is the only form in which chalk is used in medicine. It is an excellent antacid; and, as the salts which it forms in the stomach and bowels, if not astringent, are at least not purgative, it is admirably adapted to diarrhœa accompanied with acidity. It is also sometimes used in acidity of stomach attending dyspepsia and gout, when a laxative effect is to be avoided; is one of the best antidotes for oxalic acid; and has been recommended in rachitis. In scrofulous affections it may sometimes do good by forming soluble salts with acid in the primæ viæ, and thus finding an entrance into the blood-vessels. It is frequently employed as an application to burns and ulcers, which it moderately stimulates, while it absorbs the ichorous discharge, and thus prevents it from irritating the diseased surface, or the sound skin. It is given internally in the form of powder, or suspended in water by the intervention of gum arabic and sugar. (See *Mistura Cretæ.*) It is better fitted for the chalk mixture than the precipitated carbonate of calcium, in consequence of its more impalpable character and greater powers of adhesion. The dose is from ten to forty grains (0·65–2·6 Gm.) or more.

Pharm. Uses. In preparing Acidum Citricum, *Br.;* Acidum Tartaricum, *Br.*

Off. Prep. Hydrargyrum cum Cretâ; Mistura Cretæ; Pulvis Cretæ Compositus, *U. S.;* Pulvis Cretæ Aromaticus, *Br.;* Pulvis Cretæ Aromaticus cum Opio, *Br.;* Trochisci Cretæ, *U. S.*

CROCUS. *U. S., Br.* *Saffron.*

(CRŌ'CŬS.)

"The stigmas of Crocus sativus. Linné. (*Nat. Ord.* Iridaceæ.)" *U. S.* "The dried stigma, and part of the style, of Crocus sativus." *Br.*

Safran, *Fr., G.;* Zafferano, *It.;* Azafran, *Sp.*

Gen. Ch. Corolla six-parted, equal. *Stigmas* convoluted. *Willd.*

Crocus sativus. Willd. *Sp. Plant.* i. 194; Woodv. *Med. Bot.* p. 763, t. 259. The common cultivated saffron is a perennial plant, with a rounded and depressed bulb or cormus, from which the flower rises a little above the ground, upon a long, slender, white, and succulent tube. The flower is large, of a beautiful lilac or bluish purple color, and appears in September or October. The leaves are radical, linear, slightly revolute, dark green upon their upper surface with a white longitudinal furrow in the centre, paler underneath with a prominent flattened midrib, and enclosed at their base, together with the tube of the corolla, in a membranous sheath, from which they emerge soon after the appearance of the flower. The style hangs out on one side between the two segments of the corolla, and terminates in three long convoluted stigmas, which are of a rich orange color, highly odorous, rolled in at the edges, and notched at the summit. These stigmas are the officinal part of the plant. The stigmas of the *Crocus orientalis* are used in the East.

C. sativus, or *autumnal crocus*, is believed to be a native of Greece and Asia Minor, where it has been cultivated from the earliest ages. It is, however, unknown in a wild state, and, as the French plant does not produce seed, Chappellier claims that it is a hybrid. (*Bull. Soc. Bot. de France,* xx.) More recently, however, Chappellier has found that the ordinary crocus, as grown in France, is readily fertilized by the Grecian variety, and it is most probable that the species is a distinct one. There are three main varieties of it, the French, the Grecian, and the Chinese. The first of these is superior in color and flavor, the second in the amount of yield, whilst the third is said to unite these qualities. Saffron is also cultivated for medicinal use in Sicily, Spain, France, England, and other temperate countries of Europe. Large quantities of saffron are raised in Egypt, Persia, and Cashmere, whence it is sent to India. Much of the drug reaches the market of Constantinople from the neighborhood of Tiflis and the Caucasus. We cultivate the plant in this country chiefly, if not solely, as a garden flower. It is liable to two diseases, which interfere with its culture; one dependent on a parasitic fungus which attaches itself to the bulb, the other called by the cultivators in France *tacon*, by which the bulb is converted into a blackish powder. (*Journ. de Pharm.*, xviii. 41.)

In England the flowers appear in October, and the leaves continue green through the winter; but the plant does not ripen its seed, and is propagated by offsets from the bulb. These are planted in grounds prepared for the purpose, and are arranged either in rows or in small patches at certain distances. The flowers are gathered soon after they show themselves, as the period of flowering is very short. The stigmas, or summits of the pistils, together with a portion of the style, are separated from the remainder of the flower, and carefully dried by artificial heat, or in the sun. During this process, they are sometimes made to assume the form of a cake by pressure; but the finest saffron is that which has been dried loosely. The two forms are distinguished by the names of *cake-saffron* and *hay-saffron.* Five pounds of the fresh stigmas are said to yield one pound of the dried.

The English saffron, formerly most highly esteemed in this country, has disappeared from our market. What may be sold under the name is probably derived from other sources. Much of the drug is imported from Gibraltar, packed in canisters. Parcels of it are also brought from Trieste and other ports of the Mediterranean. The Spanish saffron is generally considered the best. Genuine *cake-saffron* is at present seldom found in commerce. According to Landerer, the stigmas of several other species besides those of *C. sativus* are gathered and sold as saffron in Greece and Turkey.*

Properties. Saffron has a peculiar, sweetish, aromatic odor, a warm, pungent, bitter taste, and a rich deep orange color, which it imparts to the saliva when chewed. The stigmas of which it consists are an inch or more in length, expanded and notched at the upper extremity, and narrowing towards the lower, where they terminate in a slender, capillary, yellowish portion, forming a part of the style. They are thus described by the U. S. Pharmacopœia. "Separate, or three, attached to the top of the style, about an inch and a quarter (3 cm.) long, flattish-tubular, almost thread-like, broader and notched above; orange-brown; odor strong, peculiar, aromatic; taste bitterish and aromatic. When chewed it tinges the saliva deep orange-yellow. Saffron should not be mixed with the yellow styles. When pressed between filtering-paper it should not leave an oily stain. When soaked in water it colors the liquid orange-yellow, and should not deposit any pulverulent mineral matter, nor show the presence of organic substances differing in shape from that described." *U. S.* Analyzed by Vogel and Bouillon-Lagrange, it afforded 65 per cent. of a peculiar extractive matter, and 7·5 of an odorous volatile oil, together with wax, gum, albumen, saline matter, water, and lignin. The extractive was named *polychroïte*, from the changes of color which it undergoes by the action of reagents. Weiss (Wiggers and Husemann, *Jahresbericht*, 1868, p. 35) has shown that *polychroïte* is a glucoside, from the decomposition of which results the coloring matter proper of the saffron, to which he applies the name *crocin.* For the preparation of polychroïte according to Weiss, saffron is extracted with ether, by which fat, wax, and essential oil were removed; and it was then exhausted with water. From the aqueous solution, gummy matters and some inorganic salts were precipitated by strong alcohol. After the separation of these substances polychroïte was precipitated by addition of ether. Thus obtained, it is an orange-red, viscid, deliquescent substance, which dried over sulphuric acid becomes brittle and of a fine ruby-red color. It has a sweetish taste, but is devoid of odor, readily soluble in spirit of wine or water, and sparingly in absolute alcohol. By dilute acids it is decomposed into *crocin*, sugar, and an aromatic volatile oil having the smell of saffron. Weiss gives the following formula for this decomposition.

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* At the International Exhibition, in London, in the year 1862, Dr. Geo. B. Wood noticed a specimen of saffron from the island of Ceylon, closely resembling that of the *Crocus sativus.* It consisted of the stigmas of the *Crocus orientalis.*

According to Mr. Charles A. Heinitsh, until within a few years, saffron was cultivated to a considerable extent in Lancaster County, Pa. The plant requires a rich soil, which should be deeply dug and heavily manured. The bulbs are planted in August, eight inches apart, and the growing plant should be kept free from weeds. The flowering period begins about the middle of September, and continues till the beginning of October. The flowers are picked early in the morning, and the stigmas separated and dried in the shade. This is done every day during the period of flowering. He thinks the cultivation can be profitably conducted. A plot of 72 square feet will produce 9000 stigmas, weighing 420 grains, or from 33 to 36 lbs. to the acre. (*A. J. P.*, 1867, p. 38.)

M. Monthus, an experienced cultivator in France, prefers a dry calcareous soil; plants the bulbs 3 or 4 inches deep; after the harvest in October manures the ground; and renews the planting every three years. He thus prevents the diseases peculiar to the plant.

M. Monthus recommends the *petals* of the flower as applicable to the same purposes as the stigmas, having found them to be possessed of aromatic properties. They demand no peculiar caution in drying; but to preserve them it is necessary to exclude light and moisture. Acids redden them with extreme facility, and alkalies turn them green. He therefore recommends a tincture to be made from them, as a substitute for syrup of violets. He prepares the tincture by macerating 10 parts of the dried flowers in 100 parts of alcohol of 40°, for 48 hours. A longer maceration would destroy the color. Paper may be stained with the tincture, and kept green or red, the former for acids, the latter for alkalies. (*Journ. de Pharm.*, Juillet, 1867, p. 54.)

$$\underset{\text{Polychroïte.}}{C_{45}H_{60}O_{18}} + H_2O = \underset{\text{Crocin.}}{2(C_{16}H_{18}O_6)} + \underset{\text{Essential oil.}}{C_{10}H_{14}O} + \underset{\text{Sugar.}}{C_6H_{12}O_6}.$$

Crocin is a red powder, insoluble in ether, easily soluble in alcohol, and precipitable from this solution on addition of ether. (*Pharmacographia*, 2d ed., p. 667.) It is to the essential oil, which, according to M. Henry, is present to the amount of 10 per cent., that the medicine owes its activity. It may be partially separated by distillation. It is yellow, of a hot, acrid. bitterish taste, and heavier than water, in which it is slightly soluble.

Adulterations. The high price of this medicine gives rise to frequent adulterations. Water is said to be very often added in order to increase its weight. Oil or glycerin is also added for the same purpose, or to improve the appearance. Sometimes the flowers of other plants, particularly *Carthamus tinctorius* or safflower, *Calendula officinalis* or officinal marigold, and *arnica*, are fraudulently mixed with the genuine stigmas. They may be known by their shape, which is rendered obvious by throwing a portion of the suspected mass into hot water, which causes them to expand. (See *Carthamus.*) A specimen of this adulteration has been introduced into the American market, by the name of *African saffron.* (Maisch, *A. J. P.*, March, 1872, p. 110.) Other adulterations are the fibres of dried beef, the stamens of the Crocus distinguishable by their yellow color, the stigmas previously exhausted in the preparation of the infusion or tincture, and various mineral substances easily detected upon close examination. The flowers of a Brazilian plant, named *Fuminella*, have, according to M. J. L. Soubeiran, been employed for the adulteration of saffron. They may be detected by shaking gently but repeatedly a large pinch of the suspected saffron over a piece of paper. The flowers of Fuminella, being smaller and heavier, separate and fall, and may be seen to consist of very short fragments, with a color like that of saffron, but a rusty tint which the latter does not possess. (*Journ. de Pharm.*, Avril, 1855, p. 267.) J. Müller recommends concentrated sulphuric acid as the most certain test of saffron. It instantly changes the color of pure saffron to indigo blue. (*Chem. Gaz.*, May, 1845, p. 197.)

A very successful adulteration which has been largely practised appears to consist of yellow-colored chalk or sulphate of barium, made into a thin paste probably with honey, and attached to the stigmas, sometimes isolated, sometimes in groups of five or six, enveloping them almost completely. If this saffron be kept in a dry place, and often handled, the paste becomes partly broken up, and the colored powder spreads itself in the mass and the envelope. The chalk can at once be detected by shaking the suspected saffron with water, and treating the precipitated powder with hydrochloric acid, when effervescence will occur. A less than the ordinary brightness of color in the saffron should lead to suspicion of this adulteration. Much can be told as to the purity of saffron by agitating the suspected flowers in distilled water; if the drug be pure the liquid will remain clear, assuming a fine pure yellow tint; the saffron also will retain its red color for hours. Another excellent plan is to scatter a pinch of the flowers upon the surface of warm water, when the stigmas should spread out and display their proper form.

Attention has been called to a product of the Cape of Good Hope, named *Cape saffron*, which has a remarkable resemblance to genuine saffron, having a similar odor, and yielding a similar color to water, though the flowers themselves are differently colored. It is the flower of a small plant very abundant at the Cape, belonging to the family of *Scrophulariaceæ*, and is said by Dr. Pappé, of Cape Town, to possess medical virtues closely resembling those of true saffron. The flowers have been used successfully in the convulsions of children. (*P. J. Tr.*, vi. 462, 1865.)

Choice of Saffron. Saffron should not be very moist, nor very dry, nor easily pulverized; nor should it emit an offensive smell when thrown upon live coals. The freshest is the best, and that which is less than a year old should, if possible, be selected. It should possess in a high degree the characteristic properties of color, taste, and smell. When agitated with water it should color it bright yellow, and it should not effervesce in the presence of a dilute acid. If it do not color the fingers when rubbed between them, or if it have an oily feel, or a musty flavor, or a black, yellow, or whitish color, it should be rejected. In the purchase of this medicine in cakes, those should be selected which are close, tough, and firm in tearing; and care should be taken to avoid *cakes of safflower.*

As its activity depends, partly at least, on a volatile ingredient, saffron should be kept in well-stopped vessels. Some recommend that it should be enclosed in a bladder, and introduced into a tin case.

Medical Properties and Uses. Saffron was formerly considered highly stimulant, antispasmodic, and even narcotic. It was thought also to act powerfully on the uterine system, promoting menstruation. The ancients employed it extensively, both as a medicine and condiment, under the name of *crocus.* It was also highly esteemed by the Arabians, and enjoyed considerable reputation among the physicians of modern Europe, till within a comparatively recent period. On the continent it is still much used as a stimulant and emmenagogue. But the experiments of Dr. Alexander have proved it to possess little activity; and in Great Britain and the United States it is seldom prescribed. In domestic practice saffron tea is occasionally used in exanthematous diseases, to promote the eruption. At present it is chiefly used to impart color and flavor. The dose is from ten to thirty grains (0·65–1·95 Gm.).*

Off. Prep. Decoctum Aloës Compositum, *Br.;* Pilulæ Aloës et Myrrhæ, *Br.;* Pulvis Cretæ Aromaticus, *Br.;* Tinct. Cinchonæ Comp., *Br.;* Tinct. Croci, *U. S.*, *Br.;* Tinct. Opii Ammoniata, *Br.;* Tinct. Rhei, *Br.*

CUBEBA. *U. S.*, *Br.* *Cubeba.* [*Cubeb.*]

(CŪ-BĒ'BA.)

"The unripe fruit of Cubeba officinalis. Miquel. (*Nat. Ord.* Piperaceæ.)" *U. S.* "The dried unripe fruit of Cubeba officinalis." *Br.*†

Cubebs, Cubebæ, *P. G.;* Fructus (s. Baccæ) Cubebæ, Piper Caudatum; Cubebe, Cubébe poivre à Queue, *Fr.;* Kubeben, *G.;* Cubebe, *It.;* Cubebas, *Sp.;* Kebabeh, *Ar.*

Gen. Ch. Calyx none. *Corolla* none. *Berry* one-seeded. *Willd.*

Cubeba officinalis. Miquel.—*Piper Cubeba.* Willd. *Sp. Plant.* i. 159; Woodv. *Med. Bot.*, 3d ed., v. 95. This is a climbing perennial plant, with a smooth, flexuous, jointed stem, and entire, petiolate, oblong or ovate-oblong, acuminate leaves, rounded or obliquely cordate at the base, strongly nerved, coriaceous, and very smooth. The flowers are diœcious and in spikes, with peduncles about as long as the petioles. The fruit is a globose, pedicelled berry.

This species of Piper is a native of Java, Penang, and probably other parts of the

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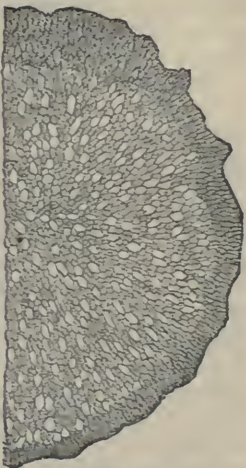
* *Syrupus Croci.* A *Syrup of Saffron* is sometimes called for, and would seem to be an appropriate preparation. The following formula is recommended by Mr. Geo. W. Kennedy, of Pottsville, as producing excellent results. Take of saffron ℥ss, glycerin ℥ij, water ℥vi. Macerate for a week, filter into a pint bottle, and add sufficient water through the filter to make ℥viij; then add 14 avoird. oz. of sugar, and dissolve without heat, frequently shaking. (*A. J. P.*, Feb. 1871, p. 54.)

† The fruit of the *Piper Afzelii* of Lindley, *Cubeba Clusii* of Miquel, figured in the *P. J. Tr.* (xiv. 201), is known in commerce as *African Cubebs, Ashantee Pepper, Guinea pepper*, or *African black pepper.* It was formerly taken to Europe in considerable quantities by the Portuguese, but has been superseded by the more agreeable products of the East Indies. The fruit is one-third smaller than the officinal cubebs, is more compact, and has a taste more analogous to that of ordinary black pepper. Dr. Stenhouse has also shown that it is chemically more analogous to black pepper than to cubebs, as it contains piperine and not cubebin. (*Ibid.*, xiv. 364.) A variety of cubebs from the Dutch East Indies differs essentially from genuine cubebs in being somewhat larger, with less distinct veins and somewhat flattened footstalks, of a less agreeable odor, and a less hot and pungent taste. It has been ascribed to *Piper anisatum.* (See *A. J. P.*, xxxv. 511.) According to the Pharmacographia, fruits of various other non-officinal Pipers appear in Eastern commerce under the name of cubebs. A product with the name of *African cubebs* has been sent to London, from Cape Coast Castle, in Africa, which is the fruit of a plant belonging to the *Xanthoxylaceæ*, probably either a *Toddalia* or *Vepris.* According to Prof. Archer, it is simply aromatic and stimulant, without any of the special virtues of cubebs. (*P. J. Tr.*, March, 1865, p. 463.)

East Indies. It is extensively grown in the coffee plantations, supported by the trees which are used for shade, and has been introduced into Ceylon. The dried unripe fruit is the officinal portion.

Properties. Cubebs are round, about the size of a small pea, of a blackish or grayish brown color, and furnished with a short stalk, which is continuous with raised veins that run over the surface of the berry, and embrace it like a net-work. The shell is hard, almost ligneous, and contains within it a single loose seed, covered with a blackish coat, and internally white and oleaginous. "Globular, about one-sixth of an inch (4 mm.) in diameter, contracted at the base into a stipe nearly a quarter of an inch (6 mm.) long, reticulately wrinkled, blackish gray, internally whitish and hollow; odor strong, spicy; taste aromatic and pungent. Cubeb should not be mixed with the nearly inodorous rachis or stalks." *U. S.* The odor of the berry is agreeably aromatic; the taste warm, bitterish, and camphorous, leaving in the mouth a peculiar sensation of coolness, like that produced by oil of peppermint. The powder is dark colored and of an oily aspect. The most obvious constituent of cubebs is the volatile oil, the proportion of which yielded by the drug varies from 4 to 13 per cent. It is, as shown by Oglialoro, a mixture of an oil $C_{10}H_{16}$, boiling at 158°–163° C. (316·4°–325·4° F.), which is present in very small amount, and two oils of the formula $C_{15}H_{24}$, boiling at 262°–265° C. (503·6°–509° F.). One of these is strongly lævogyrate, and yields a crystallized compound, $C_{15}H_{24},2HCl$, melting at 118° C., while the other is less lævogyrate, and does not combine with HCl.


Transverse section.

The oil distilled from old cubebs on cooling at length deposits large transparent inodorous octohedra of *camphor of cubebs*, $C_{30}H_{48}+2H_2O$. Another constituent of cubebs is *cubebin*. This is an inodorous substance, crystallizing in small needles or scales, melting at 125° C. (257° F.), having a bitter taste in alcoholic solution; it dissolves freely in boiling alcohol, but deposits on cooling, and is abundantly soluble in chloroform. Its composition, according to Weidel (1877), is $C_{10}H_{10}O_3$. Fused with caustic potash it yields proto-catechuic acid. The resin extracted from cubebs consists of an indifferent portion, nearly 3 per cent., and of *cubebic acid*, amounting to about 1 per cent. (Pharmacographia, 2d ed., p. 587.)

By practical trial Bernatzike has satisfied himself that the peculiar virtues of cubebs, as a remedy in gonorrhœa, depend not on the cubebin or the volatile oil, but on the cubebic acid. (See *Am. Journ. of Med. Sci.*, Oct. 1867, p. 534.) According to MM. Capitaine and Soubeiran, *cubebin* is best obtained by expressing cubebs from which the oil has been distilled, preparing with them an alcoholic extract, treating this with a solution of potassa, washing the residue with water, and purifying it by repeated crystallizations in alcohol. It bears a close resemblance to piperine, but materially differs from it in composition, as it contains no nitrogen. (*Journ. de Pharm.*, xxv. 355.) In the officinal oleoresin of cubebs a deposit takes place consisting chiefly of cubebin, which may be obtained by washing the deposit with a small quantity of cold alcohol to remove adhering resin and oil, and then dissolving repeatedly in boiling alcohol, and crystallizing until the product is white. The volatile oil is officinal. (See *Oleum Cubebæ.*) When the ethereal extract of cubebs is deprived of its volatile oil by evaporation on a water-bath, and of cubebin and wax by deposition, a soft resin is left, the *cubebic acid* of Bernatzike, in which, according to Mr. F. V. Heydenreich, who experimented with it as a physiological agent, the diuretic properties reside; the cubebin being without apparent effect, and the volatile oil, though stimulant and carminative, having no diuretic action. The soft resin, which was of the consistence of honey, of a dark olive-green color, and some remaining odor of cubebs, when taken in the dose of ten grains every two hours, for six hours, acted as a laxative, and gave the urine a peculiar odor, without increasing its quantity; but in the dose of a drachm, once repeated at an interval of three hours, while it produced the same effects as the smaller dose, considerably augmented the urine. In still larger doses it produced decided irritation of the urinary passages. (*A. J. P.*, Jan. 1868.) Mr. Heydenreich's experiments are confirmatory of Bernatzike's conclusion as to the peculiar active principles of cubebs. Cubebs gradually deteriorate by age, and in powder become rapidly weaker, in consequence of the escape of their volatile oil. They should be kept whole, and pulverized when dispensed. The powder is said to be sometimes adulterated with that of pimento.

Medical Properties and Uses. Cubebs are generally stimulant, with a special direction to the urinary organs. In considerable quantities they excite the circulation, increase the heat of the body, and sometimes occasion headache and giddiness. At the same time they frequently produce an augmented flow of the urine, to which they impart a peculiar odor. Among their effects are also occasionally nausea and moderate purging; and they are said to cause a sense of coolness in the rectum during the passage of the fæces. We have no evidence that they were known to the ancients. They were probably first brought into Europe by the Arabians, and were formerly employed for similar purposes with black pepper; but they were found much less powerful and fell into disuse. In India they have long been used in gonorrhœa and gleet, and as a grateful stomachic and carminative in disorders of the digestive organs, and are at present very frequently given both in this country and in Europe in gonorrhœa, after the subsidence of the first active inflammatory symptoms. They have been given also in leucorrhœa, cystirrhœa, the urethritis of women and female children, abscess of the prostate gland, piles, chronic bronchial inflammation, and, with great asserted advantage, in connection with copaiba, in pseudomembranous croup, and diphtheritic affections of the fauces. In connection with copaiba they have been especially recommended in affections of the neck of the bladder and the prostatic portion of the urethra. They are best administered in powder, of which the dose in gonorrhœa is from one to three drachms (3·9–11·65 Gm.) three or four times a day. For other affections, the dose is sometimes reduced to ten grains (0·65 Gm.). The volatile oil may be substituted, in the dose of ten or twelve drops (0·6–0·72 C.c.), suspended in water by means of sugar; though, if the experiments of Bernatzike and Heydenreich are to be relied on, the oil is much less efficient than the soft resin as a remedy in gonorrhœa, and in diseases of the urinary passages generally. An ethereal extract is directed by the U. S. Pharmacopœia, and considerably used; and, as it contains the soft resin or cubebic acid, it is no doubt a very efficient preparation. (See *Oleoresina Cubebæ.*) An infusion, made in the proportion of an ounce of cubebs to a pint of water, has been employed as an injection in discharges from the vagina, with asserted advantage.

Off. Prep. Extractum Cubebæ Fluidum, *U. S.;* Oleoresina Cubebæ, *U. S.;* Oleum Cubebæ; Tinctura Cubebæ.

CUPRI ACETAS. *U. S.* *Acetate of Copper.*

$Cu(C_2H_3O_2)_2.H_2O$; 199·2. (CŪ'PRĪ Ạ-CĒ'TĂS.) $CuO, C_4H_3O_3.HO$; 99·6.

Crystallized Verdigris, Crystals of Venus; Verdet, Cristaux de Vénus, *Fr.;* Essigsaures Kupfer, *G.*

This salt is now substituted for the impure subacetate of copper, formerly officinal. It may be prepared by dissolving verdigris in acetic acid, or by precipitating a concentrated solution of acetate of lead with sulphate of copper. It is the normal cupric acetate, as distinguished from the other basic salts.

Properties. "Deep green, prismatic crystals, yielding a bright green powder, efflorescent on exposure to air, odorless, having a nauseating, metallic taste and an acid reaction. Soluble in 15 parts of water and in 135 parts of alcohol at 15° C. (59° F.), in five parts of boiling water and in 14 parts of boiling alcohol. When heated above 100° C. (212° F.), the salt loses its water of crystallization, and at a temperature above 200° C. (392° F.), it is gradually decomposed. The aqueous solution of the salt has a bluish green color, which is rendered deep blue by an excess of ammonia. On heating the salt with sulphuric acid, acetous vapors are evolved. If the aqueous solution of the salt be treated with hydrosulphuric acid until all the copper is precipitated, the filtrate should leave no residue on evaporation (alkalies, alkaline earths and iron). If the aqueous solution be heated to boiling with solution of soda in excess, it will yield a filtrate which should not be clouded by hydrosulphuric acid (abs. of lead, zinc)." *U. S.* As its source is principally verdigris, it will be proper to consider this now.

VERDIGRIS (*Impure Subacetate of Copper*, U. S. 1870; *Aerugo*, P.G.; *Viride Æris, Subacetas cupricus; Verdigris; Ærugo*, Lat.; *Acetate de Cuivre brut, Vert-de-gris, Acétate basique de Cuivre, Verd-et-gris*, Fr.; *Grünspan, Spangrün, Basisches essigsaures Kupfer* (*Kupferoxyd*), G.; *Verde rame*, It.; *Cardenillo*, Sp.) is prepared in large quantities in the south of France, more particularly in the neighborhood of Montpellier. It is also manufactured in Great Britain and Sweden. In France the process is conducted in the following manner. Sheets of copper are stratified with the residue of the grape after the expression of the juice in making wine, and are allowed to remain in this state for a month or six weeks. At the end of this time the plates are found coated with a considerable quantity of verdigris. This is scraped off, and the plates are then replaced as at first, to be further acted on. The scrapings thus obtained form a paste, which is afterwards well beaten with wooden mallets, and packed in oblong leathern sacks, about ten inches in length by eight in breadth, in which it is dried in the sun, until the loaf of verdigris, as it is called, attains the proper degree of hardness. The rationale of the process is easily understood. The juice of the grape refuse undergoes the acetous fermentation, and the acetic acid attacking the copper forms the subacetate. In England a purer verdigris is prepared by alternating copper plates with pieces of woollen cloth, steeped in pyroligneous acid.

Verdigris comes to this country exclusively from France, being imported principally from Bordeaux and Marseilles. The leathern packages in which it is put up, called sacks of verdigris, weigh generally from twenty-five to thirty pounds, and arrive in casks, each containing from thirty to forty sacks.

Properties. Verdigris is in masses of a pale green color, and composed of a multitude of minute silky crystals. Sometimes, however, it occurs of a bright blue color. Its taste is coppery. It is insoluble in alcohol, and, by the action of water, a portion of it is resolved into the neutral acetate which dissolves, and the trisacetate which remains behind in the form of a dark green powder, gradually becoming black. It is hence evident that, when verdigris is prepared by levigation with water, it is altered in its nature. When verdigris is acted on by sulphuric acid, it is decomposed, vapors of acetic acid being evolved, easily recognized by their vinegar odor. It is soluble almost entirely in ammonia, and dissolves in hydrochloric and dilute sulphuric acid, with the exception of impurities, which should not exceed 5 per cent. When of good quality, it has a lively green color, is free from black or white spots, and is dry and difficult to break. The green rust, called in popular language verdigris, which copper vessels are apt to contract when not kept clean, is a carbonate of copper, and should not be confounded with true verdigris.

Composition. Verdigris, apart from its impurities, is a variable mixture of the basic acetates of copper. The *blue* variety has approximately the composition $(C_2H_3O_2)_2Cu,Cu(OH)_2 + 5H_2O$. When treated with water it is gradually decomposed into two parts according to the reaction: $3(Cu(C_2H_3O_2)_2, Cu(OH)_2 = Cu(C_2H_3O_2)_2 + 2Cu(OH)_2$ and $2Cu(C_2H_3O_2)_2 + Cu(OH)_2$. The latter of these products constitutes the *green* variety of verdigris. (Flückiger, *Pharm. Chem.*, p. 758.)

Medical Properties. The local and general action of verdigris upon the animal economy and the treatment of its poisoning are the same as those of the sulphate of copper. It is never used internally.*

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* *Linimentum Æruginis, Mel Egyptiacum.* This is a very old preparation, formerly recognized as officinal in Great Britain. The following is the process for it given in the old *London* Pharmacopœia. "Take of Verdigris (Subacetate of Copper), in powder, *an ounce;* Vinegar *seven fluidounces;* Honey *fourteen ounces.* Dissolve the Verdigris in the Vinegar, and strain through linen; then gradually add the Honey, and boil down to a proper consistence." The ounces used here are troyounces. It sometimes happens during the boiling of the acetic solution of the verdigris, that a red deposit rapidly forms, consisting of the red or suboxide of copper (cuprous oxide); and that

CUPRI SULPHAS. *U.S.*, *Br.* *Sulphate of Copper.*

$Cu\,SO_4.\,5H_2O$; 249·2. (CŪ'PRĪ SŬL'PHĂS.) $Cu\,O,\,SO_3.\,5HO$; 124·6.

"May be obtained by heating sulphuric acid and copper together, dissolving the soluble product in hot water, and evaporating the solution until crystallization takes place on cooling." *Br.*

Cuprum Sulfuricum Purum, *P.G.;* Sulfas Cupricus, Cuprum Vitriolatum; Blue Vitriol, Roman Vitriol, Blue Stone; Sulfate de Cuivre, Vitriol bleu, Couperose bleu, *Fr.;* Schwefelsaures Kupfer, Kupfervitriol, Blauervitriol, Blauer Galitzenstein, *G.;* Rame solfato, Vitriolo di Rame, *It.;* Sulfato de Cobre, Vitriolo azul, *Sp.*

Preparation, etc. Sulphate of copper occasionally exists in nature, in solution in the water which flows through copper-mines. In this case the salt is procured by merely evaporating the waters which naturally contain it. Another method of obtaining it is to roast the native sulphide in a reverberatory furnace, whereby it is made to pass, by absorbing oxygen, into the state of sulphate. The roasted mass is lixiviated, and the solution obtained evaporated that crystals may form. The salt, procured by either of these methods, contains a little ferric sulphate, from which it may be freed by adding either an excess of cuprous oxide, which precipitates the sesquioxide of iron, or recently precipitated subcarbonate of copper, which causes the deposition of the iron as a carbonate. (*A. J. P.*, xxxiv. 507.) A third method consists in wetting, and then sprinkling with sulphur, sheets of copper, which are next heated to redness, and while hot plunged into water. The same operation is repeated until the sheets are entirely corroded. At first a sulphide of the metal is formed, which, by the action of heat and air, gradually passes into the state of sulphate. This is dissolved by the water, and obtained in crystals by evaporation. A fourth method is to dissolve copper scales to saturation in sulphuric acid, contained in a wooden vessel, lined with sheet lead. The scales consist of metallic copper, mixed with oxide, and are produced in the process for annealing sheet copper. Sometimes sulphate of copper is obtained in pursuing one of the methods for separating silver from gold. The silver is dissolved by boiling the alloy in sulphuric acid. The sulphate of silver formed is then decomposed by the immersion of copper plates in its solution, with the effect of forming sulphate of copper and precipitating the silver.

In the U. S. Pharmacopœia, sulphate of copper is presumed to be obtained pure from the manufacturer; the British suggests the method in which it may be prepared, without entering into the details of the process.

Properties. Sulphate of copper has a rich deep blue color, and a strong metallic styptic taste. It reddens vegetable blues, and crystallizes in "large, translucent, deep blue, triclinic crystals, efflorescent, odorless, having a nauseous, metallic taste and an acid reaction. Soluble in 2·6 parts of water at 15° C. (59° F.), in 0·5 part of boiling water, and insoluble in alcohol. When heated to 100° C. (212° F.), the salt gradually loses 28·9 per cent. of its weight. At a temperature of about 230° C. (446° F.) it becomes anhydrous, and at a red heat it is decomposed, evolving sulphurous vapors and finally leaving black cupric oxide. The aqueous solution of the salt has a pale blue color, which is rendered deep blue by an excess of ammonia. With test-solution of chloride of barium it yields a white precipitate insoluble in hydrochloric acid. If a little hydrochloric and some diluted sulphuric acid be added to a 5 per cent. aqueous solution of the salt, and this be treated with hydrosulphuric acid until the copper is completely precipitated, the filtrate should leave no residue on evaporation (foreign metals, alkalies, and alkaline earths)." *U. S.* When heated, sulphate of copper first melts in its water of crystallization, and then dries and becomes white. If the heat be increased, it next undergoes the igneous fusion, and finally, at a high temperature, loses its acid, cupric oxide being left. Four of the

at the end of the process, little or none of the metallic salt remains in the preparation. This happens especially when granular honey is employed. (Harley, *P. J. Tr.*, xi. 357.) The change is owing to the decomposition of the cupric oxide by the grape sugar of the honey, converting it into cuprous oxide. The inference is that, in making the preparation, so as to fulfil the objects of the original prescription, simple syrup should be used. It was formerly employed, either undiluted, or mixed with some mild ointment, to destroy fungous granulations, or to repress their growth. In the latter state, it acts as a stimulant to flabby, indolent, and ill-conditioned ulcers: and, largely diluted with water, it has been used as a gargle in venereal ulcerations of the mouth and throat. It is sometimes also applied undiluted, by means of a camel's-hair brush.

molecules of water of crystallization can be driven off at 100° C. (212° F.); but the fifth only goes off at a temperature of from 220° C. (428° F.) to 240° C. (464° F.), when the anhydrous salt remains. Potassa, soda, and ammonia throw down from it a bluish white precipitate of hydrated cupric oxide, which is immediately dissolved by an excess of the last-mentioned alkali, forming a rich deep blue solution, called *aqua sappharina.* It is decomposed by the alkaline carbonates, and by borax, acetate and subacetate of lead, acetate of iron, nitrate of silver, corrosive chloride of mercury, tartrate of potassium, and chloride of calcium; and it is precipitated by all astringent vegetable infusions. If it becomes very green on the surface by the action of the air, it contains sesquioxide of iron. This oxide may also be detected by ammonia, which will throw it down along with the oxide of copper, without taking it up when added in excess. When sulphate of copper is obtained from the *dipping liquid* of manufacturers of brass or German silver ware, it is always contaminated with sulphate of zinc, as pointed out by Mr. S. Piesse. This liquid is at first a mixture of sulphuric and nitric acids, but becomes, at last, nearly saturated with copper. When zinc is present in sulphate of copper, it will be taken up by solution of potassa, added in excess, from which it may be thrown down, in white flocks, by a solution of bicarbonated alkali.

Medical Properties and Uses. Sulphate of copper is irritant or mildly escharotic; and when in dilute solution, stimulant and astringent. At one time it was given in epilepsy and other nervous diseases; but at present it is never used internally, except for its influence upon the gastro-intestinal mucous membrane. In chronic diarrhœa with ulceration it is often a useful remedy. In doses of 5 grains it acts as a powerful, prompt emetic, without causing general depression or much nausea; hence it is preferred in narcotic poisoning, to dislodge false membrane or foreign bodies from the larynx and œsophagus, and for other similar purposes. Externally it is employed in solution as a stimulant to ill-conditioned ulcers, as an escharotic for destroying warts, fungous granulations, and callous edges, and as a styptic to bleeding surfaces. It is found, in not a few instances, to promote the cicatrization of ulcers, and is not unfrequently employed, with that view, as a wash for chancres. The preparation called *cuprum aluminatum* (*lapis divinus—pierre divine*) is made, according to the French Codex, by mixing, in powder, three ounces, each, of sulphate of copper, nitrate of potassium, and alum, heating the mixture in a crucible, so as to produce watery fusion, then mixing in a drachm of powdered camphor, and, finally, pouring out the whole on an oiled stone to congeal. The mass, when cold, is broken into pieces, and kept in a well-stopped bottle. It is often desirable to employ sulphate of copper, as a caustic, in the form of pencil. Its tendency to effloresce interferes with its use in this way in the pure state. M. Llovet recommends for the purpose a mixture of one part of potassa-alum and two of sulphate of copper, which are to be first powdered, and then gradually melted together in a porcelain vessel, and poured into moulds made of bronze. (*Gaz. des Hôp.*, Juillet 28, 1863.) Another mode of preparing *pencils of sulphate of copper* is to rub briskly together four parts of that salt and one of borax, and to mould the plastic mass which results into the desired form. (*A. J. P.*, March, 1864, p. 106.) The best form is that of an elongated cone, made by selecting suitable crystals, and turning them in a lathe until the desired form is secured; or they may be made by filing the crystals into nearly the proper shape, and finishing with sand-paper.

The dose of sulphate of copper, as an astringent or tonic, is a quarter of a grain (0·016 Gm.), gradually increased; as an emetic, five grains (0·13–0·33 Gm.), repeated in fifteen minutes if necessary, but oftener than once. As a stimulant wash, the solution may be made of the strength of two, four, or eight grains to the fluidounce of water. Orfila cautions against giving large doses of this salt as an emetic in cases of poisoning; as it is apt, from its poisonous effects, to increase the mischief when not expelled by vomiting. Upon the whole, such is the activity of sulphate of copper, that it should always be exhibited with caution. For its effects as a poison, see *Cuprum.*

CUPRUM. *Br.* *Copper.*

Cu; 63·2. (CŪ'PRŬM.) Cu; 31·6.

"Fine Copper wire, about No. 25." *Br.*

Cupreum Filum; Fil de Cuivre, Cuivre, *Fr.;* Kupfer, Kupferdraht, *G.;* Rame, *It.;* Cobre, *Sp.*

This metal is very generally diffused in nature, and exists principally in four states: as native copper, as an oxide, as a sulphide, and as a salt. Its principal native salts are the sulphate, carbonate, arseniate, and phosphate. In the United States it occurs in various localities, but especially in the neighborhood of Lake Superior and in East Tennessee. The principal copper-mines of Europe are those of the Pyrenees in France, Cornwall in England, and Fahlun in Sweden.

Properties. Copper is a brilliant, sonorous metal, of a reddish color, and very ductile, malleable, and tenacious. It has a slightly nauseous taste, and emits a disagreeable smell when rubbed. Its texture is granular, and its fracture hackly. Its sp. gr. is 8·92 to 8·95, and its fusing point 1398° C. (2538° F.) according to Daniell, being intermediate between the fusing points of silver and gold. Its atomic weight is 63·5, or, according to other determinations, 63·2. Exposed to the air it undergoes a slight tarnish. Its combinations are numerous and important. With oxygen it forms two well-characterized oxides, a red suboxide, better known as *cuprous* oxide, Cu_2O, and a black oxide, known as *cupric* oxide, CuO. While a cuprous chloride, iodide, and sulphide are known, it is the cupric oxide chiefly that unites with the common acids to form cupric salts. With metals copper forms numerous alloys, of which that with zinc, called brass, and that with tin, called bronze, are the most useful.

Characteristics. Copper is recognized by its color, and the effects of tests on the solution of its nitrate. This solution, with potassa, soda, and ammonia, yields a blue precipitate, soluble in excess of the latter alkali, with which it forms a deep azure blue liquid. Ferrocyanide of potassium occasions a brown precipitate of ferrocyanide of copper; and a bright plate of iron, immersed in the solution, immediately becomes covered with a film of metallic copper. The ferrocyanide of potassium is a very delicate test for minute portions of copper in solution. Another test, proposed by M. Verguin, is to precipitate the copper in the metallic state on platinum by electro-chemical action. For this purpose a drop of the liquid to be examined is placed on a slip of platinum foil, and a slip of bright iron is brought in contact with the platinum and the liquid. If copper be present it will be instantly precipitated on the surface of the platinum.

Action on the Animal Economy. Copper, in its pure state, is perfectly inert, but in combination it is highly deleterious. Nevertheless a minute portion of the metal has been found in the human body. According to Millon, copper, when it exists in the blood, is, like the iron, attached to the red corpuscles. To bring the copper into a state favorable for ready detection, he advises that the blood, as it escapes from a vein, be received in about three times its bulk of water, and the mixture poured into a bottle of chlorine and agitated. The whole, upon being rapidly filtered, furnishes a liquid in which copper is readily detected. Wackenroder found copper in the blood of man, but does not consider it a constant and normal constituent. He also detected this metal in the blood of domestic animals living on a mixed diet, but not in their blood when nourished on vegetable food only. (*Chem. Gaz.*, May 1, 1854.) It has been found in the feathers of certain birds, as of a grass-green paroquet from Australia, which is said to frequent districts of the country where copper is found. (*Ibid.*, Oct. 24, 1873, p. 212.) The soluble combinations of copper, when taken in poisonous doses, produce a coppery taste in the mouth; nausea and vomiting; violent pain in the stomach and bowels; frequent black and bloody stools; small, irregular, sharp, and frequent pulse; faintings; burning thirst; difficulty of breathing; cold sweats; paucity of urine, and burning pain in voiding it; violent headache; cramps, convulsions, and finally death. The best antidote is the ferrocyanide of potassium, given freely, which forms, with the poison, the very insoluble ferrocyanide of copper. Soap and alkalies are also antidotal. Before the antidote can be procured, large quantities should be given of milk, and white of eggs mixed with water, which act favorably by forming the caseate and albuminate of copper;

but these compounds should be evacuated as soon as possible by vomiting and purging. Should vomiting not take place, the stomach-pump may be employed. The symptoms of slow poisoning by copper are, according to Dr. Corrigan, of Dublin, a cachectic appearance, emaciation, loss of muscular strength, colicky pains, cough without physical signs, and retraction of the gum, with a persistent purple edge, quite distinct from the blue edge produced by lead. (*Braithwaite's Retrospect*, Am. ed., xxx. 303.) But there is much doubt whether these symptoms can be produced by the metal. (See H. C. Wood's Therapeutics.)

Dr. Horsley has detected sulphate of copper in bread and flour used in London, and presumes that it was added with the view of improving the appearance of the flour. (*Chem. News*, No. 63, p. 111, and No. 65, p. 142.)

In medico-legal examinations, where cupreous poisoning is suspected, Orfila recommends that the viscera be boiled in distilled water for an hour, and that the matter obtained by evaporating the filtered decoction to dryness be carbonized by nitric acid. The carbonized product will contain the copper. By proceeding in this way, there is no risk of obtaining the copper which may happen to pre-exist in the animal tissues. This method of search is preferable to that of examining the contents of the stomach and intestines, from which copper may be absent; while it may have penetrated the different organs by absorption, especially the abdominal viscera.

Vessels of copper which are not coated with tin should not be used in pharmaceutical or culinary operations; for, although the metal uncombined is inert, yet the risk is great that the vessels may be acted on and a poisonous salt formed.

The British Pharmacopœia uses copper in preparing Spiritus Ætheris Nitrosi.

The only officinal preparations of copper are Cupri Acetas, *U. S.;* Cupri Sulphas, *U. S.*, *Br.*

CUSPARIÆ CORTEX. *Br.* *Cusparia Bark.*

(CŬS-PĀ′RĮ-Æ CŎR′TĔX.)

"The bark of Galipea Cusparia." *Br.* (*Nat. Ord.* Rutaceæ.)

Angustura, *U.S.* 1870; Angusture, *Fr.;* Angusturarinde, *G.;* Corteccia dell' Angustura, *It.;* Corteza de Angostura, *Sp.*

This bark was formerly officinal in the U. S. Pharmacopœia of 1870 under the name of Angustura, but it was dropped at the last revision.

The subject of Angustura bark, in its botanical relations, has been involved in some confusion. The drug was at first supposed to be derived from a species of Magnolia, and was referred by some to *Magnolia glauca* of this country. Humboldt and Bonpland were the first to throw light upon its true source. When at Angostura, a South American city on the Orinoco, they received specimens of the foliage of the plant from which the bark was obtained; and afterwards believed that they had found the same plant in a tree growing in the vicinity of Cumana. This latter they had the opportunity of personally inspecting, and were therefore enabled to describe accurately. Unable to attach it to any known genus, they erected it into a new one with the title of *Cusparia*, a name of Indian origin, to which they added the specific appellation of *febrifuga*. On their authority, *Cusparia febrifuga* was generally believed to be the true source of the medicine, and was recognized as such by the London College. A specimen having in the mean time been sent by them to Willdenow, the name of *Bonplandia* was imposed on the new genus by that celebrated botanist; and it was subsequently adopted by Humboldt and Bonpland themselves, in their great work on equinoctial plants. Hence the title of *Bonplandia trifoliata*, by which the tree is described in many works on Materia Medica. De Candolle, however, having found in the description all the characters of the genus *Galipea* of Aublet, rejected both these titles, and substituted that of *Galipea Cusparia*, which was adopted by the London College, and has been retained in the British Pharmacopœia. But, after all these commutations, it appears from the researches of Dr. Hancock, who resided for several months in the country of the Angustura bark tree, that it is doubtful whether the plant described by Humboldt and Bonpland is that which yields the medicine, and is not another species of the same genus. Among other striking differences between them is that of their size; the tree described by Humboldt and Bonpland being at least sixty feet high, while that from which the bark is obtained is never more than twenty feet. Hancock proposed for the latter the title of *Galipea officinalis*, which was adopted in the U. S. P. 1870.

Gen. Ch. *Corolla* inferior, irregular, four or five cleft, hypocrateriform. *Stamens* four; two sterile. *Loudon's Encyc.*

Galipea officinalis. Hancock, *Trans. Lond. Medico-Bot. Soc.*—*Galipea Cusparia.* St. Hilaire, *B. & T.* 43. This is a small tree, irregularly branched, rising to the medium height of twelve or fifteen feet, with an erect stem from three to five inches in diameter, and covered with a smooth gray bark. The leaves are alternate, petiolate, and composed of three leaflets, which are oblong, pointed at each extremity, from six to ten inches in length, from two to four in breadth, and supported upon the common petiole by short leaf-stalks. They are very smooth and glossy, of a vivid green color, marked occasionally with small whitish round spots, and when fresh, of a strong odor resembling that of tobacco. The flowers are numerous, white, arranged in axillary and terminal peduncled racemes, and of a peculiar unpleasant odor. The fruit consists of five bivalve capsules, of which two or three are commonly abortive. The seeds, two of which are contained in each capsule, one often abortive, are round, black, and of the size of a pea. The tree grows abundantly on the mountains of Carony, between the 7th and 8th degrees of N. latitude, and is well known in the missions, near the Orinoco, upwards of 200 miles from the ocean. It flourishes at the height of from six hundred to one thousand feet above the level of the sea. Its elegant white blossoms, which appear in vast profusion in August and September, add greatly to the beauty of the scenery.

The bark is generally brought from the West Indies, packed in casks; but, according to Mr. Brande, the original package, as it comes from Angostura, consists of the leaves of a species of palm, surrounded by a net-work of sticks.

Properties. The pieces are of various lengths, for the most part slightly curved, rarely quilled, sometimes nearly flat, from half a line to a line or more in thickness, pared away towards the edges, covered externally with a light yellowish gray or whitish wrinkled epidermis, easily scraped by the nail, and internally of a yellowish fawn color. They are very fragile, breaking with a short, resinous fracture, and yield, on being pulverized, a pale yellow powder; but when macerated for a short time in water, swell up to two or three times their original thickness and become soft and tenacious, and may be cut into strips with scissors. The cut surface usually exhibits under the microscope numerous white points or minute lines. *Br.* Oxalate of calcium raphides are abundant in the bark, but the most characteristic peculiarity are numerous cells, a little larger than the other parenchymatous cells and completely filled with oil or a yellowish resin.* The smell of Angustura bark is peculiar and disagreeable when fresh, but becomes fainter with age; the taste is bitter and slightly aromatic, leaving a sense of pungency at the end of the tongue. According to Fischer, it contains volatile oil, bitter extractive, a hard and bitter resin, a soft resin, a substance analogous to caoutchouc, gum, lignin, and various salts. The volatile oil, which may be obtained by distillation with water, is of a pale yellowish color, lighter than water, of an acrid taste, and with the odor of the bark. Its formula is given as $C_{13}H_{24}O$ by Dr. C. Herzog, who states that its boiling point is 266·1° C. (511° F.), probably one of the highest of the volatile oils. (*Chem. Gaz.*, May 15, 1858.) *Cusparin* is the name given by Saladin to a principle, deposited in tetrahedral crystals, when an infusion of the bark is treated with absolute alcohol, at common temperatures, and allowed to evaporate spontaneously. It is neutral, fusible at a gentle heat, by which it loses 23·09 per cent. of its weight, soluble in 200 parts of cold and 100 parts of boiling water, soluble in the concentrated acids and in the alkalies, and precipitated by the infusion of galls. (*Journ. de Pharm.*, xxii. 662.) Herzog was unable to isolate this principle. The virtues of the bark reside in the volatile oil and bitter constituent, and are extracted by water and alcohol.

Dr. A. T. Thomson states that precipitates are produced with the infusion by the solutions of sulphate of iron, tartrate of antimony and potassium, sulphate of copper, acetate and subacetate of lead, bichloride of mercury, nitrate of silver, and pure potassa; by nitric and sulphuric acids; and by the infusions of galls and yellow cinchona; but how far these substances are medicinally incompatible with the bark, it would be difficult to determine.

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* For an elaborate microscopical study of the bark, see *Journ. de Pharm.*, xxviii. 230.

FALSE ANGUSTURA. Under this title, European writers describe a bark which was introduced on the continent mixed with true Angustura bark, and, being possessed of poisonous properties, produced in some instances unpleasant effects, when dispensed by mistake for that medicine. It is distinguished by its greater thickness, hardness, weight, and compactness; by its resinous fracture; by the appearance of its epidermis, which is sometimes covered with a ferruginous efflorescence, sometimes is yellowish gray, and marked with prominent white spots; by the brownish color and smoothness of its internal surface, which is not, like that of the genuine bark, separable into laminæ; by the white slightly yellow powder which it yields; by its total want of odor, and its intense tenacious bitterness. When steeped in water, it does not become soft, like the true Angustura. Analyzed by Pelletier and Caventou, it was found to contain a peculiar alkaline principle which they called *brucine*, and upon which its poisonous operation depends. (See *Nux Vomica.*) In consequence of the presence of this principle, a drop of nitric acid upon the internal surface of the bark produces a deep red spot. The same acid, applied to the external surface, renders it emerald-green. In true Angustura bark, a dull red color is produced by the acid on both surfaces. The *false Angustura* was at first supposed to be derived from *Brucea antidysenterica*, but at present is ascribed to *Strychnos Nux Vomica*, the bark of which, according to Dr. O'Shaughnessy, exactly corresponds with the description of false Angustura, and like it contains brucia.

Brazilian Angustura Bark, the product of *Esenbeckia febrifuga*, consists of slightly curved pieces 8 to 10 inches long, about $\frac{1}{16}$ of an inch in thickness, of a persistently bitter taste. The outer surface is usually ashen gray, and always marked with longitudinal red or black spots on a yellow ground; the inner surface is reddish, with paler, distinct, elongated fibres. On maceration the bark does not swell. (Oberlin and Schlagdenhauffen, *Journ. de Pharm.*, xxviii. 242.)

Medical Properties and Uses. Angustura bark had been long used by the natives of the countries where it grows, before it became known elsewhere. From the continent its employment extended to the West Indies, where it acquired considerable reputation, and about eighty years since it was introduced into Europe. Its operation is that of a stimulant tonic. In large doses it also evacuates the stomach and bowels, and is often employed for this purpose in South America. It is said to be peculiarly efficacious in bilious diarrhœas and dysenteries, and has been recommended in dyspepsia and other diseases requiring a tonic treatment. The testimony, however, of practitioners in Europe and the United States is not strongly in its favor; and it is probably better adapted to tropical diseases than to those of temperate climates. Hancock employed it extensively in the malignant bilious intermittent fevers, dysenteries, and dropsies of Angustura and Demerara, and speaks in strong terms of its efficacy in these complaints. He used it in the form of fermented infusion, as recommended by the native practitioners.

It may be given in powder, infusion, tincture, or extract. The dose in substance is from ten to thirty grains (0·65–1·95 Gm.). In larger quantities it is apt to produce nausea. From five to fifteen grains (0·33–1 Gm.) is the dose of the extract, which, however, according to Dr. Hancock, is inferior to the powder or infusion. To obviate nausea, it is frequently combined with aromatics.

Off. Prep. Infusum Cuspariæ, *Br.*

CYDONIUM. *U. S.* *Cydonium.* [*Quince Seed.*]

(CȲ-DŌ'NI-ŬM.)

"The seed of Cydonia vulgaris. Persoon. (*Nat. Ord.* Rosaceæ, Pomeæ.)" *U. S.*

Semen Cydoniæ, *P.G.;* Semences (Pépins) des Coing, Semences de Coing, *Fr.;* Quittenkerne, Quittensamen, *G.;* Semi di Cotogno, *It.;* Semiente de Membrillo, *Sp.*

The quince-tree has been separated from the genus *Pyrus*, and erected into a new one called *Cydonia*, which differs in the circumstance that the cells of its fruit contain many seeds, instead of two only as in Pyrus.

Gen. Ch. Calyx five-parted, with leafy divisions. *Apple* closed, many-seeded. *Testa* mucilaginous. *Loudon's Encyc.*

Cydonia vulgaris. Persoon, *Enchir.* ii. 40.—*Pyrus Cydonia.* Willd. *Sp. Plant.* ii. 1020; Woodv. *Med. Bot.* p. 505, t. 182. The common quince-tree is characterized as a species by its downy deciduous leaves. It is supposed to be a native of Crete, but grows wild in Austria, on the banks of the Danube. It is abundantly cultivated in this country. The fruit is about the size of a pear, yellow, downy, of an agreeable odor, and a rough, astringent, acidulous taste; and in each of its five cells contains from eight to fourteen seeds. Though not eaten raw, it forms a very pleasant confection; and a syrup prepared from it may be used as a grateful addition to drinks in sickness, especially in looseness of the bowels, which it is supposed to restrain by its astringency. The seeds are the officinal portion.

They are ovate, angled, reddish brown externally, white within, inodorous, and nearly insipid, being slightly bitter when long chewed. Their coriaceous envelope abounds in mucilage, which is extracted by boiling water. "About a quarter of an inch (6 mm.) long, oval or oblong, triangularly compressed, brown, covered with a whitish, mucilaginous epithelium, causing the seeds of each cell to adhere. With water the seeds swell up, and form a mucilaginous mass. The unbroken seeds have an insipid taste." *U. S.* Two drachms of the seeds will render a pint of water thick and ropy. (*A. J. P.*, 1876, p. 35.) It has been proposed to evaporate the decoction to dryness, and powder the residue. Three grains of this powder form a sufficiently consistent mucilage with an ounce of water. According to M. Garot, one part communicates to a thousand parts of water a semi-syrupy consistence. (*Journ. de Pharm.*, 3e sér., iii. 298.) Dr. Pereira considers the mucilage as peculiar, and proposes to call it *cydonin.* It differs from arabin in not yielding a precipitate with silicate of potassium, and from bassorin and cerasin in being soluble in water both hot and cold. Tollens and Kirchner (*Ann. d. Chemie*, clxxv. 205–226) assign to it the formula $C_{18}H_{28}O_{14}$, regarding it as a compound of gum, $C_{12}H_{20}O_{10}$, and cellulose, $C_6H_{10}O_5$, less one molecule of water.

Medical Properties, etc. Quince mucilage may be used for the same purposes as other mucilaginous liquids. It is preferred as a local application in conjunctival ophthalmia, but in this country is less used than the infusion of sassafras pith.

Off. Prep. Mucilago Cydonii, *U. S.*

CYPRIPEDIUM. *U. S.* *Cypripedium.* [*Ladies' Slipper.*]

(ÇY̆P-RỊ-PĒ′DỊ-ŬM.)

"The rhizome and rootlets of Cypripedium pubescens, Willdenow, and of Cypripedium parviflorum, Salisbury. (*Nat. Ord.* Orchidaceæ.)" *U. S.*

Rhizoma Cypripedii; Ladies' Slipper Root; Racine de Cypripède jaune, Valeriane américaine, *Fr.;* Gelbfrauenschuh-Wurzel, *G.*

Gen. Ch. Sepals spreading; the two anterior generally united into one under the lip. *Petals* similar but usually narrower, spreading. *Lip* a large inflated sac, somewhat slipper-shaped. *Column* short, three-lobed; the lateral lobes bearing an anther under each, the middle dilated and petal-like. *Gray.*

Under the common name of *ladies' slipper*, or *moccasin plant*, several species of Cypripedium inhabit the woods in different parts of the United States. They are small plants, with large, many-nerved, plaited leaves, sheathing at the base, and large often beautiful flowers, of a shape not unlike the Indian moccasin, whence they derive one of their common names. Their generic name of Cypripedium (*Κύπρις*, Venus, and *πόδιον*, sock) had a similar origin. Several of them have been used by American physicians, the root being the part employed. Dr. R. P. Stevens, of Ceres, Pennsylvania, says of them, that he has found the *C. spectabile* and *C. acaule*, especially when growing in dark swamps, to be possessed of narcotic properties, and to be less safe than the *C. parviflorum*, which is gently stimulant with a tendency to the nervous system, and is quite equal to valerian. He has employed it advantageously in hysteria, and in the pains of the joints following scarlet fever. (*N. Y. Journ. of Med.*, iv. 359.) Dr. E. Ives considers *C. pubescens, spectabile*, and *humile* identical in their effects, but *C. pubescens* the most powerful. (*Trans. of Amer.*

Med. Assoc., iii. 312.) The roots of the two species *C. pubescens* and *C. parviflorum* are indiscriminately kept in the shops and sold by the same name.

Cypripedium pubescens. Willd. *Sp. Plant.* iv. 142. The *yellow ladies' slipper*, as this plant is called from the color of its flowers, has a simple often flexuous, pubescent, leafy stem, from one to two feet high. The leaves are pubescent, ovate-lanceolate, acuminate, narrowing at the base, about four or five inches long by two in breadth, alternate, sessile, and sheathing. The flower is usually solitary and terminal; with four divisions of the perianth, the two outer cohering nearly to the apex, the inner longer, narrower, undulatory or twisted, and the lip an inch or two in length, swelling sac-like, and of a yellow color. The fruit is an oblong capsule, tapering at each end, recurved, pubescent, and peduncled. The plant is indigenous, growing abundantly in rich, moist woods throughout the United States.

Cypripedium parviflorum. (Salisbury.) *Common Ladies' Slipper. Small-flowered Ladies' Slipper.* This is a perennial plant with a leafy stem, a foot or two in height, and comparatively small yellowish green flowers, appearing in May. The specific character of the flower, which is that also of the plant, is, that the lobe of the style is triangular and acute; the outer petals are oblong-ovate and acuminate; the inner linear and contorted; the lips shorter than the petals and compressed. This species grows extensively through the United States south of the Potomac, east and west of the Alleghanies, and in several of the Northern States, particularly New York, Michigan, Connecticut, and Vermont. In Pennsylvania, especially near Philadelphia, it does not appear to prevail, and it is not mentioned in Darlington's *Flora Cestrica* as among the plants of Chester County.

The root, in both species, is the officinal portion. This consists of a rhizome, from two to four inches long, with numerous rootlets attached. "Horizontal, bent, four inches (10 cm.) or less, long; about one-eighth of an inch (3 mm.) thick; on the upper side beset with numerous, circular, cup-shaped scars; closely covered below with simple, wiry rootlets varying from four to twenty inches (10 to 50 cm.) in length; brittle, dark brown, or orange brown; fracture short, white; odor faint but heavy; taste sweetish, bitter and somewhat pungent." *U. S.* Prof. Maisch gives a distinctive description of the roots of the two species, of which the following is a condensed account. Of *C. pubescens* the rhizome is almost horizontal, in its greatest length nearly four inches, slightly bent with a shallow downward curve, from $\frac{1}{8}$ to $\frac{3}{16}$ of an inch thick, with numerous deeply concave scars left by the stems, having fully the width of the rhizome. The rootlets are numerous, several inches in length, sometimes even nine inches or more, about $\frac{1}{14}$ of an inch thick, without branches, somewhat undulate, and, though attached to the rhizome on all sides, are abruptly turned downward, owing to its horizontal position in the ground. Their color is yellowish brown, becoming much darker on drying, which causes longitudinal wrinkles. The cortical part of both species is colored blue by iodine. The rhizome of *C. parviflorum* is altogether different from the former, being bent nearly at right angles, three or four times, each section about $\frac{3}{4}$ of an inch long; and the whole length, while only about two inches in a straight line, from end to end, is yet actually three inches along the course of the rhizome. This is about $\frac{1}{8}$ of an inch thick, and has stem-scars, about the same in width, with about three in each bend. The rootlets, which are attached to all sides of the rhizome, are numerous, four to six inches long, less undular than those of *C. pubescens*, and of a brighter color, being a decided orange brown when fresh, and changing little on drying. (*A. J. P.*, 1872, p. 297.)

The roots of the Cypripedia are sometimes mixed, as brought into the market, with those of *Hydrastis Canadensis*, from the plants occasionally growing in close contiguity. (See *Hydrastis.*) Roots of seneka have also been noticed in specimens of Cypripedium; but there can be no difficulty in distinguishing them.

Properties. Cypripedium has a somewhat aromatic odor which diminishes by time, and a bitter, sweetish, peculiar, and in the end somewhat pungent taste. It yields its virtues to water and alcohol. The root has been analyzed by Mr. Henry C. Blair, who found it to contain a volatile oil, a volatile acid, tannic and gallic acids, two resins, gum, glucose, starch, and lignin. (*A. J. P.*, 1866, p. 494.) The so-called eclectics prepare what they improperly call *cypripedin* by precipitating with water a concentrated tincture of the root. The substance thus obtained is complex, and has no claim to the name given it, which ought to be reserved for the active principle when discovered. It is probable that the virtues of the root reside in a volatile oil and bitter principle.

Medical Uses. Cypripedium appears to be a gentle nervous stimulant or antispasmodic, and has been used for the same purposes as valerian, though less powerful. Dr. E. Ives, of New Haven, Conn., has employed the remedy in a variety of nervous diseases with advantage, and has known it even to cure epilepsy. The other complaints mentioned by him are hypochondriasis, neuralgia, and morbid sensitiveness of the nervous system generally, and especially of the eye. The medicine may be used in powder, infusion, or tincture. The dose of the powder given by Dr. Ives was fifteen grains (1 Gm.) three times a day. The oleoresin, obtained by precipitating the tincture, has been given in doses varying from half a grain to three grains (0·03–0·20 Gm.).

Off. Prep. Extractum Cypripedii Fluidum, *U. S.*

DECOCTA. *Decoctions.*

(DẸ-CŎC′TẠ.)

Décoctions, *Fr.;* Abkochungen, *G.*

Decoctions are solutions of vegetable principles, obtained by *boiling* the substances containing these principles in water. Vegetables generally yield their soluble ingredients more readily, and in larger proportion, to water maintained at the point of ebullition, than to the same liquid at a lower temperature. Hence decoction is occasionally preferred to infusion as a mode of extracting the virtues of plants, when the call for the remedy is urgent, and the greatest possible activity in the preparation is desirable. The process should be conducted in a covered vessel, so as to confine the vapor over the surface of the liquid, and thus prevent the access of atmospheric air, which sometimes exerts an injurious agency upon the active principle. The boiling, moreover, should not, as a general rule, be long continued; as the ingredients of the vegetable are apt to react on each other, and thus lose, to a greater or less extent, their original character. The substance submitted to decoction should if dry be either powdered or well bruised, if fresh, should be sliced, so that it may present an extensive surface to the action of the solvent; and previous maceration for some time in water is occasionally useful by overcoming the cohesion of the vegetable fibre. Should the physician not happen to prescribe this preliminary comminution, the pharmacist should not omit it.

All vegetable substances are not proper objects for decoction. In many, the active principle is volatile at a boiling heat, in others, it undergoes some change unfavorable to its activity, and in a third set is associated with inefficient or nauseous principles, which, though insoluble or but slightly soluble in cool water, are abundantly extracted by that liquid at the boiling temperature, and thus encumber, if they do not positively injure, the preparation. In all these instances, infusion is preferable to decoction. Besides, by the latter process, more matter is often dissolved than the water can retain, so that upon cooling a precipitation takes place, and the liquid is rendered turbid, and this constitutes the greatest objection to this class of preparations. When the active principle is thus dissolved in excess, the decoction should always be strained while hot; so that the matter which separates on cooling may be mixed again with the fluid by agitation at the time of administering the remedy.

In compound decoctions, the ingredients may be advantageously added at different periods of the process, according to the length of boiling requisite for extracting their virtues; and, should one of them owe its activity to a volatile principle, the proper plan is, at the close of the process, to pour upon it the boiling decoction, and allow the liquor to cool in a covered vessel.

As a general rule, glass or earthenware vessels should be preferred; as those made of metal are sometimes corroded by the ingredients of the decoction, which thus become contaminated. Vessels of clean cast-iron or common tin, or of block tin, are preferable to those of copper, brass, or zinc; but iron pots should not be used when astringent vegetables are concerned.

Decoctions, from the mutual reaction of their constituents, as well as from the influence of the air, are apt to spoil in a short time. Hence they should be prepared only when wanted for use, and should not be kept, in warm weather, for a longer period than forty-eight hours.

The tendency of modern medicine and pharmacy has been decidedly against the employment of decoctions; the nauseous taste, bulky dose, repulsive appearance, and non-permanent character have been powerful reasons for causing their retirement, whilst the use of tinctures and fluid extracts has largely increased. In the recent revision of the U. S. Pharmacopœia the number of officinal decoctions was reduced to two, and a general formula appended for the guidance of the pharmacist, as follows.

General Formula for Decoctions. "An ordinary Decoction, the strength of which is not directed by the physician, nor specified by the Pharmacopœia, shall be prepared by the following formula: Take of the Substance, coarsely comminuted, *ten parts;* Water, *a sufficient quantity,* To make *one hundred parts.* Put the Substance into a suitable vessel, provided with a cover, pour upon it *one hundred* (100) *parts* of cold Water, cover it well, and boil for fifteen minutes; then let it cool to about 45° C. (113° F.), strain the liquid, and pass through the strainer enough cold Water to make the product weight *one hundred* (100) *parts.*

"*Caution.* The strength of Decoctions of energetic or powerful substances should be specially prescribed by the physician." *U. S.* The decoctions which were officinal in 1870 but dropped at the last revision are: *Decoction of Pipsissewa, Yellow Cinchona, Red Cinchona, Dogwood, Bittersweet, Logwood, Barley, Oak Bark, Seneka, and Uva Ursi.* With the exception of decoction of barley, these were all made by boiling a troyounce of the drug with a pint of water for fifteen minutes, straining, and adding sufficient water through the strainer to make the decoction measure a pint. If the physician orders a decoction of either of the above now, without specifying the strength, it must be made by the *general formula,* which will make the new decoctions about one and a half times as strong as the decoctions of U. S. P. 1870.

DECOCTUM ALOES COMPOSITUM. *Br.* *Compound Decoction of Aloes.*

(DẸ-CŎC'TỤM ĂL'Ọ-ĒṢ CỌM-PŎṢ'Ị-TŬM.)

Tisane (Décocté) d'Aloès composée, *Fr.;* Zusammengesetztes Aloedecoct, *G.*

"Take of Extract of Socotrine Aloes *one hundred and twenty grains;* Myrrh, Saffron, of each, *ninety grains;* Carbonate of Potash *sixty grains;* Extract of Liquorice *one ounce* [avoirdupois]; Compound Tincture of Cardamoms *eight fluidounces;* Distilled Water *a sufficiency.* Reduce the Extract of Aloes and Myrrh to coarse powder, and put them together with the Carbonate of Potash and Extract of Liquorice into a suitable covered vessel with a pint [Imperial measure] of Distilled Water; boil gently for five minutes, then add the Saffron. Let the vessel with its contents cool, then add the Tincture of Cardamoms, and, covering the vessel closely, allow the ingredients to macerate for two hours; finally strain through flannel, pouring as much Distilled Water over the contents of the strainer as will make the strained product measure thirty fluidounces." *Br.*

This is essentially the former process of the British Colleges. The direction is properly given to rub the aloes, myrrh, and carbonate of potassium together before the addition of the other ingredients. The effect of the alkaline carbonate is, by combining with the resin of the myrrh, and the insoluble portion (apotheme of *Berzelius*) of the aloes, to render them more soluble in water, while the liquorice assists in the suspension of the portion not actually dissolved. The tincture of cardamom is useful not only by its cordial property, but also by preventing spontaneous decomposition. This decoction is said not to filter clear when first made, but, if kept for some time, to deposit insoluble matter, and then to become bright and clear on filtering. (*P. J. Tr.*, xiv. 491.)

Long boiling impairs the purgative property of aloes; and the same effect is thought to be produced, to a certain extent, by the alkalies, which certainly qualify its operation, and render it less apt to irritate the rectum. This decoction, therefore, is milder as a cathartic than aloes itself: it is also more tonic and cordial, from the presence of the myrrh, saffron, and cardamom, and derives antacid properties from the carbonate of potassium. It is given as a gentle cathartic, tonic, and emmenagogue, and is especially useful in dyspepsia, habitual constipation, and those complicated cases in which suppressed or retained menstruation is connected with enfeebled digestion and a languid state of the bowels. The dose is from a half to two fluidounces (15–60 C.c.). The decoction should not be combined in prescription with acids, acidulous salts, or other bodies incompatible with the alkaline carbonate.

DECOCTUM CETRARIÆ. *U. S., Br.* *Decoction of Cetraria. Decoction of Iceland Moss.*

(DẸ-CŎC'TỤM CẸ-TRĀ'RỊ-Æ.)

Tisane (Décocté) de Lichen d'Islande, *Fr.;* Islandisch-Moos-Absud (Decoct), *G.*

"Cetraria, *five parts* [or one ounce av.]; Water, *a sufficient quantity*, To make *one hundred parts* [or twenty fluidounces]. Cover the Cetraria, in a suitable vessel, with *forty parts* [or half a pint] of cold Water, express after half an hour, and throw away the liquid. Then boil the Cetraria with *one hundred parts* [or twenty fluidounces] of Water for half an hour, strain, and add enough cold Water, through the strainer, to make the product weigh *one hundred parts* [or measure twenty fluidounces]." *U. S.*

"Take of Iceland Moss *one ounce* [avoirdupois]; Distilled Water *one pint* [Imperial measure]. Wash the Moss in cold water, to remove impurities; boil it with the Distilled Water for ten minutes in a covered vessel, and strain, with gentle pressure, while hot; then pour Distilled Water over the contents of the strainer until the strained product measures a pint [Imp. meas.]." *Br.*

This is one of the two decoctions retained in the present U. S. Pharmacopœia. It is stronger than the one officinal in 1870. At present there is 5 per cent. of Iceland moss used in the preparation, where there was formerly but about 3 per cent. It is now of the same strength as the British.

The directions of the U. S. Pharmacopœia of 1850 were to boil *half an ounce* of the Moss with *a pint and a half* of Water down to a pint, and to strain with compression; and this process is preferable when the object is to extract not only the bitter principle, but also the whole of the demulcent and nutritive matter. As the bitter principle is dissolved along with the starch-like matter of the moss, this decoction unites an unpleasant flavor to its demulcent properties; but the plan which has been proposed of first extracting the bitterness by maceration in water, or a very weak solution of an alkaline carbonate, and afterwards preparing the decoction, is inadmissible; as the peculiar virtues which distinguish the medicine from the ordinary demulcents are thus entirely lost. (See *Cetraria.*) A pint (472 C.c.) of the decoction may be taken during the day.*

DECOCTUM CINCHONÆ FLAVÆ. *Br.* *Decoction of Yellow Bark.*

(DẸ-CŎC'TỤM CĬN-ÇHŌ'NÆ FLĀ'VÆ.)

Decoctum Chinæ Regiæ; Tisane (Décocté) de Quinquina jaune, *Fr.;* Königschina-Absud, *G.*

"Take of Yellow-Cinchona Bark, in coarse powder, *one ounce and a quarter* [avoirdupois]; Distilled Water *one pint* [Imperial measure]. Boil for ten minutes in a covered vessel. Strain the decoction, when cold, and pour as much distilled water over the contents of the strainer as will make the strained product measure one pint [Imp. meas.]." *Br.*†

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* *Decoctum Chimaphilæ.* U. S. 1870. *Decoction of Pipsissewa.* "Take of Pipsissewa, bruised, *a troyounce;* Water *a sufficient quantity.* Boil the Pipsissewa in a pint of Water for fifteen minutes, strain, and add sufficient Water, through the strainer, to make the decoction measure a pint." *U. S.* 1870. This decoction is in every way inferior to the fluid extract. One pint (472 C.c.) of it may be given in the course of twenty-four hours.

† *Decoctum Cinchonæ Flavæ.* U. S. 1870. *Decoction of Yellow Cinchona.* "Take of Yellow Cinchona, bruised, *a troyounce;* Water *a sufficient quantity.* Boil the Yellow Cinchona in a pint of Water for fifteen minutes, strain, and add sufficient Water, through the strainer, to make the decoction measure a pint." *U. S.* 1870.

DECOCTUM GRANATI RADICIS. *Br.* *Decoction of Pomegranate Root.*

(DẸ-CŎC′TỤM GRẠ-NĀ′TĪ RẠ-DĪ′CĬS.)

Decoctum Corticis Radicis Granati; Tisane (Décocté) d'Écorce de la Racine de Grenadier, *Fr.;* Granatwurzel-Rinden-Absud, *G.*

"Take of Pomegranate Root Bark, sliced, *two ounces* [avoirdupois]; Distilled Water *two pints* [Imperial measure]. Boil down to a pint [Imp. meas.], and strain, making the strained product up to a pint [Imp. meas.], if necessary, by pouring distilled water over the contents of the strainer." *Br.*

For the uses and dose of this decoction, see *Granati Radicis Cortex.*

DECOCTUM HÆMATOXYLI. *Br.* *Decoction of Logwood.*

(DẸ-CŎC′TỤM HÆ-MẠ-TŎX′Ỵ-LĪ—hē-mạ-tŏk′sị-lī.)

Tisane (Décocté) de Bois de Campêche, *Fr.;* Blauholz-Absud, *G.*

"Take of Logwood, in chips, *one ounce* [avoirdupois]; Cinnamon, in coarse powder, *sixty grains;* Distilled Water *one pint* [Imperial measure]. Boil the Logwood in the Water for ten minutes in a covered vessel, adding the Cinnamon towards the end. Strain the decoction, and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint [Imp. meas.]." *Br.*

We prefer the old U. S. formula, which ordered an ounce of the logwood to be boiled with two pints down to a pint, and doubt much whether the wood is exhausted by a boiling of ten or fifteen minutes. The cinnamon of the Br. formula is in general a very suitable addition; but there might be circumstances under which it would be better omitted; and in this case, as in others, any addition to the simple decoction might be left to the judgment of the prescriber.

This is an excellent astringent in diarrhœa, particularly in that form of it which succeeds the cholera infantum of this climate, or occurs as an original complaint in children during summer. The dose for an adult is two fluidounces (60 C.c.), for a child about two years old, two or three fluidrachms (7·5–11·25 C.c.), repeated several times a day. A little bruised cinnamon may often be added with advantage at the end of the boiling, as directed in the British process.

DECOCTUM HORDEI. *Br.* *Decoction of Barley.*

(DẸ-CŎC′TỤM HŎR′DẸ-Ī.)

Tisane d'Orgo perlé, *Fr.;* Gerstenschleim, *G.*

"Take of Pearl Barley *two ounces* [avoirdupois]; Distilled Water *one pint and a half* [Imperial measure]. Wash the Barley in cold water, and reject the washings; boil the washed barley with the Distilled Water for twenty minutes, in a covered vessel, and strain." *Br.*

Barley water, as this decoction is usually called, is much employed as a nutritive

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Decoctum Cinchonæ Rubræ. U.S. 1870. *Decoction of Red Cinchona. Decoction of Red Bark.* "Take of Red Cinchona, bruised, *a troyounce;* Water *a sufficient quantity.* Boil the Red Cinchona in a pint of Water for fifteen minutes, strain, and add sufficient Water, through the strainer, to make the decoction measure a pint." *U. S.* 1870.

These decoctions have been very appropriately dropped from the Pharmacopœia. Although capable, no doubt, of impressing the system, they are very ineligible preparations.

The dose of the decoction is two fluidounces (60 C.c.), to be repeated more or less frequently according to circumstances. Two drachms of orange peel, added to the decoction while still boiling hot, improve its flavor, and render it more acceptable to the stomach.

Decoctum Cornûs Floridæ. U. S. 1870. *Decoction of Dogwood.* "Take of Dogwood, bruised, *a troyounce;* Water *a sufficient quantity.* Boil the Dogwood in a pint of Water for fifteen minutes, strain, and add sufficient Water, through the strainer, to make the decoction measure a pint." *U. S.* 1870. This decoction has been proposed as a substitute for that of Peruvian bark; but, though possessed of analogous properties, it is much inferior in efficacy, and is not likely to be extensively employed so long as the Peruvian tonic is attainable. The dose is two fluidounces (60 C.c.).

Decoctum Dulcamaræ. U. S. 1870. *Decoction of Bittersweet.* "Take of Bittersweet, bruised, *a troyounce;* Water *a sufficient quantity.* Boil the Bittersweet in a pint of Water for fifteen minutes, strain, and add sufficient Water, through the strainer, to make the decoction measure a pint." *U. S.* 1870. This is a good preparation of bittersweet if it is absolutely necessary to use an aqueous menstruum. The properties and uses of this decoction may be found under the head of *Dulcamara.* The dose is from one to two fluidounces (30–60 C.c.) three or four times a day, or more frequently.

drink in febrile and inflammatory complaints, and, from the total absence of irritating properties, is peculiarly adapted to cases in which the gastric or intestinal mucous membrane is inflamed. As the stomach of those for whom it is directed is often exceedingly delicate, and apt to revolt against anything having the slightest unpleasantness of flavor, it is important that the decoction should be properly made; and, though the office of preparing it generally falls to nurses, yet the introduction of the process into the Pharmacopœia is not without advantage; as a formula is thus ever before the physician, by which he may give his directions, with the certainty, if obeyed, of having a good preparation. The object of the washing with cold water, is completely to remove any mustiness, or other disagreeable flavor, which the barley may have acquired from exposure.

DECOCTUM PAPAVERIS. *Br.* *Decoction of Poppies.*

(DẸ-CŎC′TỤM PẠ-PĀ′VẸ-RĬS.)

Tisane de Pavot, *Fr.;* Mohnkapseln-Absud, *G.*

"Take of Poppy Capsules, bruised, *two ounces* [avoirdupois]; Distilled Water *a pint and a half* [Imperial measure]. Boil for ten minutes in a covered vessel, then strain, and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint [Imp. meas.]." *Br.*

This decoction is used as an anodyne fomentation in painful tumors, and in superficial cutaneous inflammation or excoriation. It is recommended not to reject the seeds, as their oil, suspended in the water by the mucilage of the capsules, adds to the emollient virtues of the preparation.

DECOCTUM PAREIRÆ. *Br.* *Decoction of Pareira.*

(DẸ-CŎC′TỤM PẠ-REI′RÆ—pạ-rā′rē.)

Tisane de Pareira Brava, *Fr.;* Pareirawurzel-Absud, Grieswurzel-Absud, *G.*

"Take of Pareira Root, sliced, *one ounce and a half* [avoirdupois]; Distilled Water *one pint* [Imperial measure]. Boil for fifteen minutes in a covered vessel, then strain, and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint [Imp. meas.]." *Br.*

This is apt to remain turbid after straining, but, if allowed to stand, gradually deposits insoluble matter, and then can be filtered perfectly clear. (*P. J. Tr.*, xiv. 491.) The dose is from one to two fluidounces three or four times a day.

DECOCTUM QUERCUS. *Br.* *Decoction of Oak Bark.*

(DẸ-CŎC′TỤM QUĔR′CŬS—kwĕr′kŭs.)

Tisane (Décocté) d'Écorce de Chêne, *Fr.;* Eichenrinden-Absud, *G.*

"Take of Oak Bark [bark of Quercus pedunculata], bruised, *one ounce and a quarter* [avoirdupois]; Distilled Water *one pint* [Imperial measure]. Boil for ten minutes in a covered vessel, then strain and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint [Imp. meas.]." *Br.**

This decoction contains the tannin, bitter principle, and gallic acid of oak bark. It affords precipitates with the decoction of Peruvian bark and other substances containing vegetable alkaloids, with solution of gelatin, and with most metallic salts, particularly those of iron. Alkaline solutions diminish or destroy its astringency. Its uses have been already detailed. The dose is two fluidounces (60 C.c.), frequently repeated.

DECOCTUM SARSÆ. *Br.* *Decoction of Sarsaparilla.*

(DẸ-CŎC′TỤM SÄR′SÆ—sär′sē.)

Tisane de Salsepareille, *Fr.;* Sarsaparilla-Absud, *G.*

"Take of Jamaica Sarsaparilla, cut transversely, *two ounces and a half* [avoirdupois]; Boiling Distilled Water *one pint and a half* [Imperial measure]. Digest the Sarsaparilla in the Water for an hour; boil for ten minutes in a covered vessel, cool, and strain, pouring distilled water, if required, over the contents of the strainer, or otherwise making the strained product measure a pint [Imp. meas.]." *Br.*

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* *Decoctum Quercûs Albæ.* U. S. 1870. *Decoction of White-oak Bark.* "Take of White-oak Bark, bruised, *a troyounce;* Water *a sufficient quantity.* Boil the White-oak Bark in a pint of Water for fifteen minutes, strain, and add sufficient Water, through the strainer, to make the decoction measure a pint." *U. S.* 1870.

An idea was long entertained that the virtues of sarsaparilla resided in its fecula, the extraction of which was, therefore, the main object of the decoction. Hence the long boiling formerly ordered by the London and Edinburgh Colleges. But this opinion is now admitted to have been erroneous. The activity of the root is believed to depend upon one or more acrid principles, soluble to a certain extent in water, cold or hot, and either volatilized, or rendered inert by chemical change, at the temperature of 100° C. (212° F.). This fact appears to be demonstrated by the experiments of Pope,* Hancock,† Soubeiran,‡ Beral, and others. Soubeiran macerated one portion of bruised sarsaparilla in cold water for twenty-four hours; infused another portion in boiling water, and digested with a moderate heat for two hours; boiled a third portion bruised, and a fourth unbruised, in water for two hours; and in each instance used the same relative quantities. Testing these various preparations by the taste, he found the cold and hot infusions scarcely different in this respect; and both possessed of a stronger odor and more acrid taste than the decoctions, of which that prepared with the bruised root was the strongest. From these facts the inference is obvious, that the best method of imparting the virtues of sarsaparilla to water is either by cold or hot infusion. Digestion for some hours in water maintained at a temperature of 82·2° C. (180° F.), or somewhat less, in a covered vessel, has strong testimony in its favor. Percolation in a displacement apparatus, if properly conducted, is a convenient and no doubt efficient mode of exhausting the root, so far as water will effect that object. Decoction is the worst method; and the longer it is continued, the weaker will be the preparation. For these reasons the decoction of sarsaparilla has not been officinal in the U. S. Pharmacopœia since 1840. The unsplit root is ordered in the British Pharmacopœia from the conviction, probably, that the internal amylaceous part is inert; but there can be no doubt that the drug yields its virtues more readily when well bruised or otherwise comminuted than in the natural state. Precipitates are produced by various substances with this decoction; but it has not been ascertained how far such substances interfere with its activity. Those which merely throw down the fecula do not injure the preparation.

By this preparation it is possible to administer sarsaparilla in the form of decoction, without combination with other medicines, as in the Compound Decoction.

The decoction of sarsaparilla may be administered in the dose of four or six fluidounces (120–180 C.c.) four times a day.

DECOCTUM SARSAPARILLÆ COMPOSITUM. *U. S.* *Compound Decoction of Sarsaparilla.*

(DẸ-CŎC′TỤM SÄR-SẠ-PẠ-RĬL′LÆ CỌM-PŎŞ′Ị-TŬM.)

Decoctum Sarsæ Compositum, *Br.;* Tisane (Apozème) sudorifique, Décocté de Salsepareille composé, *Fr.;* Zusammengesetztes Sarsaparilla-Decoct, *G.*

"Sarsaparilla, cut and bruised, *ten parts* [or five ounces av.]; Sassafras, in No. 20 powder, *two parts* [or one ounce av.]; Guaiacum Wood, rasped, *two parts* [or one ounce av.]; Glycyrrhiza, bruised, *two parts* [or one ounce av.]; Mezereum, cut and bruised, *one part* [or half an ounce av.]; Water, *a sufficient quantity*, To make *one hundred parts* [or three pints]. Boil the Sarsaparilla and Guaiacum Wood for half an hour in a suitable vessel with *one hundred parts* [or three pints] of Water; then add the Sassafras, Glycyrrhiza, and Mezereum, cover the vessel well and macerate for two hours; finally strain, and add enough cold Water, through the strainer, to make the product weigh *one hundred parts* [or measure three pints]." *U. S.*

"Take of Jamaica Sarsaparilla, cut transversely, *two ounces and a half;* Sassafras

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[*] Trans. of the Medico-Chirurg. Society of London, vol. xii. p. 344.

[†] Trans. of the Medico-Botan. Society of London. See also Journ. of the Phila. Coll. of Pharm., vol. i. p. 295. The observations of Dr. Hancock are entitled to much credit, as he practised long in South America, in the neighborhood of the best sarsaparilla regions.

[‡] Journ. de Pharmacie, tom. xvi. p. 38.

Root, in chips, Guaiac Wood turnings, Fresh Liquorice Root, bruised, each *a quarter of an ounce;* Mezereon Bark *sixty grains;* Boiling Distilled Water *one pint and a half* [Imperial measure]. Digest the solid ingredients in the Water for an hour; then boil for ten minutes in a covered vessel; cool and strain, pouring distilled water, if required, over the contents of the strainer, or otherwise making the strained product measure a pint [Imp. meas.]." *Br.* The ounce employed in this process is the avoirdupois ounce.

This decoction is an imitation of the celebrated *Lisbon diet drink.* The sarsaparilla and mezereon are the active ingredients; the guaiacum wood imparting scarcely any of its virtues, and the sassafras and liquorice serving little other purpose than to communicate a pleasant flavor. An improvement was made in the present U. S. formula in directing the sassafras, glycyrrhiza, and mezereum to be added, after the boiling of the ligneous drugs has been completed. Compound Decoction of Sarsaparilla now contains a little more sarsaparilla, sassafras, guaiacum wood, and glycyrrhiza than the U. S. formula of 1870, but nearly double the quantity of mezereum: as the latter has been believed by many to be the only active substance in this weak preparation, the increase in quantity was judicious.

If prepared with good sarsaparilla, and with a due regard to the practical rules which may now be considered as established, the decoction may be used with advantage as a gentle diaphoretic and alterative in secondary syphilis, either alone, or as an adjuvant to a mercurial course; also in certain scrofulous and other depraved conditions of the system, in chronic rheumatism, and in various obstinate cutaneous affections. The dose is from four to six fluidounces (120–180 C.c.) three or four times a day. The patient during its use should wear flannel next the skin, and avoid unnecessary exposure to changes of temperature.*

DECOCTUM SCOPARII. *Br.* *Decoction of Broom.*

(DẸ-CŎC′TỤM SCỌ-PĀ′RỊ-Ī.)

Tisane de Genêt à Balais, *Fr.;* Besenginster-Absud, *G.*

"Take of Broom-tops, dried, *one ounce* [avoirdupois]; Distilled Water *one pint* [Imperial measure]. Boil for ten minutes in a covered vessel, then strain, and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint [Imp. meas.]." *Br.*

This decoction is a useful diuretic in dropsy. From half a pint to a pint (236–472 C.c.) may be taken during the day, in doses of from two to four fluidounces (60–120 C.c.).†

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* The *Decoction of Zittmann* (Decoctum Zittmanni) is a preparation of Sarsaparilla much used in Germany, for similar purposes with our compound decoction of sarsaparilla; and, as it has attracted some attention in this country as a remedy in obstinate ulcerative affections, we give the formula of the German Pharmacopœia, which is generally followed in its preparation. *Decoctum Sarsaparillæ Compositum Fortius,* P. G. [*Zittmann's Stronger Decoction.*] *Stärkeres Zittmann'sches Decoct.*—"Take of sarsaparilla root, cut, *one hundred parts;* pour upon it common water, *two thousand six hundred parts;* digest for twenty-four hours; then add of sugar powdered, alum powdered, each, *six parts,* and heat them in a covered vessel, in a steam bath, for three hours, stirring frequently. Towards the end of the boiling, add of anise bruised, fennel seed bruised, each, *four parts;* senna cut, *twenty-four parts;* liquorice root cut, *twelve parts.* Strain by expression, and set aside for a short time. The clear decanted liquid should be *two thousand five hundred parts.* When not otherwise directed, a colature of two thousand five hundred grammes is divided into eight portions.

"N.B.—When Decoctum Zitmanni is prescribed, it is prepared in a similar manner, except that to the sugar and alum are added of mild chloride of mercury, *four parts;* cinnabar (red sulphide of mercury), *one part,* enclosed in a linen bag." *P. G.*

Decoctum Sarsaparillæ Compositum Mitius, P. G. [*Zittmann's Milder Decoction.*] *Milderes Zittmann'sches Decoct.*—"Take the residue of the stronger decoction and sarsaparilla root, cut, *fifty parts;* pour upon them common water, *two thousand six hundred parts,* and expose to the heat of a steam bath for three hours in a covered vessel, stirring frequently. Towards the end of the operation add of lemon peel, cassia bark, small cardamoms, liquorice root, each, cut and bruised, *three parts.* Strain by expression, and set aside for a short time. The clear decanted liquid should be *two thousand five hundred parts.* When not otherwise directed, a colature of two thousand five hundred grammes is divided into eight portions." *P. G.* Mercury was detected by Wiggers in this decoction in very small proportion. It should not be prepared in metallic vessels, lest the mercurial in solution should be decomposed. The decoction may be drunk freely.

† *Decoctum Senegæ.* U. S. 1870. *Decoction of Seneka.* "Take of Seneka, bruised, a *troyounce;* Water *a sufficient quantity.* Boil the Seneka in a pint of Water for fifteen minutes, strain, and add sufficient Water, through the strainer, to make the decoction measure a pint." *U. S.* 1870.

DECOCTUM TARAXACI. *Br.* *Decoction of Taraxacum.*

(DẸ-CŎC′TỤM TẠ-RĂX′Ạ-CĪ—tạ-răk′sạ-sī.)

Tisane de Pissenlit, *Fr.;* Löwenzahnwurzel-Absud, *G.*

"Take of Dried Dandelion Root, sliced and bruised, *one ounce* [avoirdupois]; Distilled Water *one pint* [Imperial measure]. Boil for ten minutes in a covered vessel, then strain, and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint [Imp. meas.]." *Br.*

Dose, two fluidounces (60 C.c.) two or three times a day. (See *Taraxacum.*)

DECOCTUM ULMI. *Br.* *Decoction of Elm Bark.*

(DẸ-CŎC′TỤM ŬL′MĪ.)

Décocté d'Orme, *Fr.;* Ulmenrinden-Decoct, *G.*

"Take of Elm Bark, cut in small pieces, *two and a half ounces* [avoirdupois]; Distilled Water *one pint* [Imperial measure]. Boil for ten minutes in a covered vessel, then strain, and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint." *Br.*

Dose, from two to four fluidounces (60–120 C.c.). (See *Ulmus.*)*

DIGITALINUM. *Br.* *Digitalin.*

(DĬǴ-Ị-TẠ-LĪ′NŬM.)

Digitaline, *Fr.;* Digitalin, *G.*

"Take of Digitalis Leaf, in coarse powder, *forty ounces* [avoirdupois]; Rectified Spirit, Distilled Water, Acetic Acid, Purified Animal Charcoal, Solution of Ammonia, Tannic Acid, Oxide of Lead in fine powder, Pure Ether, of each, *a sufficiency.* Digest the Digitalis with a gallon [Imperial measure] of the Spirit for twenty-four hours at a temperature of 120°; then put them into a percolator, and, when the tincture has ceased to drop, pour a gallon [Imp. meas.] of Spirit on the contents of the percolator, and allow it slowly to percolate through. Distil off the greater part of the Spirit from the tincture, and evaporate the remainder over a water-bath until the whole of the alcohol has been dissipated. Mix the residual extract with five [fluid]ounces of Distilled Water to which half an ounce [avoird.] of Acetic Acid has been previously added, and digest the solution thus formed with a quarter of an ounce of Purified Animal Charcoal; then filter, and dilute the filtrate with Distilled Water until it measures a pint [Imp. meas.]. Add Solution of Ammonia nearly to neutralization, and afterwards add one hundred and sixty grains of Tannic Acid dissolved in three [fluid]ounces of Distilled Water. Wash the precipitate that will be formed with a little Distilled Water; mix it with a small quantity of the Spirit and a quarter of an ounce of the Oxide of Lead, and rub them together in a mortar. Place the mixture in a flask, and add to it four [fluid]ounces of the Spirit; raise the temperature to 160°, and keep it at this heat for about an hour. Then add a quarter of an ounce of Purified Animal Charcoal; put it on a filter, and from the filtrate carefully drive off the Spirit by the heat of a water-bath. Lastly, wash the residue repeatedly with Pure Ether." *Br.* There is now no doubt that the product obtained by this process is a complex one, containing considerable *digitoxin*, which is at present regarded as the most important and active principle. For this reason the process for digitalin was abandoned in the last revision of the U. S. Pharm.

Under the name of *digitalin*, there have long been in commerce two distinct substances obtained from digitalis, both of them of the nature of extracts rather than of organic principles. The *French* digitalin was that originally prepared by Homolle.

This is one of the decoctions in which experience has shown that long boiling impairs the activity of the medicine. It is customary to add to the seneka in decoction an equal weight of liquorice root, which serves to cover its taste, and in some measure to obtund its acrimony. The virtues and practical application of seneka will be treated of under *Senega.* The dose of the decoction is about *two fluidounces* (60 C.c.) three or four times a day, or a tablespoonful every two or three hours.

* *Decoctum Uvæ Ursi.* U. S. 1870. *Decoction of Uva Ursi.* "Take of Uva Ursi *a troyounce;* Water *a sufficient quantity.* Boil the Uva Ursi in a pint of Water for fifteen minutes, strain, and add sufficient Water, through the strainer, to make the decoction measure a pint." *U. S.* 1870.

The preparation contains the tannin, extractive, and gallic acid of the leaves. See *Uva Ursi.* The dose is from one to two fluidounces (30–60 C.c.) three or four times a day.

It is a whitish powder, of a neutral reaction, soluble in 2000 parts of cold and in 1000 parts of hot water. It is this digitalin which is now recognized by the British Pharmacopœia. The process officinal in U. S. P. 1870 does not differ greatly from that of the British above given. The so-called *German* digitalin is at once distinguished from the French or officinal by being, in great part or entirely, freely soluble in water. According to the method of Walz (Husemann, *Die Pflanzenstoffe*, p. 900), it is prepared by extracting under pressure one part of digitalis with eight parts of alcohol, evaporating, digesting the residue with successive portions of water so long as they acquire a bitter taste, uniting the liquids, and treating them with litharge and acetate of lead until a portion filtered for testing is no longer precipitated by acetate of lead. Sulphuric acid is added to the filtrate to precipitate the lead, and, after filtration, neutralized with ammonia, and the liquid precipitated by tannic acid. The precipitate, having been well washed and pressed, is rubbed up with freshly precipitated oxide of lead, the mass boiled with alcohol, and, after the lead has been separated by precipitation with sulphuric acid, and most of the alcohol distilled off, the residue is allowed to slowly evaporate, the crude digitalin being left behind.

Homolle and Quevenne believed digitalin to be composed of three substances, which they named *digitalin*, *digitaline*, and *digitalose.* The German digitalin Walz found to be composed of *digitalin*, *digitaletin*, *digitaloin*, *digitalacrin*, and *digitalis fat.* As there is no proof that these various principles are really distinct organic principles, the reader is referred to Husemann's *Pflanzenstoffe* for an account of their methods of preparation and of their qualities.

In 1871, M. Nativelle, in conformity with the report of a commission of the French Academy, received the prize of Orfila for the discovery of the active principle of digitalis, which he had obtained in fine crystals. The method of preparation, as finally improved and modified by himself, and published in the *Journ. de Pharm.*, xx. 1874, p. 81, and a process which has the advantage of being far shorter and more readily carried out, devised by M. Tanret (*Ibid.*, Oct. 1875), will be found on p. 1143, 14th ed., U. S. Dispensatory.

Crystallized digitalin occurs in granular radiating masses of acicular crystals, or in brilliant acicular crystals. The characteristic reactions of it are stated by Tanret to be, the yellowish green color which it strikes with hydrochloric acid; the brown or rose color, according to the amount of digitalin, developed by concentrated sulphuric acid; and the violet color, which is produced in its solution in dilute sulphuric acid when a drop of bromine-water or, better still, some of the vapor of bromine is added. According to Nativelle, it is insoluble in water, very soluble in chloroform, soluble in 12 parts of cold and in 6 parts of boiling alcohol of 90 per cent. When heated to 100° C. (212° F.), it softens and becomes elastic; heated on platinum foil, it fuses without coloring, and evaporates in white vapor. Solution of chloral dissolves it readily. Hydrochloric acid dissolves it with emerald-green color; sulphuric acid with green color, changing to clear red on treatment with bromine, but turning green again on addition of water. According to Flückiger, it is also dissolved by warm concentrated phosphoric acid with intensely green color. The formula of Nativelle's digitalin is $C_{25}H_{40}O_{15}$. Nativelle's *digitalin* appears to be a glucoside, as diluted sulphuric acid decomposes it with the formation of *digitaliretin* and glucose. According to Ch. Blaquart (*L'Union Pharmaceutique*, Nov. 1872), ten per cent. of it can readily be obtained from the crude drug. Besides digitalin, M. Nativelle obtained a crystallizable but inert substance, to which he gave the name of *digitin.*

The relation of Nativelle's crystallized digitalin to digitalis and the amorphous digitalin has given rise to considerable controversy. The French commission affirmed that it acted similarly to digitalin, but was much stronger. M. Gubler, M. Vulpian, and M. Blaquart have separately arrived at a different result from this; they found the crystallized digitalin no stronger—sometimes even weaker—than the amorphous French preparation. However this may be, it is plain that Nativelle's digitalin cannot be the sole or even the chief principle of digitalis, since he found it in the residue left as exhausted and inert in the preparation of the officinal or French digitalin. Further, there is abundant proof that the French digitalin is a powerful preparation, and, if it contain no crystallized digitalin, the latter is not the sole or even the chief active principle of digitalis. Dr. Roucher (*Les Mondes*, Juillet, 1872) affirms that Nativelle's digitalin is a complex body, and O. Schmiedeberg (*Archiv für Exper. Pathologie und Pharmak.*, Bd. iii. p. 19; *P. J. Tr.*, 1875, p. 741) confirms this. The latter author has examined the constitution of digitalis very carefully, and found that there are four principles in it: *digitonin*, a substance allied to saponin, which constitutes the bulk of the German or soluble digitalin; *digitalin*, which constitutes the greater part of the French or soluble digitalin; *digitalein;* and *digitoxin*, the most active of all the substances. These principles readily break up into a number of derivatives; hence the various principles which have been obtained from digitalis by investigators.

According to Schmiedeberg (*loc. cit.*), the digitalin of Nativelle is a mixture of digitalin with digitoxin, a second base. The pure *digitalin*, according to Schmiedeberg, forms soft, colorless, uncrystallizable granules. These are easily soluble in alcohol, slightly so in ether or chloroform, and almost insoluble in water. It is a glucoside, yielding glucose and digitaliretin.

For the extraction of *digitoxin* Schmiedeberg precipitates the extract obtained with the 50 per cent. alcohol by the aid of lead acetate, evaporates the filtrate, and, washing the separated residue with weak soda solution, dries it and extracts with chloroform.

Some yellowish matter is removed with benzin, and the crude digitoxin purified by crystallization from warm alcohol of 80 per cent., adding a little charcoal. The yellowish crystals so obtained must be washed with carbonate of soda, ether, or benzin, and then recrystallized from warm absolute alcohol containing a little chloroform. The formula of digitoxin, according to Schmiedeberg, is $C_{31}H_{33}O_{7}$. It is not a glucoside, but in alcoholic solution it is decomposed by dilute acids, and then affords *toxiresin*, an uncrystallizable substance, which may easily be separated on account of its ready solubility in ether; it appears to be produced also if digitoxin is maintained for some time in the state of fusion at about 240° C. (464° F.). "Toxiresin proved to be a very powerful poison, acting energetically upon the heart and muscles of frogs. The very specific action of foxglove is due not exclusively, however, to digitoxin."

Kossmann (*P. J. Tr.* [3] 5, p. 545) prepared from digitalis leaves a *soluble digitalin*, which he says is converted by dilute acids into insoluble digitalin and sugar. The insoluble digitalin then splits into digitaliretin and sugar.

The above résumé of our present knowledge clearly shows that the chemistry of digitalis cannot be considered as settled; but it also clearly shows that the officinal digitalin does not represent digitalis. When it is further borne in mind that the digitalin of the drug-stores is always bought from large manufacturers, and that sometimes it is the French, sometimes the German preparation, and sometimes probably something else, it is plain that the practitioner cannot rely upon it, and that the revisers of the Pharmacopœia acted wisely in omitting it. The dose of powdered digitalis is so small that it is readily contained in a small pill, and there is therefore no good reason for the use of the preparation under consideration.

The dose of digitalinum should not, to begin with, exceed the fiftieth of a grain (0·0015 Gm.).

DIGITALIS. *U.S.* *Digitalis.* [*Foxglove.*]

(DĬǴ-I-TĀ'LĬS.)

"The leaves of Digitalis purpurea, Linné (*Nat. Ord.* Scrophulariaceæ), collected from plants of the second year's growth." *U. S.* "The dried leaf of Digitalis purpurea. Purple Foxglove. Collected from the wild indigenous plant, when about two-thirds of the flowers are expanded." *Br.*

Digitalis Folia, *Br.;* Digitalis Leaf: Folia Digitalis, *P. G.;* Digitalis Leaves, Foxglove Leaves, Feuilles de Digitale pourprée (de grande Digitale), Digitale pourprée, Doigtier, *Fr.;* Purpurrother Fingerhut, Fingerhutkraut, *G.;* Digitale purpurea. *It.;* Dedalera, *Sp.*

Gen. Ch. *Calyx* five-parted. *Corolla* bell-shaped, five-cleft, ventricose. *Capsule* ovate, two-celled. *Willd.*

Digitalis purpurea. Willd. *Sp. Plant.* iii. 383; Woodv. *Med. Bot.* p. 218, t. 78. The foxglove is a beautiful plant, with a biennial or perennial fibrous root, which, in the first year, sends forth large tufted leaves, and in the following summer, a single erect, downy, and leafy stem, rising from two to five feet, and terminating in an elegant spike of purple flowers. The lower leaves are ovate, pointed, about eight inches in length and three in breadth, and stand upon short, winged footstalks; the upper are alternate, sparse, and lanceolate; both are obtusely serrate, and have wrinkled velvety surfaces, of which the upper is of a fine deep green, the under paler and more downy. The flowers are numerous, and attached to the upper part of the stem by short peduncles, in such a manner as generally to hang down upon one side. At the base of each peduncle is a floral leaf, which is sessile, ovate, and pointed. The calyx is divided into five segments, of which the uppermost is narrower than the others. The corolla is monopetalous, bell-form, swelling on the lower side, irregularly divided at the margin into short obtuse lobes, and in shape and size not unlike the end of the finger of a glove, a circumstance which has suggested most of the names by which the plant is designated in different languages. Its mouth is guarded by long soft hairs. Externally, it is in general of a bright purple; internally, is sprinkled with black spots upon a white ground. There is a variety with white flowers. The filaments are white, curved, and surmounted by large yellow anthers. The style is simple, and supports a bifid stigma. The seeds are numerous, very small, grayish brown, and contained in a pyramidal two-celled capsule.

The foxglove grows wild in the temperate parts of Europe, where it flowers in the middle of summer. In this country it is cultivated both for ornament and for medical use. The leaves are the part generally employed. Much care is requisite in selecting, preparing, and preserving them, in order to insure their activity. They should be gathered in the second year, immediately before or during the period of efflorescence, and those only chosen which are full-grown and perfectly fresh (*Geiger*); but the observations of F. Schneider would lead to the conclusion that they are much stronger when not gathered before the latter part of summer, or the beginning of autumn. (*A. J. P.*, 1870, p. 221.) It is said that those plants are preferable which grow spontaneously in elevated places, exposed to the sun. (*Duncan.*) As the leafstalk and midrib are comparatively inactive, they may be rejected. Withering recommends that the leaves should be dried either in the sunshine, or by a gentle heat before the fire; and care should be taken to keep them separate while drying. Pereira states that a more common, and, in his opinion, a preferable mode, is to dry them in a basket, in a dark place in a drying stove. It is probably owing, in part, to the want of proper attention in preparing digitalis for the market, that it is so often inefficient. Much of the medicine kept in our shops is obtained from the Shakers,* and is in oblong compact masses, into which the leaves have been compressed. In some of these cakes the digitalis is of good quality; but we have seen others in which it was quite the reverse, and some which were mouldy in the interior; and, upon the whole, we cannot but consider this mode of preparing the drug as objectionable. The dried leaves should be kept in tin canisters, well closed so as to exclude light and moisture; or they may be pulverized, and the powder preserved in well-stopped and opaque bottles. As foxglove deteriorates by time, it should be frequently renewed, as often, if possible, as once a year. Its quality must be judged of by the degree in which it possesses the characteristic properties of color, smell, and especially taste. It is said to be sometimes adulterated; but if it be bought in leaf, there can be little difficulty, to one acquainted with the characters of the genuine leaves, in detecting the sophistication.

The seeds contain more of the active principle than the leaves, are less apt to suffer in drying, and keep better, but are little used. So far as the relative strength of these two parts can be determined from that of their alcoholic extracts, it would appear, from the experiments of Prof. Hirtz, that the seeds are ten times stronger than the leaves. (See *A. J. P.*, xxxiii. 414.)

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* A portion of the Shakers' digitalis, purchased in the market, with parcels from England and Germany, being chemically examined by Dr. S. P. Duffield, of Detroit, with the view of determining the relative powers of the several varieties as measured by their yield of digitalin, was found superior to the others, the English giving 63·60 grains to the pound, the German 56·50 grains, and the American 65·01 grains. (*A. J. P.*, 1869, p. 57.)

Properties. Foxglove is without smell in the recent state, but acquires a faint narcotic odor when dried. The color of the dried leaf is a dull pale green, modified by the whitish down upon the under surface; that of the powder is a fine deep green. "From four to twelve inches (10 to 30 cm.) long, ovate-oblong, narrowed into a petiole; crenate, downy; dull green and wrinkled above; paler and reticulate beneath; midrib near the base broad; odor faint, tea-like; taste bitter, nauseous." *U. S.* Digitalis yields its virtues both to water and alcohol. These virtues probably are due to several principles, to which the one name of *digitalin* has been applied by different experimenters, although the products obtained by them have varied greatly.

Besides its active principles, digitalis contains a volatile oil, a fatty matter, a red coloring substance analogous to extractive, chlorophyll, albumen, starch, sugar, gum, lignin, and salts of potassa and lime, among which, according to Rein and Haase, is superoxalate of potassium. M. Morin, of Geneva, has discovered in the leaves two acids; one fixed, called *digitalic acid*, the other volatile and resembling valerianic acid, which he proposes to name *antirrhinic acid*. (*P. J. Tr.*, vii. 294.) Dr. Morries obtained a narcotic empyreumatic oil by the destructive distillation of the leaves.

For further account of chemical studies of digitalis, see *Digitalinum.*

Medical Properties and Uses. Experiments upon the lower animals, confirmed by clinical observation, have shown that digitalis acts primarily and with most force upon the circulation, producing a great rise in the arterial pressure, followed, in poisoning, by a no less marked fall, which, however, does not take place at all after moderate doses. The increased blood force is partly due to increased cardiac action and partly to vaso-motor spasm. Upon the heart, digitalis acts by stimulating the peripheral ends of the inhibitory nerves and also the cardiac muscle. By the first influence it produces prolongation of the diastole; by the second, an increased putting forth of power in the systole. The work done by the heart under the influence of the drug is much beyond normal. After a toxic dose the systolic irritation overbalances the diastolic stimulation, and the pulse becomes dichrotic, because the diastole is interrupted by an abortive systole. Finally, the apex of the heart never dilates, diastole is continually interrupted by systolic contractions, and the aortic system remains empty, because the left ventricle never relaxes sufficiently to receive blood. The final cessation of the heart's action is not due to paralysis, but to spasm, the heart ceasing not in diastole but in systole.

This résumé of our knowledge of the physiological action clearly shadows forth the proper use of the drug. It is indicated when the heart is weak, not absolutely, but relatively weak, or, in other words, when the work required of the heart is greater than its power. When digitalis is administered in ordinary doses, it produces at first no distinct effect; but if the dose be repeated, after a time the pulse becomes less frequent. The pauses between the beats are longer than before, and the individual beat is longer, fuller, and stronger, indicating that the heart is acting with more force than normal. When the reduction of the pulse-rate has commenced, it is apt to continue for some days, and even to increase for a time, although the use of the remedy be intermitted, slowness and permanency of action being characteristic of digitalis. In some cases, gastric disturbance, and even nausea, vomiting, and diarrhœa, are produced by therapeutic doses of the drug. If sufficient of the remedy has been taken into the system, the pulse may fall to 35 or 40 a minute, still preserving the peculiarity of a distinctly dichrotic beat. Now, a very peculiar phenomenon may often be witnessed. Whilst the patient is quiet in the horizontal position the pulse is very slow and strong, but when he rises to his feet it becomes at once rapid, irregular, small, and feeble, and even hobbling.

During the milder operation of digitalis there may be some sense of cerebral disturbance, brow-tightness, and even a confusion of thought and giddiness. After toxic doses the symptoms are severe; a feeble, scarcely perceptible pulse, nausea and vomiting, stupor or delirium, cold sweats, extreme prostration of strength, hiccough, convulsions, and syncope have in several cases preceded the fatal issue.

The dilated heart is of course a weak heart, and simple cardiac dilatation is one of the strongest indications for the use of digitalis, whilst cardiac hypertrophy is a contraindication. It must not be forgotten, however, that in valvular disease of the heart, the heart, although stronger than normal, may be relatively weak, because the leakage at the diseased valve requires more power to overcome its effect than even the increased strength of the cardiac muscle is able for. Hypertrophy exists, but is not sufficient to be compensatory. In all forms of valvular lesion, when the hypertrophy is not compensatory, digitalis is very useful. It is also to be employed (hypodermically) in sudden cardiac exhaustion from any cause.

Dropsy is very frequently the result of a general venous repletion, which also interferes with the function of the kidneys. Under these circumstances digitalis is a favorite remedy, and also acts as a decided diuretic. In these cases the result is in greater or less part due to the improvement of the circulation; but the drug has some tendency, even in health, to provoke diuresis. It is especially when it fails to do this that the so-called cumulative action is apt to be witnessed. After giving the drug for a long time without apparent effect, suddenly symptoms so severe as to be toxic are manifested. In aneurism, or when from any reason the coats of the vessels are thin or fragile, digitalis is contraindicated. We have seen a dilated aorta ruptured by the powerful blood-current produced by the drug.

Externally applied, digitalis sometimes acts speedily and powerfully as a diuretic, and has proved useful in dropsy. For this purpose the fresh leaves bruised, or the dried leaves made into a poultice, or flannels wet with the tincture, may be applied to the abdomen and on the inside of the thighs. Ch. Hoffman has shown by experiments on himself that the active matter of digitalis is capable of being absorbed through the skin, and that its effects on the system may be obtained by means of baths.* A case is recorded in which a cataplasm of the leaves applied to the abdomen for the relief of obstinate and dangerous suppression of urine, and repeated in six hours, brought on excessive diuresis, with a discharge amounting to probably 8 gallons in less than 24 hours, producing fatal exhaustion. (*Med. Times and Gaz.*, Jan. 1868, p. 86.)

Digitalis is administered in substance. The dose of the powder is one grain (0·065 Gm.), repeated twice or three times a day, and gradually increased till some effect is produced upon the head, stomach, pulse, or kidneys, when it should be omitted or reduced. The infusion and tincture are officinal preparations often resorted to. (See *Infusum Digitalis* and *Tinctura Digitalis.*) The extract has also been employed; and Orfila found it, whether prepared with water or with alcohol, more powerful than the powder. Enormous doses of this medicine have been given with asserted impunity; and, when they occasion full vomiting, it is possible that they may sometimes prove harmless; but, when the alarming effects sometimes experienced from comparatively moderate doses are considered, the practice must be condemned as exceedingly hazardous.

Digitalin has been used internally, but does not completely represent digitalis, and is of uncertain strength. The dose to begin with should not exceed the fiftieth or sixtieth of a grain (0·001 Gm.), and should not be carried beyond the twelfth (0·005 Gm.). It is much administered in the form of granules, made by saturating small globules of sugar with an alcoholic solution of digitalin. The granules of Homolle, which are commonly used in Europe, each contain a milligramme, or about the seventieth of a grain; equivalent, on the average, to perhaps a grain and a half of digitalis of medium strength. One of these globules may be given as a commencing dose. Forty of them taken with a view to suicide, though followed by copious vomiting, so that most of the poison was probably discharged, produced the most alarming prostration, with a pulse, weak, 46 to 48 in a minute, intermittent, and sometimes scarcely perceptible. The patient, however, ultimately recovered. (*Ann. de Thérap.*, 1858, p. 103.)

Off. Prep. Digitalinum, *Br.;* Abstractum Digitalis, Extractum Digitalis, *U. S.;* Extractum Digitalis Fluidum; Infusum Digitalis; Tinctura Digitalis, *U. S.*

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* M. Hoffman, during a period of 44 days, took 16 baths prepared with 300 litres of water and 250 grammes of digitalis leaves. After the third bath he began to feel the effects of the medicine; namely a peculiar uneasiness, and a reduction of the pulse 4 or 5 pulsations per minute; and this condition persisted several hours. At the eighth bath the uneasiness was increased, and the pulse decreased from 68 to 51. After the sixteenth bath, the pulse fell to 48. (*Journ. de Pharm. et de Chim.*, Juillet, 1867, p. 37.)

DULCAMARA. *U.S., Br.* *Dulcamara.* [*Bittersweet.*]

(DŬL-CA̦-MĀ'RA̦.)

"The young branches of Solanum Dulcamara. Linné. (*Nat. Ord.* Solanaceæ.)" *U. S.* "The dried young branches of Solanum Dulcamara, Bittersweet, from indigenous plants which have shed their leaves." *Br.*

Stipites Dulcamaræ, *P.G.;* Tiges de Douce-amère (de Nevrelle grimpante), Douce-amère, *Fr.;* Bittersüss, Bittersüss-Stengel, Alpranken, *G.;* Dulcamara, *It., Sp.*

Gen. Ch. Corolla wheel-shaped. *Anthers* somewhat coalescing, opening by two pores at the apex. *Berry* two-celled. *Willd.*

This genus includes numerous species, of which several have been used in medicine. Besides *S. Dulcamara*, which is the only officinal species, a few others merit notice. 1. *Solanum nigrum*, the *common garden* or *black nightshade*, is an annual plant from one to two feet high, with an unarmed herbaceous stem, ovate, angular-dentate leaves, and white or pale violet flowers, arranged in peduncled nodding umbel-like racemes, and followed by clusters of spherical black berries, about the size of peas. There are numerous varieties of this species, one of which is a native of the United States. The leaves are the part employed. They are said to produce diaphoresis, sometimes diuresis and moderate purging, and in large doses nausea and giddiness. As a medicine they have been used in cancerous, scrofulous, and scorbutic diseases, and other painful ulcerous affections, being given internally, and applied at the same time to the parts affected in the form of poultice, ointment, or decoction. A grain of the dried leaves may be given every night, and gradually increased to ten or twelve grains, or till some sensible effect is experienced. The medicine, however, is scarcely used at present. By some persons the poisonous properties ascribed to the common nightshade are doubted. M. Dunal, of Montpellier, states, as the result of numerous experiments, that the berries are not poisonous to man or the inferior animals; and the leaves are said to be consumed in large quantities in the Isles of France and Bourbon as food, having been previously boiled in water. In the latter case, the active principle of the plant must have been extracted by decoction. 2. The leaves, stalks, and unripe berries of *Solanum tuberosum*, or the *common potato*, are asserted to be narcotic; and an extract prepared from the leaves has been employed in cough and spasmodic affections, in which it is said to act like opium. (*Geiger.*) Dr. Latham, of London, found the extract to produce favorable effects in protracted cough, chronic rheumatism, angina pectoris, cancer of the uterus, etc. On the other hand, Dr. Worsham, of Philadelphia, found the extract, in the quantity of nearly one hundred grains, to produce no sensible effect. (*Phila. Journ. of the Med. and Phys. Sciences*, vi. 22.) We can reconcile these opposite statements only upon the supposition that the properties of the plant vary with the season, or with the place and circumstances of culture. Dr. Julius Otto found *solanine* in the germs of the potato. He was induced to make the investigation by observing that cattle were destroyed by feeding on the residue of germinating potatoes, used for the manufacture of brandy. A case of death in a girl of fourteen, from eating the unripe fruit of the potato, is recorded in the *British Med. Journ.* for Sept. 3, 1859. The prominent symptoms were partial stupor, speechlessness, jactitation, hurried breathing, lividness of the skin, cold sweats, very frequent and feeble pulse, and a constant spitting through the closed teeth of viscid frothy phlegm. Death occurred on the second day. C. Haaf has found the same alkaloid in old potatoes which had begun to germinate, in the proportion of 0·16 in 500 parts; and in very young potatoes, deprived of their coating, precisely the same quantity. Fully ripe potatoes, which had not begun to sprout, gave a negative result. (*Neues Repert. für Pharm.*, 1864, p. 559.) 3. The well-known *tomato*, so much used as a vegetable at the table, and so advantageous through its nutritive, laxative, and antiscorbutic properties, is the fruit of a species of Solanum, denominated *S. Lycopersicum.* The juice of the fruit is free from solanine, but contains several acids. Mr. T. D. McElhenie demonstrated the presence of citric, malic, and oxalic acids. (See *A. J. P.*, 1872, p. 198.) The seeds probably contain the alkaloid, as their alcoholic extract has a bitter, pungent taste. (See *A. J. P.*, xxxiv. 519.) Solanine has been obtained from the leaves and herbaceous part of the plant generally, by Mr. Geo. W. Kennedy.

(*P. J. Tr.*, 1873, p. 606.) An infusion of the leaves is strongly recommended by M. Stanislaus Martin as a diuretic. (*Am. J. of Med. Sci.*, 1873, p. 246.) 4. Several instances of poisoning are on record from the fruit of *S. pseudocapsicum*, or *Jerusalem cherry*, which, from its resemblance to the common cherry, is liable to be eaten by children. 5. In the *Edin. Med. Journ.* (1867, p. 398), several cases are recorded by Dr. Manners, of Jamaica, W. I., of poisoning by the *susumber berries*, of which one proved fatal, and several others recovered, probably in consequence of the early evacuation of the stomach by a mustard emetic. The symptoms recorded were anxious countenance, dilated pupil, cold skin, and difficult articulation. The fatal case was not seen by Dr. Manners till after death. The susumber berries are the fruit of a species of Solanum, denominated by Lunnan, in his "Hortus Jamaicensis," *S. bacciferum*, of which there are two varieties, one relatively innocent, as its fruit is habitually used by the natives, the other poisonous, as would be inferred from the cases here noticed. 6. The *Solanum paniculatum*, called *jerubeba* in Brazil, is said to be largely used in South America, in affections of the liver and spleen, catarrh of the bladder, anæmia, and amenorrhœa. The leaves, fruit, and root are used, externally in the form of a plaster, internally in the form of syrup, wine, and extract. (*London Lancet*, 1866, p. 158.)

Solanum Dulcamara. Willd. *Sp. Plant.* i. 1028; Woodv. *Med. Bot.* p. 237, t. 84; Bigelow, *Am. Med. Bot.* i. 169. The *bittersweet* or *woody nightshade* is a climbing shrub, with a slender, roundish, branching, woody stem, which, in favorable situations, rises six or eight feet in height. The leaves are alternate, petiolate, ovate, pointed, veined, soft, smooth, and of a dull green color. Many near the top of the stem are furnished with lateral projections at their base, giving them a hastate form. Some have the projection only on one side. Most of them are quite entire, some cordate at the base. The flowers are disposed in elegant clusters, somewhat analogous to cymes, and standing opposite to the leaves. The calyx is very small, purplish, and divided into five blunt, persistent segments. The corolla is wheel-shaped, with five pointed, reflected segments, which are of a violet blue color, with a darker purple vein running longitudinally through their centre, and two shining greenish spots at the base of each. The filaments are very short, and support large, erect, lemon-yellow anthers, which cohere in the form of a cone around the style. The berries are of an oval shape and a bright scarlet color, and continue to hang in beautiful bunches after the leaves have fallen.

This plant is common to Europe and North America. In the United States it extends from New England to Ohio, and is in bloom from June to August. The root and stalk have medicinal properties, though the latter only is officinal. A case, however, of death caused by the use of the berries by a child has been recorded. (See *P. J. Tr.*, 1861, p. 436.) Bittersweet should be gathered in autumn, after the fall of the leaf; and the extreme twigs should be selected. That grown in high and dry situations is said to be the best.

The dried twigs, as brought to the shops, are of various lengths, cylindrical, about as thick as a goose-quill, externally wrinkled, and of a grayish ash color, consisting of a thin bark, an interior ligneous portion, and a central pith. They are inodorous, though the stalk in the recent state emits, when bruised, a peculiar, rather nauseous smell. Their taste, which is at first bitter and afterwards sweetish, has given origin to the name of the plant. "About a quarter of an inch (6 mm.) or less, thick, cylindrical, somewhat angular, longitudinally striate, more or less warty, usually hollow in the centre, cut into short sections. The thin bark is externally pale greenish, or light greenish brown, marked with alternate leaf-scars, and internally green; the greenish or yellowish wood forms one or two concentric rings. Odor slight; taste bitter, afterwards sweet." *U. S.* Boiling water extracts all their virtues. These are supposed to depend, at least in part, upon an alkaloid called *solanine* or *solania*, which was originally discovered by M. Desfosses, of Besançon, in the berries of *Solanum nigrum*, and has subsequently been found in the stalks, leaves, and berries of *S. Dulcamara* and *S. tuberosum*.* Winckler (1841) first observed that the alkaloid of dulcamara stems can be obtained only in an amorphous state, and that it behaves to platinic and mercuric chlorides differently from the solanine of potatoes. Moitessier (1856) confirmed this observation, and obtained only amorphous salts of the solanine of bittersweet. Zwenger and Kind on the one hand, and O. Gmelin on the other (1859 and 1858), found that solanine, $C_{43}H_{69}NO_{16}$ (or $C_{42}H_{87}NO_{15}$, according to Hilger, 1879), is a compound of sugar and a peculiar crystallizable alkaloid, *solanidine*, $C_{25}H_{39}NO$. The latter, under the influence of strong hydrochloric acid, gives up water, and is converted into the amorphous and basic compound *solanicine*. Wittstein (1852) supposed another alkaloid, *dulcamarine*, to be present, but Geissler (1875) showed that this substance was a glucoside, and not an alkaloid, yielding on decomposition with dilute acids *dulcamaretin* and sugar. He assigned the formula $C_{22}H_{34}O_{10}$ to dulcamarine, and $C_{16}H_{26}O_6$ to dulcamaretin. (Flückiger, *Pharmacographia*, 2d ed., p. 451.) *Solanine* is in the form of a white opaque powder, or of delicate acicular crystals, somewhat like those of sulphate of quinine, though finer and shorter. It is inodorous, of a bitter taste, fusible at a little above 100° C. (212° F.), scarcely soluble in water, soluble in alcohol and ether, and capable of neutralizing the acids. It is distinguished by the deep brown, or brownish yellow color which iodine imparts to its solution, and by its reaction with sulphuric acid, which becomes first reddish yellow, then purplish violet, then brown, and lastly, again colorless, with the deposition of a brown powder.* Given to a cat, it was found by M. Desfosses to operate at first as an emetic, and afterwards as a narcotic. Dr. J. Otto observed, among its most striking effects, a paralytic condition of the posterior limbs of animals. One grain of the sulphate of solanine was sufficient to destroy a rabbit in six hours. Dr. Frass did not observe paralysis of the lower limbs of animals as one of its effects. Given to different animals, he found it to occasion loss of appetite, vomiting, sometimes diarrhœa, excitement of the circulation, dilatation of the pupils, and, in large doses, heaviness, apathy, slowness of movement, and sometimes convulsions. Injected into the jugular vein, it caused accelerated circulation, difficult and even spasmodic respiration, convulsions, tetanic spasms, and death. Two grains of the acetate, injected into the rectum of a rabbit, killed it in six hours. Ten grains given to a dog, and confined by a ligature round the œsophagus, though it occasioned great disturbance, did not prove fatal. Twenty grammes (ʒv) produced no effect on a hog. (*B. & F. Medico-Chirurg. Rev.*, Am. ed., July, 1854, p. 189.) Besides solanine, the stalks of *S. Dulcamara* contain, according to Pfaff, a peculiar principle to which he gave the name of *picroglycion*, indicative of the taste, at once bitter and sweet, which it is said to possess. This was obtained by Blitz, in the following manner. The watery extract was treated with alcohol, the tincture evaporated, the residue dissolved in water, the solution precipitated with subacetate of lead, the excess of this salt decomposed by sulphuretted hydrogen, the liquor then evaporated to dryness, and the residue treated with acetic ether, which yielded the principle in small isolated crystals by spontaneous evaporation. Pfaff found also in dulcamara a vegeto-animal substance, gummy extractive, gluten, green wax, resin, benzoic acid, starch, lignin, and various salts of lime.

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* Solanine is most conveniently obtained from the sprouts of the common potato. The following is Wackenroder's process for extracting it. The sprouts, collected in the beginning of June, and

Medical Properties and Uses. Dulcamara possesses feeble narcotic properties, with the power of increasing the secretions, particularly those of the kidneys and

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pressed down in a suitable vessel by means of pebbles, are macerated for twelve or eighteen hours in water enough to cover them, previously acidulated with sulphuric acid, so as to have a strongly acid reaction during the maceration. They are then expressed by the hand; and the liquor, with the addition of fresh portions of sulphuric acid, is added twice successively, as at first, to fresh portions of sprouts, and in like manner separated by expression. After standing for some days it is filtered and treated with powdered hydrate of lime in slight excess. The precipitate which forms is separated by straining, dried in a warm air, and boiled several times with alcohol. The alcoholic solution, having been filtered while hot, will, upon cooling, deposit the solanine in flocculent crystals. An additional quantity of the alkaloid may be obtained by evaporating the mother-liquor to one-quarter, and then allowing it to cool. The whole residuary liquor will assume a gelatinous consistence, and, upon being dried, will leave the solanine in the form of a translucent, horny, amorphous mass. (*Pharm. Centralb.*, 1843, p. 174.)

* The following reaction is proposed as a test for solanine. Equal measures of concentrated sulphuric acid and alcohol are mixed. A trace of solanine added to the mixture, while warm, produces a rose-red color; larger quantities, a cherry-red color, which disappears after five or six hours, and the intensity of which is not affected by the presence of morphine even in large quantities. (*A. J. P.*, 1873, p. 484.)

skin. We have observed, in several instances, when the system was under its influence, a dark purplish color of the face and hands, and at the same time considerable languor of the circulation. Its narcotic effects do not become obvious unless when it is taken in large quantities. In overdoses it produces nausea, vomiting, faintness, vertigo, and convulsive muscular movements. A case is recorded in Casper's *Wochenschrift*, in which a man took, in one forenoon, from three to four quarts of a decoction made from a peck of the stalks, and was attacked with pain in the joints, numbness of the limbs, dryness of the mouth, and palsy of the tongue, with consciousness unimpaired, the pulse quiet, but small and rather hard, and the skin cool. The symptoms disappeared under the use of stimulants. (*Lond. Med. Gaz.*, 1850, p. 548.)* Dulcamara has been recommended in various diseases, but is now chiefly employed in the treatment of cutaneous eruptions, particularly those of a scaly character, as lepra, psoriasis, and pityriasis. In these complaints it is often beneficial, especially in combination with minute doses of the antimonials. Its influence upon the secretions is insufficient to account for its favorable effects. Perhaps they may be ascribed to its sedative influence on the capillary circulation. It is said to have been beneficially employed in chronic rheumatism and chronic catarrh. Antaphrodisiac properties have been ascribed to it. We have seen it apparently useful in mania connected with strong venereal propensities. The usual form of administration is that of decoction, of which two fluidounces may be taken four times a day, and gradually increased till some slight disorder of the head indicates the activity of the medicine. (See *Decoctum Dulcamaræ.*) An extract and fluid extract are officinal. The dose of the former is from five to ten grains (0·33–0·65 Gm.), of the latter from thirty minims to a fluidrachm (1·9–3·75 C.c.) That of the powder would be from thirty grains to a drachm (1·95–3·9 Gm.). In cutaneous affections, a strong decoction is often applied to the skin at the same time that the medicine is taken internally.

Off. Prep. Extractum Dulcamaræ Fluidum, *U. S.;* Infusum Dulcamaræ, *Br.*

ELATERINUM. *U. S.* *Elaterin.*

$C_{20}H_{28}O_5$; 348. (ĔL-Ạ-TẸ-RĪ'NŬM.) $C_{40}H_{28}O_{10}$; 348.

"A neutral principle extracted from Elaterium, a substance deposited by the juice of the fruit of Ecbalium Elaterium. A. Richard. (*Nat. Ord.* Cucurbitaceæ.)" *U. S.*

This is a new officinal; its introduction into the present Pharmacopœia is due to the well-known variability in the quality of commercial elaterium. (See *Elaterium.*) It is believed that the new officinal preparation, "Trituratio Elaterini," which contains a definite quantity of elaterin with sugar of milk, will be more satisfactory than the elaterium of commerce. Theoretically this view is correct, yet care must be taken to examine the elaterin, which is itself liable to be adulterated. It is in "small, colorless, shining, hexagonal scales or prisms, permanent in the air, odorless, having a bitter, somewhat acrid taste and a neutral reaction. Insoluble in water; soluble in 125 parts of alcohol at 15° C. (59° F.); in 2 parts of boiling alcohol, in 290 parts of ether, and also in solutions of the alkalies, from which it is precipitated by supersaturating with an acid. When heated to 200° C. (392° F.), the crystals turn yellow and melt; on ignition they are wholly dissipated. A solution of Elaterin in cold, concentrated sulphuric acid assumes a yellow color gradually changing to red. The alcoholic solution should not be precipitated by tannic acid nor by salts of mercury or of platinum (abs. of, and difference from alkaloids)." *U. S.* It has no alkaline reaction. It may be procured by evaporating an alcoholic tincture of elaterium to the consistence of thin oil, and throwing the residue while yet warm into a weak boiling solution of potassa. The potassa holds the green resin in solution, and the elaterin crystallizes as the liquor cools. Mr. Hennell obtained it by treating with ether the alcoholic extract procured by the spontaneous evaporation of the tincture. This consists of elaterin and the green resin, the latter of which, being much more soluble in ether than the former, is completely extracted by this fluid, leaving the elaterin pure. But, as elaterin is also slightly soluble in ether, a portion of this principle is wasted by Mr. Hennell's method. By evaporating the ethereal solution, the green resin is obtained separate. Mr. Hennell says that this was found to possess the purgative property of elaterium, as it acted powerfully in a dose less than one-third of a grain. But the effect was probably owing to the presence of a portion of elaterin which had been dissolved by the ether. Flückiger prefers to exhaust elaterium with chloroform, and add to the percolate ether, which precipitates elaterin. The precipitate may be dissolved in chloroform and recrystallized.

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* Prof. Caylus, of Leipsic, has made numerous experiments upon man and animals, in relation to the physiological effects and relative strength of dulcamara, and its preparations, including solanine, with the following results. 1. They are poisonous, and may prove fatal in overdoses. 2. In the character of their operation they are identical. 3. The extract of the twigs is from five to ten times stronger than the twigs themselves, that of solanine 30 times stronger than the extract. 4. They produce congestion of the kidneys, and sometimes an increased flow of urine, which, in that case, is always albuminous. 5. They cause a constant and remarkable diminution in the frequency of respiration, and death from their action is ascribed to a paralyzing influence on the respiratory nerve-centres. 6. In the last period of their operation, they weaken while they accelerate the action of the heart. 7. Prof. Caylus thinks that they act especially on the spinal marrow and medulla oblongata, as evinced not only by their influence on the breathing, but also by the tetanic contraction they occasioned in the muscles of the chest and extremities. 8. They produce little direct effect on the brain, and cause but a feeble contraction of the pupil. 9. They increase the sensibility of the skin, and have no direct irritant influence on the stomach and bowels.

They are applicable, the professor thinks, to spasmodic and irritative affections of the respiratory organs; and inflammation either of the lungs or bowels constitutes no contraindication to them. He recommends solanine in the form of acetate, in the dose of from one-sixth of a grain to a grain. He prefers the alcoholic extract to the aqueous. (*Ann. de Thérap.*, 1859, p. 24, and *Arch. Gén.*, Mars, 1859, p. 350.)

Medical Properties. The late Dr. Duncan, of Edinburgh, ascertained that elaterin produced, in the quantity of $\frac{1}{12}$ or $\frac{1}{16}$ of a grain (0·005 or ·004 Gm.), all the effects of a dose of elaterium. These doses are, however, probably too large, and it would scarcely be safe to commence with more than $\frac{1}{20}$ of a grain (0·003 Gm.).

Mr. Morries obtained 26 per cent. from the best British elaterium, 15 per cent. from the worst, and only 5 or 6 per cent. from the French; while a portion, procured according to the directions of the London College, yielded to Mr. Hennell upwards of 40 per cent. The Br. Pharmacopœia directs that the proportion of elaterin should not be less than 20 per cent. Experiments by Mr. John Williams satisfactorily prove that the fruit, exhausted of the free juice from which elaterium is obtained, contains very little if any elaterin, certainly not enough to compensate for the cost of its extraction. (*Chem. News*, 1860, p. 124.)

Off. Prep. Trituratio Elaterini, *U. S.*

ELATERIUM. *Br.* *Elaterium.*

(ĔL-Ạ-TĒ′RỊ-ŬM.)

"A sediment from the juice of the Squirting Cucumber fruit." *Br.*

The British Pharmacopœia recognizes the fruit under the name of *Ecbalii Fructus, Squirting Cucumber Fruit,* and defines it as the fruit, very nearly ripe, of Ecbalium officinarum.

Elaterium, Elaterion, *Fr.;* Elaterium, *G.;* Elaterio, *It., Sp.*

Gen. Ch. MALE. *Calyx* five-cleft. *Corolla* five-parted. *Filaments* three. FEMALE. *Calyx* five-cleft. *Corolla* five-parted. *Style* trifid. *Gourd* bursting elastically. *Willd.*

Momordica Elaterium. Willd. *Sp. Plant.* iv. 605; Woodv. *Med. Bot.* p. 192, t. 72.—*Ecbalium agreste.* Richard; Lindley, *Med. and Œcon. Bot.* p. 95.—*Ecbalium officinarum.* Br.—*Ecbalium Elaterium.* French Codex, 1837. The *wild* or *squirting cucumber* is a perennial plant, with a large fleshy root, from which rise several round, thick, rough stems, branching and trailing like the common cucumber, but without tendrils. The leaves are petiolate, large, rough, irregularly cordate, and of a grayish green color. The flowers are yellow, and proceed from the axils of the leaves. The fruit has the shape of a small oval cucumber, about an inch and a half long, an inch thick, of a greenish or grayish color, and covered with stiff hairs or prickles. When fully ripe, it separates from the peduncle, and throws out its juice and seeds with considerable force through an opening at the base, where it was attached to the footstalk. The name of squirting cucumber was derived from this circumstance, and the scientific and officinal title is supposed to have had a similar origin; though some authors maintain that the term *elaterium* was applied to the medicine rather from the mode of its operation upon the bowels, than from the projectile property of the fruit.*

This species of Momordica is a native of the south of Europe, and is cultivated in Great Britain, where, however, it perishes in the winter. Elaterium is the substance spontaneously deposited by the juice of the fruit, when separated and allowed to stand. From the experiments of Dr. Clutterbuck, it has been supposed that only the free juice about the seeds, which is obtained without expression, affords the product. The substance of the fruit itself, the seeds, as well as other parts of the plant, have been thought to be nearly or quite inert. From the statements made by Mr. Bell (see note below), these opinions must probably be somewhat modified; but there is no doubt that strong expression injures the product. When the fruit is sliced and placed upon a sieve, a perfectly limpid and colorless juice flows out, which soon becomes turbid, and in the course of a few hours begins to deposit a sediment. This, when collected and carefully dried, is very light and pulverulent, of a yellowish white color, slightly tinged with green. It is the genuine elaterium, and was found by Clutterbuck to purge violently in the dose of one-eighth of a grain. But the quantity contained in the fruit is very small. Clutterbuck obtained only six grains from forty cucumbers. Commercial elaterium is often a weaker medicine, owing in part, perhaps, to adulteration, but much more to the mode in which it is prepared. In order to increase the product, the juice of the fruit is often expressed with great force; and there is reason to believe that it is sometimes evaporated so as to form an extract, instead of being allowed to deposit the active matter. The French elaterium is prepared by expressing the juice, clarifying it by rest and filtration, and then evaporating to a suitable consistence. As the liquid remaining after the deposition of the sediment is comparatively inert, it will be perceived that the preparation of the French Codex must be relatively feeble. The following are the directions of the British Pharmacopœia. "Cut the fruit lengthwise, and lightly press out the juice. Strain it through a hair sieve, and set aside to deposit. Carefully pour off the supernatant liquor; pour the sediment on a linen filter, and dry it on porous tiles, with a gentle heat. The decanted fluid may deposit a second portion of sediment, which can be dried in the same way." The latter portion deposited is of a lighter color. (*Pereira.*) The slight pressure directed is necessary for the separation of the juice from the somewhat immature fruit employed. The perfectly ripe fruit is not used; as, in consequence of its disposition to part with its contents, it cannot be carried to market. In the British Pharmacopœia, the former name of Extractum Elaterii of the London College has been very properly abandoned; as the preparation is in no correct sense of the word an extract. Elaterium is brought chiefly from England; but it is probable that a portion of the elaterium, of which Dr. Pereira speaks as coming from Malta, reaches our market also.†

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* From the Greek ἐλαύνω, I drive, or ἐλατήρ, driver. The word *elaterium* was used by Hippocrates to signify any active purge. Dioscorides applied it to the medicine of which we are treating.

† The following notice of the cultivation of the elaterium plant, and the preparation of the drug at Mitcham, in Surrey, England, condensed from a paper by Mr. Jacob Bell in the *P. J. Tr.* for October, 1850, may have some interest for the American reader. The seeds are sown in March, and the seedlings planted in June. In luxuriant plants the stem sometimes acquires an extraordinary breadth. In one instance, though not thicker than the forefinger where it issued from the earth, it was in its broadest part four inches wide and half an inch thick. A wet season interferes with the productiveness of the plant. At the spontaneous separation of the fruit, it throws out its juice sometimes to the distance of twenty yards; and hazard of injury to the eyes is incurred by walking among the plants at their period of maturity. A bushel of the fruit weighs 40 pounds, and the price varies from 7 to 10 shillings sterling. In the manufacture of elaterium, which begins early in September, the fruit, having been washed, if necessary, to cleanse it from earthy matters, is sliced longitudinally into halves, and then submitted to expression, wrapped in a hempen cloth, in a common screw-press. Considerable force is used in the expression. The juice is then strained through hair, cypress, or wire sieves, and set aside for deposition. The deposit usually takes place in three or four hours. When this part of the process is completed, the supernatant liquor is carefully poured off, the deposit is placed on calico cloths resting on hair sieves, and allowed to drain for about twelve hours, after which it is removed by a knife, spread over small cloths, and dried on canvas frames in the drying stove. About half an ounce of fine elaterium is obtained from a bushel of fruit. Some obtain more; but the product is inferior, in con-

Properties. The *best elaterium* is in thin flat or slightly curled cakes or fragments, often bearing the impression of the muslin upon which it was dried, of a greenish gray color becoming yellowish by exposure, of a feeble odor, and a bitter somewhat acrid taste. It is pulverulent and inflammable, and so light that it swims when thrown upon water. When of *inferior quality*, it is sometimes dark-colored, much curled, and rather hard, breaking with difficulty, or presenting a resinous fracture. The *Maltese elaterium* is in larger pieces, of a pale color, sometimes without the least tinge of green, destitute of odor, soft, and friable, and not unfrequently gives evidence of having been mixed with chalk or starch. It sinks in water.

Dr. Clutterbuck first observed that the activity of elaterium resided in the portion of it soluble in alcohol and not in water. This fact was afterward confirmed by Dr. Paris, who found that the alcoholic extract, treated with boiling distilled water, and afterwards dried, had the property of purging in minute doses, while the remaining portion of the elaterium was inactive. The subsequent experiments of Mr. Hennell, of London, and Mr. Morries, of Edinburgh, which were nearly simultaneous, demonstrated the existence of a crystallizable matter in elaterium, which is the active principle, and has been named *elaterin.* (See *Elaterinum.*) According to Mr. Hennell, 100 parts of elaterium contain 44 of elaterin, 17 of a green resin (*chlorophyll*), 6 of starch, 27 of lignin, and 6 of saline matters. The alcoholic extract which Dr. Paris called *elatin* is probably a mixture of elaterin and the green resin or chlorophyll.[*]

Walz (1859) found in the juice of the fruits and herb of *Ecballium*, as well as in that of *Cucumis Prophetarum*, L., a second crystallizable bitter principle, *prophetin*, and the amorphous substances *ecballin* or *elateric acid*, *hydro-elaterin*, and *elateride*, all of which require further examination.

Choice of Elaterium. The inequality of elaterium depends probably more on diversities in the mode of preparation than on adulteration. Sometimes, however, it is greatly sophisticated; and large quantities are said to have been imported into this country, consisting mainly of chalk, and colored green artificially. (B.

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sequence of the use of too much force in the expression. Good elaterium has a pale pea-green tint; that of inferior quality is of a duller hue. The juice expelled in bursting is said to undergo very little change in the air, while that expressed from the ripe fruit immediately afterwards becomes milky, and deposits elaterium. The recently burst fruit, therefore, is nearly if not quite as good for the preparation of the drug as that collected before perfect maturity. For a paper on the cultivation of the elaterium plant at Hitchin, Herts, England, see *A. J. P.*, 1860, p. 163.

[*] *Chlorophyll.* The substance to which Pelletier gave this name, under the impression that it was a peculiar proximate principle, was subsequently supposed by that chemist to be a mixture of wax and a green fixed oil. (*Journ. de Pharm.*, xix. 109.) Afterwards, M. Frémy succeeded, by the joint action of a menstruum composed of two parts of ether and one of hydrochloric acid diluted with a little water, in separating chlorophyll into two coloring principles, one yellow and the other blue; the former being dissolved by the ether, and the latter by the hydrochloric acid. The yellow, M. Frémy proposed to name *phylloxanthin*, the blue *phyllocyanin.* (*Ibid.*, Avril, 1860.)

Phylloxanthin is neutral, insoluble in water, soluble in alcohol and ether, and crystallizable, sometimes in yellow plates, sometimes in reddish prisms, resembling bichromate of potassium, and possessing dyeing powers analogous to those of chromic acid.

Phyllocyanic acid is soluble in water. alcohol, and ether, giving to these an olive-like color, with bronze-red or violet reflections. All its salts are brown or green; but only the alkaline are soluble in water. This acid dissolves in sulphuric and hydrochloric acid, giving rise to solutions which, according to their strength, are green, reddish, violet, or beautifully blue. This M. Frémy considers the important fact of the investigation, as it explains the various tints which chlorophyll offers in vegetation.

According to Filhol, chlorophyll in alcoholic solution is decomposed by hydrochloric acid into four distinct coloring matters: one, rich in nitrogen, brown, and insoluble in alcohol; one, free from nitrogen, yellow, and soluble in alcohol; one blue, which forms on adding an excess of hydrochloric acid, and a yellow compound separated from this latter by ether.

Stokes also makes chlorophyll to be a mixture of four coloring substances optically different. Of these two are green and two yellow. The green colors fluoresce strongly with red tint; the yellow colors, on the contrary, do not show any fluorescence.

It follows, from all that has been said, that chlorophyll is an immediate proximate principle, of great mobility, which undergoes diversified changes of color in the progress of vegetation, and other changes, such as have been mentioned, under the influence of different reagents. (*Journ. de Pharm. et de Chim.*, 4e sér., ii. 185, 1865.)

An interesting fact in relation to chlorophyll is the part it plays in vegetable growth. By its presence in the vegetable cells, carbon is assimilated through the agency of light; while, in its absence, light alone is not able to effect such assimilation. (*Chem. News*, 1872, p. 132.)

Canavan, *N. Y. Journ. of Pharm.*, iii. 385.) It should possess the sensible properties above indicated as characterizing good elaterium, should not effervesce with acids, and should yield from one-sixth to one-fourth of elaterin. (See *Elaterinum.*)

Medical Properties and Uses. Elaterium is a powerful hydragogue cathartic, and in a large dose generally excites nausea and vomiting. If too freely administered, it operates with great violence both upon the stomach and bowels, producing inflammation of these organs, which has in some instances eventuated fatally. It also increases the flow of urine. The fruit was employed by the ancients, and is recommended in the writings of Dioscorides as a remedy in mania and melancholy. Sydenham and his contemporaries considered elaterium highly useful in dropsy; but, in consequence of some fatal results from its incautious employment, it fell into disrepute, and was generally neglected till again brought into notice by Dr. Ferriar. It is now considered one of the most efficient hydragogue cathartics in the treatment of dropsical diseases, in which it has sometimes proved successful after all other remedies have failed. The full dose of commercial elaterium, as formerly found in commerce, was often from one to two grains (0·065 to 0·13 Gm.); but, as the quality has greatly improved, this dose might now be much too large, and the best plan is to give it in the dose of a sixth to a quarter of a grain (0·01 to 0·016 Gm.), repeated every hour till it operates, and increased if necessary. It should be observed that these doses are inapplicable to the very old and feeble and those prostrated by disease. A case is recorded in which two-fifths of a grain proved fatal by excessive purging in an old lady of 70 years, in the last stage of liver and heart disease, complicated with dropsy; a result which a very little consideration would have anticipated. (*A. J. P.*, 1868, p. 373.) The dose of Clutterbuck's elaterium is the eighth of a grain (·008 Gm.), that of elaterin is from the twentieth to the sixteenth of a grain (0·003 to 0·004 Gm.). One grain may be dissolved in a fluidounce of alcohol with four drops of nitric acid, and from 25 to 30 minims may be given diluted with water, but the granule affords a preferable method.

ELEMI. *Br.* *Elemi.*

(ĔL′Ẹ-MĪ.)

"Botanical source undetermined, probably from Canarium commune. A concrete resinous exudation." *Br.* (*Nat. Ord.* Terebintaceæ, *Juss.*)

Résine élemi, *Fr.;* Oelbaumharz, Elemi, *G.;* Elemi, *It.;* Goma de Limon, *Sp.*

Gen. Ch. Calyx four-toothed. *Petals* four, oblong. *Stigma* four-cornered. *Berry* drupaceous. *Willd.*

Some botanists separate from this genus the species which have their fruit in the form of a capsule instead of a nut, and associate them together in a distinct genus with the name of *Icica.* This is recognized by De Candolle.

Most of the trees belonging to these two genera yield, when wounded, a resinous juice analogous to the turpentines. It is not improbable that the drug, usually known by the name of *elemi*, is derived from several different trees. That known to the ancients is said to have been obtained from Ethiopia, and all the elemi of commerce was originally brought from the Levant. The tree which afforded it was not accurately known, but was supposed to be a species of Amyris. At present the drug is said to be derived from three sources, namely, Brazil, Mexico, and Manilla. The Brazilian is believed to be the product of a plant mentioned by Marcgrav under the name of *icicariba*, and called by De Candolle *Icica Icicariba.* It is a lofty tree, with pinnate leaves, consisting of three or five pointed, perforated leaflets, smooth on their upper surface and woolly beneath. It is erroneously stated in some works to be a native of Carolina. The elemi is obtained by incisions into the trees, through which the juice flows and concretes upon the bark. The Mexican is said by Dr. Royle to be obtained from a species of Elaphrium, which that author has described from dried specimens, and proposes to name *E. elemiferum.* (*Mat. Med.*, Am. ed., p. 339.) The Manilla elemi is conjecturally referred to *Canarium commune.* (*Ibid.*, p. 340.)

Elemi is in masses of various consistence, sometimes solid and heavy like wax, sometimes light and porous; unctuous to the touch; diaphanous; of diversified colors, generally greenish with intermingled points of white or yellow, sometimes greenish white with brown stains, sometimes yellow like sulphur; fragile and friable when cold: softening by the heat of the hand; of a terebinthinate somewhat aromatic odor, diminishing with age, and said, in some varieties, to resemble that of fennel; of a warm, slightly bitter, disagreeable taste; entirely soluble, with the exception of impurities, in boiling alcohol; and affording a volatile oil by distillation. A variety examined by M. Bonastre was found to consist of 60 parts of resin, 24 of a resinous matter soluble in boiling alcohol, but deposited when the liquid cools, 12·5 of volatile oil, 2 of extractive, and 1·5 of acid and impurities. M. Baup found the resin to be of two kinds, one amorphous, the other crystallizable; the latter of which, as obtained from West-India elemi, he proposes to call *elemin*, and considers identical with the crystallizable resin *amyrin*, obtained from Manilla elemi. (*Journ. de Pharm.*, 3e sér., xx. 331.) Elemi is sometimes adulterated with colophony and turpentine. The Manilla elemi is in masses of a light yellowish color, internally soft, and of a strong odor of fennel. (*Royle.*) We have been told that a considerable amount of elemi is used in this country by the hatters. Dr. Emil Mannkoff obtained from Brazilian elemi about 6 per cent. of a colorless volatile oil, insoluble in water, but easily dissolved both by alcohol and ether, of a not unpleasant odor, and a somewhat acrid and bitter taste. (*B. & F. Medico-Chir. Rev.*, July, 1859, p. 170.) Prof. Flückiger obtained as much as 10 per cent. of essential oil from Manilla elemi. He found it to be a fragrant, colorless, neutral oil of sp. gr. 0·861 at 15° C. (59° F.), and strongly dextrogyrate. Deville, on the other hand, obtained an oil equally strongly lævogyrate. It consists chiefly of a terpene, $C_{10}H_{16}$, and is in many respects like oil of turpentine.

Medical Properties and Uses. Elemi has properties analogous to those of the turpentines, but is exclusively applied to external use. In the United States it is rarely employed even in this way. In the pharmacy of Europe it enters into the composition of numerous plasters and ointments. We are told that it is occasionally brought to this country in small fragments mixed with the coarser kinds of gum arabic from the Levant and India.

Off. Prep. Unguentum Elemi, *Br.*

ELIXIRIA. *Elixirs.*

(ĔL-I̤X-ĬR′I̤-A̤—ĕl-i̤k-sĭr′e̤-a̤.)

Elixirs as they are known in modern American pharmacy are aromatic, sweetened, spirituous preparations, containing small quantities of active medicinal substances. They differ greatly from the liquids formerly termed elixirs, from the fact that the first object sought for in the modern elixir is an agreeable taste, and usually this is attained only by such sacrifices as to render the effect of the medicine almost *nil*, whilst the principal activity is due to the alcohol, which has proved in many cases very injurious. These considerations have heretofore prevented an official recognition of elixirs, and the present Pharmacopœia recognizes but one, *i.e.*, elixir of orange, which has been introduced merely as a vehicle. Owing to their extensive use by practitioners all over our country, it becomes necessary to notice some of the most important in this commentary. For the convenience of the pharmacist they are grouped together below.*

* *Elixir of Bismuth.* Dissolve 256 grains of ammonio-citrate of bismuth in 4 fluidounces of distilled water; mix with 12 fluidounces of simple elixir, and filter. (C. S. Diehl.)

Elixir of Beef, Wine, and Iron, usually called, simply, *Beef, Wine, and Iron.* Extract beef (Liebig's), ½ ounce av.; ammonio-citrate of iron, 256 grains; spirit of orange (1 to 10), ½ fluidounce; distilled water, 1½ fluidounces; sherry wine, sufficient to make 16 fluidounces.

Dissolve the ammonio-citrate of iron in the water; dissolve the extract of beef in the sherry wine; add the spirit of orange, and mix the solutions.

Elixir of Bromide of Potassium. One fluidrachm contains 5 grains of the salt. Bromide of potassium, 640 grains; elixir of orange, 16 fluidounces.

Dissolve and filter. (W. S. Thompson.)

Elixir of Bromide of Ammonium and *Elixir of Bromide of Sodium* are prepared like Elixir of Bromide of Potassium, substituting the proper salts.

Elixir Calisayæ. Calisaya Elixir. Sulphate of quinine, 72 grains; sulphate of cinchonine, 24 grains; sulphate of quinidine, 20 grains; sulphate of cinchonidine, 12 grains; elixir of orange, 8 pints; caramel, q. s.

Triturate the mixed sulphates with one pint of the elixir; pour the mixture into a glass flask,

ELIXIR AURANTII. *U. S.* *Elixir of Orange.* [*Simple Elixir.*]

(Ẹ-LĬX'ỊR ÂU-RĂN'TỊ-Ī—ẹ-lĭk'sụr âw-răn'shẹ-ī.)

"Oil of Orange, *one part* [or two and a half fluidrachms]; Cotton, *two parts* [or half an ounce av.]; Sugar, in coarse powder, *one hundred parts* [or twenty-five and heat in a water-bath until the solution is effected; while still hot, add the remainder of the elixir and caramel; when cold, filter. (W. S. Thompson.)

Elixir of Calisaya Bark. Calisaya bark, 24 troyounces; Curaçoa orange peel (ribbons), 16 troyounces; coriander, 4 troyounces; cardamom, 1½ troyounces; cinnamon, 3 troyounces; anise, 1 troyounce; cocoa (Baker's), 8 troyounces.

Reduce to a moderately fine powder, displace with a mixture consisting of one part, by measure, of strong alcohol, and three parts of water; obtain 2½ gallons of percolate.

Meanwhile, prepare from six pints of solution of tersulphate of iron, hydrated oxide of iron, by the formula of the Pharmacopœia, measure it, and add to every four measures one measure of alcohol; then add of this sufficient of the percolate obtained as above to deprive it of its cinchotannic acid. The absence of the latter is readily ascertained by the addition of a drop of tincture of chloride of iron to a filtered portion of the liquid in operation, which should not be colored by such addition. Should coloration result, the intensity or faintness will serve as a guide to the further quantity of hydrated oxide of iron necessary to completely detannate the preparation. As soon as this result is attained, strain the mixture upon a muslin strainer, and when the liquid ceases to pass, wash the residue upon the strainer with sufficient of a mixture of 1 measure of stronger alcohol to 3 of water, to make the strained liquid measure 5 gallons. Now triturate together oil of orange (fresh) ½ fluidounce (or solution of 5 fluidounces), with precipitated chalk 6 ounces. When thoroughly mixed, incorporate it with the strained liquid obtained as above, agitate well, and filter through paper. Express the filter between muslin, filter the expressed liquid, and mix with the previous filtrate, in which dissolve 15 lbs. of sugar. If necessary, the elixir should be filtered, but simple straining will usually answer. (C. L. Diehl.)

Ferrated Elixir of Calisaya, or *Elixir of Calisaya and Iron.* [One fluidrachm contains 2 grains of the ammonio-citrate of iron.] Citrate of iron and ammonium, 256 grains; calisaya elixir, 16 fluidounces.

Dissolve and filter. (W. S. Thompson.)

Elixir of Calisaya, Iron, and Bismuth. [One fluidrachm contains 2 grains of the ammonio-citrate of iron and 1 grain of the ammonio-citrate of bismuth.] Citrate of bismuth and ammonium, 128 grains; elixir of calisaya and iron, 16 fluidounces; water of ammonia, q. s.

Dissolve the citrate of bismuth and ammonium in the elixir; add water of ammonia carefully until the reaction is perfectly neutral, then filter. (W. S. Thompson.)

Elixir of Chloral Hydrate. Dissolve 2 ounces of chloral hydrate in 1 pint of simple elixir, and filter.

Elixir of Coca Leaves. Fluid extract of coca, 21 fluidounces, 160 minims; alcohol, 13 fluidounces; glycerin, 5 fluidounces; Curaçoa flavor, 5 fluidounces; sherry wine, 8 fluidounces; solution of caustic soda (sp. gr. 1·22), ½ fluidounce; elixir of orange, sufficient to make 1 gallon.

The soda is added to increase the activity. (Gardner.)

Elixir of Corydalis, Compound (*Turkey Corn*). Elixir of orange, 10 fluidounces; stronger alcohol, 2 fluidounces; fluid extract of corydalis, 1 fluidounce; fluid extract of stillingia, 1 fluidounce; fluid extract of prickly ash bark, 4 fluidounces; fluid extract of blue flag, 1½ fluidounces; iodide of potassium, 360 grains.

Mix the liquids in the above order; dissolve in the mixture the iodide of potassium, set aside for twenty-four hours, and then filter.

Elixir of Gentian. Fluid extract of gentian, 1 fluidounce; elixir of orange, 15 fluidounces.

Mix and filter. (W. S. Thompson.)

Elixir of Gentian and Iron. [One fluidrachm contains 1 grain of pyrophosphate of iron.] Pyrophosphate of iron, 128 grains; elixir of gentian, 16 fluidounces.

Dissolve and filter. (W. S. Thompson.)

Elixir of Guarana. [Ten grains to each fluidrachm.] Fluid extract of guarana, 2 fluidounces; stronger alcohol, 2 fluidounces; elixir of orange, 8 fluidounces.

Mix and filter.

Elixir of Hops. Add 2½ fluidounces of fluid extract of hops (made according to formula for F. E. Gentian, U. S.) to 13½ fluidounces of *simple elixir;* mix and filter.

Elixir of Iron and Quinine. Citrate of iron and quinine, 256 grains; distilled water, 1 fluidounce; simple elixir, 15 fluidounces.

Dissolve and mix.

Elixir of Liquorice (*Aromatic*). Oil of cloves, 5 minims; oil of true cinnamon, 3 minims; simple syrup, ½ pint; alcohol, 6 fluidounces; fluid extract of liquorice, U. S. P., 2 fluidounces.

Dissolve the oils in the alcohol, add to the syrup and fluid extract, filter after the addition of a drachm of carbonate of magnesia. (Remington.)

Elixir of Pepsin and Bismuth. [One fluidrachm contains 2 grains each of saccharated pepsin and ammonio-citrate of bismuth.] Saccharated pepsin, 256 grains; citrate of bismuth and ammonium, 256 grains; stronger alcohol, 2 fluidounces; rose water, 2 fluidounces; sugar, 5 ounces; caramel, 30 minims; water, q. s.; water of ammonia, q. s.

Dissolve the citrate of bismuth and ammonium in eight fluidounces of water, filter and dissolve the pepsin, and then the sugar, in the filtrate without heat. Mix the alcohol and rose water, and add the mixture to the solution. Neutralize the elixir carefully with water of ammonia, add the ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *three hundred parts* [about four pints]. Mix Alcohol and Water in the proportion of *one part* [or one pint] of Alcohol to *three parts* [or two and a half pints] of Water. Add the Oil of Orange to the Cotton, in small portions at a time, distributing it thoroughly by picking the Cotton apart after each addition; then pack tightly in a conical percolator, and gradually pour on the mixture of Alcohol and Water, until *two hundred parts* [or three and a quarter pints] of filtered liquid are obtained. In this liquid dissolve the Sugar by agitation, without heat, and strain." *U. S.*

This is a new officinal preparation. Its introduction grew out of the necessity for some official action, which would enable pharmacists to readily furnish elixirs when called for by an extemporaneous or speedy process. The elixir of orange is, of course, merely a base or vehicle, and in many cases the medicinal substance may be simply dissolved in the elixir. It may be necessary to add some insoluble, inert powder, like precipitated chalk, carbonate of magnesium, etc., to the liquid before filtering, in order to obtain a perfectly transparent elixir, and it is customary in many parts of the country to color the preparation with cochineal or caramel.

caramel, and strain through canton flannel, without pressure, adding enough water through the strainer to make the finished elixir measure one pint.

Elixir of Pepsin, Bismuth, and Strychnine. [One fluidrachm contains 2 grains each of saccharated pepsin and ammonio-citrate of bismuth, and $\frac{1}{64}$ of a grain of sulphate of strychnine.] Sulphate of strychnine, 2 grains; elixir of pepsin and bismuth, 16 fluidounces.

Dissolve.

Elixir of Pyrophosphate of Iron. Soften 256 grains of pyrophosphate of iron in ½ fluidounce of water; add 15½ fluidounces of simple elixir; mix and filter.

Elixir of the Phosphates of Iron and Quinine. [One fluidrachm contains 1 grain of pyrophosphate of iron, and ½ grain of the alkaloid quinine.] Quinine (alkaloid), 64 grains; pyrophosphate of iron, 128 grains; stronger alcohol, 2 fluidounces; water, 3 fluidounces; syrup, 3 fluidounces; elixir of orange, 8 fluidounces.

Dissolve the quinine in the alcohol, and the pyrophosphate of iron in the water. Mix the two solutions, add the syrup and the elixir. Filter if necessary. (W. S. Thompson.)

Elixir of the Phosphates of Iron, Quinine, and Strychnine. [One fluidrachm contains 1 grain of pyrophosphate of iron, ½ grain of quinine, and $\frac{1}{64}$ grain of strychnine.] Strychnine, 2 grains; quinine, 64 grains; pyrophosphate of iron, 128 grains; stronger alcohol, 2 fluidounces; water, 3 fluidounces; syrup, 3 fluidounces; elixir of orange, 8 fluidounces.

Dissolve the strychnine, and afterwards the quinine, in the alcohol. Dissolve the pyrophosphate of iron in the water. Mix the two solutions and add the syrup and the elixir. Filter, if necessary. (W. S. Thompson.)

Elixir of Pyrophosphate of Iron, Quinine, and Strychnine. Sulphate of quinine, 60 grains; strychnine, 1 grain; citric acid, 5 grains; stronger alcohol, 3 fluidounces; solution of oil of orange, 50 minims; syrup, 6 fluidounces; pyrophosphate of iron, 240 grains; distilled water, 7 fluidounces; water of ammonia, q. s.

Triturate the sulphate of quinine, strychnine, and citric acid together until minutely divided; then add the alcohol and solution of oil of orange. Warm the syrup slightly (to about 150° F.), and add to the turbid mixture; when, upon stirring, the mixture becomes clear. To this add the pyrophosphate of iron, previously dissolved in the distilled water, and, finally, carefully, water of ammonia (drop by drop), until the elixir is perfectly neutral to test-paper; filter. The solution of oil of orange is made by dissolving 1 fluidrachm of oil in 9 fluidrachms of alcohol.

The finished preparation has a greenish yellow color, a pleasant flavor of orange, and is permanent. (Diehl & Scheffer.)

Compound Elixir of Taraxacum. Taraxacum root, 6 ounces; wild cherry bark, 4 ounces; gentian root, 1 ounce; orange peel, 2 ounces; cinnamon, coriander, of each, 1 ounce; anise, cardamom, caraway seed, of each, 2 drachms; liquorice root, 1 ounce; simple syrup, 2½ pints.

Mix water and alcohol together in the proportion of 3 parts of the former and 1 part of the latter. Moisten the drugs, which have previously been powdered together, with 6 fluidounces of the mixture, pack in a conical percolator, pour on sufficient of the alcoholic mixture to obtain 6½ pints, add the syrup, and mix.

This is the original formula of Mr. P. C. Candidus.

Compound Elixir of Taraxacum. Fluid extract of taraxacum, 6 fluidounces; fluid extract of gentian, 1 fluidounce; oil of orange, 100 drops; oil of cinnamon, 12 drops; oil of anise, 10 drops; oil of caraway, 5 drops; oil of coriander, 20 drops; extract of liquorice, 1 ounce; syrup of wild cherry, 2½ pints; alcohol, 1½ pints; water, 4 pints.

Mix the oils with the alcohol, and the extracts with the syrup, add the water, and filter. (Formula of A. P. A., 1871.)

Elixir of Valerianate of Ammonium. [One fluidrachm contains 2 grains of the salt.] Valerianate of ammonium, 260 grains; water, 1 fluidounce; elixir of orange, 15 fluidounces; water of ammonia, q. s.

Mix the salt with the water, and add gradually water of ammonia, until a solution neutral to test-paper is obtained. Mix this solution with the elixir of orange and filter. This is usually colored with tincture of cochineal.

EMPLASTRA. *Plasters.*

(ẸM-PLĂS′TRẠ.)

Emplâtres, *Fr.;* Pflaster, *G.*

Plasters are solid compounds intended for external application, adhesive at the temperature of the human body, and of such a consistence as to render the aid of heat necessary in spreading them. Most of them have as their basis a compound of olive oil and litharge, constituting the Emplastrum Plumbi of the Pharmacopœias. Others owe their consistence and adhesiveness to resinous substances, or to a mixture of these with wax and fats.

In the preparation of the plasters, care is requisite that the heat employed be not sufficiently elevated to produce decomposition, nor so long continued as to drive off any volatile ingredient upon which the virtues of the preparation may in any degree depend. After having been prepared, they are usually shaped into cylindrical rolls, and wrapped in paper to exclude the air. Plasters should be firm at ordinary temperatures, should spread easily when heated, and, after being spread, should remain soft, pliable, and adhesive, without melting, at the heat of the human body. When long kept, they are apt to change color and to become hard and brittle; and, as this alteration is most observable upon their surface, it must depend chiefly upon the action of the air, which should therefore be as much as possible excluded. The defect may usually be remedied by melting the plaster with a moderate heat, and adding a sufficient quantity of oil to give it the due consistence.

Plasters are prepared for use by spreading them upon leather, linen, or muslin, according to the particular purposes they are intended to answer. Leather is most convenient when the application is made to the sound skin, linen or muslin when the plaster is used as a dressing to ulcerated or abraded surfaces, or with the view of bringing and retaining together the sides of wounds. The leather usually preferred is white sheep-skin, or the kind known commercially as "hemlock splits." A margin about a quarter or half an inch broad should usually be left uncovered, in order to facilitate the removal of the plaster, and to prevent the clothing in contact with its edges from being soiled. An accurate outline may be obtained by pasting upon the leather a piece of paper, so cut as to leave in the centre a vacant space of the required dimensions, and removing the paper when no longer needed. The same object may often be accomplished by employing two narrow rulers of sheet tin graduated in inches, and so shaped that each of them may form two sides of a rectangle. These may be applied in such a manner as to enclose within them any given rectangular space, and may be fixed by weights upon the leather, or preferably adjusted by set-screws, while the plaster is spread. For any other shape, as in the instance of plasters for the breast, pieces of tin may be employed having a vacuity within, corresponding to the required outline. The spreading of the plaster is most conveniently accomplished by the use of a spatula or plaster iron. This may be heated by means of a spirit lamp. Care must be taken that the instrument be not so hot as to discolor or decompose the plaster; and special care is requisite in the case of those plasters which contain a volatile ingredient. A sufficient portion of the plaster should first be melted by the heated instrument, and, having been received on a piece of coarse stiff paper, or in a shallow tin tray open on one side, should, when nearly cool, be transferred to the leather, and applied quickly and evenly over its surface. By this plan the melted plaster is prevented from penetrating the leather, as it is apt to do when applied too hot. Before removing the paper from the edge of the plaster, if this has become so hard as to crack, the iron should be drawn over the line of junction. When linen or muslin is used, and the dimensions of the portion to be spread are large, as is often the case with adhesive plaster, the best plan is to pass the cloth "on which the plaster has been laid through a machine, formed of a spatula fixed by screws at a proper distance from a plate of polished steel." A machine for spreading plasters is described by M. Hérent in the *Journ. de Pharm.* (3e ser., ii. 403).* (See also *N. R.*, 1879, p. 337.)

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* It has been customary with apothecaries to employ an apparatus, such as that figured on the opposite page, for spreading quantities of plasters. An oblong rectangular block of hard wood (*a e*) has its upper surface (*c*) slightly convex. To this is attached by a movable joint (at *r*) a sheet-

The spreading of plasters has become to a great extent a lost art to the pharmacist of this country, owing to the introduction of machine-spread plasters, which contain india rubber in the adhesive composition. These are reasonably permanent, and do not require the application of heat. When made by reliable manufacturers they are in many cases to be preferred, but, unfortunately, the introduction of immense quantities of worthless plasters by unscrupulous makers has caused many practitioners to direct these to be spread by the pharmacist from officinal plaster. The perforation or "porousing" of plasters is usually accomplished on a large scale by expensive apparatus. Prof. J. P. Remington has devised an inexpensive apparatus whereby the apothecary can perforate those spread by himself. (*A. J. P.*, 1878, p. 171.)*

EMPLASTRUM AMMONIACI. *U. S.* *Ammoniac Plaster.*

(ẸM-PLĂS'TRỤM ĂM-MỌ-NĪ'Ạ-CĪ.)

Emplâtre de Gomme Ammoniaque, Emplâtre fondant (résolutif), *Fr.*: Ammoniak-Pflaster, *G.*

"Ammoniac, *one hundred parts* [or five ounces av.]; Diluted Acetic Acid, *one hundred and forty parts* [or half a pint]. Digest the Ammoniac in the Diluted Acetic Acid, in a suitable vessel, avoiding contact with metals, until it is entirely emulsionized; then strain and evaporate the strained liquid, by means of a water-bath, stirring constantly, until a small portion, taken from the vessel, hardens on cooling." *U. S.*

This plaster has been omitted in the British Pharmacopœia.

As ammoniac is not usually kept purified in our shops, the straining of the solution in the diluted acid is directed, as the most convenient method of separating impurities. Dr. Duncan remarked that the plaster, prepared in iron vessels, "ac-

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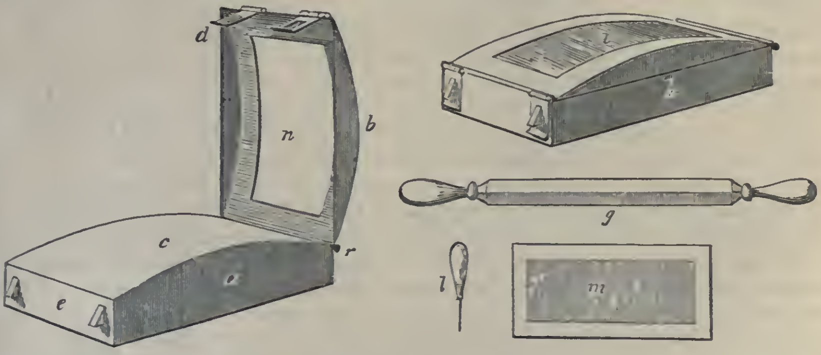
iron frame (*b*), with an opening (*n*) of the dimensions of the plaster to be spread, and clasps (*d*) at the other end, by which this may be fixed to the block. Another portion of the apparatus is a sheet-iron or tin frame (*m*), by which the leather is cut out, and the margin marked. The leather thus prepared is laid on the convex surface of the block (*c*); the sheet-iron frame is brought down on it evenly (as at *h i*); the plaster, previously melted, but not too hot, is poured on the leather in the centre, and, by means of an iron instrument (*g*) previously heated by a spirit lamp, is spread uniformly over the surface, the thickness being regulated by the frame against which the iron is pressed. Any excess of plaster is thus pressed over upon the frame. The point of a sharp instrument (*l*) is then



drawn along the interior edge of the frame so as to separate the plaster from it, after which the clasps are unfastened and the plaster removed.

* *Emplastrum Aconiti. Aconite Plaster.* (Emplâtre d'Aconit, *Fr.*; Aconit-Pflaster, *G.*) "Take of Aconite Root, in fine powder, *sixteen troyounces;* Alcohol, Resin Plaster, each, *a sufficient quantity.* Moisten the Aconite Root with six fluidounces of Alcohol, and pack it in a conical percolator. Cover the surface with a disk of paper, and pour upon it ten fluidounces of Alcohol. When the liquid begins to drop, cork the percolator, and, having closely covered it to prevent evaporation, set it aside in a moderately warm place for four days. Then remove the cork, and gradually pour on Alcohol until two pints of tincture have been obtained or the Aconite Root is exhausted. Distil off a pint and a half of alcohol, and evaporate the residue to a soft uniform extract by means of a water-bath. Add to this sufficient Resin Plaster, previously melted, to make the mixture weigh sixteen troyounces, and then mix them thoroughly." *U. S.* 1870.

This plaster was introduced into the Pharmacopœia of 1870. The formula is a modification of that proposed by Prof. Procter. (*A. J. P.*, xxv. 202.) Aconite Plaster may be used whenever it is desired to produce a very powerful local anodyne effect.

quires an unpleasant dark color, from being impregnated with iron, whereas, when prepared in a glass or earthenware vessel, it has a yellowish white color, and more pleasant appearance." Care should also be used to avoid iron spatulas in its preparation, as the acetic acid acts on that metal, and discolors the plaster. The use of a moderate heat will facilitate the action of the diluted acid; and at best it is a thick creamy mass that is obtained, which requires the aid of the hand to strain it properly.

Medical Properties. The ammoniac plaster is stimulant, and is applied over scrofulous tumors and chronic swellings of the joints, to promote their resolution. It often produces a papular eruption, and sometimes occasions considerable inflammation of the skin.

EMPLASTRUM AMMONIACI CUM HYDRARGYRO. *U.S., Br.*

Ammoniac Plaster with Mercury.

(ẸM-PLȦS'TRỤM ĂM-MỌ-NĪ'Ạ-CĪ CŬM HȲ-DRÄR'ǤỴ-RŌ.)

Emplâtre de Gomme Ammoniaque mercuriel, *Fr.;* Quecksilber- und Ammoniak-Pflaster, *G.*

"Ammoniac, *seven hundred and twenty parts* [or thirteen ounces av.]; Mercury, *one hundred and eighty parts* [or three and one-quarter ounces av.]; Olive Oil, *eight parts* [or sixty grains]; Sublimed Sulphur, *one part* [or eight grains]; Diluted Acetic Acid, *one thousand parts* [or seventeen fluidounces]; Lead Plaster, *a sufficient quantity*, To make *one thousand parts* [or eighteen ounces av.]. Digest the Ammoniac in the Diluted Acetic Acid, in a suitable vessel, avoiding contact with metals, until it is entirely emulsionized; then strain, and evaporate the strained liquid by means of a water-bath, stirring constantly, until a small portion, taken from the vessel, hardens on cooling. Heat the Olive Oil, and gradually add the Sulphur, stirring constantly until they unite; then add the Mercury, and triturate until globules of the metal cease to be visible. Next add, gradually the Ammoniac, while yet hot; and finally, having added enough Lead Plaster, previously melted by means of a water-bath, to make the mixture weigh *one thousand parts* [or eighteen ounces av.], mix the whole thoroughly." *U. S.*

"Take of Ammoniacum *twelve ounces* [avoirdupois]; Mercury *three ounces* [avoird.]; Olive Oil *one fluidrachm;* Sublimed Sulphur *eight grains.* Heat the Oil, and add the Sulphur to it gradually, stirring till they unite. With this mixture triturate the Mercury until globules are no longer visible; and, lastly, add the Ammoniacum, previously liquefied, mixing the whole carefully." *Br.*

The finished preparation does not differ materially from that produced by the formula of the last Pharmacopœia. The use of diluted acetic acid to facilitate the straining of the ammoniac is an improvement over the water formerly used. The use of lead plaster to bring up the weight is needless, in our opinion.

The only use of the sulphur is to aid in the extinguishment of the mercury; as the compound formed by it with the metal is probably inert. When ammoniac not previously prepared is used, as it is not fusible by heat, it must be brought to the proper consistence by softening it in a small quantity of hot water, straining, and evaporating.

Medical Properties and Uses. This plaster unites with the stimulant power of the ammoniac the specific properties of the mercury, which is sometimes absorbed in sufficient quantity to affect the gums. It is used as a discutient in enlargement of the glands, tumefaction of the joints, nodes, and other indolent swellings, especially when dependent on a venereal taint. It is also sometimes applied over the liver in chronic hepatitis.*

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* *Emplastrum Antimonii. Antimonial Plaster.* (Emplastrum Stibiatum, s. Antimoniale; Emplâtre (Poix) émétisée, Emplâtre antimonial, *Fr.;* Brechweinstein-Pflaster, *G.*) "Take of Tartrate of Antimony and Potassium, in fine powder, *a troyounce;* Burgundy Pitch *four troyounces.* Melt the Pitch by means of a water-bath, and strain; then add the powder, and stir them well together until the mixture thickens on cooling." *U. S.* 1870.

This is a useful formula, although no longer officinal. It affords one of the most convenient methods of obtaining the local pustulating effects of tartar emetic. For its effects and uses, see *Antimonii et Potassii Tartras.*

EMPLASTRUM ARNICÆ. *U. S.* *Arnica Plaster.*

(ẸM-PLĂS'TRỤM ÄR'NỊ-ÇÆ—är'nį-sē.)

Emplâtre d'Arnique, *Fr.;* Arnicapflaster, *G.*

"Extract of Arnica Root, *fifty parts* [or four ounces av.]; Resin Plaster, *one hundred parts* [or eight ounces av.]. Add the Extract to the Plaster, previously melted by means of a water-bath, and mix them thoroughly." *U. S.*

These ingredients incorporate readily, and form a good plaster. The preparation was introduced into the Pharmacopœia, to enable the apothecary to meet the demand for a convenient preparation of arnica for external use. It is supposed to be useful in sprains and bruises, and sometimes probably acts beneficially by its stimulant properties in chronic rheumatism and other chronic external inflammations.

EMPLASTRUM ASAFŒTIDÆ. *U. S.* *Asafetida Plaster.*

(ẸM-PLĂS'TRỤM ĂS-Ạ-FŒT'Ị-DÆ—ăs-ạ-fĕt'į-dē.)

Emplastrum Assafœtidæ, Emplastrum Fœtidum; Emplâtre d'Asefétide, Emplâtretfétide (antihystérique), *Fr.;* Stinkasant-Pflaster, *G.*

"Asafetida, *thirty-five parts* [or thirteen ounces av.]; Lead Plaster, *thirty-five parts* [or thirteen ounces av.]; Galbanum, *fifteen parts* [or five and a half ounces av.]; Yellow Wax, *fifteen parts* [or five and a half ounces av.]; Alcohol, *one hundred and twenty parts* [or three pints]. Digest the Asafetida and Galbanum with the Alcohol on a water-bath, separate the liquid portion, while hot, from the coarser impurities by straining, and evaporate it to the consistence of honey; then add the Lead Plaster and the Wax, previously melted together, stir the mixture well, and evaporate to the proper consistence." *U. S.*

This plaster has been omitted in the British Pharmacopœia.

The directions of the U. S. Pharmacopœia indicate the mode in which the gum-resins may be brought to the liquid state before being incorporated with the other ingredients. Galbanum melts sufficiently by the aid of heat to admit of being strained; but this is not the case with asafetida, which must be prepared by dissolving it in a small quantity of hot water or alcohol, straining, and evaporating to the consistence of honey; and even galbanum may be most conveniently treated in the same way. Formerly these gum-resins were ordered merely to be melted and strained.

This plaster may be advantageously applied over the stomach or abdomen, in cases of hysteria attended with flatulence, and to the chest or between the shoulders in hooping-cough.

EMPLASTRUM BELLADONNÆ. *U. S., Br.* *Belladonna Plaster.*

(ẸM-PLĂS'TRỤM BĔL-LẠ-DŎN'NÆ.)

Emplâtre de Belladone, *Fr.;* Belladonna-Pflaster, *G.*

"Belladonna Root, in No. 60 powder, *one hundred parts* [or 16 ounces av.]; Alcohol, Resin Plaster, each, *a sufficient quantity*, To make *one hundred parts.* Moisten the powder with *forty parts* [or 7 fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Belladonna Root is exhausted. Reserve the first *ninety parts* [or 14 fluidounces] of the percolate; evaporate the remainder at a temperature not exceeding 50° C. (122° F.), to *ten parts* [or 2 fluidounces]; mix this with the reserved portion, and evaporate at or below the above-mentioned temperature to a soft uniform extract. Add to this enough Resin Plaster, previously melted, to make the whole weigh *one hundred parts* [or 16 ounces av.], and mix thoroughly." *U.S.*

"Take of Extract of Belladonna, Resin Plaster, each, *three ounces* [avoirdupois]; Rectified Spirit *six fluidounces* [Imperial measure]. Rub the Extract and Spirit together in a mortar, and when the insoluble matter has subsided, decant the clear solution, remove the spirit by distillation or evaporation, and mix the alcoholic extract thus obtained with the Resin Plaster melted by the heat of a water-bath, continuing the heat until with constant stirring the plaster has acquired a suitable consistence." *Br.*

This preparation was formerly prepared with the extract made from the inspissated juice of the leaves, and is so still in the British process; but in the last edition of the U. S. Pharmacopœia an alcoholic extract of the root was substituted with the effect of rendering the plaster easier to be spread and more adhesive, and the officinal preparation is now of a light yellowish brown color, without a shade of green. It is a useful anodyne application in neuralgic and rheumatic pains, and in dysmenorrhœa. We have seen the constitutional effects of belladonna result from its external use.* Machine-spread belladonna plaster can be found in the market, which was admitted by a representative of the manufacturer to contain no extract of belladonna whatever, but to be purely factitious.

EMPLASTRUM CALEFACIENS. *Br.* *Warm Plaster.*

(ẸM-PLĂS′TRỤM CĂL-Ẹ-FĀ′CỊ-ẸNṢ—kăl-ẹ-fā′shẹ-ẹnz.)

See *Emplastrum Picis cum Cantharide.* U. S.

EMPLASTRUM CANTHARIDIS. *Br.* *Cantharides Plaster.* *Blistering Plaster.*

(ẸM-PLĂS′TRỤM CẠN-THĂR′Ị-DĬS.)

See *Ceratum Cantharidis.* U. S.

EMPLASTRUM CAPSICI. *U. S.* *Capsicum Plaster.*

(ẸM-PLĂS′TRỤM CĂP′SỊ-CĪ.)

"Resin Plaster, Oleoresin of Capsicum, each, *a sufficient quantity.* Melt the Resin Plaster at a gentle heat, spread a thin and even layer of it upon muslin, and allow it to cool. Then having cut off a piece of the required size, apply a thin coating of Oleoresin of Capsicum, by means of a brush, leaving a narrow, blank margin along the edges. A space of four inches, or ten centimeters square, should contain four grains, or twenty-five centigrammes, of Oleoresin of Capsicum." *U. S.*

This is a new officinal. It is a convenient way of obtaining the rubefacient effects of capsicum; of course the practice will be for the pharmacist to employ machine adhesive plaster as the base; although, with a little experience, very good work can be done by hand.

EMPLASTRUM CERATI SAPONIS. *Br.* *Soap Cerate Plaster.*

(ẸM-PLĂS′TRỤM CẸ-RĀ′TĪ SẠ-PŌ′NĬS.)

Emplâtre de Savon saturné, *Fr.;* Seifencerat-Pflaster, *G.*

"Take of Hard Soap, in powder, *ten ounces* [avoirdupois]; Yellow Wax *twelve and a half ounces* [avoir.]; Olive Oil *one pint* [Imperial measure]; Oxide of Lead *fifteen ounces* [avoir.]; Vinegar *one gallon* [Imp. meas.]. Boil the Vinegar and Oxide of Lead together, by the heat of a steam-bath, constantly stirring them until the Oxide has combined with the Acid; then add the Soap and boil again until most of the moisture is evaporated; finally, add the Wax and Oil melted together, and stir the whole continuously, maintaining the heat until by the evaporation of the remaining moisture the product has acquired the proper consistence for a plaster." *Br.*

This is the old *Ceratum Saponis Compositum* of the London College, the name of which has been changed in the British Pharmacopœia, because, the former class of Cerates having been abandoned, it was necessary to put the preparation into another class with a different title. It is not strictly a plaster, as this term is understood in American pharmacy; for heat is not required to spread it, it being applied to the leather or cloth by means of a spatula, like our Cerates, to which it properly belongs. Indeed, it is essentially the same preparation as the *Ceratum Saponis* of the U. S. P. 1870, consisting, like that, of soap plaster with wax and olive oil, though made differently, and containing some acetate of sodium, as an incidental result of the process. In the British formula, subacetate of lead is first formed by the boiling of litharge or oxide of lead with vinegar; and the subacetate is then converted, by double decomposition with hard soap, into a compound of the oxide of lead and the fatty acids of the soap, and acetate of sodium, which, with some glycerin formed in the process, remains as an ingredient of the lead plaster. The process is completed by incorporating this with the melted wax and oil, thus in fact converting the preparation into a cerate. (See *Ceratum Saponis.*)

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* Mr. T. W. Worthington proposes a formula for making belladonna plaster with caoutchouc in the *A. J. P.,* xliii. 153.

EMPLASTRUM FERRI. *U.S.* *Iron Plaster.* [*Strengthening Plaster.*]

(ẸM-PLĂS'TRỤM FĔR'RĪ.)

Emplastrum Roborans, *Br.;* Chalybeate Plaster; Emplastrum Ferratum, s. Martiale; Emplâtre d'Oxyde rouge de Ner, Emplâtre de Canet, *Fr.;* Eisenpflaster, Stärkendes Pflaster, *G.*

"Hydrated Oxide of Iron, dried at a temperature not exceeding 80° C. (176° F.), *ten parts* [or one ounce av.]; Canada Turpentine, *ten parts* [or one ounce av.]; Burgundy Pitch, *ten parts* [or one ounce av.]; Lead Plaster, *seventy parts* [or seven ounces av.], To make *one hundred parts* [or ten ounces av.]. Melt the Lead Plaster, Canada Turpentine, and Burgundy Pitch by means of a water-bath; then add the Oxide of Iron, and stir constantly until the mixture thickens on cooling." *U. S.*

"Take of Hydrated Peroxide of Iron, in fine powder, *one ounce;* Burgundy Pitch *two ounces;* Lead Plaster *eight ounces.* Add the Peroxide of Iron to the Burgundy Pitch and Lead Plaster, previously melted together, and stir the mixture constantly till it stiffens on cooling." *Br.*

This preparation differs from that officinal in 1870 in the substitution of hydrated oxide of iron for the subcarbonate, and of Canada turpentine for a portion of the Burgundy pitch. This latter change is of questionable utility, the object being to render the plaster more adhesive and flexible. It will probably be found too soft now, and the Canada turpentine irritant. The same end could have been accomplished, if desired, by the addition of olive oil. The use of hydrated oxide of iron in the place of the subcarbonate is an improvement, and in this respect the plaster is in accord with the British formula.

This preparation has enjoyed some popular celebrity, under the impression that it strengthens the parts to which it is applied; whence it has derived the name of strengthening plaster. It is used in those conditions of the loins, larger muscles, and joints which, though usually ascribed to debility, are in fact most frequently dependent on rheumatic or other chronic inflammatory affections, and, if relieved by the plaster, are so in consequence of the gentle excitation produced by it in the vessels of the skin, or of the exclusion of the air. It may also, in some instances, give relief by affording mechanical support; but neither in this nor in any other respect can it be deemed very efficient.

EMPLASTRUM GALBANI. *U. S., Br.* *Galbanum Plaster.*

(ẸM-PLĂS'TRỤM GĂL'BẠ-NĪ.)

Emplastrum Galbani Compositum, *U. S.* 1870; Emplastrum Lithargyri (vel Plumbi) Compositum, Emplastrum Diachylon Compositum; Emplâtre de Galbanum, *Fr.;* Mutterharz-Pflaster, Gummipflaster, Zugspflaster, *G.*

"Galbanum, *sixteen parts* [or eight ounces av.]; Turpentine, *two parts* [or one ounce av.]; Burgundy Pitch, *six parts* [or three ounces av.]; Lead Plaster, *seventy-six parts* [or thirty-eight ounces av.], To make *one hundred parts* [or fifty ounces av.]. To the Galbanum and Turpentine, previously melted together and strained, add, first, the Burgundy Pitch, then the Lead Plaster, melted over a gentle fire, and mix the whole thoroughly." *U. S.*

"Take of Galbanum, Ammoniacum, Yellow Wax, of each, *one ounce;* Lead Plaster, *eight ounces.* Melt the Galbanum and Ammoniacum together, and strain. Then add them to the Lead Plaster and Wax, also previously melted together, and mix the whole thoroughly." *Br.*

This is the Compound Galbanum Plaster of the U. S. Pharm. 1870, the title having been changed, with the trifling alteration of 4 per cent. increase of lead plaster.

In the British process the galbanum and ammoniac are best prepared by dissolving them in a small quantity of hot water or diluted alcohol, straining the solution, and evaporating it to the proper consistence for mixing with the other ingredients.

Before being employed in this process, the galbanum should be purified, as it often contains foreign matters which must injure the plaster. It may be freed from these by melting it with a little water or diluted alcohol, straining, and evaporating to the due consistence.

This plaster acts as an excellent local stimulant in chronic scrofulous enlargements of the glands and joints. We have employed the compound plaster in obstinate cases of this kind, which, after having resisted general and local depletion, blistering, and other measures, have yielded under its use. As a discutient it is also employed in the induration which sometimes remains after the discharge of abscesses. It is said to have been useful in rickets, applied over the whole lumbar region, and has been recommended in chronic gouty and rheumatic articular affections. It should not be used in the discussion of tumors in which any considerable inflammation exists.

EMPLASTRUM HYDRARGYRI. *U. S., Br.* *Mercurial Plaster.*

(ẸM-PLĂS'TRỤM HȲ-DRÄR'ÇỴ-RĪ.)

Emplastrum Mercuriale; Emplâtre mercuriel, *Fr.;* Quecksilber-Pflaster, *G.*

"Mercury, *thirty parts* [or three ounces av.]; Olive Oil, *ten parts* [or one ounce av.]; Resin, *ten parts* [or one ounce av.]; Lead Plaster, *fifty parts* [or five ounces av.], To make *one hundred parts* [or ten ounces av.]. Melt the Olive Oil and Resin together, and, when the mixture has become cool, rub the Mercury with it until globules of the metal cease to be visible. Then gradually add the Lead Plaster, previously melted, and mix the whole thoroughly." *U. S.*

"Take of Mercury, *three ounces;* Olive Oil, *one fluidrachm;* Sublimed Sulphur, *eight grains;* Lead Plaster, *six ounces.* Heat the Oil and add the Sulphur to it gradually, stirring until they unite; with this mixture triturate the Mercury until globules are no longer visible, then add the Lead Plaster, previously liquefied, and mix the whole thoroughly." *Br.* The ounce employed in this process is the avoirdupois ounce.

The present officinal process differs from that of the U. S. Pharm. 1870 in employing about 9 per cent. less of lead plaster. The quantity of mercury is thus slightly increased, there being now 30 per cent. where there was formerly 27·3 per cent. The British preparation is stronger, containing nearly 50 per cent.

The U. S. and former British processes may be considered identical in their results. The sulphuretted oil which was employed in the process of the London College to facilitate the extinguishment of the mercury was abandoned in the first British Pharmacopœia, as just in proportion to the increased facility of the process it lessened the efficacy of the resulting plaster; sulphide of mercury being wholly inert. Nevertheless, the Pharmacopœia has in its last revision gone back to the old London formula. Mr. Thomas Blunt has found it almost impossible to divide the mercury sufficiently by trituration with oil and resin, and the resulting plaster was so crumbly that it could not be formed into rolls; but by substituting a weight of Venice turpentine equal to that of the oil and resin combined, he found it to answer completely. An objection, however, to the turpentine is, that it might render the plaster too irritant for susceptible skins. (*P. J. Tr.*, 1864, p. 56.)

This plaster is employed to produce the local effects of mercury upon venereal buboes, nodes, and other chronic tumefactions of the bones or soft parts, dependent on a syphilitic taint. In these cases it sometimes acts as a powerful discutient. It is frequently also applied to the side in chronic hepatitis or splenitis. In peculiarly susceptible persons it occasionally affects the gums.

From observations made in France by M. Serres and others, it appears that the mercurial plaster of the Codex (*Emplastrum de Vigo cum Mercurio*) has the power, when applied over the eruption of smallpox, before the end of the third day from its first appearance, to check its progress, and prevent suppuration and pitting. This operation of the plaster, so far from being attended with an increase of the general symptoms, seems to relieve them in proportion to the diminution of the local affection. It is also thought that the course of the disease is favorably modified when the mercurial impression is produced upon the system. That the local effect is not ascribable to the mere exclusion of the air is proved by the fact that the use of lead plaster was not followed by the same results. It is probable that other mercurial preparations would answer the same purpose; and the common mercurial ointment has, in our own hands, proved effectual in rendering the eruption upon the face to a considerable extent abortive, in one bad case of smallpox. But, as the most successful results were obtained with the plaster above mentioned, we give the formula of the French Codex for its preparation.

Emplastrum de Vigo cum Mercurio. "Take of simple plaster [lead plaster] *forty ounces;* yellow wax *two ounces;* resin *two ounces;* ammoniac, bdellium, olibanum, and myrrh, each, *five drachms;* saffron *three drachms;* mercury *twelve ounces;* turpentine [common European] *two ounces;* liquid storax *six ounces;* oil of lavender *two drachms.* Powder the gum-resins and saffron, and rub the mercury with the storax and turpentine in an iron mortar until completely extinguished. Melt the plaster with the wax and resin, and add to the mixture the powders and volatile oil. When the plaster shall have been cooled, but while it is yet liquid, add the mercurial mixture, and incorporate the whole thoroughly." This should be spread upon leather or linen cloths, and applied so as to effectually cover the part to be protected.

EMPLASTRUM ICHTHYOCOLLÆ. *U. S.* *Isinglass Plaster.* [*Court Plaster.*]

(ẸM-PLĂS'TRỤM ĬÇH-THỴ-Ọ-CŎL'LÆ.)

"Isinglass, *ten parts* [or one hundred and fifty-five grains]; Alcohol, *forty parts* [or one and three-fourths fluidounces]; Glycerin, *one part* [or twelve minims]; Water, Tincture of Benzoin, each, *a sufficient quantity.* Dissolve the Isinglass in a sufficient quantity of hot Water to make the solution weigh *one hundred and twenty parts* [or measure four fluidounces]. Spread one-half of this in successive layers, upon taffeta (stretched on a level surface), by means of a brush, waiting after each application until the layer is dry. Mix the second half of the Isinglass solution with the Alcohol and Glycerin, and apply it in the same manner. Then reverse the taffeta, coat it on the back with Tincture of Benzoin and allow it to become perfectly dry. Cut the plaster in pieces of suitable length and preserve them in well-closed vessels. Substituting *gramme* (15·5 *grains*) for *part*, the above quantities are sufficient to cover a piece of taffeta *fifteen inches* (*thirty-eight cm.*) square." *U. S.*

This is a new officinal preparation. Although it will probably be seldom made by the pharmacist, the introduction of a formula will be of service by indicating the manner in which isinglass plaster can be made by those who desire to furnish a good preparation. The addition of glycerin prevents it from becoming brittle, and the tincture of benzoin is intended to render it water-proof. This it only partially accomplishes. Castor oil and weak collodion have been used instead with better results. (See *Court Plaster*, Part II.)

EMPLASTRUM OPII. *U. S., Br.* *Opium Plaster.*

(ẸM-PLĂS'TRỤM Ō'PỊ-Ī.)

Emplastrum Opiatum, *P. G.;* Emplastrum Cephalicum, s. Odontalgicum; Emplâtre d'Opium, Emplâtre céphalique (temporal, odontalgique, calmant), *Fr.;* Opiumpflaster, Hauptpflaster, *G.*

"Extract of Opium, *six parts* [or one ounce av.]; Burgundy Pitch, *eighteen parts* [or three ounces av.]; Lead Plaster, *seventy-six parts* [or twelve and one-half ounces av.]; Water. *eight parts* [or one and a half fluidounces], To make *one hundred parts* [or seventeen ounces av.]. Rub the Extract of Opium with the Water, until uniformly soft, and add it to the Burgundy Pitch and Lead Plaster, melted together by means of a water-bath; then continue the heat for a short time, stirring constantly, until the moisture is evaporated." *U. S.*

"Take of Opium, in fine powder, *one ounce;* Resin Plaster *nine ounces.* Melt the Resin Plaster by means of a water-bath; then add the Opium by degrees, and mix thoroughly." *Br.*

We decidedly prefer the extract of opium, as employed in the present U. S. process, to the opium itself of the British formula. It not only forms a better plaster, but, being soluble, is more likely to produce the anodyne effect desired, by being brought by the perspiration to the liquid state necessary for its absorption. The use of water in the former process is also an advantage, as it enables the opium to be more thoroughly incorporated with the other ingredients; but care should be taken that the moisture be well evaporated.

The opium plaster is intended to relieve rheumatic and other pains in the parts to which it is applied.

EMPLASTRUM PICIS. *Br.* *Pitch Plaster.*

(ẸM-PLĂS'TRỤM PĪ'CĬS.)

"Take of Burgundy Pitch *twenty-six ounces;* Common Frankincense [Terebinthina, U. S.] *thirteen ounces;* Resin, Yellow Wax, of each, *four ounces and a half;* Expressed Oil of Nutmeg *one ounce;* Olive Oil, Water, of each, *two fluidounces.* Add the Oils and the Water to the Frankincense, Burgundy Pitch, Resin, and Wax, previously melted together; then, constantly stirring, evaporate to a proper consistence." *Br.* The ounce used in this process is the avoirdupois ounce, and the fluidounce that of the Imperial measure.

This is a rubefacient plaster, applicable to catarrhal and other pectoral affections, chronic inflammation of the liver, and rheumatic pains in the joints and muscles. It often keeps up a serous discharge, which requires that it should be frequently renewed. The irritation which it sometimes excites is so great as to render its removal necessary.

EMPLASTRUM PICIS BURGUNDICÆ. *U. S.* *Burgundy Pitch Plaster.*

(ẸM-PLĂS'TRỤM PĪ'CĬS BŬR-GŬN'DỊ-ÇÆ.)

Emplastrum Picatum, *F.P.;* Emplâtre de Poix de Bourgogne, *Fr.;* Bergunder Pech-Pflaster, *G.*

"Burgundy Pitch, *ninety parts* [or nine ounces av.]; Yellow Wax, *ten parts* [or one ounce av.], To make *one hundred parts* [or ten ounces av.]. Melt them together, strain the mixture, and stir constantly until it thickens on cooling." *U. S.*

In the present revision of the Pharmacopœia the quantity of wax has been diminished 3 per cent. in this plaster. This is undoubtedly a step in the wrong direction; it was done to round up the formula, but it would have made a better plaster if 15 per cent. of wax had been directed instead of 10, whilst the addition of 5 per cent. of olive oil would have still further improved it. The object of the wax is to give a proper consistence to the Burgundy pitch, and to prevent its great tendency to become brittle. M. Lavigne proposes to obviate the tendency of Burgundy pitch plaster to crack by incorporating with it caoutchouc, in the following method. Dissolve 35 parts, by weight, of caoutchouc, in small pieces, in 13 parts of oil of petroleum in a close vessel. Melt together 300 parts of Burgundy pitch and 25 parts of white wax. Warm the solution of caoutchouc in a suitable vessel, and add gradually, with constant stirring, the melted pitch and wax, and finally incorporate thoroughly with the mass 3 parts of glycerin. (*Journ. de Pharm.*, 4e sér., ix. 131.)

EMPLASTRUM PICIS CANADENSIS. *U. S.* *Canada Pitch Plaster.* [*Hemlock Pitch Plaster.*]

(ẸM-PLĂS'TRỤM PĪ'CĬS CĂN-Ạ-DĔN'SỊS.)

Hemlock Plaster; Emplâtre de Poix de Canada, *Fr.;* Canadapech-Pflaster, *G.*

"Canada Pitch, *ninety parts* [or nine ounces av.]; Yellow Wax, *ten parts* [or one ounce av.], To make *one hundred parts* [or ten ounces av.]. Melt them together, strain the mixture, and stir constantly until it thickens on cooling." *U. S.*

The yellow wax, in this preparation, answers the same purpose as in the Burgundy Pitch Plaster, and is even more necessary, in order to give the proper consistence to the Canada Pitch. As in the case of Burgundy Pitch Plaster, 15 per cent. of wax would have been preferable to 10. (See *Emplastrum Picis Burgundicæ.*)

EMPLASTRUM PICIS CUM CANTHARIDE. *U. S.* *Pitch Plaster with Cantharides.* [*Warming Plaster.*]

(ẸM-PLĂS′TRỤM PĪ′CĬS CŬM CẠN-THĂR′Ị-DĒ.)

Emplastrum Calefaciens, *Br.;* Emplâtre de Poix cantharidé, *Fr.;* Pechpflaster mit Canthariden, *G.*

"Burgundy Pitch, *ninety-two parts* [or twenty-three ounces av.]; Cerate of Cantharides, *eight parts* [or two ounces av.], To make *one hundred parts* [or twenty-five ounces av.]. Heat the Cerate as nearly as possible to 100° C. (212° F.) on a water-bath, and, having continued the heat for fifteen minutes, strain it through a close strainer which will retain the Cantharides. To the strained liquid add the Pitch, melt them together by means of a water-bath, and, having removed the vessel, stir the mixture constantly until it thickens on cooling." *U. S.*

"Take of Cantharides, in coarse powder, Expressed Oil of Nutmeg, Yellow Wax, Resin, of each, *four ounces* [avoir.]; Soap Plaster *three pounds and a quarter* [avoir.]; Resin Plaster *two pounds* [avoir.]; Boiling Water *one pint* [Imperial measure]. Infuse the Cantharides in the Boiling Water for six hours; squeeze strongly through calico, and evaporate the expressed liquid by a water-bath, till reduced to one-third. Then add the other ingredients, and melt in a water-bath, stirring well until the whole is thoroughly mixed." *Br.*

This Plaster is an excellent rubefacient, more active than Burgundy pitch, yet in general not sufficiently so to produce vesication. As prepared by the former U. S. process, it occasionally blistered; and the proportion of cantharides has, therefore, been considerably diminished in the present formula. This is unfortunate; for, while such a reduction may render the plaster insufficiently active in most cases, it does not entirely obviate the objection; as the smallest proportion of flies, or even the Burgundy pitch alone, would vesicate in certain persons. In whatever mode, therefore, this plaster may be prepared, it cannot always answer the expectations which may be entertained; and the only plan, when the skin of any individual has been found to be very susceptible, is to accommodate the proportions to the particular circumstances of the case. Much, however, may be accomplished by care in the preparation of the plaster, towards obviating its tendency to blister. If the flies of the *Ceratum Cantharidis* have been coarsely pulverized, the larger particles, coming in contact with the skin, will exert upon the particular part to which they may be applied their full vesicatory effect, while if reduced to a very fine powder they would be more thoroughly enveloped in the other ingredients, and thus have their strength much diluted. Hence the cerate, when used as an ingredient of the warming plaster, should contain the cantharides as minutely divided as possible; and, if that usually kept is not in the proper state, a portion should be prepared for this particular purpose. The plan of keeping the cerate used in this preparation, for a considerable time, at the temperature of 100° C. (212° F.), and then straining it so as to separate the flies is a good one, but it would be better yet to substitute cerate *of the extract* of cantharides for the cerate of cantharides. (See *Ceratum Cantharidis.*) The mode frequently pursued of preparing the warming plaster by simply sprinkling a very small proportion of powdered flies upon the surface of Burgundy pitch is altogether objectionable.

It has been objected to the U. S. plaster that it is apt to be too soft in hot weather. Mr. G. C. Close, ascribing this inconvenience to the proportion of lard in the cerate employed, proposes to obviate it by substituting Burgundy pitch plaster for Burgundy pitch, and powdered cantharides for the cerate, and offers a formula in compliance with this suggestion. (See *A. J. P.*, 1867, p. 20; from *Proc. A. P. A.*, 1866.)

The warming plaster is employed in chronic rheumatism, and in chronic internal diseases attended with inflammation or an inflammatory tendency; such as catarrh, asthma, pertussis, phthisis, hepatitis, and the sequelæ of pleurisy and pneumonia.

EMPLASTRUM PLUMBI. *U.S., Br.* *Lead Plaster.* [*Diachylon Plaster.*]

ẸM-PLĂS'TRỤM PLŬM'BĪ.)

Emplastrum Lithargyri, *Br.* 1864; Emplastrum Lithargyri Simplex, *P.G.;* Emplastrum Simplex, *F.P.;* Emplastrum Diachylon Simplex, Emplastrum Album Coctum; Litharge Plaster, Emplâtre simple, Emplâtre de Plumb (de Litharge), *Fr.;* Emplastrum Cerusæ, Froschlaichpflaster, Bleipflaster, Diachylon-Pflaster, *G.*

"Oxide of Lead, in very fine powder, *thirty-two parts* [or thirty-two ounces av.]; Olive Oil, *sixty parts* [or sixty-three fluidounces]; Water, *a sufficient quantity.* Rub the Oxide of Lead with about one-half of the Olive Oil, and add the mixture to the remainder of the Oil, contained in a suitable vessel of a capacity equal to three times the bulk of the ingredients. Then add *ten parts* [or ten fluidounces] of boiling Water, and boil the whole together until a homogeneous plaster is formed, adding, from time to time, during the process, a little Water, as that first added is consumed." *U. S.*

"Lead Plaster is white, pliable, and tenacious, free from greasiness or stickiness. It should be entirely soluble in warm oil of turpentine (abs. of uncombined oxide of lead)." *U. S.*

"Take of Oxide of Lead, in fine powder, *four pounds;* Olive Oil *one gallon;* Water *three pints and a half.* Boil all the ingredients together gently by the heat of a steam-bath, and keep them simmering for four or five hours, stirring constantly, until the product acquires a proper consistence for a plaster, and adding more water during the process if necessary." *Br.* The weights used in this process are the avoirdupois, and the measures the Imperial.

The importance of this plaster, as the basis of most of the others, requires a somewhat detailed account of the principles and manner of its preparation.

It was formerly thought that the oil and oxide of lead entered into direct union, and that the presence of water was necessary only to regulate the temperature and prevent the materials from being decomposed by heat. The discovery, however, was afterwards made, that this liquid was essential to the process; and that the oil and oxide alone, though maintained at a temperature of 220° F., would not combine; while the addition of water, under these circumstances, would produce their immediate union. It was now supposed that the oil was capable of combining only with the hydrated oxide of lead, and that the use of the water was to bring the oxide into that state; and, in support of this opinion, the fact was advanced that the hydrated oxide of lead and oil would form a plaster, when heated together without any free water. But, since the general reception of Chevreul's views in relation to oils, and their combinations with alkalies and other metallic oxides, the former opinions have been abandoned; and it is now admitted that the preparation of the lead plaster affords a genuine example of saponification, as explained by that chemist. A reaction takes place between the oil and water, resulting in the development of *glycerin,* and of two acid bodies, *oleic* and *palmitic acids,* to which, when animal fat is employed instead of olive oil, a third is added, namely *stearic acid.* The plaster is formed by a union of these acids with the oxide, and, prepared according to the directions of the Pharmacopœias, is in fact an oleo-palmitate of lead, and if the olive oil contained stearin it would be an oleo-stearo-palmitate of lead. The glycerin remains dissolved in the water, or mechanically mixed with the plaster. That such is the correct view of the nature of this compound is evinced by the fact that, if the oxide of lead be separated from the plaster by digestion at a moderate heat in very dilute nitric acid, the fatty matter which remains will unite with litharge with the greatest facility, without the intervention of water. According to the modern chemical views, the fixed or fatty oils are compounds of the free fatty acids mentioned and the radical *glyceryl.* When boiled with the oxide of lead and water, the fatty acids combine with the metallic oxide to form the plaster, and the glyceryl unites with the liberated hydrogen and becomes glycerin.

The reaction for olein and lead oxide is as follows: $2C_3H_5\,\underset{\text{olein}}{(C_{18}H_{33}O_2)_3} + \underset{\text{litharge}}{3PbO} + \underset{\text{water}}{3H_2O} = \underset{\text{lead oleate}}{3Pb\,(C_{18}H_{33}O_2)_2} + \underset{\text{glycerin}}{2C_3H_5\,(OH)_3}$. The radical glyceryl ($C_3H_5$) is a triad, and combines with three groups of a fatty acid or three groups of hydroxyl (OH).

Other oleaginous substances and other metallic oxides are susceptible of the same combination, and some of them form compounds having the consistence of a plaster; but, according to M. Henry, of Paris, no oily matter except animal fat can properly be substituted for olive oil, and no metallic oxide, not even one of the other oxides of lead, for litharge. He ascertained, moreover, that the English litharge is preferable for the formation of lead plaster to the German. From more recent experiments of Soubeiran, it appears that massicot or even minium may be substituted for litharge, and a plaster of good consistence be obtained; but that a much longer time is required for completing the process than when the officinal formula is followed. Owing to the necessity for its partial deoxidation the use of minium requires a longer continuance of the process than when massicot is employed. According to M. Davallon, Professor in the School of Medicine and Pharmacy at Lyons, it is important that the olive oil employed should be pure; for when adulterated, as it frequently is, it yields an imperfect product. Mr. N. S. Thomas prepared a good plaster by substituting lard for olive oil, in the proportion of eight pounds of lard to five of litharge (*A. J. P.*, xix. 175); and we are told that it is a common practice, in this country, to make lead plaster with a mixture of lard oil and olive oil. Mueller uses equal parts of lard, olive oil, and litharge, having previously heated the litharge, until a small sample causes no effervescence when dropped into nitric acid, showing the absence of carbonate. (*Pharm. Ztg.*, 1879, p. 70; *A. J. P.*, 1879, p. 190.) It is said that the English plaster-makers rarely follow the Br. Pharm. direction, preferring the recipe of the old London Pharmacopœia, which contains more litharge and yields a much firmer and less adhesive product.[*] (*P. J. Tr.*, 3d ser., v. 701, 716.)

Lead plaster has also been prepared by double decomposition between soap and acetate or subacetate of lead; but the results have not been so advantageous as to lead to the general adoption of this process. (See *A. J. P.*, ix. 727, and *Journ. de Pharm.*, xxiii. 163 and 322.)[†]

Preparation. The vessel in which the lead plaster is prepared should be of such a size that the materials will not occupy more than two-thirds of its capacity. The oil should be first introduced, and the litharge then sprinkled in by means of a sieve, the mixture being constantly stirred with a spatula. The particles of the oxide are thus prevented from coalescing in small masses, which the oil would not easily penetrate, and which would therefore delay the process. While the water exerts an important chemical agency in the changes which occur, it is also useful by preventing too high a temperature, which would decompose the oil, and cause the reduction of the oxide. The waste must, therefore, be supplied by fresh additions as directed in the process; and the water added for this purpose should be previously heated, as otherwise it would not only delay the operation, but by producing explosion might endanger the operator. During the continuance of the boiling, the material should be constantly stirred, and the spatula should be repeatedly passed along the bottom of the vessel, from side to side, so as to prevent any of the oxide, which is disposed by its greater density to sink to the bottom, from remaining in that situation. The materials swell up considerably, in consequence partly of the vaporization of the water, partly of the escape of carbonic acid gas, which is liberated by the oily acids from some carbonate of lead usually contained in the litharge. The process should not be continued longer than is sufficient to produce complete union of the ingredients, and this may be known by the color and consistence of the mass. The color of the litharge gradually becomes paler, and at length almost white when the plaster is fully formed. The consistence increases with the progress of the boiling, and is sufficiently thick, when a portion of the plaster, taken out and allowed to cool upon the end of a spatula, or thrown into cold water, becomes solid, without adhering in this state to the fingers. The portion thus solidified should not present, when broken, any red points, which would indicate the presence of a portion of uncombined litharge. When the plaster is formed, it should be removed from the fire, and after a short time cold water should be poured upon it. Portions should then be detached from the mass, and, having been well kneaded under water, in order to separate the viscid solution of glycerin contained in the interior, should be formed into cylindrical rolls, and wrapped in paper. Such at least has been the course of proceeding usually recommended. But M. Davallon maintains that the presence of glycerin in the plaster is useful by keeping it in a plastic state, and that washing and kneading are injurious, the former by removing the glycerin, the latter by introducing particles of air and moisture into the mass, which is thus rendered more disposed to raneidity. (*A. J. P.*, xv. 274; from *Journ. de Chim. Méd.*) By employing steam heat in the preparation of this plaster, the risk of burning it is avoided. For a good arrangement for this purpose, see *Mohr and Redwood's Pharmacy*, edited by Prof. Procter, p. 420.

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[*] *Schwarze's Mutterpflaster, Emplastrum Fuscum* of the German Pharmacopœia, is made by boiling 64 parts of olive oil with 32 parts of very finely powdered red lead in a copper kettle until the mass is of a dark brown color, and then adding 16 parts of yellow wax.

Emplastrum Fuscum Camphoratum is the same, with the addition of 1 per cent. of camphor.

[†] M. de Mussey, physician of the hospital *de la Pitié*, having witnessed inconveniences from lead plaster in consequence of the absorption of the lead, substituted for it a plaster with a basis of oxide of zinc, which he has found to answer very well in practice. It cannot be made by direct combination of the oxide; and it is necessary to have recourse to the method of double decomposition. Solutions of white olive oil soap and of sulphate of zinc being mixed, a copious precipitate takes place of oleo-palmitate of zinc, which, after being washed and dried, may be combined with resins, oil, and wax, to give it the necessary consistence. (*Journ. de Pharm.*, xxvii. 100.)

Mr. C. Lewis Diehl has found it almost impossible, in following the U. S. directions of 1860, to obtain a plaster wholly free from uncombined litharge. He obviated the difficulty by first rubbing the sifted litharge with about half its weight of oil, then stirring the mixture with the remainder of the oil, in a tinned copper kettle, adding the water, and heating to 212 °F. until a uniform plaster was formed. (*A. J. P.*, 1867, p. 385.)

Medical Properties and Uses. This plaster, which has long been known under the name of *diachylon*, is used as an application to excoriated surfaces, and to slight wounds, which it serves to protect from the action of the air. It may also be beneficial by the sedative influence of the lead which enters into its composition. A case is on record in which lead colic resulted from its long-continued application to a large ulcer of the leg. (*Am. Journ. of Med. Sci.*, xxiii. 246.) Dr. J. M. Bigelow reports a case of excessive sweating of the feet, which he cured by putting the patient in bed for thirteen days and keeping the feet enveloped in strips of lead plaster. (*N. R.*, Oct. 1875.) Its chief use is in the preparation of other plasters.[*]

Off. Prep. Emplastrum Ammoniaci cum Hydrargyro, *U. S.;* Emplastrum Asafœtida, *U. S.;* Emp. Ferri; Emp. Galbani, *Br.*, *U. S.;* Emp. Hydrargyri; Emp. Opii, *U. S.;* Emp. Resinæ; Emp. Saponis.

EMPLASTRUM PLUMBI IODIDI. *Br.* *Iodide of Lead Plaster.*

(ẸM-PLĂS'TRỤM PLŬM'BĪ Ī-ŎD'Ị-DĪ.)

Emplâtre d'Iodure de Plomb, *Fr.;* Jodblei-Pflaster, *G.*

"Take of Iodide of Lead *one ounce;* Soap Plaster, Resin Plaster, each, *four*

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[*] *Logan's Plaster.* Take of Litharge, Carbonate of Lead, each, *a pound;* Castile Soap, *twelve ounces;* Butter (fresh) *four ounces;* Olive Oil *two and a half pints;* Mastic, in powder, *two drachms.* It is to be understood that the pound and ounce are of the avoirdupois weight. Having mixed the Soap, Oil, and Butter, add the Litharge, and boil the mixture gently, constantly stirring, for an hour and a half, or until it shall assume a pale brown color; then increase the heat somewhat, and continue to boil, until a portion of the liquid, dropped on a smooth board, is found not to adhere to it on cooling; then remove it from the fire, and mix the Mastic with it. Logan's plaster has long been in popular use in Philadelphia, and is yet employed by regular practitioners as a protective and discutient application.

Plaster of Carbonate of Lead. This was originally introduced into our Pharmacopœia as a substitute for *Mahy's plaster*, at one time much employed in some parts of the United States; but was omitted in the edition of 1840. It is a good application to surfaces inflamed or excoriated by friction, and may be resorted to with advantage in those troublesome cases of cutaneous irritation, and even ulceration, which are apt to occur upon the back and hips during long-continued confinement to one position. We give the process as contained in the Pharmacopœia of 1830. "Take of Carbonate of Lead *a pound;* Olive Oil *two pints;* Yellow Wax *four ounces;* Lead Plaster *a pound and a half;* Florentine Orris, in powder, *nine ounces.* Boil together the Oil and Carbonate of Lead, adding a little water, and constantly stirring, till they are thoroughly incorporated; then add the Wax and Plaster, and, when these are melted, sprinkle in the Orris, and mix the whole together." By this process a good plaster may be prepared, rather too soft at first, but soon acquiring the proper consistence.

ounces. Add the Iodide of Lead, in fine powder, to the Plasters previously melted, and mix them intimately." *Br.*

This is a local discutient plaster, which may also be used with other means to affect the system. (See *Plumbi Iodidum.*)

EMPLASTRUM RESINÆ. *U. S.*, *Br.* *Resin Plaster.* [*Adhesive Plaster.*]

(ẸM-PLĂS′TRỤM RẸ-ṢĪ′NÆ.)

Emplastrum Adhesivum, *P.G.;* Emplâtre résineux (adhésif), *Fr.;* Heftpflaster, *G.*

"Resin, in fine powder, *fourteen parts* [or seven ounces av.]; Lead Plaster, *eighty parts* [or forty ounces av.]; Yellow Wax, *six parts* [or three ounces av.], To make *one hundred parts* [or fifty ounces av.]. To the Lead Plaster and Wax, melted together over a gentle fire, add the Resin, and mix them." *U. S.*

"Take of Resin *four ounces;* Lead Plaster *two pounds;* Hard Soap *two ounces.* To the Lead Plaster, previously melted with a gentle heat, add the Resin and Soap, first liquefied, and stir them until they are thoroughly mixed." *Br.* The weights here referred to are the avoirdupois.

The alteration from the previous officinal formula is the addition of yellow wax, which is an improvement, rendering the plaster somewhat less irritating without diminishing its adhesive properties.

Resin plaster differs from the lead plaster in being more adhesive and somewhat more stimulating. It is the common adhesive plaster of commerce, and is much employed for retaining the sides of wounds in contact, and for dressing ulcers according to the method of Baynton, by which the edges are drawn towards each other, and a firm support is given to the granulations. As prepared by the Dublin College it contained soap, which gave it greater pliability, and rendered it less liable to crack in cold weather, without impairing its adhesiveness; and the process of that College has been adopted in the British Pharmacopœia. It is usually spread upon muslin; and the spreading is best accomplished, on a large scale, by means of a machine, as described in the general observations upon plasters. It is kept ready spread by the pharmacist; but, as the plaster becomes less adhesive by long exposure to the air, the supply should be frequently renewed. When the skin is very delicate, it occasionally excites some irritation, and, under these circumstances, a plaster may be substituted containing a smaller proportion of resin. That originally employed by Baynton contained only six drachms of resin to the pound of lead plaster. To obviate the same evil, M. Herpin recommends the addition of tannate of lead, the proportion of which, when adhesiveness is required in the plaster, should not exceed one-twentieth, but, under other circumstances, may be increased to one-twelfth. (*Bull. de Thérap.*, xlviii. 155.)

In order to render the plaster more adhesive, and less brittle in cold weather, it is customary with many manufacturers to employ a considerable proportion of Burgundy pitch or turpentine in its preparation; but these additions are objectionable, as they greatly increase the liability of the plaster to irritate the skin, and thus materially interfere with the purposes for which the preparation was chiefly intended.*

Off. Prep. Emplastrum Arnicæ, *U. S.;* Emplastrum Belladonnæ; Emplast. Calefaciens, *Br.;* Emplastrum Capsici, *U. S.;* Emplast. Opii, *Br.;* Emplast. Plumbi Iodidi, *Br.*

EMPLASTRUM SAPONIS. *U. S.*, *Br.* *Soap Plaster.*

(ẸM-PLĂS′TRỤM SẠ-PŌ′NĬS.)

Emplastrum Saponatum, *P.G.;* Emplastrum cum Sapone, *F.P.;* Emplâtre de Savon, *Fr.;* Seifenpflaster, *G.*

"Soap, dried and in coarse powder, *ten parts* [or one ounce av.]; Lead Plaster,

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* An adhesive plaster, exempt from oxide of lead, is prepared by Pettenkofer. It consists of calcareous soap incorporated with turpentine and suet, and may be prepared in the following manner. A solution of soap is decomposed by a solution of chloride of calcium. The precipitate, having been expressed and dried, is powdered with half its weight of turpentine dried by heat; and the mixture is melted, along with an eighth part of suet, in boiling water. The mixture is boiled until the mass melts into a homogeneous fluid, when it is worked by the hand, in the ordinary manner, in cold water. Should portions of the calcareous soap not melt, they should be separated by straining through flannel. (*Journ. de Pharm.*, 3e sér., x. 358.)

ninety parts [or nine ounces av.]; Water *a sufficient quantity.* Rub the Soap with Water until brought to a semi-liquid state; then mix it with the Lead Plaster, previously melted, and evaporate to the proper consistence." *U. S.*

"Take of Hard Soap *six ounces;* Lead Plaster *two pounds and a quarter;* Resin *one ounce.* To the Lead Plaster, melted by a gentle heat, add the Soap and the Resin, first liquefied; then, constantly stirring, evaporate to a proper consistence." *Br.* The avoirdupois weights are used in this process.

The present U. S. formula is an improvement upon that of a former edition of the Pharmacopœia. By directing the soap to be in powder instead of sliced, it may be more thoroughly incorporated with the plaster. Greater plasticity is accomplished, in some degree, in the British process by the resin. In preparing the U. S. plaster, Mr. C. Lewis Diehl has found some difficulty in rubbing the soap up perfectly and rapidly with the water, and has, therefore, adopted the plan of first rubbing the soap with its weight of water, then straining the mixture through coarse muslin, and lastly reducing the residue with a proportionate quantity of water, before stirring the whole into the melted plaster. (*A. J. P.*, 1867, p. 386.)

Soap plaster is considered discutient, and is sometimes used as an application to tumors, where a dressing is required. Somewhat softer in its character, the soap cerate, formerly officinal, may be found useful.*

Off. Prep. Emplastrum Calefaciens, *Br.;* Emplastrum Plumbi Iodidi, *Br.*

ENEMATA. *Clysters.*

(Ẹ-NĔM'Ạ-TẠ.)

These can scarcely be considered proper objects for officinal direction; but, having been introduced into the former British Pharmacopœias, and retained in the present, the plan of this work requires that they should be noticed. They are substances in the liquid form, intended to be thrown up the rectum, with the view either of evacuating the bowels, of producing the peculiar impression of a remedy upon the lower portion of the alimentary canal and neighboring organs, or of acting on the system generally through the medium of the surface to which they are applied. They are usually employed to assist the action of remedies taken by the mouth, or to supply their place when the stomach rejects them or is insensible to their impression. Sometimes they are preferably used when the seat of the disorder is in the rectum or its vicinity. As a general rule, three times as much of any remedy is required to produce a given impression by enema, as when taken into the stomach; but this rule should be acted on with caution, as the relative susceptibilities of the stomach and rectum are not the same in all individuals; and, with regard to all very active remedies, the best plan is to administer less than the stated proportion. Attention should also be paid to the fact that, by the frequent use of a medicine, the susceptibility of the stomach may be in some measure exhausted, without a proportionate diminution of that of the rectum.

When the object is to evacuate the bowels, the quantity of liquid administered should be considerable; for an adult, from ten fluidounces to a pint; for a child of eight or ten years, half that quantity; for an infant within the year, from one to three fluidounces. Much larger quantities of mild liquids may sometimes be given with safety and advantage; as the bowels will occasionally feel the stimulus of distention, when insensible to irritating impressions.

When the design is to produce the peculiar impression of the remedy upon the neighboring parts, or on the system, it is usually desirable that the enema should be retained, and the vehicle should therefore be bland, and as small in quantity as is compatible with convenient administration. A solution of starch, flaxseed tea, or other mucilaginous fluid should be selected, and the quantity should seldom exceed two or three fluidounces. In every case, the patient should be instructed to resist any immediate disposition to discharge the injected fluid; and his efforts to retain it should be assisted, if necessary, by pressure with a warm folded towel upon the fundament. The best instrument for administering enemata is a rubber bulb and tube syringe.

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* *Ceratum Saponis.* U. S. 1870. *Soap Cerate.* (Cérat de Savon, *Fr.;* Seifencerat, *G.*) "Take of Soap Plaster *two troyounces;* White Wax *two troyounces and a half;* Olive Oil *four troyounces.* Melt together the Plaster and Wax, add the Oil, and, after continuing the heat a short time, stir the mixture until cool." *U. S.* 1870.

Soap cerate is thought to be cooling and sedative, and is used in scrofulous swellings and other instances of chronic external inflammation.

ENEMA ALOES. *Br.* *Enema of Aloes.*

(ĔN′Ẹ-MẠ ĂL′Ọ-ĒȘ.)

"Take of Aloes *forty grains;* Carbonate of Potash *fifteen grains;* Mucilage of Starch *ten fluidounces.* Mix and rub together." *Br.*

This is intended as a formula for the use of aloes in cases of ascarides in the rectum, and of amenorrhœa attended with constipation.

ENEMA ASSAFŒTIDÆ. *Br.* *Enema of Assafetida.*

(ĔN′Ẹ-MẠ ĂS-SẠ-FŒT′Ị-DÆ—ăs-ạ-fĕt′ị-dē.)

Enema Fœtidum; Fetid Enema.

"Take of Assafetida *thirty grains;* Distilled Water *four fluidounces.* Rub the Assafetida in a mortar with the Water added gradually, so as to form an emulsion." *Br.*

This is carminative and antispasmodic as well as laxative. In the former Br. Pharmacopœia it was directed to be made by mixing the tincture and Distilled Water; and, in commenting on it, we stated that we should prefer a preparation consisting of the gum-resin rubbed up with water; as the alcohol of the tincture might in some instances prove injurious. In the present formula this plan has been adopted. The whole quantity directed may be administered at once.

ENEMA MAGNESIÆ SULPHATIS. *Br.* *Enema of Sulphate of Magnesia.*

(ĔN′Ẹ-MẠ MĂG-NĒ′ȘỊ-Æ SŬL-PHĀ′TĬS.)

Enema Catharticum; Cathartic Clyster.

"Take of Sulphate of Magnesia *one ounce* [avoirdupois]; Olive Oil *one fluidounce;* Mucilage of Starch *fifteen fluidounces.* Dissolve the Sulphate of Magnesia in the Mucilage, add the Oil, and mix." *Br.*

The laxative enema, most commonly employed in this country, consists of a tablespoonful of common salt, two tablespoonfuls of lard or olive oil, the same quantity of molasses, and a pint of warm water. It has the advantage of consisting of materials which are always at hand in families, and is in all respects equal to the officinal preparation.

ENEMA OPII. *Br.* *Enema of Opium.*

(ĔN′Ẹ-MẠ Ō′PỊ-Ī.)

Enema Opii vel Anodynum; Anodyne Enema.

"Take of Tincture of Opium *half a fluidrachm;* Mucilage of Starch *two fluidounces.* Mix." *Br.*

This formula is unobjectionable. Every one in the habit of prescribing opium in this way, must have seen a much greater effect produced by a certain amount of laudanum injected into the rectum than by one-third of the quantity swallowed. The fluidrachm contains at least one hundred drops of laudanum of the ordinary size, and not less than one hundred and twenty as they are often formed. From twenty to twenty-five drops are usually considered a medium dose by the mouth; so that sixty drops, equivalent to about thirty minims, are abundantly sufficient by enema. As the object is that the enema should remain in the rectum, the smaller the quantity of the vehicle the better; and a mucilaginous fluid is preferable to water, as it involves the tincture, and prevents the irritation of the alcohol before the opium begins to take effect. The ordinary anodyne enema, employed in this country, consists of about sixty drops of laudanum and one or two fluidounces of flaxseed tea or solution of starch, conforming precisely with the present British formula.

This is an admirable remedy in obstinate vomiting, strangury from blisters, painful affections of the kidneys, bladder, and uterus, and in the tenesmus of dysentery. It may also frequently be employed to produce the effects of opium upon the system, when circumstances prevent the administration of that medicine by the mouth.

ENEMA TABACI. *Br.* *Enema of Tobacco.*

(ĔN′Ẹ-MẠ TĂB′Ạ-CĪ.)

"Take of Leaf Tobacco *twenty grains;* Boiling Water *eight fluidounces.* Infuse in a covered vessel, for half an hour, and strain." *Br.*

The whole quantity is to be given at once. The dose is somewhat less than that usually employed in this country.

ENEMA TEREBINTHINÆ. *Br.* *Enema of Turpentine.*

(ĔN′Ẹ-MẠ TĔR-Ẹ-BĬN′THỊ-NÆ.)

"Take of Oil of Turpentine *one fluidounce;* Mucilage of Starch *fifteen fluidounces.* Mix." *Br.*

For the dose of this preparation, see *Oleum Terebinthinæ.*

ERGOTA. *U. S., Br.* *Ergot.* [*Ergot of Rye.*]

(ẸR-GŌ′TẠ.)

"The sclerotium of Claviceps purpurea, Tulasne (*Nat. Ord.* Fungi), replacing the grain of Secale cereale, Linné. (*Nat. Ord.* Graminaceæ.)" *U. S.* "The sclerotium (compact mycelium or spawn of Claviceps purpurea, *Tulasne*), produced within the paleæ of the common rye, Secale cereale." *Br.*

Secale Cornutum, *P.G.;* Secale Clavatum, Mater Secalis, Clavus Secalinus; Spurred Rye; Ergot, Seigle ergoté (noir), Blé cornu, *Fr.;* Mutterkorn, Kornmutter, Lapfenkorn, *G.*

"Ergot should be preserved in a dry place, and should not be kept longer than a year." *U. S.*

In all the Graminaceæ, or grass tribe, and in some of the Cyperaceæ, the place of the seeds is sometimes occupied by a morbid growth, which, from its resemblance to the spur of a cock, has received the name of *ergot*, adopted from the French. This product is most frequent in the rye, *Secale cereale*, and from that grain was adopted in the first edition of the U. S. Pharmacopœia, under the name of *secale cornutum*, or *spurred rye.* In the edition of 1840 the name was changed to *ergota.* It is probable that this morbid growth has similar properties from whatever plant derived; and the fact has been proved in relation to the ergot of wheat. (See *Am. Journ. of Med. Sci.*, N. S., xxxii. 479.) Indeed, in a case reported by Dr. D. L. McGugin (*Iowa Med. Journ.*, iv. 93), this variety of ergot is said to have succeeded promptly, when that of rye, previously tried, had failed.* A short thick ergot, produced upon the wild rice of Minnesota, is said to be used as an abortifacient and during labor by the Indian women.

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* Ergot was at one time thought to be merely the seed altered by disease. A second opinion considered it a parasitic fungus, occupying the place of the seed. This was entertained by De Candolle, who called the fungus *Sclerotium Clavus.* According to a third and intermediate opinion, the ergot is the seed, diseased and entirely perverted in its nature by the influence of a parasitic fungus, attached to it from the very beginning of its development. This view was put forth by M. Leveillé. (*Annals of the Linnæan Society of Paris*, 1826.) Leveillé gave to the supposed fungus the name of *Sphacelia segetum.* According to Mr. E. J. Quekett, London, the beginning of the growth of the ergot is marked by the appearance, about the young grain and its appendages, of multitudes of minute filaments like cobwebs, which run over all its parts, cementing anthers and stigmas together, and of a white coating upon the surface of the grain, from which, upon immersion in water, innumerable minute particles separate, which after a time sink in the fluid. These particles, when examined by the microscope, prove to be the germs or *sporidia* of a species of fungus, and may be observed to sprout and propagate in various ways under favorable circumstances. Their length, upon the average, is about the four-thousandth of an inch. The filaments are the results of the growth of these singular germs. The sporidia and filaments do not increase with the increase of the ergot; and, when this has projected beyond the paleæ and become visible, it has lost a portion of its white coating, and presents a dark violet color. It now increases with great rapidity, and attains its full size in a few days. When completely developed it exhibits very few of the filaments or sporidia upon its surface. But Mr. Quekett believed that the germs of the fungus emit their filaments through the tissue of the ergot when young and tender, and that, as this increases, it is made up partly of the diseased structure of the grain, and partly of the fungus. The plant was named by Mr. Quekett *Ergotætia abortifaciens;* for which title Dr. Pereira, at the suggestion of the Rev. M. J. Berkeley, substituted that of *Oidium abortifaciens.* (See *A. J. P.*,

M. Leperdriel, Jr., of Montpellier, in France, affirms that the *ergot of wheat* is destitute of the poisonous properties of that of rye, and is less liable to change. The former point is, to say the least, very uncertain. Prof. Bentley, of London, found that of two specimens, one of the ergot of rye, the other of wheat, which had been kept under similar circumstances for ten years, the former was quite destroyed, while the latter was apparently unchanged. Ergot is rarer in wheat than in rye; and in the head of the former there is generally but one and very rarely more than two of the diseased grains. It is produced usually in wheat in wet seasons, and on that side of the head most exposed to the dampness. It is shorter and much thicker than the ergot of rye, being about half an inch long and three-quarters of an inch or more in circumference, and cleft into two or three divisions. In color and smell it resembles the spurred rye. (*P. J. Tr.*, March and April, 1863.)

The very beautiful and praiseworthy investigations of M. Tulasne have shown that ergot is not the diseased grain of the rye, but is the *sclerotium* of a fungus, the *Claviceps purpurea*, Tulasne. This fungus has three stages in its life-history. The development of the *sphacelia*, or first stage, commences with that of the pistil, which serves as a soil for it. The ovary of the rye consists of a cellular membrane of two coats, the outer of which has a thick parenchyma, white and gorged with juice; the inner is very delicate and green. The sphacelia, when it takes possession of the ovary, identifies itself with the outer parenchyma, and in some measure replaces it, being as it were borne by the inner membrane. It rapidly increases, taking the form of the ovary, and almost obliterating its cavity. The ovule is either entirely wanting, or may be seen, on a careful examination, in an imperfect form. For some time the parasite is represented entirely by the sphacelia, which is an oblong, fungous mass, almost homogeneous, soft and tender, marked on its surface by numerous sinuous furrows, and having within many irregular cavities, which, as well as the outer coat, are uniformly covered with linear parallel cells. From the summits of these peripherio cells, internal as well as external, issue oval corpuscles, from ·005 to ·007 mm. in length, which spread upon neighboring objects, and especially the glumes of the flowers they inhabit. They are a kind of reproductive cells, called conidia, which are produced by many fungi, long before the perfect plant is developed. M. Tulasne calls them "*spermatie.*" In the early stage, the sphacelia respects the top of the ovary and the stigmas attached. The stamens often abort; but the filaments and anthers may sometimes be seen buried in the tissue of the sphacelia, and altered by its action. Sometimes the ovule is not completely aborted, but it is certainly never developed into a monster grain. In all ergotized plants, the pistils and stigmas, when they remain, are often covered with a mouldiness, consisting of spores and entangled filaments, which end by covering the parts with an abundant ashy or sooty powder. This is a different fungus, and was confounded by Mr. Quekett with the ergot plant. It is found as well in the non-ergotized as in the ergotized flowers, and in those of plants which do not bear ergot. At a somewhat advanced period of the development of the sphacelia, there exudes, especially from the summit, a very adhesive juice, which spreads over that structure, bearing along with it an immense number of the seedlets or "*spermaties.*" This leaves on the surface when dry an oily appearance, and afterwards the spots, where it remains, become brownish or blackish. But this exudation does not appear until the sphacelia has ceased to constitute the whole plant.

At the base of the sphacelia is produced a compact body, violet black without and white within, which is the ergot in a rudimentary state. With this commences the second stage in the development of the fungus. The young ergot is everywhere

xi. 116 and 237.) The observations of Mr. Quekett were generally correct, and have been verified by M. Tulasne himself; yet the plant is only accidentally present, and is wholly distinct from the true ergot fungus. The fact noted that the sporidia of Mr. Quekett's fungus are apparently capable, if applied to the seeds of certain Graminaceæ, or sprinkled on the soil where they grow, of giving rise to ergot in these plants, is readily explicable on the supposition that the sporidia might have been mixed with those of the proper ergot.

invested by the tissue of the sphacelia (which Tulasne calls also *spermagonia*, from its office); but, as it increases, it seems to be placed below the spermatopherous apparatus, and raises it steadily out of the floral bracts which concealed it, ending by supporting it wholly at its summit. Sometimes it carries with it the atrophied ovary, which still shows the hairs that crowned it, and some remains of the stigmas. It results that the ergot, which is technically the *sclerotium* of the fungus, remains for some time concealed in the sphacelia, so that this seems to constitute the whole plant. But, when the function belonging to this has been fulfilled, it begins to become dry, and is much deformed. The ergot, on the contrary, increases in all directions, and soon appears above the glume. As it augments, the thin coating which it has received from the spermatopherous tissue, especially below, gradually becomes thinner, and seems to disappear; so that its surface, instead of being uniformly violet black, is only here and there covered with the remains of the tissue, or by a deposit of the conidia or "*spermatie*." Nevertheless, the sphacelia, deformed, shrunken, and worn away by rains and other causes, remains long at the top of the ergot, along with the abortive ovary, etc., and may even continue to adhere when the ergot is detached from the plant. The time required for the full development of the sphacelia and the ergot or sclerotium varies. In an example under the observation of M. Tulasne, at least a month elapsed after the appearance of the sphacelia, before the growth was completed.

Ergot has absolutely nothing in common with normal grain. The anatomical structure and all the physical characters of ergot are those of the mushrooms, or rather of a sclerotic mycelium. The parenchyma, which is whitish, dry, and brittle, consists in all its parts of irregular, globular, or polyhedric thick-walled cells, intimately united, and filled with a limpid oil, but feebly colored by iodine. The superficial utricles, which alone are colored, have an outer wall thicker than the inner, and the color of these is what gives its characteristic hue to ergot. Not the least trace of starch is to be detected.

If ergot be planted in a suitable soil, evidences of germination are seen in about three months. Little globular prominences appear on its surface, and gradually enlarge, and raise themselves upon cylindrical stems, and finally become perfect pilei or fruiting fungi, and produce elongated, rod-like spores in flask-shaped cavities, which open by a little pore. These little fungi belong to the genus *Sphæria*. As they increase, the interior of the ergot becomes exhausted, by contributing to their growth. Falling to the ground, in its natural course, the ergot in the soil germinates, and produces pilei, the spores of which, carried up with the juices of rye, become lodged in the ovary, where they begin the course of life and progress which has been delineated. Different grains are probably infested with different species of Claviceps; but there is no reason to think that any other species is concerned in the product of any officinal variety of ergot. (*Annales des Sciences Naturelles*, 3e sér., xx. 5, 1853.)

The ergot usually projects out of the glume or husk beyond the ordinary outline of the spike or ear. In some spikes the place of the seeds is wholly occupied by the ergot, in others only two or three spurs are observed. It is said to be much more energetic when collected before than after harvest. Rye has generally been thought to be most subject to the disease in poor and wet soils, and in rainy seasons; and intense heat succeeding continued rains has been said to favor its development, especially if these circumstances occur at the time the flower is forming. It is now, however, asserted that moisture has little or nothing to do with its production. It should not be collected until some days after it has begun to form; as, according to M. Bonjean, if gathered on the first day, it does not possess the poisonous properties which it exhibits when taken on the sixth day. (See *P. J. Tr.*, Jan. 1842.)

Properties. Ergot is in solid, brittle yet somewhat flexible grains, from a third of an inch to an inch and a half long, from half a line to three lines in thickness, cylindrical or obscurely triangular, tapering towards each end, obtuse at the extremities, usually curved like the spur of a cock, marked with one or two longitudinal furrows, often irregularly cracked or fissured, of a violet brown color and often somewhat glaucous externally, yellowish white or violet white within, of an unpleasant smell when in mass resembling that of putrid fish, and of a taste which is at first scarcely perceptible, but ultimately disagreeable and slightly acrid. "Somewhat fusiform, obtusely triangular, usually curved, about one inch (25 mm.) long, and one-eighth of an inch (3 mm.) thick; three-furrowed, obtuse at both ends, purplish black, internally whitish, with some purplish striæ, breaking with a short fracture; odor peculiar, heavy, increased by trituration with solution of potassa; taste oily and disagreeable." *U. S.* Ergot yields its virtues to water and alcohol. The aqueous infusion or decoction is claret-colored, and has an acid reaction. It is precipitated by acetate and subacetate of lead, nitrate of silver, and tincture of galls, but affords with iodine no evidence of the presence of starch. Long boiling impairs the virtues of the medicine.

Ergot has been analyzed by Vauquelin, Winckler, Wiggers, Wright, Legrip, Wenzell, Tanret, Dragendorff, and several others. The analysis by M. Legrip is among the most complete of the earlier researches on ergot. That chemist obtained from 100 parts of ergot 34·50 parts of a thick, fluid, fixed oil, of a fine yellow color; 2·75 of starch; 1·00 of albumen; 2·25 of inulin; 2·50 of gum; 1·25 of uncrystallizable sugar; 2·75 of a brown resin; 3·50 of *fungin;* 13·50 of vegeto-animal matter; 0·75 of osmazome; 0·50 of a fatty acid; 24·50 of lignin; 0·50 of coloring principles; an odorous principle not isolated; 2·25 of fungate of potassium; 0·50 of chloride of sodium; 0·50 of sulphate of calcium and magnesium; 1·25 of subphosphate of calcium; 0·25 of oxide of iron; 0·15 of silica; and 2·50 of water, with 2·35 loss. (*Ann. de Thérap.*, 1845, p. 44.) Crystals of sulphate of potassium were obtained in considerable quantity on one occasion in carrying out the British officinal process for liquid extract of ergot, which may possibly have pre-existed in the ergot, but were more probably formed during the process out of constituents pre-existing. (Attfield, *P. J. Tr.*, March, 1869, p. 513.) Dr. Wright supposed the virtues of ergot to reside in the fixed oil, which he therefore recommended as a substitute for the medicine. The *oil of ergot*, when obtained from grains recently collected, is, according to Dr. Wright, often quite free from color; but, as usually prepared, it is reddish brown. It has a disagreeable, somewhat acrid taste, is lighter than water, and is soluble in alcohol and alkaline solutions. It is prepared by forming an ethereal tincture of ergot by the process of displacement, and evaporating the ether with a gentle heat. It may be more cheaply prepared by substituting benzin for ether. Experience has shown that, though the oil thus prepared with ether may have produced effects analogous to those of ergot, they were to be ascribed rather to some principle extracted along with the oil by the menstruum than to the oil itself; for, when procured by expression, this has been found to be inactive; although Prof. Procter has ascertained that it contains a little *secalin*, one at least of the active principles of ergot, which may be separated from it by washing with acidulated water. According to Mr. T. R. Baker, the oil has a taste and smell similar to those of castor oil, with which it also agrees in ultimate composition, and yields analogous results in saponification. (*A. J. P.*, xxiv. 101–2.) Dr. T. C. Herrmann investigated specially the chemical constitution of the oil of ergot. As obtained by means of ether, it was brownish yellow, of an aromatic smell and acrid taste, viscid, of the sp. gr. 0·9249, and without the drying property. It consists of 22·703 per cent. of palmitic acid, 69·205 of oleic acid, and 8·091 of glycerin. (*N. R.*, 1872, p. 238; from *Buchner's Repertorium*, 1871, p. 283.) The *sugar of ergot* was found by Mitscherlich to be peculiar, and was named by him *mycose.* He described it as crystallizable, very soluble in water, almost insoluble in cold but dissolved by about 100 parts of boiling alcohol, quite insoluble in ether, and without the action of glucose on the salts of copper. Its formula is $C_{12}H_{22}O_{11} + 2H_2O$, allying it to cane sugar, and possibly making it identical with *trehalose.*

According to Wenzell (*A. J. P.*, May, 1864), ergot of rye contains two peculiar alkaloids, which he designates *ecboline* and *ergotine*, and claims to be the active principles of the drug. The two bases of ergot are, according to Wenzell, combined with *ergotic acid*, the existence of which has been further admitted by Ganser. It is said to be a volatile body yielding crystallizable salts.

A crystallized, colorless alkaloid, *ergotinine*, $C_{35}H_{40}N_4O_6$, has been isolated (1877–

78) by Tanret. He obtained it to the amount of 0·04 per cent., some amorphous ergotinine, moreover, being present. The solutions of ergotinine turn greenish and red very soon; they are fluorescent. Sulphuric acid imparts to it a red, violet, and finally a blue hue.

Dragendorff and several of his pupils since 1875 have isolated the following *amorphous* principles of the drug: 1, *sclerotic acid*, said to be a very active substance, used chiefly in subcutaneous injections; about 4 per cent. of colorless acid may be obtained from good ergot of rye; 2, *scleromucin*, a mucilaginous matter which may be precipitated by alcohol from aqueous extracts of the drug; 3, *sclererythrin*, the red coloring matter probably allied to anthrachinon and the coloring substances of madder, chiefly to purpurin; 4, *scleroiodin*, a bluish black powder soluble in alkalies; 5, *fusco-sclerotinic acid;* 6, *picrosclerotine*, apparently a highly poisonous alkaloid; lastly, 7, *scleroxanthin*, $C_7H_7O_3 + H_2O$, and 8, *sclerocrystallin*, $C_7H_7O_3$, have been obtained in crystals; their alcoholic solution is but little colored, yet assumes a violet hue on addition of ferric chloride.

Tanret also observed in ergot of rye a volatile *camphoraceous* substance.

When ergot or its alcoholic extract is treated with an alkali, it yields as products of the decomposition of the albuminoid matters ammonia or ammonia bases, according to Ludwig and Stahl, *methylamine;* according to others, *trimethylamine.* Wenzell states that phosphate of trimethylamine is present in an aqueous extract of ergot, but Ganser ascertained that no such base pre-exists in ergot. Flückiger found that the crystals which abound in the extract after it has been kept for some time are an acid phosphate of sodium and ammonium with a small proportion of sulphate.

We quote from Dilg's summary of "the active constituents of ergot" (*A. J. P.*, 1878, p. 335) Dragendorff's process for the two most active constituents of ergot, *sclerotic* or *sclerotinic acid* and *scleromucin.* "Digest ergot, previously exhausted by ether and absolute alcohol, with water, dialyse, evaporate the dialysate to a syrupy consistence, and treat with sufficient alcohol to obtain a mixture containing 40 to 45 per cent. alcohol, which precipitates the potassium phosphate, while more alcohol added until the strength is increased to 75 or 80 per cent., precipitates the salts of sclerotic acid, which are soluble in dilute but insoluble in stronger alcohol, and leave about 19 per cent. of ash.

"The filtrate, upon which alcohol has no further effect, produces with ether a slight precipitate, which after a few days' standing forms a syrupy, brown mass, which has scarcely any medicinal virtue. The filtrate from this precipitate, in which the reactions still distinctly indicate the presence of Wenzell's alkaloids, after evaporating the ether and alcohol, does *not* produce the specific action of ergot.

"The dark liquid remaining on the dialysator, when mixed with sufficient alcohol to bring it to 45–50 per cent., precipitates the *scleromucin*, which while moist forms a mucilaginous solution with water, but after drying is only partially soluble, differing in this respect from sclerotic acid, which is soluble, in all proportions, before and after drying.

"*Sclerotic acid* is obtained in a nearly pure state by kneading the mixed sclerotates as obtained above, with 80 per cent. alcohol, and afterwards dissolving them in 40 per cent. alcohol; the solution is mixed with an excess of hydrochloric acid, and after several hours precipitated with absolute alcohol, whereby the ash is reduced to about 3 per cent., and consists mainly of some silica, magnesia, and phosphates of iron and potassium. The acid is not a glucoside, and yields no precipitates with the reagents for alkaloids, except with phosphomolybdic acid a yellow, and with tannin a nearly colorless one.' Sclerotic acid is obtained as a yellowish brown, tasteless and inodorous substance, which has a very slight acid reaction, and is hygroscopic without being deliquescent. It is very well adapted for subcutaneous applications, in doses of 0·03–0·045 Gm.

"*Scleromucin* is darker in color, slightly hygroscopic, gummy, inodorous and tasteless; yields 26·8 per cent. of ash, and, like sclerotic acid, contains nitrogen, is not a glucoside, and is precipitated by tannin and phosphomolybdic acid.

"Good ergot yields about 4 to 4½ per cent. of sclerotic acid, and about 2 to 3 per cent. of scleromucin."

The odor of ergot is no doubt owing to the liberation of its volatile alkaloid, probably in consequence of a slow decomposition of the native salt. A method of detecting ergot in a mixed powder, rye flour for example, is thus afforded. If, on the addition of solution of potassa, the odor of ergot be perceived, its presence is sufficiently proved.

Ergot, when perfectly dry and kept in well-stopped bottles, will retain its virtues for a considerable time; but, exposed to air and moisture, it speedily undergoes chemical change and deteriorates. M. Gobley kept for more than ten years, perfectly sound, some ergot which he had selected from the year's harvest, carefully sifted, wiped with linen, then exposed to a heat of from 50° to 60° C. for three or four hours, and finally put into small boxes, holding each about 30 Gm. (a troyounce), previously heated with the ergot, and finally closed air-tight with pitch. (*Journ. de Pharm.*, Mar. 1873, p. 216.) It is, moreover, apt to be attacked by a minute worm, which consumes the interior of the grain, leaving merely the exterior shell and an excrementitious powder. This insect is sometimes found in the ergot before removal from the plant. In the state of powder, the medicine still more readily deteriorates; but Prof. Dragendorff believes that the decay is due to oxidization of the fatty principles of the ergot, and can be prevented by depriving the ergot of its oil before powdering. (*A. P. S.*, xxv.) This has since been confirmed by Zschiesing, who preserved ergot for two years, and Bombelon, who kept ergot in good condition for nine years, by previously removing the fixed oil with ether (*Phar. Zeitung*, No. 49, p. 51; *A. J. P.*, 1881, p. 457.) It is best, as a general rule, to renew it every year or two. M. Viel recommends that it should be well dried at a gentle heat, and incorporated with double its weight of loaf sugar, by means of which, if protected from moisture, it will retain its virtues for many years. According to M. Zanon, the same result is obtained by stratifying it with well washed and perfectly dried sand, in a bottle from which air and light are excluded. Camphor and powdered benzoin are said to prevent injury from worms.

Medical Properties and Uses. Given in small doses to men or non-pregnant women, ergot produces no obvious effect. In the quantity of half a drachm or a drachm it may occasion nausea or vomiting, but in order to produce very distinct symptoms enormous doses must be taken. We have given the fluid extract in doses of three ounces, daily, for one or more weeks without perceiving any marked effect. In some cases, after very large doses, the pulse is distinctly reduced in frequency, and Dr. Hardy has noted that the fœtal cardiac pulsations are rendered infrequent by it. But one instance of fatal poisoning has occurred, except when abortion has been produced. A case is recorded in which ergot produced great prostration, with an almost absent pulse, paleness and coldness of the surface, partial palsy, with pricking of the limbs, and great restlessness, without stupor or delirium. (*Gazette Med. de Paris*, Juillet 25, 1857.) The symptoms in another case, recorded by Dr. Oldright, were very similar to those just detailed. The most characteristic is the intense coldness of the surface, which has also been noted in the lower animals. In the fatal case narrated by Dr. Pratschke, uneasiness in the head, oppression of stomach, diarrhœa, urgent thirst, burning pains in the feet, tetanic spasms, violent convulsions, and death ensued upon eating freely of ergotized grain. (*Lond. Med. Gaz.*, Oct. 1850, p. 579.)

The long-continued and free use of ergot is highly dangerous, even when no immediate effects are perceptible. Fatal epidemics in different parts of the continent of Europe, particularly in certain provinces of France, have long been ascribed to the use of bread made from rye contaminated with this fungus.* Dry gangrene, typhus fever, and disorder of the nervous system attended with convulsions, are the forms of disease which have followed the use of this unwholesome food. It is true that ergot has been denied to be the cause; but accurate investigations, made by competent men upon the spot where the epidemics have prevailed, together with the results of experiments made upon inferior animals,* leave no room for reasonable doubt that at least the gangrenous affection alluded to has resulted from it.

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* Dr. Hofmann states that $\frac{1}{10}$ per cent. of ergot can be detected in bread by macerating 30 grains of coarsely grated bread in 40 grains of ether and 20 drops of diluted sulphuric acid for 24 hours, straining, shaking with solution of bicarbonate of sodium and allowing to stand, when the solution separates and is of a violet color.

Upon the lower animals ergot acts as upon man. Besides its influence upon the uterus, the most important physiological action of the drug is upon the vaso-motor nervous system. It has been abundantly proved that in full therapeutic dose it raises remarkably the arterial pressure by producing a general vaso-motor spasm. This spasm is almost certainly the result of a stimulation of the vaso-motor nerve centres, but there are still some authorities who believe that the drug acts peripherally upon the muscular coats of the vessels or upon the nerves connected therewith.

On the continent of Europe, in Germany, France, and Italy, ergot has long been empirically employed by midwives for promoting the contraction of the uterus; and its German name of *mutterkorn* implies a popular acquaintance with its peculiar powers. But the attention of the medical profession was first called to it by Dr. Stearns, of Saratoga County, N. Y., in the eleventh volume of the *New York Medical Repository*, 1807. In its operation upon the pregnant uterus, it produces a constant unremitting contraction and rigidity, rather than that alternation of spasmodic effort and relaxation which is observable in the natural process of labor. Hence, unless the os uteri and external parts are sufficiently relaxed, the medicine is apt to produce injury to the fœtus by the incessant pressure which it maintains; and the death of the child is thought not unfrequently to have resulted from its injudicious employment. The cases to which it is thought to be especially adapted are those of lingering labor, when the os uteri is sufficiently dilated and the external parts sufficiently relaxed, when no mechanical impediment is offered to the passage of the child, and the delay is ascribable solely to want of energy in the uterus. Other cases are those in which the death of the fœtus has been ascertained, and when great exhaustion or dangerous constitutional irritation imperiously calls for speedy delivery. The medicine may also be given to promote the expulsion of the placenta, to restrain inordinate hemorrhage after delivery, and to hasten the discharge of the fœtus in protracted cases of abortion. In women subject to dangerous flooding, a dose of ergot given immediately before delivery is said to have the happiest effects. Ergot is also much used to cause the expulsion of coagula of blood, polypi, and hydatids from the uterine cavity, and even a number of successful cases of its employment for the destruction by strangulation of fibroid tumors of the uterus have been reported. In uterine hemorrhage, unconnected with pregnancy, the medicine is very useful; and it is probably the most used and most efficient of all remedies in pulmonary and other similar internal hemorrhages. Its action in these cases is no doubt the result of the contracting power it has over the smaller vessels. In a similar manner ergot is often advantageous in acute congestions, especially of the spinal cord and brain; also in mania and diarrhœa.

In hemorrhoids, and in varicose veins of the leg, it has been injected into the diseased tissue with success, but probably acts only by producing a severe local inflammation.

The fluid extract of ergot is usually selected for internal use, although the powdered drug may be given in doses of from half a drachm to two drachms (1·9–7·5 C.c.). The *oil of ergot*, prepared by means of ether or benzin, as already described (page 559), was given by Dr. Wright in the dose of from twenty to fifty drops (1·25–3·12 C.c.), diffused in cold water, warm tea, or weak spirit and water, but is nearly destitute of therapeutic powers. Dr. J. V. Shoemaker believes it to be useful as a local application in acute eczema, cracked nipples, herpes of the genitals, seborrhœa, erysipelas; in rosacea, after puncturing the enlarged vessels and allowing them to bleed freely; in catarrh of the mucous membrane of the nose and cervix uteri; in gleet; as an injection in leucorrhœa and gonorrhœa, and as a substitute for the ordinary hair oils.

Under the name of Bonjean's *ergotin*, a purified extract is sometimes used in the dose of from five to ten grains (0·33–0·65 Gm.). It is made by exhausting ergot with water, evaporating to the consistence of syrup, precipitating the albumen, gum, etc., by a large excess of alcohol, decanting the clear liquid, and evaporating to the consistence of a soft extract.

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* An epidemic among sheep was caused by eating ergotized grain. See *P. J. Tr.*, x. 195.

When promptness and certainty of action are required, ergot may be used hypodermically. It undoubtedly acts best when so employed, but is very prone, even when the greatest care is exercised, to produce local inflammation and abscess. The best preparation for use is a strong aqueous solution of purified extract (see *Extract of Ergot*) carefully filtered so as to remove all solid particles. Five grains of the extract dissolved in 1·5 minims of water may be employed at once.

Dujardin-Beaumetz gives the dose of Tanret's crystallized ergotine for hypodermic use as 5 milligrammes ($\frac{7}{100}$ grain). (*Bull. Thérap.*, xciv. 236.) Sclerotinic acid does not represent ergot, as was, so far as concerns the commercial article, shown by experiments made in the laboratory of the University of Pennsylvania; indeed, the research of Nikitin, who claims that it is the active principle, affords abundant evidence that it is not so. (*Lond. Med. Record*, 1879, p. 21.)

Off. Prep. Extractum Ergotæ Fluidum, *U. S.;* Extractum Ergotæ, *U. S.;* Extractum Ergotæ Liquidum, *Br.;* Infusum Ergotæ, *Br.;* Tinctura Ergotæ, *Br.;* Vinum Ergotæ, *U. S.*

ERYTHROXYLON, *U. S.* *Erythroxylon.* [*Coca.*]

(ĔR-Ỵ-THRŎX'Ỵ-LO̤N.)

"The leaves of Erythroxylon Coca. Lamarck. (*Nat. Ord.* Erythroxylaceæ.)" *U.S.*

Feuilles de Coca. *Fr.;* Cocablätter, *G.*

Gen. Ch. *Calyx* five-parted, at the base five-angular. *Styles*, three, distinct to the base and not united into one. *De Candolle, Prodromus*, i. 573.

E. coca. Lam. *B. & T.* i. 40. Leaves ovate, areolate, membranaceous, branches squamous, pedicels lateral, aggregated in twos or threes, a little longer than the flower. *De C.*

Although it grows wild in various parts of South America, the coca shrub is largely cultivated for the sake of its leaves. The plant, which is propagated from the seed in nurseries, begins to yield in eighteen months, and continues productive for half a century. The leaves, when mature, are carefully picked by hand so as to avoid breaking them or injuring the young buds, are slowly dried in the sun, and then packed in bags (*cestos*) holding from twenty-five to one hundred and fifty pounds each. They were in general use among the natives of Peru at the time of the conquest, and have continued to be much employed to the present time. It is affirmed that nearly ten million dollars' worth, or forty million pounds, are annually produced; some plantations yielding three or four harvests a year.

Properties. The leaves resemble in size and shape those of tea, being oval-oblong, pointed, two inches or more in length by somewhat over an inch in their greatest breadth, and furnished with short delicate footstalks; but they are not, like the tea-leaves, dentate, and are distinguished from most other leaves by a slightly curved line on each side of the midrib, running from the base to the apex. These lines are not ribs but curves, which have been produced by the peculiar folding of the leaf in the bud. Good specimens are perfectly flat, of a fine green color; brown leaves should always be rejected as inferior. They have an agreeable odor resembling that of tea, and a peculiar taste, which, in decoction, becomes bitter and astringent. "Oval or obovate-oblong, two to three inches (50 to 75 mm.) long, short-petiolate, entire, rather obtuse or emarginate at the apex, reticulate on both sides, with a prominent midrib, and, on each side of it, a curved line running from base to apex; odor slight and tea-like; taste somewhat aromatic and bitter." *U. S.*

Chemical Constitution. In 1853, Wackenroder demonstrated the existence of tannic acid in coca leaves; and in 1859, M. Stanislas Martin found in them a peculiar bitter principle, resin, tannin, an aromatic principle, extractive, chlorophyll, a substance analogous to theine, and salts of lime. Previous to this (1855) Gardeke had isolated the crystalline alkaloid and given it the name of *erythroxyline.* Dr. Albert Niemann, of Goslar, made the first thorough investigation of the leaves, and gave to the alkaloid the name it now usually bears of *cocaine.* The following was his process. The leaves were exhausted with 85 per cent. alcohol acidulated with 2 per cent. of sulphuric acid; the tincture was treated with milk of lime and filtered; the filtrate was neutralized with sulphuric acid, and the alcohol distilled off. The syrupy residue was treated with water to separate resin, and then precipitated by carbonate of sodium. The deposited matter was exhausted by ether, and the ethereal solution, after most of the ether had been distilled, was allowed to evaporate spontaneously. The cocaine was thus obtained in colorless crystals, mixed with a yellowish brown matter of a disagreeable odor, which was separated by washing with cold alcohol. Pure cocaine is in colorless transparent prisms, inodorous, of a bitterish taste, soluble in 704 parts of cold water, more soluble in alcohol, and freely so in ether. The solution has an alkaline reaction, and a bitterish taste, leaving a peculiar numbness on the tongue, followed by a sensation of cold. The alkaloid melts at 97·7° C. (208° F.), and on cooling congeals into a transparent mass, which gradually becomes crystalline. Heated above this point it changes color, and is decomposed. It is inflammable, burning with a bright flame, and leaving charcoal. With the acids it forms soluble and crystallizable salts, which are more bitter than the alkaloid itself. The formula is $C_{17}H_{21}NO_4$. Dr. Niemann also obtained wax, a variety of tannic acid (*coca-tannic acid*), and a concrete volatile odorous substance. (See *A. J. P.*, 1861, p. 122.) A volatile alkaloid, *hygrine*, first noticed by Maclagan, but named by Lossen, is a thick, pale yellow, oily liquid, having a strong alkaline reaction, burning taste, and the odor of trimethylamine. M. Lossen has examined cocaine, and ascertained that, when heated with hydrochloric acid, it splits into benzoic acid and a new base which he calls *ecgonine.* The mutability of cocaine with acids explains why the attempts to extract the alkaloid with acid liquids have failed. M. Lossen therefore recommends the omission of acid in operating on the leaves, and proposes the following modification of Niemann's plan. An infusion is first made; this is precipitated with acetate of lead; the lead is removed by sulphate of sodium; the liquid is concentrated, carbonate of sodium added, and the whole shaken with ether. The ether extracts the alkaloid, and yields it in a crude state by evaporation. It is then purified as in the process of Dr. Niemann. (*Journ. de Pharm.*, Juin, 1862, p. 522.) The tannin of coca leaves strikes a green-black with ferric salts, and has received the name of *coca-tannic acid.*

The alkaloid cocaine acts upon the lower animals much as does theine. It tetanizes frogs, or in overwhelming doses paralyzes the sensory nerves and the posterior columns. Rabbits and dogs are killed by it through paralysis of the respiratory centres. In proper doses it elevates arterial pressure by an action upon the vasomotor centres and the cardiac-motor system. (*I. Ott.*)

Medical Properties. As a nerve stimulant, coca has been used immemorially by the Peruvian and Bolivian natives. In 1853, Dr. Weddell stated that it produces a gently excitant effect, with an indisposition to sleep; in these respects resembling tea and coffee; also, that it will support the strength for a considerable time in the absence of food; but does not supply the place of nutriment, and probably, in this respect also, acts like the two substances referred to. The Indians, while chewing it, pass whole days in travelling or working without food; but they nevertheless eat freely in the evenings. Weddell affirms that persons unused to it are liable to unpleasant effects from its abuse; and he has known instances of hallucinations apparently resulting from this cause. The natives chew with it some alkaline substance, as the ashes of certain plants, or lime. (Weddell, *Voyage dans le Nord de la Bolivie.*)

The sustaining powers of coca have been strongly confirmed by various observers, both in this country and in Europe (see *P. J. Tr.*, vi. 883; viii. 1877; *Bost. Med. and Surg. Journ.*, 1877, i.; *Tr. A. P. S.*, xxvi. 774), and it is probable that it acts similarly to tea and coffee, but much more powerfully.

In large quantities, it is said to produce a general excitation of the circulatory and nervous systems, imparting increased vigor to the muscles as well as to the intellect, with an indescribable feeling of satisfaction, amounting sometimes to a species of delirium; and, what is most singular, if true, this state of exaltation is asserted not to be followed by any feelings of languor or depression. (Mantegazza, *N. Am. Med.-Chir. Rev.*, March, 1860, p. 340.) From experiments by MM. Gorse and

Mantegazza, it is inferred that it increases the frequency of the heart's contractions considerably more than does tea or coffee; and, in doses of about an ounce, it causes intense fever, attended with hallucinations and delirium. (Dr. Reis, *P. J. Tr.*, 2d ser., viii. 299; from *Bull. Gén. de Thérap.*, Fev. 28, 1866.) M. Moreno, in experiments on animals with coca, found that, instead of supplying the place of food, it causes a more speedy death and a greater loss of weight than starvation alone. (*Ann. de Thérap.*, 1869, p. 64.) The dose of coca is from two to three drachms. If given in infusion the leaves should be swallowed, as it is by no means certain that they yield their virtues to water.

The fluid extract is now officinal, and is a very eligible preparation; a *tincture of coca*, made in the proportion of one part in five of diluted alcohol, and *a wine of coca*, one in ten, would also be efficient. The *elixir of coca*, as usually found, is too weak to be of much value.

Off. Prep. Extractum Erythroxyli Fluidum.

EUCALYPTUS. *U. S.* *Eucalyptus.*

(EŪ-CẠ-LY̆P′TỤS—yū-kạ-lĭp′tụs.)

"The leaves of Eucalyptus globulus, Labillardière (*Nat. Ord.* Myrtaceæ), collected from rather old trees." *U. S.*

Eucalyptus Leaves; Feuilles d'Eucalyptus, *Fr.;* Eucalyptus-Blätter, *G.*

Gen. Ch. Calyx obovate or globose cupulæform, the tube persistent, the limb deciduous, dehiscing by a circular irregular line from the operculiform base. *Stamens* free. *Capsule* 4 loculate or by abortion 3 loculate, dehiscent at the apex, many-seeded. *De Candolle*, *Prodromus*, iii. 220.

The genus Eucalyptus affords one of the most characteristic features of the Australian and Tasmanian landscapes. There are about one hundred and thirty-five described species, all evergreens, and most of them large trees, popularly known as *Gum trees*, *Woolly butts*, *Iron barks*, etc.* The most important of them is the *E. globulus.*

E. globulus. Labill. *B. & T.* ii. 109. The young operculum conical, the length of the four-sided cupule, the adult depressed and mucronate in the middle; axillary peduncles very short, one-flowered; leaves alternate, lanceolate, subfalcate.

This is one of the largest known trees, attaining sometimes a height of 300 or even 350 feet, with a smooth, ash-colored bark; leaves a foot in length, and varying, according to age, from a glaucous white to a bluish green color; and large pinkish white axillary flowers, sometimes single, sometimes in clusters. Although its wood is very resinous, hard, and durable, the tree is remarkable for the rapidity of its growth, reaching, under favorable circumstances, fifty feet of height in five or six years. It flourishes best in valleys having a rich, moist soil, and has very largely been naturalized in semi-tropical countries, partly on account of its economic value, but chiefly because of the reputation it enjöys as a means of overcoming malaria. It does not seem to require great heat for its perfection, but is exceedingly sensitive to frost. Large forests of it have been planted in Algeria and Southern Europe, and its culture is spreading to California, Florida, and other of our Southern States. Its sanitary powers appear to be established, numerous notoriously miasmatic stations and districts having been rendered healthful by its growth. It is not probable that the destruction of the miasma is due so much to emanations from the tree as to the fact that it evaporates water so rapidly from its innumerable large leaves as to drain the swamps and marshes in which it is planted. It is possible, however, that the large amount of volatile oil which must escape from it has some effect, and it is even affirmed (*A. J. P.*, 1875, p. 423) that the parasitic phylloxera will not attack the grape-vines growing near it.

Properties. The leaves are the officinal portion of the plant: they are "petiolate, lanceolately scythe-shaped, from six to twelve inches (15 to 30 cm.) long, rounded below, tapering above, entire, leathery, gray-green, glandular, feather-veined between the midrib and marginal veins; odor strongly camphoraceous; taste pungently aromatic, somewhat bitter and astringent." *U. S.*

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* Descriptions and accurate figures of most of this species may be found in Baron Ferd. von Mueller's *Descriptive Notes of the Eucalypts of Australia*, London and Melbourne, 1882.

In March, 1870, M. Cloez (*Journ. de Pharm.*, 4e sér., xii. 201) reported an elaborate chemical study of the Eucalyptus leaves, and his results have been substantially confirmed by Debray (*De l'Eucalyptus Globulus*, Paris, 1872), M. Rabuteau (*Mém. de l'Académie*, Nov. 1872), and by Mr. Broughton (*P. J. Tr.*, 3d ser., iii. 463). M. Cloez found, besides chlorophyll, resin, tannin, and inert substances, an essential oil, upon which the virtues of the drug appear to depend. Of this oil, the fresh leaves afforded 2·75 parts per hundred, the recently dried leaves 6 parts; leaves which had been kept some time yielded a much smaller percentage. In the distillation, the oil for a time comes over freely at from 170° C. (338° F.) to 178° C. (352·4° F.); subsequently another portion of oil distils at 188° C. (370·4° F.) to 190° C. (374° F.), and finally a very minute portion does not volatilize until the temperature reaches 200° C. (392° F.). M. Cloez believes the oil to be composed of two camphors, differing in their volatility. The bulk of the oil yielded is the portion first distilled; to this Cloez has given the name of *eucalyptol.* To obtain it pure a redistillation from caustic potash or chloride of calcium is necessary. It is very liquid, nearly colorless, with a strong, aromatic camphoraceous odor, polarizes to the right, is slightly soluble in water, but very soluble in alcohol, and has the formula $C_{12}H_{20}O$. Nitric acid produces with it a crystallizable acid; by the action of phosphoric acid (*Journ. de Pharm.*, 4e sér., xii. 204) it is converted into *eucalyptene*, a substance allied to cymene, and *eucalyptolen.*

According to M. Duquesnel, the oil is adulterated—with alcohol, to be detected by means of fuchsin, which is insoluble in the pure oil but soluble in that containing even a very small percentage of alcohol; with fixed oil, to be detected by boiling with water, when the fixed oil remains on the surface; with essential oil of copaiba or turpentine, to be detected by means of the boiling point, that of eucalyptol being 170° C. (338° F.), that of oil of turpentine 155° C. (311° F.), that of oil of copaiba 260° C. (500° F.). (*Journ. de Pharm.*, 4e sér., xvi. 45.) It is affirmed that much of the oil of Eucalyptus of commerce is obtained not from *E. globulus*, but *E. amygdalina*, and does not yield *eucalyptol.* (*A. J. P.*, 1879, p. 303.)

Medical Properties. Eucalyptus was originally recommended as a remedy in intermittent fever, but experience has failed to establish its value as an antiperiodic. Whatever medical virtues it possesses beyond astringency reside in the volatile oil. This when applied locally acts as a powerful irritant. When taken internally in doses from 20 to 30 drops, it causes increased rapidity of pulse and general excitation, with restlessness and increased venereal appetite, usually followed by a feeling of calmness and repose, ending in sleep. In some cases, disturbance of the bowels, fever, constitutional disturbance, and even symptoms of cerebral congestion have been produced. In animals small doses produce the same effect as in man, and after large doses symptoms of general depression are manifested by falling of the arterial pressure, progressive diminution of temperature, muscular weakness deepening into paralysis, loss of sensibility, irregular respiration, and finally death from failure of respiration. Upon man, when taken in sufficient quantity, the oil exerts a similar influence. In a case noted by M. Gimbert, 80 drops of the oil produced in an old man a feeling of great internal heat, followed by almost complete loss of power and of feeling in the limbs; and after 75 drops Prof. Binz noted somewhat similar phenomena. The palsy produced by toxic doses is due to a direct action upon the spinal cord. Taken internally it is eliminated by the breath, to which it imparts its odor, and also in a condition of oxidation by the kidneys, to the secretion of which it gives a strong smell of violets. M. Gimbert found that in rabbits it augmented to a marvellous extent the excretion of urea. As a stimulating narcotic the oil of eucalyptus has been used with asserted success in migraine and other forms of neuralgia. As an antispasmodic it has been highly lauded in asthma. In this affection it is best given by inhalation. Cigarettes may be made by rolling up the dried leaves, or the vapor from boiling water containing the oil may be inhaled. In chronic or subacute bronchitis it may often be employed with advantage, especially where there is a tendency to spasm. In subacute or chronic inflammation of the genito-urinary organs it is said to exert a very happy influence. The experiments of Binz and of Gimbert have shown that it acts very positively upon the infusoria and other low forms of life. Gimbert even claims superiority for it as an antiseptic over carbolic acid. Externally it may be used in chronic skin affections and ulcerations when a stimulant antiseptic application is indicated. Various formulas have been published for tinctures, fluid extracts, etc., of the leaves, but the oil is now officinal, and is much the best form for internal administration. It should be given in doses of 10 to 15 drops (0·5 to 0·72 C.c.) on sugar or in a sweetened emulsion.

Off. Prep. Extractum Eucalypti Fluidum, *U. S.*

EUONYMUS. *U. S.* *Euonymus.* [*Wahoo.*]

(EŪ-ŎN′Y̦-MU̦S—yū-ŏn′ę-mu̦s.)

"The bark of Euonymus atropurpureus. Jacquin. (*Nat. Ord.* Celastraceæ.)" *U. S.*

Gen. Ch. Flowers perfect. *Sepals* 4 or 5, united at the base, forming a short and flat calyx. *Petals* 4–5, rounded, spreading. *Stamens* very short, inserted on the edge or face of a broad and flat 4–5 angled disk, which coheres with the calyx and is stretched over the ovary, adhering to it more or less. *Style* short or none. *Pod* 3–5 lobed, with 1–3 seeds in each cell in a red arillus.

Euonymus Atropurpureus. Willd. *Sp. Plant.* i. 1132; Gray's *Manual*, p. 81; figured in Griffith's *Med. Bot.*, p. 219. The plant has been named variously *wahoo*, *spindle-tree*, and *burning-bush.* It is a tall, erect shrub, with quadrangular branchlets, and opposite, petiolate, oval-oblong, pointed, serrate leaves. The flowers, which stand in loose cymes on axillary peduncles, are small and dark purple, with sepals and petals commonly in fours. The capsule or pod is smooth and deeply lobed. The plant is indigenous, growing throughout the Northern and Western States, and sometimes cultivated for the beauty of its crimson fruit.

The plants belonging to this genus are shrubs or small trees, presenting in the autumn a striking appearance from the rich red color of their fruit, which has obtained for them the name of *burning-bush. E. Americanus* and *E. Europæus* have been cultivated in gardens as ornamental plants. Two or more of the species have been used in medicine. Their properties are probably similar, if not identical. Grundner, who experimented with the fruit of *E. Europæus*, found it to have no other effect than that of a diuretic. (*Pharm. Centralbl.*, 1847, p. 873.) An oil expressed from the seeds is used in Europe for the destruction of vermin in the hair, and sometimes also as an application to old sores. (*Ibid.*, 1851, p. 641.) Dr. Griffith says that the seeds of this and other species are purgative and emetic, and that the leaves are poisonous to sheep and other animals feeding on them. He states also that the inner bark of *E. tingens* is beautifully yellow, and used in India for dyeing, and in diseases of the eye. (*Med. Bot.*, p. 220.) It is probable that much of the wahoo of our drug-stores has been obtained from *E. Americanus*, which is distinguished from *E. atropurpureus* by its rough, warty, depressed pods, and almost sessile, thickish leaves.

Properties. The dried bark is in thin pieces, whitish with a darker grayish epidermis, brittle, of a feeble, peculiar, not disagreeable odor, and a bitterish slightly sweetish taste, and somewhat pungent after-taste. "In quilled or curved pieces, about one-twelfth of an inch (2 mm.) thick; outer surface ash-gray, with blackish patches, detached in thin and small scales; inner surface whitish or slightly tawny, smooth; fracture smooth, whitish, the inner layers tangentially striate; nearly inodorous; taste sweetish, somewhat bitter and acrid." *U. S.* It imparts its virtues to water and alcohol. Analyzed by Mr. Wm. T. Wentzell, it was found to contain a bitter principle which he named *euonymin*, asparagin, a soft resin, a crystallizable resin, a yellow resin, a brown resin, fixed oil, wax, starch, albumen, glucose, pectin, and various salts of organic and inorganic acids. Euonymin was obtained by agitating with chloroform a tincture made with diluted alcohol, separating the chloroformic solution and allowing it to evaporate spontaneously, treating the residue with ether, dissolving what was left in alcohol, adding acetate of lead to the solution, filtering, precipitating the lead with hydrosulphuric acid, and evaporating. The euonymin obtained was uncrystallizable, intensely bitter, soluble in water and alcohol, and neuter in its reactions. It was abundantly precipitated from its solution by subacetate of lead and phospho-molybdic acid. (*A. J. P.*, 1862, p. 387.) Mr. W. P. Clothier found the bark to yield no volatile oil on distillation. According to the same writer, if a concentrated tincture be poured into water, a dark yellow substance will be thrown down, containing resin and fixed oil, which is the euonymin of the eclectics, very improperly so named, as, though it contains a portion of the active principle, it is a very complex substance. Mr. Clothier found it to purge actively without griping. (*Ibid.*, 1861, p. 491.) Kubel has discovered in the fresh inner bark of *E. Europæus* a saccharine, crystallizable substance, closely resembling mannite, but differing in its crystalline form, and its melting point. He calls it *euonymite.* (*Journ. de Pharm.*, Dec. 1862, p. 523.)

Medical Properties and Uses. About twenty years since, this bark was introduced into notice in Philadelphia, as a remedy for dropsy, under the name of Wahoo,* by Mr. George W. Carpenter, who had obtained a knowledge of its virtues in the Western States. In some cases it acts as a mild cathartic, but at other times it fails to produce purgation. We have also seen distinct evidences of an irritant influence upon the gastro-intestinal mucous membrane. Cholagogue properties have been ascribed to it, and probably with correctness, as in the experiments of Prof. Rutherford it was found to act most powerfully in causing hepatic secretion in dogs, and in some clinical studies we have made it seemed to have a similar action on man. The fluid extract of it is an efficient preparation, and may be given in doses, as a purgative, of one to two fluidrachms (3·75–7·5 C.c.); as a laxative, of half a fluidrachm to one fluidrachm (1·9–3·75 C.c.).

Off. Prep. Extractum Euonymi, *U. S.*

EUPATORIUM. *U. S.* *Eupatorium.* [*Thoroughwort.*]

(EŪ-PẠ-TŌ′RỊ-ŬM—yū-pạ-tō′rị-ŭm.)

"The leaves and flowering tops of Eupatorium perfoliatum. Linné. (*Nat. Ord.* Compositæ.)" *U. S.*

Herba Eupatorii Perfoliati; Boneset, Indian Sage; Herbe d'Eupatoire perfoliée, Herbe à Fièvre, Herbe parfaite, *Fr.;* Durchwachsener Wasserhauf, *G.*

Gen. Ch. Calyx simple or imbricate, oblong. *Style* long and semi-bifid. *Receptacle* naked. *Pappus* pilose, or more commonly scabrous. *Seed* smooth and glandular, quinquestriate. *Nuttall.*

Of this numerous genus, comprising not less than thirty species within the limits of the United States, most of which probably possess analogous medical properties, *E. perfoliatum* alone now holds a place in our national Pharmacopœia, *E. purpureum* and *E. teucrifolium* having been discarded at the revision of 1840. They merit, however, a brief notice, if only from their former officinal rank.

Eupatorium purpureum, or *gravel root*, is a perennial herbaceous plant, with a purple stem, five or six feet in height, and furnished with ovate-lanceolate, serrate, rugously veined, slightly scabrous, petiolate leaves, placed four or five together in the form of whorls. The flowers are purple, and consist of numerous florets contained in an eight-leaved calyx. It grows in swamps and other low grounds, from Canada to Virginia, and flowers in August and September. The root has, according to Dr. Bigelow, a bitter aromatic and astringent taste, and is said to be diuretic. Its vulgar name of gravel root indicates the popular estimation of its virtues.

Eupatorium teucrifolium (Willd. *Sp. Plant.* iii. 1753), *E. pilosum* (Walt. *Flor. Car.* 199), *E. verbenæfolium* (Mich. *Flor. Am.* ii. 98), commonly called *wild horehound*, is also an indigenous perennial, with an herbaceous stem, which is about two feet high, and supports sessile, distinct, ovate, acute, scabrous leaves, of which the lower are coarsely serrate at the base, the uppermost entire. The flowers are small, white, composed of five florets within each calyx, and arranged in the form of a corymb. The plant grows in low wet places from New England to Georgia, and abounds in the Southern States. It is in flower from August to November. The whole herb is used. In sensible properties it corresponds with *E. perfoliatum*, though less bitter and disagreeable. It is said to be tonic, diaphoretic, diuretic, and aperient, and has been employed as a domestic remedy in intermittent and remittent fevers. It is usually given in the form of infusion, made with an ounce to a quart of water, the whole to be taken during the day.

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* The name of Wahoo or Waahoo (pronounced *wawhoo*) was given to it by the Indians. The same name has also been applied to *Ulmus alata*, of the Southern States, and has thus led to mistakes.

Other species, natives of this continent, are noticed in an article on the American Eupatoria, by Dr. J. M. Bigelow, published in the *P. J. T.*, Oct. 1874, p. 303, among which the *E. incarnatum* and *E. aromaticum* are said to contain an aromatic principle similar to if not identical with coumarin, obtained by Guibourt from *Coumarouna odorata*, or Tonka bean.

E. Cannabinum, of Europe, the root of which was formerly used as a purgative, and *E. Aya-Pana*, of Brazil, the leaves of which at one time enjoyed a very high reputation, have fallen into entire neglect. The *aya-pana* is an aromatic bitter, like *E. perfoliatum*, but weaker. A species of Eupatorium, probably *E. nervosum*, is said to be a favorite with the medical profession in Jamaica, where it is known by the name of *bitter-bush*. It is thought to have proved very efficacious in cholera, and, being actively stimulant, is much used in typhus and typhoid fevers, and small-pox. Cholagogue properties have been ascribed to it. Decoction and tincture are the forms in which it is given. (*P. J. Tr.*, Oct. 1866, p. 222.)

Eupatorium perfoliatum. Willd. *Sp. Plant.* iii. 1761; Bigelow, *Am. Med. Bot.* i. 33; Barton, *Med. Bot.* ii. 125. *Thoroughwort*, or *boneset*, is an indigenous perennial plant, with numerous herbaceous stems, which are erect, round, hairy, from two to five feet high, simple below, and trichotomously branched near the summit. "Leaves opposite, united at base, lanceolate, from four to six inches (10 to 15 cm.) long, tapering, crenately serrate, rugosely veined, rough above, downy and resinous-dotted beneath; flower-heads corymbed, numerous, with an oblong involucre of lance-linear scales, and with from ten to fifteen white florets, having a bristly pappus in a single row." *U. S.* The leaves serve to distinguish the species at the first glance. They may be considered either as perforated by the stem, *perfoliate*, or as consisting each of two leaves, joined at the base, *connate*. In the latter point of view, they are opposite and in pairs, which decussate each other at regular distances upon the stem; in other words, the direction of each pair is at right angles with that of the pair immediately above or beneath it. They are narrow in proportion to their length, broadest at the base where they coalesce, gradually tapering to a point, serrate, much wrinkled, paler on the under than on the upper surface, and beset with whitish hairs, which give them a grayish green color. The uppermost pairs are sessile, not joined at the base. The flowers are white, numerous, supported on hairy peduncles, in dense corymbs, forming a flattened summit. The calyx, which is cylindrical and composed of imbricated, lanceolate, hairy scales, encloses from twelve to fifteen tubular florets, having their border divided into five spreading segments. The anthers are five, black, and united into a tube, through which the bifid filiform style projects.

This species of Eupatorium inhabits meadows, the banks of streams, and other moist places, growing generally in bunches, and abounding in almost all parts of the United States. It flowers from the middle of summer to the end of October. All parts of it are active; but the herb only is officinal.

It has a faint odor, and a strongly bitter, somewhat peculiar taste. The virtues of the plant are readily imparted to water and alcohol. Mr. W. Peterson found it to contain a peculiar bitter principle, chlorophyll, resin, a crystalline matter of undetermined character, gum, tannin, yellow coloring matter, extractive, lignin, and salts. (*A. J. P.*, xxiii. 210.) Mr. Bickley found also albumen, gallic acid, and signs of volatile oil. (*Ibid.*, xxvi. 495.) Dr. Peter Collier, chemist of the Department of Agriculture, recently submitted it to analysis, finding 18·84 per cent. of bitter extractive, which he considers the constituent of medicinal importance, 2·87 per cent. of an indifferent crystalline substance, obtained from the alcoholic extract, and traces only of a volatile oil. (*Ibid.*, 1879, p. 342.)

Medical Properties and Uses. Thoroughwort is tonic, diaphoretic, and in large doses emetic and aperient, and was at one time employed as an antiperiodic.

The medicine has also been used as a tonic and diaphoretic in remittent and typhoid fevers. Given in warm infusion, so as to produce vomiting or copious perspiration, at the commencement of catarrh, of influenza, or of that form of muscular rheumatism known as a general cold, it will sometimes abort the attack. As a tonic it is given with advantage in dyspepsia, general debility, and other cases in which the simple bitters are employed. Dr. H. S. Wilkins has found the infusion useful in the expulsion of tapeworm. (*A. J. P.*, 1874, p. 295.)

With a view to its tonic effects, it is best administered in substance, or cold infusion. The dose of the powder is twenty or thirty grains (1·3–1·95 Gm.), that of the infusion a fluidounce (30 C.c.) frequently repeated. (See *Infusum Eupatorii.*) The aqueous extract has been used with advantage. When the diaphoretic operation is required in addition to the tonic, the infusion should be administered warm, and the patient remain covered in bed. As an emetic and cathartic, a strong decoction, prepared by boiling an ounce with three half pints of water to a pint, may be given in doses of from four fluidounces to a half-pint (118 to 236 C.c.), or more.

Off. Prep. Extractum Eupatorii Fluidum, *U. S.*

EXTRACTA. *Extracts.*

(EX-TRĂC′TA.)

Extraits, *Fr.;* Extrakte, *G.*

Extracts, as the term is employed in the Pharmacopœias, are solid preparations, resulting from the evaporation of the solutions of vegetable principles, obtained either by exposing a dried drug to the action of a solvent, or by expressing the juice from a fresh plant. A distinction was formerly made between those prepared from the infusions, decoctions, or tinctures, and those from the expressed juices of plants, the former being called *Extracta*, the latter *Succi Spissati;* but the distinction has been generally abandoned. There is no such essential difference between these two sets of preparations as to require that they should be separately classed; and something is gained in the simplicity of nomenclature, as well as of arrangement, which results from their union. We shall consider them under the same head, taking care, however, to detail distinctly whatever is peculiar in the mode of preparing each.

The composition of extracts varies with the nature of the vegetable, the character of the solvent, and the mode of preparation. The object is generally to obtain as much of the active principle of the plant, with as little of the inert matter as possible; though sometimes it may be desirable to separate two active ingredients from each other, when their effects upon the system are materially different; and this may be accomplished by employing a menstruum which, while it dissolves one, leaves the other untouched. The proximate principles most commonly present in extracts are gum, sugar, starch, tannin, extractive, coloring matter, salts, and the peculiar principles of plants; to which, when a spirituous solvent is employed, may usually be added resinous substances, fatty matter, and frequently more or less essential oil; gum and starch being excluded when the menstruum is pure alcohol. Of these substances, as well as of others which, being soluble, are sometimes necessarily present in extracts, we have taken occasion to treat under various heads in this commentary. There is one, however, which, from its supposed almost uniform presence in this class of preparations, and from the influence it is thought to exert upon their character, deserves particular consideration in this place. We allude to *extractive*, or, as it is sometimes called, *extractive matter*.

It has long been observed that in most vegetables there is a substance, soluble both in water and alcohol, which, in the preparation of extracts, undergoes chemical change during the process of evaporation, imparting to the liquid, even if originally limpid, first a greenish, then a yellowish brown, and ultimately a deep brown color, and becoming itself insoluble. This substance, originally called *saponaceous matter* by Scheele, afterwards received the more expressive name of *extractive*, derived from its frequent presence in extracts. Its existence as a distinct principle is denied, or at least doubted, by some chemists, who consider the phenomena supposed to result from its presence, as depending upon the mutual reaction of other principles; and, in relation to Peruvian bark, it appears to have been proved that the insoluble matter which forms during its decoction in water is a compound of starch and tannin. A similar compound must also be formed in other cases when these two principles coexist; but they are not always present in the same vegetable, nor can all the changes which have been attributed to extractive be accounted for by their union, even when they are present; so that, until further light is shed on the subject, it is best to admit the existence of a distinct class of substances, which, though not the same in all plants, possess sufficient identity of character to be entitled, like sugars, resins, etc., to a generic name. The most important property of extractive is its disposition to pass, by the influence of atmospheric air at a high temperature, into an insoluble substance. If a vegetable infusion or decoction be evaporated in the open air to the consistence of an extract, then diluted, filtered, and again evaporated, and the process repeated so long as any insoluble matter is formed, the whole of the extractive will be separated from the liquid, while the other ingredients may remain. If chlorine be passed through an infusion or decoction, a similar precipitate is formed with much greater rapidity. The change is usually ascribed to the absorption of oxygen by the extractive, which has, therefore, been called, in its altered condition, oxidized extractive; but De Saussure ascertained that, though oxygen is absorbed during the process, an equal measure of carbonic acid gas is given out, and the oxygen and hydrogen of the extractive unite to form water in such a manner as to leave the principle richer in carbon than it was originally. The name of oxidized extractive is, therefore, obviously incorrect; and Berzelius proposed to substitute for it that of *apotheme*, synonymous with deposit. According to Berzelius, apotheme is not completely insoluble in water, but imparts a slight color to that liquid when cold, and is rather more soluble in boiling water, which becomes turbid upon cooling. It is still more soluble in alcohol, and is freely dissolved by solutions of the alkalies and alkaline carbonates, from which it is precipitated by acids. It has a great tendency, when precipitated from solutions, to unite with other principles, and to carry them along with it; thus acquiring properties somewhat different according to the source from which it is obtained. In this way, also, even when the extractive of a plant is itself medicinally inert, its conversion into apotheme may be injurious by causing a precipitation of a portion of the active principle; and, in practical pharmaceutical operations, this change should always, if possible, be avoided. With these preliminary views, we shall proceed to the consideration of the practical rules necessary to be observed in the preparation of extracts. We shall treat of the subject under the several heads of, 1, the extraction of the soluble principles from the plant; 2, the method of conducting the evaporation; 3, the proper condition of extracts, the changes they are liable to undergo, and the best method of preserving them.

1. *Extraction of the Soluble Principles.*

There are two distinct modes of obtaining, in a liquid state, the principles which we wish to extract; 1, by expression alone; 2, by the agency of a solvent, with or without expression.

1. By Expression. This method is applicable to recent vegetables. All plants cannot be usefully treated in this way, as many have too little juice to afford an appreciable quantity upon pressure, and of the succulent a considerable portion do not yield all their active principles with their juice. Succulent fruits, and various acrid and narcotic plants, are proper subjects for this treatment. The plants should be operated upon, if possible, immediately after collection. Mr. Battley, of London, recommended that, if not entirely fresh, they should be revived by the immersion of the stalks in water for twelve or eighteen hours, and those only used which recover their freshness by this management. They should then be cut into pieces, and bruised in a stone mortar till brought to a pulpy consistence. When the plant is not very succulent, it is necessary to add a little water during this part of the process, in order to dilute the juice. After sufficient contusion, the pulp is introduced into a linen or canvas bag, and the liquid parts expressed. Mr. Brande states that light pressure only should be employed; as the extract is thus procured greener, of a less glutinous or viscid consistence, and, in his opinion, more active than when considerable force is used in the expression. (*Manual of Pharmacy.*) The juice thus obtained is opaque and usually green, in consequence of the presence of green wax or chlorophyll, and of a portion of the undissolved vegetable fibre in minute division. By heating the juice to about 71·1° C. (160° F.) the albumen contained in it coagulates, and, involving the chlorophyll and vegetable fibre, forms a greenish precipitate. If the liquid is now filtered, it becomes limpid and nearly colorless, and is prepared for evaporation. The clarification, however, is not absolutely necessary, and is generally neglected. Sometimes the precipitate carries with it a considerable portion of the active principle; in which case it should be subsequently incorporated with the juice, when reduced by evaporation to the consistence of syrup. Ether added to the expressed juices of plants enables them to be kept long without injurious change. M. Lepage, of Gisors, France, has kept the juice of belladonna in this way more than ten years, and found it, at the end of that time, to yield an extract, identical in physical, chemical, and physiological properties with that obtained from the fresh juice. If this fact is found to be of general applicability, it will be of considerable importance, as enabling the pharmaceutist to supply himself, at pleasure, with extracts to be relied on, without reference to the season.

2. By Solution. The active principles of dried vegetables can be extracted only by means of a liquid solvent. The menstruum usually employed is either water or alcohol, or a mixture of the two. Water, on account of its cheapness, is always preferred, when circumstances do not strongly call for the use of alcohol. It has the advantage, moreover, that it may be assisted in its action, if necessary, by a higher degree of heat than the latter. Pump water is often unfit for the purpose, in consequence of the quantity of its saline matter, which, in some instances, may exert an unfavorable influence on the active principle, and must always be left in the extract. Rain, river, or distilled water should be preferred. Alcohol is employed when the principles to be extracted are insoluble, or but slightly soluble in water, as in the case of the resins; when it is desirable to avoid in the extract inert substances, such as gum and starch, which are dissolved by water and not by alcohol; when the heat required to evaporate the aqueous solution would dissipate or decompose the active ingredients of the plant, as the volatile oils and the active principle of sarsaparilla; when the reaction of the water itself upon the vegetable principles is injurious; and, finally, when the nature of the substance to be exhausted requires so long a maceration in water as to endanger spontaneous decomposition. The watery solution requires to be soon evaporated, as this fluid rather promotes than counteracts chemical changes; while an alcoholic tincture may be preserved unaltered for an indefinite period. An addition of alcohol to water is sufficient to answer some of the purposes for which the former is preferable; and the employment of both fluids is essential, when the virtues of the plant reside in two or more principles, all of which are not soluble in either of these menstrua. In this case it is usually better to submit the vegetable to the action of the two fluids successively, than of both united. Extracts obtained by the agency of water are called *watery* or *aqueous extracts;* those by means of alcohol, undiluted or diluted, *alcoholic* or *spirituous extracts.* Sometimes the term *hydro-alcoholic* is applied to extracts obtained by the joint agency of alcohol and water.

The method of preparing the solution is not a matter of indifference. The vegetable should be thoroughly bruised, or reduced to a coarse powder, so as to allow the access of the solvent to all its parts, and yet not so finely pulverized as to prevent a ready precipitation of the undissolved and inactive portion. When water is employed, it has been customary to boil the medicine for a considerable time, and, if the first portion of liquid does not completely exhaust it, to repeat the operation with successive portions, till the whole of the active matter is extracted. This may be known by the sensible properties of the liquid, and by its influence upon reagents. But the boiling temperature produces the decomposition of many vegetable principles, or at least so modifies them as to render them inert; and the extracts prepared by decoction are usually less efficient than those made with a less degree of heat. From numerous experiments upon extracts, Orfila concluded that their virtues were less in proportion to the heat employed. It has, therefore, been recommended to substitute for decoction the process of maceration, digestion, or hot infusion; in the first of which the liquid acts without heat, in the second is assisted by a moderately increased temperature sustained for a considerable time, and in the third is poured boiling hot upon the vegetable matter, and allowed to stand for a short period in a covered vessel. When the active principles are readily soluble in cold water, *maceration* is often preferable to the other modes, as starch, which is inert, is thus left behind; but in many instances the preparation would spoil before the extraction would be completed. By *digestion*, though the solvent power of water is moderately increased, the advantage is often more than counterbalanced by the increased disposition to spontaneous decomposition. *Hot infusion*, therefore, is to be preferred where the vegetable does not readily yield its virtues to cold water. It has the advantage, moreover, in the case of albuminous substances, that the albumen is coagulated, and thus prevented from increasing the bulk of the extract, without adding to its virtues. A convenient mode of performing this process, is to introduce the solid material into a vessel with an opening near the bottom temporarily closed, or into a funnel with its mouth loosely stopped, then to pour on the boiling water, and, having allowed it to remain a sufficient length of time, to draw it off through the opening. This operation may be repeated till the water comes away without any obvious impregnation. It is always desirable to obtain the solution in the first place as concentrated as possible, so as to prevent the necessity of long-continued evaporation, which injures the extract. It is better, therefore, to incur the risk, both when decoction and infusion are employed, of leaving a portion of the active matter behind, than to obtain a very weak solution. When successive portions of water are employed, those which are least impregnated should be brought by evaporation to the strength of that first obtained before being mixed with it, as the latter thus escapes unnecessary exposure to heat.

Sometimes the filtering of a turbid infusion or decoction, before evaporation, causes the resulting extract to keep better, by removing substances which, besides undergoing decomposition themselves, may act as a ferment, and thus occasion the decomposition of the active matter of the extract.

When alcohol is employed as a menstruum, the vegetable should be macerated in it for one or two weeks, and care should be taken that the tincture be as nearly saturated as possible. The extraction may be hastened by substituting digestion for maceration; as the moderate heat employed, while it facilitates the action of the alcohol, has in this case no effect in promoting decomposition, and the influence of the atmospheric air may be excluded by performing the process in close vessels. When alcohol and water are both used, it is best, as a general rule, to exhaust the vegetable with each separately, as the two menstrua require different modes of treatment. In whichever of these modes the extraction is effected, it requires the assistance of occasional agitation; and, when the vegetable matter is very porous, and absorbs a large quantity of the solvent, expression must be resorted to.

Acetic acid has been introduced into use as a menstruum in the preparation of extracts. It is supposed to be a better solvent of the active principles of certain substances than either water or alcohol alone. According to Girolamo Ferrari, the acrid narcotics, such as aconite, hemlock, hyoscyamus, and stramonium, yield much stronger extracts with distilled vinegar than with water, and still stronger with alcohol to which strong acetic acid has been added. (*Journ. de Pharm.*, 3e sér., i. 239.) This acid is used in the preparation of the acetic extract of colchicum.

Ether also is now used to a considerable extent in the preparation of certain extracts. Having the property of dissolving volatile oil and resin, and of evaporating at a temperature insufficient to volatilize the oil, it is admirably adapted for the preparation of extracts from those substances, the virtues of which reside in the two principles referred to. An ethereal tincture is first prepared by the process of percolation or displacement, and the ether is then either allowed to escape by spontaneous evaporation, or is distilled off at a very moderate heat. The oleoresinous extracts thus obtained are usually of a thick fluid or semi-fluid consistence. Several of them are now ranked among the officinal preparations, in the U. S. Pharmacopœia, under the title of *Oleoresins.*

The process of *percolation* or *displacement* has in this country been very advantageously applied to the preparation of extracts, both with water and spirituous menstrua. It has the following great advantages: 1, that it enables the soluble principles to be sufficiently extracted by cold water, thereby avoiding the injury resulting from heat in decoction and hot infusion; 2, that it effects the extraction much more quickly than can be done by maceration, thereby not only saving time, but also obviating the risk of spontaneous decomposition; and, 3, that it affords the opportunity of obtaining highly concentrated solutions, thus diminishing the injurious effects of the subsequent evaporation. While thus advantageous, it is less liable in this particular case than in others to the objection of yielding imperfect results if not well performed; for, though an inexpert or careless operator may incur loss by an incomplete exhaustion of the substance acted on, and the extract may be deficient in quantity, it may still be of the intended strength and quality, which is not the case with infusions or tinctures unskilfully prepared upon this plan. In the U. S. Pharmacopœia, all the extracts to which the process is applicable are prepared by percolation, and with merely sufficient previous maceration or digestion to thoroughly soften the extractive. In the British Pharmacopœia, the process is applied, as it were, hesitatingly to a portion of the extracts, and withheld in others to which it seems equally appropriate; and, as if there were an unwillingness to trust this exotic method entirely, previous maceration for a greater or less length of time, never less than twelve, and more generally twenty-four hours, is with a single exception universally adopted, whenever percolation is employed. The first requisite in performing the process of percolation is to have the drug reduced to the proper degree of fineness. The U. S. Pharmacopœia gives the following directions on the subject.

Fineness of Powder. "The fineness of powder is expressed, in the Pharmacopœia, either by descriptive words (generally so in the case of brittle or easily pulverizable substances), or in terms expressing the number of meshes to a linear inch, in the sieve.

"These different forms of expression correspond to each other as follows:

A *very fine* powder	should pass through a sieve having 80 or more meshes to the linear inch	= No. 80 powder.
A *fine* powder	should pass through a sieve having 60 meshes to the linear inch	= No. 60 powder.
A *moderately fine* powder	should pass through a sieve having 50 meshes to the linear inch	= No. 50 powder.
A *moderately coarse* powder	should pass through a sieve having 40 meshes to the linear inch	= No. 40 powder.
A *coarse* powder	should pass through a sieve having 20 meshes to the linear inch	= No. 20 powder.

"In certain cases, powders of a different degree of fineness (*e.g.*, No. 30, No. 12) are directed to be taken." *U. S.*

Percolation. The officinal directions for this process are as follows. "The process of percolation, or displacement, directed in this Pharmacopœia, consists in subjecting a substance or substances, in powder, contained in a vessel called a percolator, to the solvent action of successive portions of menstruum in such a manner that the liquid, as it traverses the powder in its descent to the recipient, shall be charged with the soluble portion of it, and pass from the percolator free from insoluble matter.

"When the process is successfully conducted, the first portion of the liquid, or percolate, passing through the percolator will be nearly saturated with the soluble constituents of the substance treated; and if the quantity of menstruum be sufficient for its exhaustion, the last portion will be destitute of color, odor, and taste, other than that possessed by the menstruum itself.

"The percolator most suitable for the quantities contemplated by this Pharmacopœia should be nearly cylindrical, or slightly conical, with a funnel-shaped termination at the smaller end. The neck of this funnel-end should be rather short, and should gradually and regularly become narrower toward the orifice, so that a perforated cork, bearing a short glass tube, may be tightly wedged into it from within until the end of the cork is flush with its outer edge. The glass tube, which must not protrude above the inner surface of the cork, should extend from one and one-eighth to one and one-half inch (3 to 4 cm.) beyond the outer surface of the cork, and should be provided with a closely-fitting rubber tube, at least one-fourth longer than the percolator itself, and ending in another short glass tube, whereby the rubber tube may be so suspended that its orifice shall be above the surface of the menstruum in the percolator, a rubber band holding it in position.

"The dimensions of such a percolator, conveniently holding five hundred grammes of powdered material, are preferably the following: Length of body, fourteen inches (36 cm.); length of neck, two inches (5 cm.); internal diameter at top, four inches (10 cm.); internal diameter at beginning of funnel-shaped end, two and one-half inches (6·5 cm.); internal diameter of the neck, one-half inch (12 mm.), gradually reduced at the end to one-fifth of an inch (1 cm.). It is best, constructed of glass, but, unless otherwise directed, may be constructed of a different material.

"The percolator is prepared for percolation by gently pressing a small tuft of cotton into the space of the neck above the cork, and a small layer of clean and dry sand is then poured upon the surface of the cotton to hold it in place.

"The powdered substance to be percolated (which must be uniformly of the fineness directed in the formula, and should be perfectly air-dry before it is weighed) is put into a basin, the specified quantity of menstruum is poured on, and it is thoroughly stirred with a spatula, or other suitable instrument, until it appears uniformly moistened. The moist powder is then passed through a coarse sieve—No. 40 powders and those that are finer requiring a No. 20 sieve, whilst No. 30 powders require a No. 15 sieve for this purpose. Powders of a less degree of fineness usually do not require this additional treatment after the moistening. The moist powder is now transferred to a sheet of thick paper and the whole quantity poured from it into the percolator. It is then shaken down lightly and allowed to remain in that condition for a period varying from fifteen minutes to several hours, unless otherwise directed; after which the powder is pressed, by the aid of a plunger of suitable dimensions, more or less firmly, in proportion to the character of the powdered substance and the alcoholic strength of the menstruum; strongly alcoholic menstrua, as a rule, permitting firmer packing of the powder than the weaker. The percolator is now placed in position for percolation, and, the rubber tube having been fastened at a suitable height, the surface of the powder is covered by an accurately-fitting disk of filtering paper, or other suitable material, and a sufficient quantity of the menstruum poured on through a funnel reaching nearly to the surface of the paper. If these conditions are accurately observed, the menstruum will penetrate the powder equally, until it has passed into the rubber tube and has reached, in this, the height corresponding to its level in the percolator, which is now closely covered to prevent evaporation, and the apparatus allowed to stand at rest for the time specified in the formula.

"To begin percolation, the rubber tube is lowered and its glass end introduced into the neck of a bottle previously marked for the quantity of liquid to be percolated, if the percolate is to be measured, or of a tared bottle, if the percolate is to be weighed; and by raising or lowering this recipient, the rapidity of percolation may be increased or lessened as may be desirable, observing, however, that the rate of percolation, unless the quantity of material taken in operation is largely in excess of the pharmacopœial quantities, shall not exceed the limit of ten to thirty drops in a minute. A layer of menstruum must constantly be maintained above the powder, so as to prevent the access of air to its interstices, until all has been added, or the requisite quantity of percolate has been obtained. This is conveniently accomplished, if the space above the powder will admit of it, by inverting a bottle containing the entire quantity of menstruum over the percolator in such a manner that its mouth may dip beneath the surface of the liquid, the bottle being of such shape that its shoulder will serve as a cover for the percolator.

"When the dregs of a tincture or similar preparation are to be subjected to percolation, after maceration with all or with the greater portion of the menstruum, the liquid portion should be drained off as completely as possible, the solid portion packed in a percolator, as before described, and the liquid poured on, until all has passed from the surface, when immediately a sufficient quantity of the original menstruum should be poured on to displace the absorbed liquid, until the prescribed quantity has been obtained.

"*Modification of the above Process.* Authority is given to employ, in the case of Fluid Extracts, where it is applicable, the process of Repercolation, without change of the initial menstruum." *U. S.*

For an account of Dr. Squibb's process of *Repercolation*, see *Extracta Fluida.*

Some prefer the mode of expression to that of displacement. This also is applicable both to watery and alcoholic menstrua. The substance to be acted upon is mixed with the menstruum, cold or hot according to circumstances; and the mixture is allowed to stand from twelve to twenty-four hours. The liquid part is then filtered off, and the remainder submitted to strong pressure, in a linen bag, by means of a common screw press, or other convenient instrument. Another portion of the menstruum may then be added, and pressure again applied, and, if the substance is not sufficiently exhausted, the same operation may be performed a third time. Frequently only a single expression is required, and very seldom a third. The quantity of menstruum added must vary with the solubility of the principles to be extracted. According to Mohr, the method of expression has the advantages over that of displacement, that it yields solutions of more uniform concentration, that it does not require the materials to be so carefully powdered, or otherwise so skilfully managed, in order to insure favorable results, and finally that it occupies less time.

2. *Mode of Conducting the Evaporation.*

In evaporating the solutions obtained in the modes above described, attention should always be paid to the fact that the extractive matter is constantly becoming insoluble at high temperatures with the access of air, and that other chemical changes are going on, sometimes not less injurious than this, while the volatile principles are expelled with the vapor. The operator should, therefore, observe two rules: 1, to conduct the evaporation at as low a temperature as is consistent with other objects; 2, to exclude atmospheric air as much as possible, and, when this cannot be accomplished, to expose the liquid the shortest possible time to its action. According to Berzelius, the injurious influence of atmospheric air is much greater at the boiling point of water than at a less heat, even allowing for the longer exposure in the latter case; and therefore a slow evaporation at a moderate heat is preferable to the more rapid effects of ebullition. Bearing these principles in mind, we shall proceed to examine the different modes in practice. First, however, it is proper to observe that decoctions generally let fall upon cooling a portion of insoluble matter; and it is a question whether this should be rejected, or retained so as to form a part of the extract. Though it is undoubtedly in many instances inert, as in that of the insoluble tannate of starch formed during the decoction of certain vegetable substances, yet, as it frequently also contains a portion of the active principle which a boiling saturated solution necessarily deposits on cooling, and as it is difficult to decide with certainty when it is active and when otherwise, the safest plan, as a general rule, is to allow it to remain.

The method of evaporation formerly resorted to in the case of aqueous solutions is rapid boiling over a fire. The more quickly the process is conducted, the better, provided the liquid is to be brought to the boiling point; for the temperature cannot exceed this, and the length of exposure is diminished. But, where this method is employed, it should never be continued till the completion of the evaporation; for when most of the water has escaped, the temperature can no longer be kept down to the boiling point, and the extract is burnt. The caution, therefore, should always be observed of removing the preparation from the fire before it has attained the consistence of thick syrup, and completing the evaporation, either by means of a water-bath, or in shallow vessels at a moderate heat. When large quantities of liquid are to be evaporated, it is best to divide them into portions and evaporate each separately; for, as each portion requires less time for evaporation than the whole, it will thus be a shorter time exposed to heat. (*Mohr.*) But the mode of evaporation by boiling is always objectionable, and should be employed only in cases where the principles of the plant are so fixed and unchangeable as to authorize their extraction by decoction.

Evaporation by means of the water-bath, from the commencement of the process, is safer than the plan just mentioned, as it obviates all danger of burning the extract; but, as the heat is not supplied directly from the fire, the volatilization of the water cannot go on so rapidly, and the temperature being nearly the same, when the water-bath is kept boiling, there is greater risk of injurious action from the air. The liquid should be stirred during the process. The use of the steam-bath has become very general in this country; as it requires a smaller consumption of fuel, and the heat imparted to the liquid, while sufficient to evaporate it, is less than 100° C. (212° F.). The apparatus consists of an ordinary boiler, containing water, the vapor of which is conducted through a pipe into the evaporating vessels, communicating with each other by means of iron steam pipes. These vessels have the form of an ordinary copper basin, to the inside of which is riveted a shallow tinned copper evaporating basin, intended to contain the liquid to be evaporated. The vapor from the boiler circulates between these vessels, and the water into which it condenses is allowed to escape through a steam valve attached to the bottom of each vessel. The liquid to be evaporated is first distributed in two or three basins, but, when considerably concentrated, is transferred to a single one, where it is stirred towards the close of the process to hasten the evaporation. The heat applied to the liquid can be easily regulated by the steam valves. An incidental advantage of this apparatus is, that it may be made to afford a large supply of distilled water.

As the heat capable of being applied by a boiling water-bath to the evaporating liquid does not exceed 93·3° C. (200° F.), while that by steam can, by a moderate pressure, be increased to the boiling point or beyond it, the evaporation by the latter agency may be much more rapid than by the former, when the pressure is from ten to twenty pounds to the square inch; so that there is a temptation to raise the heat to a degree seriously injurious to the product. Evaporation, therefore, by steam heat always requires caution, while the water-bath is much less liable to be abused. In this respect, the latter method has the advantage.

A good plan of evaporation, though slow, is to place the liquid in a broad, shallow vessel, exposed in a stove or drying room to a temperature of about 100° F., or a little higher, taking care that the air have free access in order to facilitate the evaporation. This mode is particularly applicable to those cases in which maceration or infusion is preferred to decoction for extracting the active principles. Berzelius says that we may thus usually obtain the extract in the form of a yellowish transparent mass, while extracts prepared in the ordinary way are almost black, and are opaque even in very thin layers. Even when the liquid is boiled at first, the process may often be advantageously completed in this manner. It has been proposed to effect the evaporation at the common temperature, by directing a strong current of air, by means of a pair of smith's bellows, over the surface of the liquid; and, in reference to substances which are injured by heat and not by atmospheric air, the plan will be found useful.

Plans have been proposed and carried into execution for performing evaporation without the admission of atmospheric air. The apparatus for *evaporation in vacuo*, now largely used by manufacturing pharmacists, is well calculated to meet this object, at the same time that, by removing the atmospheric pressure, it enables the water to rise in vapor more rapidly, and at a comparatively low temperature. The method of Barry consists in distilling the liquid into a large receiver, from which the air has been expelled by steam, and in which the vapor is condensed by cold water applied to the surface of the receiver, so as to maintain a partial vacuum. Prof. Redwood modified this process by keeping an air-pump in action during the evaporation, thus removing not only the air, but the vapor as fast as it forms, and maintaining a more complete vacuum than can be done by the condensation of the vapor alone. (*Journ. de Pharm.*, 3e sér., i. 231.)*

A convenient plan of excluding the air, though it does not at the same time meet the object of reducing the degree of heat, is to distil off the water in close vessels. Berzelius says that this is the best mode of concentration next to that *in vacuo*. Care, however, must be taken that the fire be not too long applied, lest the extract should be burnt. The process should, therefore, be completed by means of the water-bath.

In the concentration of alcoholic solutions, distillation should always be performed; as not only is the atmospheric air thus excluded, but the alcohol is recovered, if not absolutely pure, certainly fit for the purpose to which it was originally applied. Here also the water-bath should be employed, to obviate any possible risk of injury from the fire. When the decoction or infusion and the tincture of the same vegetable have been made separately, they should be separately evaporated to the consistence of syrup, and then mixed together, while they are of such a consistence as to incorporate without difficulty. The object of this separate evaporation is, that the spirituous extract may not be exposed to the degree of heat, or lengthened action of the air, which is necessary in the ordinary mode of concentrating the infusion or decoction.

In every instance, care should be taken to prevent any portion of the extract from becoming dry and hard on the sides of the evaporating vessel, as in this state it will not readily incorporate with the remaining mass. The heat, therefore, should be applied to the bottom and not to the sides of the vessel.

3. *Condition and Preservation of Extracts.*

Extracts are prepared of two different degrees of consistence: soft so that they may be readily made into pills, and hard that they may be pulverized. (See *Abstracta.*) The soft extracts always contain a notable percentage of water; in the case of belladonna and hyoscyamus, this has been found by Mr. Chas. Ekin to be about 20 per cent., and in that of conium 25 per cent. (*P. J. Tr.*, iv. 391.) In astringent extracts, the evaporation should be carried to dryness. Those obtained from the expressed juices of plants are apt to attract moisture from the air, in consequence of the deliquescent nature of the salts existing in the juice. They are thus rendered softer, and more liable to become mouldy upon the surface. Others, especially such as contain much chlorophyll, harden by time, in consequence of the escape of their moisture; and it not unfrequently happens that small crystals of saline matter are formed in their substance. Most extracts, especially those containing nitrogenous principles, are capable, when left to themselves, of producing nitrates. Prof. John Attfield, of London, has made a chemical examination of the crystals found in numerous extracts, and ascertained that, in a large number, they consisted of chloride of potassium, and, in a comparatively few, of the nitrate of potassium.* The air, moreover, exercises an unfavorable chemical influence over the softer extracts, which are enfeebled, and ultimately become nearly inert, by the same changes which they undergo more rapidly in the liquid state at an elevated temperature. If an extract be dissolved in water, and the liquid be saturated with common salt or any other very soluble salt of difficult decomposition, the greater part of it will be precipitated, in consequence of the insolubility of this class of substances in saline solutions. The precipitate may be again dissolved in pure water.

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* A very ingenious apparatus for evaporating in vacuo on a small scale has been invented by Prof. A. B. Prescott (*A. J. P.*, xlii. 349). Two vessels are required: a small one, for evaporation; a large one, which is best made of copper, and should be so arranged as to be readily heated or refrigerated at will. The two are to be connected by glass tubing, through rubber corks, and into the cork of the evaporating dish is to be set a short straight glass tube with a piece of rubber tubing fitted to it so that it can be tightly closed with a glass rod at will. An ounce or two of water having been put in the receiver, and the material in the evaporating vessel, a gentle heat is, by means of water, applied to the evaporating vessel, but a strong heat to the receiver. The water in this latter boils furiously, and the vapor escapes through the opened tube in the evaporating vessel. When the water is exhausted the tube is closed and the receiver refrigerated. Of course a vacuum results, and is maintained by the continuous condensation of vapor in the receiver.

At the last revision of the U. S. Pharmacopœia it was not deemed advisable to introduce powdered extracts, containing sugar of milk and standardized, under the name of powdered extracts, for fear that they would be prescribed under the impression that they were 20 or 25 per cent. stronger than the pilular extract, having lost that much moisture. They were therefore given a distinctive name, *Abstracts.* (See *Abstracta.*) There are, however, at present (1882) many powdered extracts in the market, claiming to be of the same strength as the pilular extract, having merely the moisture replaced by some dry inert powder. It is to be feared that in most cases the evaporation of the remaining traces of moisture is accomplished at such a high temperature as seriously to injure the activity of the extract. It is quite common to perceive an empyreumatic odor about them.

Extracts, in order that they may keep well, should be placed in glazed earthenware, glass, or porcelain jars, and completely protected from the access of the air. This may be effected by covering their surface with a layer of melted wax, or with a piece of paper moistened with strong spirit, then closing the mouth of the vessel with a cork, spreading wax or rosin over this, and covering the whole with leather, or a piece of bladder. (*Duncan.*) The dry extracts, being less liable to be affected by atmospheric oxygen, do not require so much care. The application of alcohol to the surface has a tendency to prevent mouldiness. A method of protecting extracts from the action of the air, frequently resorted to, is to cover them closely with oiled bladder; but this, though better than to leave them uncovered, is not entirely effectual. Should the extract become too moist, it may be dried by means of a water-bath; should it, on the contrary, be too dry, the proper consistence may be restored by softening it in the same manner, and incorporating with it a little distilled water. Martin (1880) proposes to preserve extracts in a soft condition by surrounding the vessel containing the extract by another of larger diameter, which is furnished with a tight cover, the space between the two vessels being filled with crystallized sulphate of sodium, which gradually parts with its water of crystallization and prevents the extract from becoming hard and dry.

Some extracts when powdered have a tendency to cohere again. According to Geiseler, this may be obviated by the addition of sugar of milk or powdered liquorice-root; two or three parts of the former and one part of the latter to one of the extract being sufficient for the purpose. (*Pharm. Centralb.*, 1850, p. 238.) Mohr recommends the following plan of drying and preserving extracts. Take equal parts of powdered liquorice-root and of the extract, rub them well together in a mortar, put the resulting paste into an earthen vessel with a flat bottom, place this in another of iron, a little deeper, containing chloride of calcium thoroughly dried by heat insufficient to melt it; then enclose the whole with a cover fitted to the iron vessel, and allow them to stand for a day or more. When the mixture is quite dry, powder it, and add so much of the powdered root as to make the weight double that of the original extract. (*Ibid.*, p. 119.) This process has been substantially adopted in the new German Pharmacopœia (1882). The old process of using dextrin as a diluent was found very objectionable, principally on account of the tendency of the extracts to reabsorb moisture. Four parts of extract are now mixed with three parts of finely powdered liquorice-root, and dried in a porcelain capsule at 40°–50° C. (104°–122° F.) until the mixture ceases to lose weight. The mass is then rubbed to powder, and sufficient powdered liquorice-root added to make the whole weigh eight parts, or double the weight of extract used. In our opinion this method is not so good as that adopted for abstracts. The German powdered extracts are always half the strength of the extracts, no relation whatever with the drug is established, and the variations in the yield of extract from different drugs has been repeatedly shown to be great. Kirchmann proposes exsiccated sodium sulphate as a diluent instead of dextrin, liquorice-root, etc. (*Phar. Zeitung*, 1881, p. 116.) W. Stromeyer has found sugar to answer very well as an addition to too moist narcotic extracts. It is necessary, however, that the extract be not exposed to a heat of over 112° F., else it remains soft. (*A. J. P.*, 1872, pp. 300, 353.)

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* Thus, chloride of potassium was detected in the extracts of belladonna, hemlock, sarsaparilla (compound), colchicum seeds, stramonium seeds, and aconite; nitrate of potassium in extracts of belladonna, hyoscyamus, and lettuce; and sulphate of sodium in extract of stramonium seeds. (*P. J. Tr.*, March, 1862, p. 448.)

The plan of incorporating a little glycerin with extracts has been adopted in the formulas of the present U. S. Pharmacopœia. By its unchangeable liquid character it keeps the extract soft, so that it can be readily made into pills, and exercises also a favorable influence through its chemical properties. It is preferable to add a definite weight of the glycerin to the pilular extract. If added to the menstruum, owing to the variation in the yield of extracts from plants, some samples would be too soft, and at another time, in the case of a large yield of extract, the quantity of glycerin would be insignificant.

Extracts from recent plants should be prepared at the season when the plant is medicinally most active; and a good rule is to prepare them once a year.*

EXTRACTA FLUIDA. *Fluid Extracts.*

(ẸX-TRĂC′TẠ FLÛ′Ị-DẠ.)

Extracta Liquida, *Br.;* Extraits liquides, *Fr.;* Flüssige Extrakte, *G.*

These were first introduced into the U. S. Pharmacopœia of 1850, as a distinct class of preparations; the fluid extract of sarsaparilla being the only one previously directed, either in our own officinal code, or by the British Colleges. Since then they have increased so rapidly in favor that at the present time seventy-seven are officinal, and in addition large quantities of non-officinal fluid extracts are annually produced. They are now perhaps the most important class of liquid preparations in use. Their distinctive character is the concentration of the active ingredients of medicinal substances into a small bulk, in the liquid form, a cubic centimetre or fluigramme of any one of them now representing a gramme of the crude drug. Independently of the greater convenience of administration, the advantage of this class of preparations is that, the evaporation not being carried so far as in the ordinary extracts, the active principles are less liable to be injured by heat. Formerly the main difficulty, in relation to them, was the liability of substances in the liquid state to undergo spontaneous decomposition. In the Pharmacopœia of 1850 this was counteracted by means of sugar and of alcohol, but in 1865 (*A. J. P.*, 1865, p. 50) Mr. Alfred B. Taylor proposed the use of glycerin, and in the revision of the Pharmacopœia for 1870 his suggestion was adopted. Glycerin, while it exerts a powerful preservative influence, possesses the very valuable property of dissolving matters which were deposited by some of the fluid extracts when made with sugar, as in the old officinal recipes. Consequently these fluid extracts were much clearer and more elegant preparations than were the old ones. Subsequent experience with these fluid extracts has shown that the use of glycerin should be circumscribed, and that it was employed too freely in the formulas of the fluid extracts of the last Pharmacopœia. The solvent powers of glycerin are so great that the fluid extracts were frequently loaded with many inert principles, which it dissolved, giving them a dense, rich appearance without increasing their activity. As the primary object of fluid extracts is concentration, suitable menstrua should in each case be selected with the single object of dissolving and retaining permanently the active constituents of the drug. In order to do this, many experiments are necessary to determine which is the most suitable menstruum, and each drug must be separately and individually studied. Whilst the formulas for the fluid extracts in the U. S. Pharmacopœia of 1880 show a great improvement in this respect over all others, ten years' experience will demonstrate the necessity of further changes. The relative strength adopted at the last revision differs from that formerly used, and will doubtless elicit considerable criticism. An exception is made here to the usual rule followed in the Pharmacopœia of constructing all formulas in parts by weight. Although there is no difficulty in making fluid extracts of such strength that one troyounce should represent one troyounce of the drug, the Committee of Revision believed it to be better to substitute measure for weight here, not only on account of the greater convenience of measuring the reserved portion, but also because of there being less variation in strength from the fluid extracts of 1870.

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* M. Lepage, of Gisors, gives the following method of testing the quality of the narcotic extracts, and determining whether they contain any of the alkaloids to which they owe their efficiency. Take a gramme (15·5 grs.) of the extract, dissolve it in twice its weight of distilled water, introduce the solution into a test-tube, and add from 25 to 30 centigrammes (4 or 5 grs.) of powdered bicarbonate of potassium. When effervescence has ceased, add to the mixture 5 or 6 times its bulk of pure ether, cork the tube, and shake briskly three times in 2 or 3 minutes. Then let the mixture rest; and, when the ether has become transparent, decant, and allow it to evaporate spontaneously. Dissolve the residue in 6 or 8 grammes (fʒiss to fʒij) of water, acidulated with a drop or two of hydrochloric acid. If the extract be good, the solution will be rendered very turbid by a few drops of a solution of the double iodide of mercury and potassium, and will give a flocculent precipitate with solution of tannic acid. (*Journ. de Pharm.*, Mai, 1863, p. 362.) The test is applicable to the extracts of aconite, belladonna, hyoscyamus, and conium.

The present fluid extracts are just *five per cent. weaker* than those formerly officinal, and are based upon the theory that from a given weight of drug an amount of fluid extract shall be made equal in measure to the bulk of the same weight of distilled water; in other words, the relation of gramme to cubic centimetre.* Many will prefer to use weights and measures that they have been accustomed to; in such cases, to make 20 *fluidounces* of fluid extract 19 *troyounces* of drug will be required, whilst if avoirdupois weight is preferred, which it doubtless will be, the most convenient relation to recollect will be that 50 *avoirdupois ounces* are required to make 48 *fluidounces*, or *three pints* of fluid extract. The general formula for the preparation of fluid extracts does not differ materially from that formerly officinal; the length of time required for maceration has been judiciously reduced, whilst the quantity reserved has been generally slightly increased, although the formulas are not uniform in this respect. The fact cannot escape observation, that there has been a close study of the solubilities, physical properties, and individuality of each drug, whilst uniformity amongst the formulas has not been sought for, so much as the best method of producing the fluid extract. The general formula may be expressed as follows. 100 Gm. of the powdered drug is moistened with a certain quantity of menstruum, packed in a suitable percolator, and enough menstruum added to saturate the powder and leave a stratum above it; the lower orifice of the percolator is closed when the liquid begins to drop, and the percolator is closely covered to prevent evaporation and permit maceration for a specified time; additional menstruum is poured on and percolation continued until the drug is exhausted. Usually from seven- to nine-tenths of the first portion of the percolate is reserved, and the remainder evaporated to a soft extract; this is to be dissolved in the reserved portion, and enough menstruum added to make the fluid extract measure 100 C.c. The precipitation experienced heretofore when the evaporated weak percolate was added to the reserved portion is considerably diminished by causing the former to be evaporated to a soft extract. This precipitation, formerly noticed more particularly in alcoholic fluid extracts, was due to the greater volatility of the alcohol in the weak percolates, which, when evaporated, left the residue to a great extent aqueous; when this was added to the strongly alcoholic reserved portion, a precipitation of resinous and frequently active matter took place, which necessitated the storing of the fluid extract until precipitation ceased, and subsequent filtration. This is almost altogether avoided by evaporating to a soft extract, and the loss of activity through precipitation thus greatly diminished.

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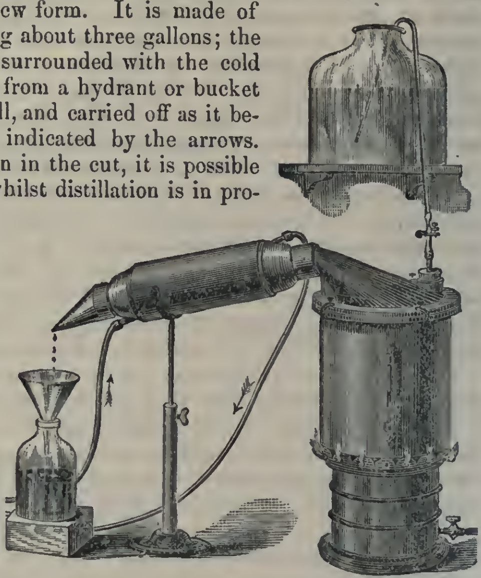
* The following table shows the relation of the crude drug to the fluid extract when made by the process of the U. S. Pharmacopœias of 1880 and 1870:

Weight of Drug.	*Measure of Fluid Extract.*	
	Pharm. 1880.	Pharm. 1870.
100 grammes of drug make	100 C.c.	94·9 C.c.
100 troyounces of drug make	105·3 fluidounces.	100 fluidounces.
100 avoirdupois ounces of drug make	96 fluidounces.	91·1 fluidounces.

A useful distillatory apparatus has been contrived by Prof. Jos. P. Remington for recovering alcohol from weak percolates, and for general pharmaceutical uses. The still shown in the cut is the new form. It is made of tinned copper, the still body holding about three gallons; the condenser has seven straight tubes surrounded with the cold water introduced by a rubber tube from a hydrant or bucket of water placed higher than the still, and carried off as it becomes warmed by another tube as indicated by the arrows. By the siphon arrangement shown in the cut, it is possible to feed the still from a reservoir, whilst distillation is in progress, thus using a three-gallon still where a much larger one would have been necessary. The joints are carefully ground, and troublesome lutes and water-joints are entirely superseded. The condenser having straight tubes, instead of a spiral one, is easily cleaned, and is powerful enough to condense a gallon of alcohol in thirty minutes.

The still may be set into a kettle partly filled with water and thus used as a water-bath, or a shallow tinned-copper dish with flat rim, which accompanies the still, may be placed between the two brass ring bands and clamped securely. (*A. J. P.*, May, 1879.)



For valuable papers on percolation and fluid extracts, by Prof. Procter, Dr. Squibb, Alonzo Robbins, and others, see *Proc. A. P. A.*, 1859, p. 265; 1863, p. 222; *A. J. P.*, 1878, pp. 209, 329; 1873, pp. 85, 189.

Several methods have been suggested for preparing fluid extracts more economically. The most important is the plan of repercolation, as proposed by Dr. E. R. Squibb, to this class of preparations as well as to the dry extracts.

Repercolation. In consequence of the existing high price of alcohol, it is important to adopt some plan by which, while the ends aimed at are attained, the consumption of the menstruum used in percolation may be diminished. This object has been accomplished, to a considerable extent, by Dr. E. R. Squibb, of Brooklyn, N. Y., by a modification of the process of percolation to which he has given the name at the head of the present paragraph. As defined by the author, repercolation consists in the successive application of the same percolating menstruum to fresh portions of the substance to be percolated. The result is that the same menstruum, acting repeatedly on unexhausted portions of the substance, becomes concentrated to the greatest possible extent; so that much of the menstruum is saved, while subsequent evaporation is avoided, which is itself an object of great importance in the preparation of extracts. It is obvious that repercolation is not applicable to the preparation of infusions, decoctions, tinctures, etc., in which the object in general is less a high degree of concentration than precision in the strength of the preparation, and consequently in the dose. It is to the extracts and fluid extracts that the process is peculiarly adapted, and there now remains no doubt whatever of the great value of the improvement. One of its disadvantages is that the substance treated is less completely exhausted than when the proceeding is inverted, and fresh portions of menstruum are made to act on the same material until the latter is deprived of all its soluble matter. But the loss in this way is trifling, compared with the gain when a menstruum as high-priced as alcohol is at the present time, is employed. Another practical disadvantage is the inconvenience of keeping the weak percolates, as these have to be labelled, numbered, and stored away for use until the same operation is repeated. In deciding when to adopt it, the operator will of course be influenced by the relative value of the drug and the menstruum. In order to secure the most favorable results in repercolation, certain methods of proceeding are advisable in various steps of the process, differing with the character of the substance to be acted on; and these can be determined only by a careful study, confirmed by repeated experiment. Dr. Squibb uses repercolation exclusively on the large scale in the manufacture of extracts and fluid extracts, and has applied it especially to the preparation of fluid extract of cinchona; and since his first paper, which was reproduced in the 14th revision of the U. S. Dispensatory, p. 1164, he has introduced several improvements, which are intended to make the process useful to the apothecary in his every-day work. By presenting in a note below an abstract of his plan of proceeding in this case, with the accompanying explanations, we can more forcibly impress on the mind of the pharmaceutical student the lessons applicable to the case than by a general description.[*]

[*] *Dr. Squibb's Process for Extract of Cinchona by Repercolation*, revised and improved (1878): "Take of Yellow Cinchona, in powder No. 50, 32 parts; Stronger Alcohol, sp. gr. ·819, 2 parts; Glycerin, sp. gr. 1·250, 1 part; Water, 2 parts, or a sufficient quantity of menstruum.

"Weigh the Stronger Alcohol, Glycerin, and Water in succession, in any convenient quantity at a time, into a tared bottle, and mix them thoroughly for a menstruum.

"Moisten 8 parts of the Cinchona with 8 parts of the menstruum, by thoroughly mixing them, and allow the mixture to stand 8 hours in a closely covered vessel. Then pass the moist powder through a No. 8 sieve, and pack it firmly in a percolator. Pour menstruum on top until the mass is filled with liquid and a stratum remains on top unabsorbed; cover the percolator closely and macerate for 48 hours. Then arrange the percolator for an automatic supply of menstruum, and start the percolation at such a rate as to give 1 part of percolate in about 4 hours. Reserve the first 6 parts of percolate and continue the percolation until the Cinchona is exhausted, separating the percolate received after the reserved portion into fractions of about 8 parts each.

"Moisten a second portion of 8 parts of the Cinchona with 8 parts of the weak percolate,—the first portion that was obtained next after the reserved percolate,—and allow the moist powder to stand for 8 hours in a vessel closely covered. Then pack it moderately in a percolator, and supply the percolator automatically with the remaining fractions of the weak percolate in the order in which they were received, and finally with fresh menstruum until the Cinchona is exhausted. Percolate in the same manner and at the same rate as with the first portion of Cinchona, and, reserving 8 parts of the first percolate, separate the weaker percolate into fractions of about 8 parts each.

"Percolate the third and fourth portions of 8 parts each of the Cinchona in the same way as the second portion.

"Finally mix the four reserved percolates together to make 30 parts of finished fluid extract; and having corked, labelled, and numbered the bottles containing the fractions of weak percolate, set them away until the process for Cinchona is to be resumed.

"When this fluid extract is to be again made, repeat the process as with the second portion, and reserve 8 parts of the first percolate as finished fluid extract from each 8 parts of Cinchona from that time forward so long as the fractions of weak percolate are carried forward with which to commence each operation."

Dr. Squibb draws the following deductions, which, although they have reference to the fluid extracts of the U. S. P. 1870, yet they apply in some respects to the new officinal preparation:

"First, that the present formulas and processes for percolation (U.S. 1870) are so defective that the relation to the drug which they profess is not practically accurate either as to quality or quantity, and therefore that a better process is greatly needed.

"Second, that the process by repercolation, though it has some grave disadvantages, and is liable to defects in practice, yet gives far better results both in quality and quantity of product; while it is not difficult in practice except by comparison with the delusive simplicity of the former processes; and therefore that repercolation is better adapted to pharmacopœial uses as a model or standard process than any which has yet been tried.

"Third, that repercolation may be used on a scale as small as 4 or 8 ounces, by great care and skill, but is not very successful with less than an avoirdupois pound of material for each percolation.

"Fourth, that powders for percolation should not be finer than No. 60 for hard compact substances, nor coarser than No. 40 for more loose and spongy substances,—with a few special exceptions.

"Fifth, that the menstruum should be so adjusted as to dissolve out the medicinal principles with the least practicable disturbance of their natural relations to each other and to the extractive matters whereby they are rendered soluble and permanent. Next that the menstruum should contain the smallest practicable proportion of alcohol; and glycerin only when absolutely necessary, as in Cinchonas. By repercolation the exhaustion is never less than 90 per cent. and perhaps rarely more than 97 per cent. of the total soluble matter.

"Sixth, that the powder be moistened with as much liquid as it can be made to hold and yet pass through a No. 8 sieve; that it be not tightly packed; and that it be well macerated before starting the percolation.

"Seventh, that the rate of percolation be uniform and very slow. At first, for the reserved portion, the percolate in 24 hours should not exceed the weight of the powder; nor need the rate be slower than to obtain the weight of the powder in 48 hours, although as a general rule the slower the rate the better the results. After the reserved portion the rate may be increased gradually so that the last portion be received in about 6 hours. The separate portions of weak percolate should not exceed the weight of the powder.

"Eighth, that a good practical exhaustion requires—as a general rule—for the first percolation, with fresh menstruum, that the total percolates should weigh 3·5 times the weight of the powder.

The plan of Mr. N. Spencer Thomas consists in exposing the substance to be acted on to successive expressions, by means of a press, with the menstruum divided

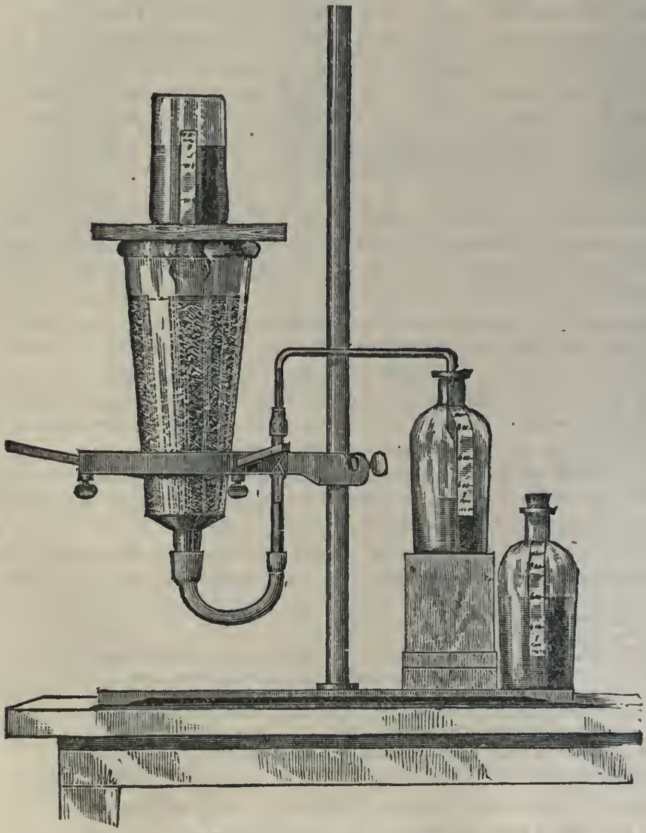
That for the second percolation or first repercolation, the weight should be 4·5 times that of the powder. And for all subsequent repercolations the weight should be 5, 6, or 7 times that of the powder, according to the nature of the substance percolated, and the skill and care with which the process is managed.

"Ninth, that the relation of weight for weight, instead of minim for grain, should be established under proper controlling conditions: but that, unless properly guarded in the quality and moisture of the drug used, the new relation is liable to be even more inaccurate than the old, because, the poorer the quality of the drug the less dense will be the percolates, and the greater will be the volume for the prescribed weight, and this involves the serious difficulty that, when the fluid extract is made by weight but administered by measure, the poorer the drug from which it was made, the smaller, as well as the weaker, the dose will be.

"Tenth, that some good practical method of comparing fluid extracts by a standard is very much needed; and that for such drugs as Cinchona, a method of arithmetical dilution would be easy and practical if well worked out."

Dr. Squibb has devised an ingenious siphon percolator whereby the rapidity of the flow of the percolate may be controlled.

The accompanying illustration shows a convenient way of applying the principles involved in the siphon percolator to the glass percolator in common use. The cut is so plain and so easily understood that it needs but little explanation. The percolator is shown in the position of having been stopped for the night lest the receiving bottle should be filled beyond the proper mark. The siphon here is made in two parts, one end of the upper part being telescoped within a larger piece of glass tubing, and the junction made tight by a short section of rubber tubing through which the smaller tube is free to slide. During maceration, or when the percolation is arrested, the upper part of the siphon is drawn up until the liquid will no longer flow over into the bottle, and the height at which this column of liquid ceases to flow over is a measure of the comparative density of the liquid within and without. As seen in the cut, the liquid will not flow over into the bottle although the column is several inches short of the height of the liquid in the percolator. But as



Scale, one-sixth of the actual linear size.

into different portions; so that fresh portions of liquid are brought to act on the same solid body in different stages of exhaustion; and then mixing the expressed liquids. The due proportion between the weight of the medicine and the bulk of the ultimate fluid extract is secured by regulating the measure of the last-added portion of menstruum, which, in the process as described by Mr. Thomas, is the third. Whatever may be the advantages of this method, and it is not without its recommendations, it is liable to the objections of loss of alcohol through exposure during expression, and of being patented. (*A. J. P.*, 1866, p. 219.)

Another method of limiting the quantity of alcohol used, has been proposed by Mr. S. P. Duffield, of Detroit. It consists in macerating, for from six to ten days, the medicine to be acted on, previously deprived, by means of a vacuum apparatus, of all the air, and of all readily volatilizable matter contained in its pores, with a certain volume of the menstruum, which is forced through a tube into the vacuum pan by atmospheric pressure, and thus brought into the most intimate contact with all parts of the powder. The process is completed by submitting the mass thus impregnated to hydraulic pressure, and, after allowing the liquid to settle in glass carboys, drawing off the clear liquid into bottles. It is only by experience that the value of this process can be determined. (*Ibid.*, Jan. 1869, p. 2.) It is obviously inapplicable to substances whose virtues depend in any considerable degree upon readily volatilizable constituents. Mr. Campbell (*A. J. P.*, xlii. 17) has proposed a method for doing away with the use of heat, which, however, although in some cases it may do well, cannot be relied upon for the complete exhaustion of all drugs. In carrying it out, mix with sixteen troyounces of the powder four to six fluidounces of the menstruum (usually alcohol), and pack it in a glass funnel moderately but uniformly tight, a piece of sponge having previously been put in the beak of the funnel; then cover the surface of the powder with a disk of paper, and pour on twelve fluidounces of menstruum. When the sponge becomes saturated, cork tightly the beak of the funnel, and set the whole aside for four days, at the end of which time the percolation may be allowed to proceed. Mr. James W. Mill has called attention to the advantage of separating the powder into fine and coarse parts by means of sieves and packing the finer powder at the bottom.

H. Biroth (*Pharmacist*, April, 1877) proposes the method which he terms "*insuccation*," for making non-alcoholic fluid extracts; the advantages claimed for it are simplicity and economy. Sixteen troyounces of the drug, cut, crushed, or whole, are placed in a stone jar or tin percolator. Eight fluidounces of glycerin mixed with four pints of boiling water are poured upon the drug and allowed to "insuccate," or macerate, for twenty-four hours, the liquid poured off, and the residue treated with four pints more of boiling water as before. The decanted liquors are mixed, strained, and evaporated by means of a water-bath to one pint and filtered. It is obvious that this process is adapted to a very limited number of drugs, and it is

exhaustion progresses and the liquid in this column becomes less dense, its counterbalancing height becomes greater, until finally, when the powder is exhausted and the liquid within and without is of the same density, the column rises to the level of the liquid within the percolator, minus the friction and capillarity. When the percolation is to be started, the siphon is simply pushed down through the rubber until the liquid flows over, and then the rate is established by carefully raising or lowering the siphon. This sliding joint for varying the length of this column of liquid at will being understood, the other details are plain enough, whilst the charging and the general management are the same as in the smaller and larger percolators.

The powder, moistened with great care and uniformity, is packed loosely, firmly, or very firmly, according to its nature or condition, with the square end of a stick, say ·8 inch = 2 mm. diameter. As a rule, the largest practicable proportion of liquid should be used in moistening the powder, because then the powder occupies the smallest space in the percolator, requires the loosest packing, and is saturated for the maceration by the smallest additional quantity of liquid, and therefore gives the most concentrated first percolate for the reserve, and secures the most rapid exhaustion by the smallest quantity of liquid. A disk of filtering paper is placed on the surface of the powder, of such size that the edge is reflected up against the glass. A disk of board, card-board, or better of thick sheet rubber, with a central hole 1·5 inches = 37 mm. in diameter, is used for a cover. A stratum of liquid, maintained at a uniform thickness of ·25 inch = 6 mm., should cover the powder from first to last, so that it may not drain and contract, or admit air; and this is best maintained by an inverted bottle of the supply liquid, as shown in the cut. The length of the neck and mouth of such bottle may be conveniently elongated when needed, so as to regulate the depth of the stratum of liquid above the powder, by stretching over it a short section of rubber tubing in the manner shown in the cut.

equally certain that the resulting preparation is not entitled to the name of fluid extract, as it is understood in this country; boiling water and glycerin are not effective as general solvents for thoroughly exhausting many drugs; a better name would be "concentrated infusions."

Prof. J. U. Lloyd proposes to recover the alcohol which remains absorbed by the residue after percolation by mixing the wet residues with an equal bulk or less of dry sawdust, and then percolating this with water. (*A. J. P.*, June, 1877.)

Wm. M. Thomson, of Philadelphia, has lately devised a very complete method of preparing fluid extracts on a large scale; the principles of his process are maceration and percolation *in vacuo*, and although the principles which have been applied have been long known, and similar apparatus used by Duffield and others, there are many useful practical points which merit a notice in detail. The percolators are egg-shaped, and made of tinned copper; they are capable of being tightly covered, and communicate by means of stopcocks above and below, and iron and stout rubber tubing, with a very efficient double-acting air-pump. The moistened powder is packed tightly in the percolator, and the cover securely bolted on. The stopcock in the cover is now opened, which communicates with the air-pump and a partial vacuum created in the space above the moistened drug; the stopcock is now closed and another stopcock in the cover opened, which communicates by a tube with the reservoir containing the menstruum. The menstruum, of course, quickly penetrates the powder, taking the place of the interstitial air, and when the powder is saturated, it is permitted to macerate *in vacuo* a sufficient length of time. To start percolation, a receiver is connected with the beak of the percolator, and, the air being exhausted from it, the percolate at once makes its appearance. When the flow slackens, if desired, air may be forced by the pump in the space above the powder, and the receiver again exhausted below. In this way it can be seen that entire control of these powerful physical forces may be secured. The advantages are very apparent in preventing the loss of volatile principles and alcohol, whilst protecting from chemical change caused by exposure to the air. It is quite possible to make many officinal fluid extracts without recourse to subsequent evaporation of weak percolate. For a cut of this apparatus, see *A. J. P.*, 1882, p. 237; or *Amer. Pharmacist*, 1882, p. 11.

In order to carry out the strictly alphabetical arrangement now adopted in the U. S. Pharmacopœia, it will be necessary in this commentary to deviate from the plan heretofore used of treating of the Extracts and Fluid Extracts in separate classes. Whilst the wisdom of adopting this course on the part of the Committee of Revision of the Pharmacopœia may be open to question, it is obviously the duty of the commentator to follow the authority.

☞ IMPORTANT. As before noted, the quantity of drug selected for the practical alternative formula is in the case of fluid extracts *fifty avoirdupois ounces*, the end product being *three pints;* the relative proportions of the various menstrua, ingredients, etc., are of course retained, and in each case are preceded by the word "or," and the alternative quantities always enclosed in brackets.

EXTRACTUM ACONITI. *U. S., Br.* *Extract of Aconite.*

(ẸX-TRĂC'TỤM ĂC-Ọ-NĪ'TĪ.)

Extract of Aconite Root; Extrait de Racine d'Aconit, *Fr.;* Eisenhutknollen-Extrakt, *G.*

"Aconite, in No. 60 powder, *one hundred parts* [or sixteen ounces av.]; Tartaric Acid, *one part* [or seventy grains]; Glycerin, Alcohol, each, *a sufficient quantity.* Moisten the powder with *forty parts* [or seven and a half fluidounces] of Alcohol in which the Tartaric Acid has previously been dissolved, and pack it firmly in a cylindrical glass percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until *three hundred parts* [or three and a half pints] of tincture are obtained, or the Aconite is exhausted. Reserve the first *ninety parts* [or fifteen and a half fluidounces] of the percolate, evaporate the remainder in a porcelain capsule, at a temperature not exceeding 50° C. (122° F.), to *ten parts* [or one and a half fluidounces], add the reserved portion, and evaporate at or below the above-mentioned temperature, until an extract of a pilular consistence remains. Lastly, weigh the Extract and thoroughly incorporate with it, while still warm, *five per cent.* of Glycerin." *U. S.*

"Take of the fresh Leaves and Flowering Tops of Aconite *one hundred and twelve pounds* [avoirdupois]. Bruise in a stone mortar, and press out the juice; heat it gradually to 130°, and separate the green coloring matter by a calico filter. Heat the strained liquor to 200° to coagulate the albumen, and again filter. Evaporate the filtrate by a water-bath to the consistence of a thin syrup; then add to it the green coloring matter previously separated, and, stirring the whole together assiduously, continue the evaporation at a temperature not exceeding 140°, until the extract is of a suitable consistence for forming pills." *Br.*

The extract from the fresh leaves of aconite was abandoned in the U. S. Pharmacopœia in 1870 in favor of one made by means of alcohol from the dried plant, probably because the plant was not generally cultivated in this country. But the *present preparation is very much stronger* than either; aconite root having been substituted for the leaves, which are no longer officinal, and alcohol for diluted alcohol as a menstruum. It is greatly to be regretted that the title of this Extract is not Extractum Aconiti Radicis; there will be likely to be three extracts of Aconite in use, of varying strengths,—*i.e.*, the present officinal alcoholic extract made from the root, the former hydro-alcoholic extract made from the leaves, and the English extract made from the fresh leaves. When serious changes are made in powerful preparations, great care should be taken to draw as much attention to the alteration as possible. The use of tartaric acid is in accordance with the views of Duquesnel and C. R. Alder Wright. (See *Abstractum Aconiti.*) The exhaustion of the aconite in the U. S. process is indicated by the absence of its peculiar taste in the liquid which passes. To save the alcohol at the low temperature at which the evaporation is directed, would require the aid of a vacuum apparatus. The attempt to save the alcohol by ordinary distillation would imply an elevation of the heat above that officinally ordered, and thus endanger the decomposition of the active principle of the aconite; and views of economy should never be allowed to interfere with the efficiency of medicines. It will be perceived that, in the British process, not the leaves only but the flowering tops also are used, as experience has shown that these are at least equally efficient. The process consists essentially in the evaporation of the expressed juice; and the product, therefore, ranks with inspissated juices.

In relation to the preparation of this extract, as well as of all others derived from the expressed juices of narcotic plants, the following summary of the plan pursued by Mr. Battley, an experienced apothecary of London, may be of service. Having passed the expressed juice through a fine hair sieve, he places it immediately upon the fire. Before it boils, a quantity of green matter rises to the surface, which in some plants is very abundant. This is removed by a perforated tin dish, and preserved. It ceases to appear soon after the liquid begins to boil. The boiling is continued till rather more than half the fluid has been evaporated, when the decoction is poured into a conical pan and allowed to cool. An abundant dark green precipitate forms, from which the supernatant liquid is poured off; and this, having been reduced one-half by a second boiling, is again allowed to stand. The precipitate which now falls is less green than the first. The remaining fluid is once more placed over the fire, and allowed to boil till it assumes the consistence of syrup, when it is removed. The matter at first collected by skimming, together with that precipitated, is now incorporated with it, and the whole placed in a metallic pan, and by means of a water-bath evaporated to the consistence of an extract. In the latter part of the process, care is necessary to prevent the extract from hardening on the sides of the vessel, as it thus loses its fine green color, and becomes proportionately feeble.

The superiority of this plan over a continuous boiling is, that the portions of active matter which are deposited at different stages of the process are subjected for a shorter time to heat than if allowed to remain in the liquor, and are consequently less deteriorated. The matter which coagulates before the fluid boils is chiefly albumen, embracing portions of chlorophyll and of the undissolved vegetable fibre. It might probably be thrown away without diminishing the virtues of the extract; but as chlorophyll, though itself inactive, has often associated with it a portion of the active principle, it is the most economical plan to incorporate it with the other matters, and, besides, its presence in the mass is said to render it easier to be worked into pills. Mr. Brande states that one cwt. of fresh aconite yields about five pounds of extract. According to Geiger, one pound yields an ounce and a half.

In the process of the British Pharmacopœia, it will be perceived that a discrimination is made between the chlorophyll and albumen; the former, which coagulates at 54·4° C. (130° F.), being at first separated in order to prevent the continuous action of heat upon it, and afterwards added to the extract; the latter, coagulating at 93·3° C. (200° F.), is separated and rejected. The rejection of the albumen is altogether advisable, as it is not only inert, but renders the extract more liable to decomposition. The chlorophyll is retained for the reasons stated in the preceding paragraph, and also to give a greenish color to the extract, which has come to be associated in general opinion with its goodness of quality.

If made from recently dried leaves, which have not yet been impaired by time, the extract officinal in 1870 was a good preparation of aconite; and it was believed to be more powerful, and to keep better, than the inspissated juice. According to Prof. Schroff, of Vienna, it had four times the strength of that preparation. The dose is half a grain or a grain (0·03 to 0·065 Gm.), to be gradually increased if necessary. The alcoholic extract of U. S. P. 1880 is stronger, and may be given in the dose of one-sixth or one-quarter of a grain (0·01 to 0 016 Gm.), to be gradually increased until its effects are experienced; and it would be well to specify on prescription (*U. S. P.*, 1880) when that preparation is desired.

When properly prepared, the British extract has a greenish brown color, with a disagreeable narcotic odor, and the acrid taste of the plant. It may be given in the dose of one or two grains (0·065 to 0·13 Gm.), night and morning, to be gradually increased till the system is affected. Twenty grains (1·3 Gm.) or more have been given in the course of a day.

EXTRACTUM ACONITI FLUIDUM. *U. S. Fluid Extract of Aconite.*

(ẸX-TRĂC′TỤM ĂC-Ọ-NĪ′TĪ FLŪ′Ị-DŬM.)

Fluid Extract of Aconite Root; Extrait liquide de Racine d'Aconit, *Fr.;* Flüssiges Eisenhutknollen-Extrakt, *G.*

"Aconite, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Tartaric Acid, *one gramme* [or half an ounce av.]; Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *forty grammes* [or twenty-three fluidounces] of Alcohol in which the Tartaric Acid has previously been dissolved, and pack it firmly in a cylindrical glass percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Aconite is exhausted. Reserve the first *ninety cubic centimeters* [or forty-three fluidounces] of the percolate, and evaporate the remainder in a porcelain capsule, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is a new officinal preparation of Aconite-root; it will be found useful as a basis for making the other preparations of Aconite—the abstract, plaster, extract, tincture, or liniment. This fluid extract is of a bright deep reddish brown color; it may be given internally in doses of one-half to one minim (0·03 to 0·06 C.c.), but on account of its very powerful character should always be used with caution, beginning with the smallest dose. It will doubtless be frequently employed as an addition to liniments for obtaining the peculiar effects of aconite.

EXTRACTUM ALOES AQUOSUM. *U. S.* *Aqueous Extract of Aloes.*

(ẸX-TRĂC'TỤM ĂL'Ọ-ĒṢ Ạ-QUŌ'SŬM—ạ-kwō'sŭm.)

Extrait d'Aloès, *Fr.;* Aloe-Extrakt, *G.*

"Aloes, *one hundred parts* [or sixteen ounces av.]; Boiling Distilled Water, *one thousand parts* [or ten pints]. Mix the Aloes with the Water in a suitable vessel, stirring constantly, until the particles of Aloes are thoroughly disintegrated, and let the mixture stand for twelve hours; then pour off the clear liquor, strain the residue, mix the liquids, and evaporate to dryness by means of a water or steam bath." *U. S.*

This is a new officinal, and the process is based upon the British formulas for extract of Barbadoes aloes and Socotrine aloes, which are treated of in the two articles following this. With a purified aloes officinal, the necessity for this preparation is not obvious. An extract made with cold distilled water is officinal in the German Pharmacopœia, as is also the vitriolated extract, "*Extractum Aloes Acido Sulfurico Correctum,*" made by suspending eight parts of extract of aloes in thirty-two parts of distilled water, adding drop by drop one part of pure sulphuric acid, and evaporating in a porcelain vessel to dryness; the dose is from two to ten grains (0·13–0·65 Gm.).

EXTRACTUM ALOES BARBADENSIS. *Br.* *Extract of Barbadoes Aloes.*

(ẸX-TRĂC'TỤM ĂL'Ọ-ĒṢ BÄR-BẠ-DĔN'SỊS.)

Extrait d'Aloès de Barbades, *Fr.;* Barbadoes Aloe-Extrakt, *G.*

"Take of Barbadoes Aloes, in small fragments, *one pound* [avoirdupois]; Boiling Distilled Water *one gallon* [Imperial measure.] Add the Aloes to the Water, and stir well until they are thoroughly mixed. Set aside for twelve hours; then pour off the clear liquor, strain the remainder, and evaporate the mixed liquors by a water-bath or a current of warm air to dryness." *Br.*

EXTRACTUM ALOES SOCOTRINÆ. *Br.* *Extract of Socotrine Aloes.*

(ẸX-TRĂC'TỤM ĂL'Ọ-ĒṢ SŎC-Ọ-TRĪ'NÆ.)

Extrait d'Aloès sucotrin, *Fr.;* Socotora Aloe-Extrakt, *G.*

This is prepared precisely as the Extract of Barbadoes Aloes.

The object of these processes is to separate from Aloes the resinoid matter, the *apotheme* of Berzelius, which is supposed to irritate the bowels, without possessing purgative properties, but the truth appears to be that, when deprived of a small portion of adhering extractive, this matter is quite inert. It cannot, therefore, injuriously affect the virtues of the medicine; and, as it exists in comparatively small proportion, and during the process a part of the extractive becomes insoluble, the preparation may be considered as at best unnecessary. The dose of the purified aloes is from two to ten grains (0·13 to 0·65 Gm.).*

Off. Prep. Decoctum Aloes Compositum, *Br.;* Extractum Colocynthidis Compositum, *Br.*

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* *Glycerate of Aloes. Glycerole of Aloes.* Under the latter name, M. Chausit brought to the notice of the profession a preparation consisting of an alcoholic extract of aloes dissolved in glycerin. Mr. Haselden prepared this in the following method. Macerating half an ounce of aloes in four fluidounces of alcohol until dissolved, he filtered the tincture through bibulous paper, evaporated it to the consistence of molasses, and, while it was still warm, added enough glycerin to make four fluidounces. Finding that the aloes was wholly dissolved, with the exception of a little impurity, he concluded that the spirit might very well be dispensed with, and the aloes used directly in the process. Accordingly he proposes to substitute the following method. Mix well in a mortar half an ounce of Socotrine aloes, in fine powder, and four fluidounces of glycerin; transfer the mixture to a bottle, and agitate occasionally for several days; if the aloes be not now dissolved, heat for fifteen minutes by a water-bath, and strain through linen to separate impurities. The resulting liquid is of a bright mahogany color, and of the consistence of glycerin. The preparation has been recommended as an external remedy in lichen agrius and the excoriations of eczema, applied by means of a camel's-hair brush. (*P. J. Tr.*, 1859, p. 322.) For the mode of preparing *a fluid extract of aloes* with the aid of glycerin, by Prof. Procter, see *Proc. A. P. A.*, 1863, p. 240.

EXTRACTUM ANTHEMIDIS. *Br.* *Extract of Chamomile.*

(ẸX-TRĂC′TỤM ẠN-THĔM′Ị-DĬS.)

Extrait de Camomille romaine, *Fr.;* Extractum Chamomillæ Romanæ; Römisch-Kamillen-Extrakt, *G.*

"Take of Chamomile Flowers *one pound* [avoirdupois]; Oil of Chamomile *fifteen minims;* Distilled Water *one gallon* [Imperial measure]. Boil the Chamomile with the Water until the volume is reduced to one-half, then strain, press, and filter. Evaporate the liquor by a water-bath until the extract is of a suitable consistence for forming pills, adding the Oil of Chamomile at the end of the process." *Br.*

According to Mr. Brande, one cwt. of dried chamomile flowers affords upon an average 48 pounds of extract.

This extract has a deep brown color, with the bitter taste and aroma of chamomile. It much better represents the chamomile than did the old Edinburgh extract, which, being obtained by decoction and inspissation, contained none of the volatile oil of the plant. In the present British process, care is taken not only to avoid boiling, but also to supply any possible loss of oil during the cautious evaporation, by the addition of a small portion near the close of the process. The extract may be given for the same purpose as the flowers, but is most used as a vehicle for other tonics in the pilular form. The dose is from two to ten grains (0·13 to 0·65 Gm.). An extract may be prepared having the peculiar flavor as well as bitterness of chamomile, by macerating the flowers in water, and evaporating the infusion *in vacuo.*

EXTRACTUM ARNICÆ RADICIS. *U. S.* *Extract of Arnica Root.*

(ẸX-TRĂC′TỤM ĂR′NỊ-ÇÆ RẠ-DĪ′CĬS.)

Extrait de Racine d'Arnique, *Fr.;* Arnika-Extrakt, *G.*

"Arnica Root, in No. 60 powder, *one hundred parts* [or sixteen ounces av.]; Glycerin, Diluted Alcohol, each, *a sufficient quantity.* Moisten the powder with *forty parts* [or six and a half fluidounces] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for twenty-four hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until *three hundred parts* [or three pints] of tincture are obtained, or the Arnica Root is exhausted. Reserve the first *ninety parts* [or fourteen fluidounces] of the percolate; evaporate the remainder to *ten parts* [or two fluidounces] at a temperature not exceeding 50° C. (122° F.), mix the residue with the reserved portion, and evaporate at or below the above-mentioned temperature to a pilular consistence. Lastly, weigh the Extract and thoroughly incorporate with it, while still warm, *five per cent.* of Glycerin." *U. S.*

This extract differs from the extract formerly officinal, in being made from the root in place of the flowers; it very well represents the virtues of arnica, and is a convenient form for its administration. The dose is from three to five grains (0·20 to 0·33 Gm.). But the chief employment of the extract is in the preparation of the plaster. (See *Emplastrum Arnicæ.*)

EXTRACTUM ARNICÆ RADICIS FLUIDUM. *U. S.* *Fluid Extract of Arnica Root.*

(ẸX-TRĂC′TỤM ĂR′NỊ-ÇÆ RẠ-DĪ′CĬS FLŪ′Ị-DŬM.)

Extrait liquide de Racine d'Arnique, *Fr.;* Flüssiges Arnicawurzel-Extrakt, *G.*

"Arnica Root, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Diluted Alcohol, *a sufficient quantity,* To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *forty grammes* [or twenty fluidounces] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Arnica Root is exhausted.

Reserve the first *ninety cubic centimeters* [or forty-three fluidounces] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is one of the new officinal fluid extracts; it is of a clear, reddish brown color, possessing little odor, and having an acrid taste. It well represents the virtues of the root, and will probably be used as a basis for preparing the extract when wanted for the plaster. The dose, if desired for internal administration, would be from five to ten minims (0·3–0·6 C.c.).

EXTRACTUM AROMATICUM FLUIDUM. *U. S.* *Aromatic Fluid Extract.*

(ẸX-TRĂC′TỤM ĂR-Ọ-MĂT′Ị-CŬM FLŪ′Ị-DŬM.)

Extrait liquide aromatique, *Fr.;* Flüssiges Aromatisches Extrakt, *G.*

"Aromatic Powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *thirty-five grammes* [or twenty fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Aromatic Powder is exhausted. Reserve the first *eighty-five cubic centimeters* [or forty fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U.S.*

This is another new officinal fluid extract; it is an excellent aromatic in concentrated form, and will be found very useful not only as an addition to liquids when an aromatic is desired, but its concentrated form will permit its use in small quantities with dry powders like pepsin, subnitrate of bismuth, etc., when desired for administration. It will probably be rarely used alone, but may be given in the dose of ten to twenty minims (0·6–1·25 C.c.), diluted with water, or dropped on sugar.

EXTRACTUM AURANTII AMARI FLUIDUM. *U. S.* *Fluid Extract of Bitter Orange Peel.*

(ẸX-TRĂC′TỤM ÂU-RĂN′TỊ-Ī Ạ-MĀ′RĪ FLỤ̂′Ị-DŬM—âw-răn′shẹ-ī.)

Extrait liquide d'Écorce d'Oranges amères, *Fr.;* Flüssiges Pomeranzenschale-Extrakt, *G.*

"Bitter Orange Peel, in No. 40 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix *two parts* of Alcohol with *one part* of Water [or four and a half pints of alcohol and two pints of water], and, having moistened the powder with *thirty-five grammes* [or nineteen fluidounces] of the mixture, pack it moderately in a conical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, until the Orange Peel is exhausted. Reserve the first *eighty cubic centimeters* [or thirty-eight fluidounces] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is another new officinal fluid extract; it will be found useful as a tonic; the bitter orange peel having very little oil present in its dry condition, there is necessarily very little agreeable orange flavor to the fluid extract. Monroe Bond recommends a *Fluid Extract of Sweet Orange Peel*, made with a menstruum of seven parts of alcohol and one of glycerin. (*A. J. P.*, 1873, p. 482.) It is simply a concentrated pure bitter tonic, and may be given in doses of fifteen to thirty minims (0·9–1·9 C.c.).

EXTRACTUM BELÆ LIQUIDUM. *Br.* *Liquid Extract of Bael.*

(ẸX-TRĂC'TỤM BĒ'LÆ LĬQ'UỊ-DŬM—lĭk'wẹ-dŭm.)

Extrait liquide de Bael, *Fr.;* Flüssiges Bael-Extrakt, *G.*

"Take of Bael Fruit *one pound* [avoirdupois]; Distilled Water *twelve pints* [Imperial measure]; Rectified Spirit *two fluidounces.* Macerate the Bael for twelve hours in one-third of the Water; pour off the clear liquor; repeat the maceration a second and third time for one hour in the remaining two-thirds of the Water; press the marc; and filter the mixed liquors through flannel. Evaporate to fourteen fluidounces; and, when cold, add the Rectified Spirit." *Br.*

This is an officinal of the British Pharmacopœia, of which very little is known in the United States. It is one of the forms in which the India remedy bael is employed, and the reader is referred to the article on that subject. Each fluidounce of the extract represents an avoirdupois ounce of the medicine, and the dose is from one to four fluidrachms (3·75–15 C.c.).

EXTRACTUM BELLADONNÆ. *Br.* *Extract of Belladonna.*

(ẸX-TRĂC'TỤM BĔL-LẠ-DŎN'NÆ.)

Extrait de Belladone, *Fr.;* Tollkirschen-Extrakt, *G.*

This extract made from the fresh leaves was formerly recognized by the U. S. Pharmacopœia, but was very properly abandoned in the last revision. It has been supplanted of late years by the alcoholic extract, which has been proved to be much more reliable.

The British Pharmacopœia takes the "fresh leaves and young branches of Belladonna," and prepares the Extract from them in the same manner precisely as Extract of Aconite. (See *Extractum Aconiti.*)

The U. S. Pharmacopœia of 1870 directed the extract to be prepared from the leaves of the plant, the British from the leaves and young branches. The latter direction was probably based on experiments by Mr. Squire, of London, who found that an extract prepared from the soft herbaceous parts of the plant generally, including leaves, flowers, and young stalks, not only has a better consistence, and is less apt to become mouldy by keeping, than that made from the leaves exclusively, but is more effectual in the same quality. (*P. J. Tr.*, 1861, p. 300.) There is little doubt of the accuracy of these results. It is probable that these remarks are as applicable to other extracts prepared from fresh leaves as to that of belladonna, at least in relation to perennial plants.

From the experiments of MM. Solon and Soubeiran, it appears that, in relation to this extract, the insoluble matter separated from the expressed juice by filtering, and that coagulated by heat, are nearly if not quite inert; so that advantage results from clarifying the juice by these means before evaporating it. So far as the albumen is concerned, there can be no doubt of the accuracy of this statement; but it is questionable whether the same remark is applicable to the chlorophyll which first separates, and which is reserved in the British process. (See *Extractum Aconiti.*) Mr. Brande states that one cwt. of fresh belladonna yields from 4 to 6 pounds of extract. According to M. Recluz, nearly ten parts may be obtained from one hundred. The best extract is brought chiefly from England; but Mr. Alfred Jones has found that it may be prepared of equally good quality from the plant grown in the United States. (*A. J. P.*, xxiv. 108.) It has usually a dark brown color, a slightly narcotic not unpleasant odor, a bitterish taste, and a soft consistence which it long retains. Asparagin has been found in this extract. (*Journ. de Pharm.*, xxi. 178.)

Its medical properties and uses have been detailed under the head of Belladonna.

The dose of the extract is uncertain on account of its variable strength. The best plan is to begin with one-quarter or one-half of a grain (0·016 or 0·03 Gm.), repeated two or three times a day, and gradually to increase the dose till the effects of the medicine are experienced. To a child two years old not more than one-twelfth of a grain (0·005 Gm.) should be administered at first.

Off. Prep. Emplastrum Belladonnæ, *Br.;* Unguentum Belladonnæ, *Br.*

EXTRACTUM BELLADONNÆ ALCOHOLICUM. *U. S. Alcoholic Extract of Belladonna.*

(ẸX-TRĂC′TỤM BĔL-LẠ-DŎN′NÆ ĂL-CỌ-HŎL′Ị-CŬM.)

Extrait de Belladone alcoolique, *Fr.;* Spirituöses Tollkirschen-Extrakt, *G.*

"Belladonna Leaves, in No. 60 powder, *one hundred parts* [or sixteen ounces av.]; Alcohol, *two hundred parts* [or two pints and four fluidounces]; Water, *one hundred parts* [or one pint]; Glycerin, Diluted Alcohol, each, *a sufficient quantity.* Mix the Alcohol and Water, and, having moistened the powder with *forty parts* [or seven fluidounces] of the mixture, pack it firmly in a cylindrical percolator, then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then Diluted Alcohol, until *three hundred parts* [or three pints] of tincture are obtained, or the Belladonna Leaves are exhausted. Reserve the first *ninety parts* [or fourteen fluidounces] of the percolate, evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to *ten parts* [or two fluidounces]; mix the residue with the reserved portion, and evaporate at or below the above-mentioned temperature to a pilular consistence. Lastly, weigh the Extract, and thoroughly incorporate with it, while still warm, *five per cent.* of Glycerin." *U. S.*

The formula for this extract does not differ essentially from that officinal in the former revision; it is a good preparation, and is officinal in the French Codex. It is much used externally. Thus, in rigidity of the os uteri, it is applied at intervals to the neck of the uterus, mixed with simple ointment in the proportion of one drachm to an ounce; but care must be taken not to affect the system too powerfully; and the preparation, therefore, should be used in a small quantity at first. In irritability of the bladder, chordee, spasm of the urethra, and painful constriction of the rectum, it may either be rubbed in the form of ointment upon the perineum, along the urethra, etc., or may be used in the form of enema; but care is requisite not to introduce it too freely into the bowel. It is sometimes smeared upon the bougie, mixed with oil, in the treatment of stricture of the urethra. In the form of ointment it has been beneficially employed in phimosis and paraphimosis, and in that of plaster or ointment, in local neuralgic or rheumatic pains. (See *Emplastrum Belladonnæ.*) For internal use, the dose to begin with is one-fourth of a grain (0·016 Gm.).

Off. Prep. Unguentum Belladonnæ, *U. S.*

EXTRACTUM BELLADONNÆ FLUIDUM. *U. S. Fluid Extract of Belladonna.*

(ẸX-TRĂC′TỤM BĔL-LẠ-DŎN′NÆ FLŪ′Ị-DŬM.)

Extrait liquide de Racine de Belladone, *Fr.;* Flüssiges Tollkirschenwurzel-Extrakt, *G.*

"Belladonna Root, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, *a sufficient quantity,* To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *thirty-five grammes* [or twenty fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Belladonna Root is exhausted. Reserve the first *ninety cubic centimeters* [or forty-three fluidounces] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This fluid extract was formerly officinal under the name of *Extractum Belladonnæ Radicis Fluidum,* and it is to be regretted that this name was not continued, as both the root and leaves of the plant are officinal, and it had become an established custom, when the part of this plant was not specified, to understand that the leaf was wanted. We now have the extract made from the leaves and the fluid extract made from the root, yet called respectively extract and fluid extract of belladonna. The fluid extract of the root is a good preparation, of reddish brown color, very different in appearance from the fluid extract of the leaves which is often seen in the market, and which is of a deep green color. It may be given internally in doses of one or two minims (0·06–0·12 C.c.).

Off. Prep. Linimentum Belladonnæ, *U. S.*

EXTRACTUM BRAYERÆ FLUIDUM. *U. S.* *Fluid Extract of Brayera.*

(ẸX-TRĂC′TỤM BRĀY-E′RÆ FLŪ′Ị-DŬM.)

Fluid Extract of Kousso; Extrait liquide de Kousső, *Fr.;* Flüssiges Kosso-Extrakt, *G.*

"Brayera, in No. 40 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, a *sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *forty grammes* [or twenty-three fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Brayera is exhausted. Reserve the first *ninety cubic centimeters* [or forty-three fluidounces] of the percolate; by means of a water-bath, distil off the Alcohol from the remainder, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is a new officinal fluid extract, and, although possessing a very disagreeable bitter taste, well represents the activity of kousso; the bitter resinous principle upon which the anthelmintic virtues are now believed to depend is readily extracted by alcohol. This preparation should be of a dark green color; the objection to it is the large dose and the considerable quantity of strong alcohol which the patient gets; as it is best to give the remedy fasting, the stimulating action of the alcohol would be apt to be apparent. The dose is from a half to one fluidounce (15–30 C.c.). An extract made by evaporating the fluid extract spontaneously would be a good preparation, and the objection to the alcohol could be thus overcome.

EXTRACTUM BUCHU FLUIDUM. *U. S.* *Fluid Extract of Buchu.*

(ẸX-TRĂC′TỤM BŪ′ȻHŪ FLŪ′Ị-DŬM—bū′kū.)

Extrait liquide de Bucco, *Fr.;* Flüssiges Bucco-Extrakt, *G.*

"Buchu, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix *two parts* of Alcohol with *one part* of Water [or four and a half pints of alcohol and two pints of water], and, having moistened the powder with *thirty grammes* [or one pint] of the mixture, pack it firmly in a cylindrical percolator, then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, until the Buchu is exhausted. Reserve the first *eighty-five cubic centimeters* [or forty fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This fluid extract has been greatly improved by lessening the alcoholic strength of the menstruum. After having ordered a stronger alcoholic menstruum for twenty years, the Pharmacopœia now adopts the menstruum originally suggested by Prof. I. J. Grahame as long ago as 1859. (See *A. J. P.*, 1859, p. 349.) It has been abundantly proved by experience that the weaker menstruum effectually exhausts buchu of its virtues, whilst there is no doubt of its superiority when the fluid extract is an ingredient in an aqueous mixture.

In consequence of the peculiar structure of the leaves, it is somewhat difficult to powder them in a mortar, and it will be convenient to resort to a mill for the purpose. As the most active ingredient of buchu is volatile, the direction in the formula to set aside the first portion of tincture obtained, which is a highly concentrated solution, is peculiarly important; for, if it were subjected to evaporation, much of the volatile oil would necessarily escape. The tincture subsequently obtained probably contains a large proportion of the fixed ingredients of the leaves, and will, therefore, allow of concentration without material loss.

This fluid extract is clear, greenish black, and possessed in a high degree of the sensible properties of the leaves. It acquires the odor of mint when long kept, showing that some change takes place in its volatile oil. This fluid extract affords the best means at our command for the exhibition of buchu. It is often combined with Liquor Potassæ with excellent results. The dose is thirty minims to a fluidrachm (1·9–3·8 C.c.), to be given diluted with water three to five times a day.

EXTRACTUM CALAMI FLUIDUM. *U. S.* *Fluid Extract of Calamus.*

(ẸX-TRĂC′TỤM CĂL′Ạ-MĪ FLÛ′Ị-DŬM.)

Extrait liquide d'Acore vrai, *Fr.;* Flüssiges Kalmuswurzel-Extrakt, *G.*

"Calamus, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *thirty-five grammes* [or twenty fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Calamus is exhausted. Reserve the first *ninety cubic centimeters* [or forty-three fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is a new officinal fluid extract, which has been introduced with the view of bringing into use an excellent indigenous aromatic stimulant. It will probably be most frequently used in combination with tonics in dyspepsia and gastric disorders to relieve flatulence, etc. The dose is from five to fifteen minims (0·3–0·9 C.c.).

EXTRACTUM CALUMBÆ. *Br.* *Extract of Calumba.*

(ẸX-TRĂC′TỤM CẠ-LŬM′BÆ.)

Extractum Colombo, *P. G.;* Extrait de Colombo, *Fr.;* Kolombo-Extrakt, *G.*

"Take of Calumba Root, cut small, *one pound* [avoirdupois]; Distilled Water *four pints* [Imperial measure]. Macerate the Calumba with two pints of the Water for twelve hours, strain and press. Macerate again with the same quantity of Water, strain and press as before. Mix and filter the liquors, and evaporate them by the heat of a water-bath until the extract is of a suitable consistence for forming pills." *Br.*

We prefer the Br. process of 1864, in which proof spirit was employed as a menstruum, or better yet, a menstruum of two parts alcohol and one part water. As proof spirit takes up all the active matter of calumba, leaving the starch and albumen behind, the extract prepared according to that formula had, in a comparatively small bulk, all the powers of the root, except those of the small proportion of volatile oil which may be dissipated in the process. In the present process, though the starch is left behind, the albumen is taken up, and adds to the bulk of the extract. Besides, the alcoholic preparation has the advantage of requiring less heat in the evaporation, and consequently of retaining more of the volatile oil in the product. Its only disadvantage is its greater costliness. The extract may be given in the dose of from five to fifteen grains (0·33–1 Gm.) three times a day. It is an efficient preparation for tonic pills.

EXTRACTUM CALUMBÆ FLUIDUM. *U. S.* *Fluid Extract of Calumba.*

(ẸX-TRĂC′TỤM CẠ-LŬM′BÆ FLÛ′Ị-DŬM.)

Extrait liquide de Colombo, *Fr.;* Flüssiges Kolombo-Extrakt, *G.*

"Calumba, in No. 20 powder, *one hundred grammes* [or fifty ounces av.]; Diluted Alcohol, *a sufficient quantity,* To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *thirty grammes* [or fifteen and a half fluidounces] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Calumba is exhausted. Reserve the first *seventy cubic centimeters* [or thirty-four fluidounces] of the percolate; by means of a water-bath, distil off the Alcohol from the remainder, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

The formula for fluid extract of calumba of U. S. Pharm. 1870 was faulty, in directing the root to be in fine powder: the large quantity of mucilage present swelled under the influence of the menstruum, and frequently prevented the passage of the percolate; indeed, the powder will probably still be found to give trouble, as there will be some difficulty in thoroughly exhausting it; it should be slowly percolated. This extract is a dark brown liquid, of an intense and purely bitter taste. The absence of tannin makes it a very desirable tonic, in combination with chalybeates. The dose is from fifteen to thirty minims (0·9–1·9 C.c.).

EXTRACTUM CANNABIS INDICÆ. *U. S., Br.* *Extract of Indian Hemp. Extract of Indian Cannabis.*

(ẸX-TRĂC′TỤM CĂN′NẠ-BĬS ĬN′DỊ-ÇÆ.)

Extrait de Chanvre indien, *Fr.;* Indischer Hanf-Extrakt, *G.*

"Indian Cannabis, in No. 20 powder, *one hundred parts* [or sixteen ounces av.]; Alcohol, *a sufficient quantity.* Moisten the powder with *thirty parts* [or seven fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol until *three hundred parts* [or three and a half pints] of tincture are obtained, or the Cannabis is exhausted. By means of a water-bath, distil off the Alcohol from the tincture, and, having placed the residue in a porcelain capsule, evaporate it, on a water-bath, to a pilular consistence." *U. S.*

"Take of Indian Hemp, in coarse powder, *one pound* [avoirdupois]; Rectified Spirit *four pints* [Imperial measure]. Macerate the Hemp in the Spirit for seven days, and press out the tincture. Distil off the greater part of the Spirit, and evaporate what remains by a water-bath to the consistence of a soft extract." *Br.*

It will be noticed that the English name of the drug has been changed in the U. S. Pharmacopœia to Indian Cannabis to prevent its being mistaken for the root of *Apocynum Cannabinum,* which is also called Indian Hemp. Several mistakes have occurred through this unfortunate confusion of nomenclature.

Although there is some difference in the details of the two processes, the preparations of the U. S. and Br. Pharmacopœias are practically identical. The preparation varies exceedingly in strength, so that it is wisest to commence with a small dose, one-quarter of a grain (Gm. 0·016), and rapidly increase the amount given until some effect is produced.

Prof. Procter investigated the subject of the tests for the purified extract or resin, and came to the following conclusions. Its peculiar odor when moderately heated, its indifference to alkalies, and its solubility in alcohol, ether, chloroform, benzol, and oil of turpentine, are characteristic though not entirely distinctive properties.

The best test, he found, was nitric acid (sp. gr. 1·38), which acts slowly when cold, but with heat rapidly, evolving red fumes, and converting the resin into an orange-red resinoid substance, which, when washed and dried, closely resembles gamboge in color. (*Proc. A. P. A.*, 1864.) The dose of an active preparation is a quarter of a grain (0·016 Gm.).

Off. Prep. Tinctura Cannabis Indicæ, *Br.*

EXTRACTUM CANNABIS INDICÆ FLUIDUM. *U.S.* *Fluid Extract of Indian Cannabis.*

(ẸX-TRĂC'TỤM CĂN'NẠ-BĬS ĬN'DỊ-ÇÆ FLÛ'Ị-DŬM.)

Extrait liquide de Chanvre indien, *Fr.;* Flüssiges Indischer Hanf-Extrakt, *G.*

"Indian Cannabis, in No. 20 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *thirty grammes* [or seventeen fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Indian Cannabis is exhausted. Reserve the first *ninety cubic centimeters* [or forty-three fluidounces] of the percolate; by means of a water-bath distil off the alcohol from the remainder, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is another new officinal fluid extract. It has come into use because of its convenience, and probably on account of the impression that heat injures the activity of the drug, and that the extract owes its inactivity sometimes to the influence of heat. The fluid extract is of a dark green color, having the characteristic peculiar odor of the drug. The dose is one-half to one minim (0·03 to 0·06 C.c.).

EXTRACTUM CAPSICI FLUIDUM. *U.S.* *Fluid Extract of Capsicum.*

(ẸX-TRĂC'TỤM CĂP'SỊ-CĪ FLÛ'Ị-DŬM.)

Extrait liquide de Capsique, *Fr.;* Flüssiges Spanischer Pfeffer-Extrakt, *G.*

"Capsicum, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *fifty grammes* [or twenty-nine fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Capsicum is exhausted. Reserve the first *ninety cubic centimeters* [or forty-three fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

The necessity for an officinal fluid extract of capsicum is not apparent. The oleoresin and tincture are preparations which are well known and established, and why three liquid preparations of this very active drug are needed is not apparent. It will probably be rarely necessary to administer it internally. The dose is one-half to one minim (0·03 to 0·06 C.c.).

EXTRACTUM CASTANEÆ FLUIDUM. *U.S.* *Fluid Extract of Castanea.*

(ẸX-TRĂC'TỤM CĂ̇S-TĀ'NẸ-Æ FLÛ'Ị-DŬM.)

Extrait liquide de Feuilles de Châtaignier, *Fr.;* Flüssiges Kastanienblätter-Extrakt, *G.*

"Castanea, in No. 30 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Pour *five hundred cubic centimeters* [or fifteen pints] of Boiling Water upon the powder, allow it to macerate for two hours, then express the liquid, transfer the residue to a percolator, and pour Water upon it until the powder is exhausted. Evaporate the united liquids, on a water-bath, to *two hundred cubic centimeters* [or six pints], let cool, and add *sixty cubic centimeters* [or twenty-nine fluidounces] of Alcohol. When the insoluble matter has subsided, separate the clear liquid, filter the remainder, evaporate the united liquids to *eighty cubic centimeters* [or thirty-eight fluidounces], allow to cool, and add enough Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This fluid extract has acquired some reputation in the treatment of hooping-cough, and it has been shown that the efficacy largely depends upon the mucilaginous principle found in the leaves. The object of the special process is to obtain and retain this principle, and it will be observed that the preparation is an aqueous fluid extract with only sufficient alcohol to preserve it. It is a thick reddish brown liquid, having an astringent taste. The dose is one to two fluidrachms (3·75–7·5 C.c.).

EXTRACTUM CHIMAPHILÆ FLUIDUM. *U. S.* *Fluid Extract of Chimaphila.*

(ẸX-TRĂC′TỤM ȻHỊ-MĂPH′Ị-LÆ FLÛ′Ị-DŬM.)

Extrait liquide de Pyrole ombellée, *Fr.;* Flüssiges Doldenblüthiges Harnkraut-Extrakt, *G.*

"Chimaphila, in No. 30 powder, *one hundred grammes* [or fifty ounces av.]; Glycerin, *ten grammes* [three and three-quarter fluidounces]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix the Glycerin with *ninety grammes* [or forty-six and a half fluidounces] of Diluted Alcohol. Moisten the powder with *forty grammes* [or twenty fluidounces] of the mixture, and pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterward, Diluted Alcohol, until the Chimaphila is exhausted. Reserve the first *seventy cubic centimeters* [or thirty-four fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

The quantity of glycerin has been greatly reduced in the formula for this fluid extract, in accordance with the views expressed in the general article on Fluid Extracts. The advantage of using a comparatively small proportion of glycerin in fluid extracts of drugs containing tannin is well established. This is a rather thick dark brownish green fluid extract, and may be given in the dose of a fluidrachm (3·75 C.c.).

EXTRACTUM CHIRATÆ FLUIDUM. *U. S.* *Fluid Extract of Chirata.*

(ẸX-TRĂC′TỤM ȻHỊ-RĀ′TÆ FLŪ′Ị-DŬM.)

Extrait liquide de Chirette, *Fr.;* Flüssiges Chiretta-Extrakt, *G.*

"Chirata, in No. 30 powder, *one hundred grammes* [or fifty ounces av.]; Glycerin, *ten grammes* [three and three-quarter fluidounces]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix the Glycerin with *ninety grammes* [or forty-six and a half fluidounces] of Diluted Alcohol. Moisten the powder with *thirty-five grammes* [or eighteen fluidounces] of the mixture, and pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterward, Diluted Alcohol, until the Chirata is exhausted. Reserve the first *eighty-five cubic* *centimeters* [or forty fluidounces] of the percolate; by means of a water-bath, distil off the Alcohol from the remainder, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is a useful addition to the list of fluid extracts. The necessity for the use of Glycerin is, however, not apparent, although the amount is insufficient to be harmful. This extract is a clear, reddish brown liquid, of an intensely bitter taste. The dose is half a fluidrachm (1 9 C.c.).

EXTRACTUM CIMICIFUGÆ FLUIDUM. *U. S.* *Fluid Extract of Cimicifuga.*

(ẸX-TRĂC'TỤM CĬM-Ị-CĬF'Ú-G̣Æ FLŪ'Ị-DŬM.)

Extrait liquide d'Actée à Grappes, *Fr.;* Flüssiges Cimicifuga-Extrakt, *G.*

"Cimicifuga, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *twenty-five grammes* [or fourteen and a half fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Cimicifuga is exhausted. Reserve the first *ninety cubic centimeters* [or forty-three fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints.]" *U. S.*

This formula does not differ essentially from that of the U. S. Pharm. 1870. There probably cannot be two opinions about the menstruum, although it has been asserted that a good fluid extract can be made with a menstruum of three parts alcohol and one part water. The probabilities are, however, that a portion of the resinous principle would precipitate on standing. This fluid extract is of a deep reddish brown color, and thoroughly represents the drug. The dose is from thirty minims to one fluidrachm (1·9 to 3·75 C.c.).

EXTRACTUM CINCHONÆ. *U. S.* *Extract of Cinchona.*

(ẸX-TRĂC'TỤM CĬN-C̣HŌ'NÆ.)

Extractum Chinæ; Extrait de Quinquina jaune, *Fr.;* China-Extrakt, *G.*

"Yellow Cinchona, in No. 60 powder, *one hundred parts* [or sixteen ounces av.]; Alcohol, *three hundred parts* [or three and a half pints]; Water, *one hundred parts* [or one pint]; Glycerin, Diluted Alcohol, each, *a sufficient quantity.* Mix the Alcohol and Water, and, having moistened the powder with *thirty-five parts* [or six fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then Diluted Alcohol, until *four hundred parts* [or four and a half pints] of tincture are obtained, or the Cinchona is exhausted. By means of a water-bath, distil off the Alcohol from the tincture, and, having placed the residue in a porcelain capsule, evaporate it on a water-bath, to a pilular consistence. Lastly, weigh the Extract, and thoroughly incorporate with it, while still warm, *five per cent.* of Glycerin." *U. S.*

The yellow or Calisaya bark is selected for this preparation, as it can usually be relied on as efficient. By this process all the virtues of the bark are extracted. In the officinal formula of 1870 the alcohol and water were used separately; the parts soluble in alcohol being first taken up, and afterwards those in water. This proceeding had the advantage that no more heat was necessary to evaporate the tincture than the alcoholic menstruum required; while, if the two liquids were mixed, it would be necessarily subjected to a longer continuance if not a higher degree of heat;

and the advantage was the greater as most of the active matter was extracted in the first percolation with alcohol. The present officinal process is an excellent one, and if proper care be taken in executing the process, both in relation to the percolation and the avoidance of too high a temperature, the extract will fully represent the virtues of the bark.

The former extracts of cinchona of the British Colleges are all omitted in the new British Pharmacopœia, which directs in their place a fluid extract, under the name of *Extractum Cinchonæ Liquidum* (which see).

A very good extract of bark was formerly prepared, in Philadelphia, by macerating cinchona for a considerable length of time in a large proportion of water, and slowly evaporating the infusion, by a very moderate heat, in large shallow dishes placed upon the top of a stove. Many years ago Dr. Geo. B. Wood found ten grains of this extract equivalent to nearly a drachm of powdered cinchona.

Medical Uses. The extract of Peruvian bark is at present much less employed than before the discovery of quinine. It is still, however, occasionally prescribed as a tonic in combination with other medicines; and, as it possesses, when properly prepared with a spirituous menstruum, almost all the active principles as they exist in the bark itself, it may be used in preference to the sulphate of quinine, whenever it is supposed that the latter is incapable of exerting all the curative influence of cinchona. We are led to believe, however, that, on account of the high price of Calisaya bark, much of the extract now in the market is prepared from inferior varieties. The dose is from ten to thirty grains (0·65–1·95 Gm.), equivalent to about a drachm (3·9 Gm.) of the powdered bark.

EXTRACTUM CINCHONÆ FLUIDUM. *U. S., Br. Fluid Extract of Cinchona.*

(ẸX-TRĂC′TỤM CĬN-ȻHŌ′NÆ FLŪ′Ị-DŬM.)

Extractum Cinchonæ Flavæ Liquidum, *Br.;* Liquid Extract of Yellow Cinchona. Extractum Chinæ Calisayæ Fluidum; Extrait liquide de Quinquina jaune, *Fr.;* Flüssiges Kalisayarinden-Extrakt, *G.*

"Yellow Cinchona, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Glycerin, *twenty-five grammes* [or nine and a half fluidounces]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix the Glycerin with *seventy-five grammes* [or forty-four fluidounces] of Alcohol. Moisten the powder with *thirty-five grammes* [or eighteen fluidounces] of the mixture, pack it firmly in a cylindrical percolator, and pour on the remainder of the menstruum. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, and, when the liquid in the percolator has disappeared from the surface, gradually pour on a mixture of Alcohol and Water, made in the proportion of *three parts* [or three and a half pints] of Alcohol to *one part* [or one pint] of Water, and continue the percolation until the Cinchona is exhausted. Reserve the first *seventy-five cubic centimeters* [or thirty-six fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough of a mixture of Alcohol and Water, using the same proportions as before, to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

"Take of Yellow-Cinchona Bark, in coarse powder, *one pound* [avoirdupois]; Distilled Water *a sufficiency;* Rectified Spirit *one fluidounce.* Macerate the Cinchona Bark in two pints [Imp. meas.] of the Water for twenty-four hours, stirring frequently; then pack in a percolator, and add more Water, until twelve pints [Imp. meas.] have been collected, or until the Water ceases to dissolve anything more. Evaporate the liquor at a temperature not exceeding 160° to a pint [Imp. meas.]; then filter through paper, and continue the evaporation to three fluidounces, or until the sp. gr. of the liquid is 1·200. When cold, add the Spirit gradually, constantly stirring. The sp. gr. should be about 1·100." *Br.*

Of these two formulas, the first is decidedly preferable. It is based upon that of Mr. Alfred B. Taylor, of Philadelphia. (*A. J. P.*, Jan. 1865.) The British Pharmacopœia uses water only as the menstruum, while it adds alcohol to the liquid to preserve it. In the U. S. process a mixture of alcohol and glycerin is used as the menstruum. Now, it is well known that Peruvian bark cannot be exhausted by water alone; and, though by its use as a menstruum the resin and cinchonic red are mainly left behind, so also is a considerable proportion of the alkaloids. By using alcohol, the U. S. Pharmacopœia extracts all the virtues of the bark, though it may also take up some of the resin and cinchonic red. Of the British preparation, four fluidounces are intended to represent an avoirdupois pound or sixteen ounces of the bark; but they certainly fail to do so to an indefinite degree. Of the U. S. preparation, one fluidounce represents slightly more than an ounce of the bark, and may be relied on, if well prepared, to produce all its effects. The U. S. fluid extract of cinchona is a moderately thin, dark reddish brown translucent fluid, of a bitter, astringent taste. The dose equivalent to a drachm (3·9 Gm.) of the bark is two fluidrachms (7·5 C.c.); and to produce an antiperiodic effect, at least two fluidounces (60 C.c.) should be taken between the paroxysms.

EXTRACTUM COLCHICI. *Br.* *Extract of Colchicum.*

(ẸX-TRĂC'TỤM CŎL'ȻHỊ-CĪ—kŏl'kį-sī.)

Extrait de Colchique, *Fr.,* **Zeitlosen-Extrakt,** *G.*

"Take of Fresh Colchicum Corms, deprived of their coats, *seven pounds* [avoir.]. Crush the Corms; press out the juice; allow the feculence to subside, and heat the clear liquor to 212°; then strain through flannel, and evaporate by a water-bath, at a temperature not exceeding 160°, until the extract is of a suitable consistence for forming pills." *Br.*

There scarcely seems to be occasion for both this and the following extract. The dose is one or two grains (0·065–0·13 Gm.).

In Great Britain a preparation called *preserved juice of colchicum* is given in the dose of five minims (0·3 C.c.) or more. It is made by expressing the fresh bulb, allowing the juice to stand for forty-eight hours that the feculent matter may subside, then adding one-quarter of its bulk of alcohol, allowing it again to stand for a short period, and ultimately filtering.

EXTRACTUM COLCHICI RADICIS. *U.S.* *Extract of Colchicum Root.*

(ẸX-TRĂC'TỤM CŎL'ȻHỊ-CĪ RẠ-DĪ'CĬS—kŏl'kį-sī.)

Extractum Colchici Aceticum, *Br.;* Extrait de Colchique acétique, *Fr.;* Zeitlosen Essigextrakt, *G.*

"Colchicum Root, in No. 60 powder, *one hundred parts* [or sixteen ounces av.]; Acetic Acid, *thirty-five parts* [or five and a half fluidounces]; Water, *a sufficient quantity.* Mix the Acetic Acid with *one hundred and fifty parts* [or twenty-three fluidounces] of Water, and, having moistened the powder with *fifty parts* [or seven and a half fluidounces] of the mixture, pack it moderately in a cylindrical glass percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then Water, until the Colchicum Root is exhausted. Evaporate the percolate, in a porcelain vessel, by means of a water-bath, at a temperature not exceeding 80° C. (176° F.), to a pilular consistence." *U. S.*

In the British Pharmacopœia this extract is directed to be prepared by adding *six fluidounces* of Acetic Acid (*Br.*) to the crushed corms before expression, and the strained liquor is to be evaporated to the consistence of a soft extract.

As the fresh colchicum bulb is rarely to be had in this country, the U. S. Pharmacopœia employs the dried bulb; and its process, if properly conducted, will afford a very efficient extract. In our opinion it would be preferable to add the whole of the menstruum specified, to the powdered colchicum root, and satisfy its tendency to swell at once, instead of using the small quantity directed to moisten. The swelling of the powder will frequently cause an entire stoppage of the percolation and necessitate the repacking of the percolator. Some inconveniences are experienced in preparing the extract, according to the London process, from the recent bulb by expression, which would seem to render the U. S. process under all circumstances preferable. (*P. J. Tr.*, xiii. 62.)

The use of the acetic acid, in this preparation, is to render more soluble the alkaloid upon which the virtues of meadow-saffron are thought to depend. The acetic extract of colchicum is highly commended by Sir C. Scudamore, who prefers it made by evaporating, to the consistence of honey, a saturated acetic infusion of the dried bulb. (*Lond. Med. Gazette*, Dec. 10, 1841.) The dose of the extract is one or two grains (0·065–0·13 Gm.), to be repeated two or three times a day, and increased if necessary.

EXTRACTUM COLCHICI RADICIS FLUIDUM. *U. S.* *Fluid Extract of Colchicum Root.*

(ẸX-TRĂC′TỤM CŎL′ÇHỊ-CĪ RẠ-DĪ′CĬS FLŪ′Ị-DŬM.)

Extrait liquide de Bulbe de Colchique, *Fr.;* Flüssiges Zeitlosenknollen-Extrakt, *G.*

"Colchicum Root, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix *two parts* [or four and a half pints] of Alcohol with *one part* [or two pints] of Water, and, having moistened the powder with *thirty-five grammes* [or twenty fluidounces] of the mixture, pack it moderately in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, until the Colchicum Root is exhausted. Reserve the first *eighty-five cubic centimeters* [or forty fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This fluid extract is not essentially different from that formerly officinal. The principal difference is in the disuse of glycerin, which solvent there is certainly no advantage in retaining. The present menstruum will thoroughly exhaust the root, and this fluid extract is now a good preparation. It is of a reddish brown color and bitter taste. The dose is from two to eight minims (0·12–0 5 C.c.).

EXTRACTUM COLCHICI SEMINIS FLUIDUM. *U. S.* *Fluid Extract of Colchicum Seed.*

(ẸX-TRĂC′TỤM CŎL′ÇHỊ-CĪ SĔM′Ị-NĬS FLŪ′Ị-DŬM.)

Extrait liquide de Semences de Colchique, *Fr.;* Flüssiges Zeitlosensamen-Extrakt, *G.*

"Colchicum Seed, in No. 30 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix *two parts* [or four and a half pints] of Alcohol with *one part* [or two pints] of Water, and, having moistened the powder with *thirty grammes* [or seventeen fluidounces] of the mixture, pack it firmly in a cylindrical percolator, then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, until the Colchicum Seed is exhausted. Reserve the first *eighty five cubic centimeters* [or forty fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

The use of glycerin in this fluid extract (U. S. P. 1870) was even more objectionable than in that of the root, as the fixed oil contained in the seeds was always thrown out of solution, and was usually found floating on the fluid extract, rendering the preparation unsightly. L. I. Morris (*A. J. P.*, 1881, p. 7) believes that it is unnecessary to grind the colchicum seeds, and that if the whole seeds are digested with diluted alcohol at 80° C. (176 F.) the colchicine is easily extracted.

Considering that we had one tincture, two wines, and two extracts of Colchicum, all efficient preparations requiring small doses, these additions to our pharmacy might have been spared, unless some peculiar advantage could have been gained from them. They are, however, well made, and no doubt concentrate the virtues of colchicum, and have a limited use. The dose is from two to eight minims (0·12–0·5 C.c.).

EXTRACTUM COLOCYNTHIDIS. *U.S. Extract of Colocynth.*

(ẸX-TRĂC'TỤM CŎL-Ọ-CȲN'THỊ-DĬS.)

Extrait de Coloquinte, *Fr.;* Koloquinten-Extrakt, *G.*

"Colocynth, dried and freed from the seeds, *one hundred parts* [or sixteen ounces av.]; Diluted Alcohol, *a sufficient quantity.* Reduce the Colocynth to a coarse powder by grinding or bruising, macerate it in *two hundred and fifty parts* [or forty-one fluidounces] of Diluted Alcohol for four days, with occasional stirring; then express strongly, and strain through flannel. Pack the residue, previously broken up with the hands, firmly in a cylindrical percolator, cover it with the strainer, and gradually pour Diluted Alcohol upon it until the tincture and expressed liquid, mixed together, weigh *five hundred parts* [or measure five pints]. Having recovered from the mixture *three hundred parts* [or three and a half pints] of Alcohol by distillation, evaporate the residue to dryness, by means of a water-bath. Lastly, reduce the dry mass to powder. Extract of Colocynth should be kept in well-stopped bottles." *U. S.*

Colocynth should be deprived of its seeds, as directed by the U. S. Pharmacopœia, before being submitted to the action of the menstruum. Dr. Duncan found half a pound of colocynth to contain 2770 grains of seeds, which, boiled by themselves, yielded almost nothing to water. Dr. Squibb found selected fruits to yield from 25·8 to 34 per cent. of medullary part; and this, when well exhausted by diluted alcohol, to yield 60·7 to 60·8 per cent. of dry extract; while from the whole fruit, including pulp and seeds, from 15·69 to 20·6 per cent. was obtained, according to the degree of dryness. (*A. J. P.*, 1857, p. 98.) Boiling water extracts so much pectic acid and mucilage from colocynth, that the decoction or hot infusion gelatinizes on cooling; and the extract made by means of it is loaded with inert matter, and, besides, is apt to become mouldy, or so tough and hard as to resist trituration and formation into pills. Hence the London College, following in this respect the French Codex, directed, in the last edition of its Pharmacopœia, maceration with cold water; but diluted alcohol has been found to be a much better menstruum, and has been adopted in the U. S. process; while in the British Pharmacopœia the simple extract has been discarded altogether. The chief, if not exclusive, use of the alcoholic extract is in the preparation of the compound extract.

Off. Prep. Extractum Colocynthidis Compositum, *U. S.*

EXTRACTUM COLOCYNTHIDIS COMPOSITUM. *U.S.* *Compound Extract of Colocynth.*

(ẸX-TRĂC'TỤM CŎL-Ọ-CȲN'THỊ-DĬS CỌM-PŎṢ'Ị-TŬM.)

Extrait de Coloquinte composé, *Fr.;* Zusammengesetztes Koloquinten-Extrakt, *G.*

"Extract of Colocynth, *sixteen parts* [or eight ounces av.]; Aloes, *fifty parts* [or twenty-five ounces av.]; Cardamom, in No. 60 powder, *six parts* [or three ounces av.]; Resin of Scammony, in fine powder, *fourteen parts* [or seven ounces av.]; Soap, dried and in coarse powder, *fourteen parts* [or seven ounces av.]; Alcohol, *ten parts* [or six fluidounces]. Heat the Aloes, on a water-bath, until it is completely melted; then add the Alcohol, and, having stirred the mixture thoroughly, strain it through a fine sieve, which has just been dipped into boiling water. To the strained mixture, contained in a suitable vessel, add the Soap, Extract of Colocynth, and Resin of Scammony, and heat the mixture at a temperature not exceeding 120° C. (248° F.), until it is perfectly homogeneous, and a thread taken from the mass becomes brittle when cool. Then withdraw the heat, thoroughly incorporate the Cardamom with the mixture, and cover the vessel until the contents are cold. Finally, reduce the product to a fine powder. Compound Extract of Colocynth should be kept in well-stopped bottles." *U. S.*

"Take of Colocynth Pulp *six ounces;* Extract of Socotrine Aloes *twelve ounces;* Resin of Scammony *four ounces;* Hard Soap, in powder, *three ounces;* Cardamom Seeds, in fine powder, *one ounce;* Proof Spirit *one gallon* [Imperial measure]. Macerate the Colocynth in the Spirit for four days; press out the tincture, and distil off the Spirit; then add the Aloes, Scammony, and Soap, and evaporate by a water-bath until the extract is of a suitable consistence for forming pills, adding the Cardamoms towards the end of the process." *Br.* The ounce employed in this process is the avoirdupois.

The U. S. formula of 1870 differed from that of 1850, in taking the extract of colocynth already prepared, instead of directing its preparation from the colocynth, and in substituting resin of scammony for the scammony itself. This provision insures uniformity of result so far as the colocynth is concerned; whereas by the old formula this was impossible, owing to the variable quality of the colocynth employed, unless an unusual amount of care was taken in its selection. The second change contributes to the same result of uniformity; because the resin of scammony is very nearly of equable strength, while scammony is notoriously otherwise; and it has the additional advantage of yielding a stronger extract, as the resin is much more energetic in an equal dose than the crude drug as ordinarily found in the market. The object of the soap in this formula is to improve the consistence of the mass, which, when hardened by time, it renders more soluble in the liquors of the stomach. It may possibly also serve the purpose of qualifying the action of the aloes. In the U. S. process the extract is in the form of powder, which is very convenient for admixture with other substances; while, if given uncombined, it may be readily made into pills by suitable additions. The alternative of using the scammony or its resin, in the first British formula, which appeared to us very objectionable, has been abandoned in the present edition, and the resin only directed. It was objected to the U. S. compound extract of 1860, that it is apt to gripe in consequence of deficiency in the proportion of the aromatic ingredient, and the addition of some aromatic oil, as oil of cloves, was recommended; but this was remedied in the revision of 1870 by increasing the proportion of cardamom. The plan of having the powders simply mixed is liable to the objection, that the mixture is not apt to be so thoroughly effected as to obtain a uniform result; and hence the present Pharmacopœia adopted Dr. Squibb's suggestion, to melt together all the ingredients unpowdered, except the cardamom, add a little alcohol, and, when the mixture is thoroughly made, to stir in the powdered aromatic, and finally to reduce the whole to a fine powder. The active principle of the cardamom (the volatile oil) is thus not dissipated, but absorbed by the other ingredients, and one of the objections to the British process is avoided—*i.e.*, the necessity for directing cardamom in fine powder. The previous desiccation of the cardamom, a requisite if a fine powder is desired, being very wasteful of the volatile oil.

This extract is an energetic and safe cathartic, possessing the activity of its three purgative ingredients, with comparatively little of the drastic character of the colocynth and scammony. It may be still further and advantageously modified by combination with rhubarb, jalap, calomel, etc., with one or more of which it is often united in prescription. In such combination it is much employed whenever an active cathartic is desirable, particularly in the commencement of fevers and febrile complaints, in congestion of the liver or portal system, and in obstinate constipation. In small doses it is an excellent laxative in that state of habitual costiveness, depending on a want of the due irritability of the bowels, which often occurs in old people. The dose is from five to thirty grains (0·33–1·95 Gm.), according to the effect to be produced, and the susceptibility of the bowels. A very eligible combination is the compound cathartic pill of the U. S. Pharmacopœia. We are informed that much of the extract sold in this country is made with inferior scammony and aloes, and an insufficient proportion of colocynth, so that it is comparatively inert. Compound extract of colocynth should be looked on with suspicion when cheap, and the pharmacist should always prepare it for himself.

Off. Prep. Pilulæ Catharticæ Compositæ, *U. S.*

EXTRACTUM CONII. *Br.* *Extract of Hemlock.*

(ẸX-TRĂC′TỤM CỌ-NĪ′Ī.)

Extract of Hemlock; Extrait de Ciguë, *Fr.;* Schierlings-Extrakt, *G.*

Owing to the great variability in the quality of this extract, it was very properly abandoned in the last revision of the U. S. Pharmacopœia in favor of the abstract or an alcoholic extract of conium fruit. (See next article.)

The directions of the British Pharmacopœia for this extract are precisely the same as those for the extract of aconite, the fresh leaves and young branches of conium being used.

The most important point in the preparation of this extract is to evaporate the juice without an undue degree of heat. At a temperature of 100° C. (212° F.), or upwards, its active principle undergoes rapid decomposition, being converted into resinous matter and ammonia. This is detected by the operator by the ammoniacal odor mixed with that which is peculiar to the plant. The juice always to a certain extent undergoes this decomposition when evaporated over a fire, and is not exempt from it even when the heat is regulated by a water-bath. Hence the propriety of the directions in the British Pharmacopœia. An excellent plan in the evaporation is to conduct it first in a vacuum, and afterwards in shallow vessels with a current of air at common temperatures. By the direction to heat the juice to the boiling point, or 93·3° C. (200° F.) (*Br.*), and then to filter, whereby the inert albumen is coagulated, and, with the equally inert chlorophyll and vegetable fibre, is separated from the liquid before evaporation, the extract is procured in a more concentrated state, and, besides, deprived of substances which might favor its decomposition. Long-continued exposure to the air is productive of the same result as too much heat, so that old extracts are frequently destitute of activity. (*Journ. de Pharm.*, xxii. 416.) No one of the extracts is more variable in its qualities than this. The season at which the herb is collected, the place and circumstances of its growth, the method of preparing the extract, are all points of importance, and are all too frequently neglected. (See *Conii Folia.*) In this country the process has often been carelessly conducted; and large quantities of an extract, prepared by boiling the plant in water and evaporating the decoction, have been sold as the genuine drug. The apothecary should always prepare the extract himself, or procure it from persons in whom he can have confidence. That imported from London has usually been considered the best; but the new officinal *Abstract* made from the fruit or seed is greatly to be preferred. It is not improbable that, as suggested by Professor Procter, the addition of a portion of acetic acid to the juice, before evaporation, might tend to fix the conine, and enable it better to resist the influence of heat, than in its native combination. The activity of any specimen of the extract may be in some measure judged of by rubbing it with potassa, which, disengaging the conine and rendering it volatile, gives rise to the peculiar mouse-like odor of that principle. If no odor be evolved under these circumstances, the extract may be deemed inert.

The extract of hemlock prepared without separating the chlorophyll has a fresh olive or green color. It should have a strong narcotic, somewhat fetid odor, and a bitterish saline taste. According to Brande, from three to five pounds are obtained from one cwt. of the leaves. M. Recluz got rather more than an ounce from sixteen ounces. Of the medical properties and application of this extract, we have spoken under the head of Conium. The dose is two grains (0·13 Gm.), two, three, or four times a day, to be gradually increased till evidences of its action upon the system are afforded. It may be administered in pill or solution.

Off. Prep. Pilula Conii Composita, *Br.;* Vapor Coniæ, *Br.*

EXTRACTUM CONII ALCOHOLICUM. *U. S.* *Alcoholic Extract of Conium.*

(ẸX-TRĂC′TỤM CỌ-NĪ′Ī ĂL-CỌ-HŎL′Ị-CŬM.)

Alcoholic Extract of Hemlock; Extrait alcoolique de Ciguë, *Fr.;* Spirituöses Schierlings-Extrakt, *G.*

"Conium (Fruit), in No. 40 powder, *one hundred parts* [or sixteen ounces av.];

Diluted Hydrochloric Acid, *three parts* [or three fluidrachms]; Glycerin, Diluted Alcohol, each, *a sufficient quantity.* Moisten the powder with *thirty parts* [four and a half fluidounces] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until *three hundred parts* [three pints] of tincture are obtained, or until the Conium is exhausted. Reserve the first *ninety parts* [or fourteen fluidounces] of the percolate, add the Diluted Hydrochloric Acid to the remainder, and evaporate it at a temperature not exceeding 50° C. (122° F.), to *ten parts* [or one and a half fluidounces]; mix this with the reserved portion, in a porcelain capsule, and evaporate at or below the before-mentioned temperature, to a pilular consistence. Lastly, weigh the Extract, and thoroughly incorporate with it, while still warm, *five per cent.* of Glycerin." *U. S.*

This preparation is not identical with the preparation formerly officinal under the above title, the very important change of substituting the fruit for the leaves having been made. As the preparation has thus been made considerably stronger, it is our opinion that the word "Fructus" should have been inserted in the title to draw attention to this fact. In the event of accident, the Committee of Revision might properly be severely censured. The change itself is undoubtedly a good one, and the improvement was needed; if carefully made, the extract is now reliable. The addition of hydrochloric acid is an important one, as the volatile alkaloid is thereby rendered more stable by being in combination. The dose to begin with is one-half to one grain (0·03–0·065 Gm.), to be increased if necessary.

EXTRACTUM CONII FLUIDUM. *U.S.* *Fluid Extract of Conium.*

(EX-TRĂC'TỤM CỌ-NĪ'Ī FLŪ'Ị-DŬM.)

Extractum Conii Frūctus Fluidum, *U. S.* 1870; Fluid Extract of Conium Seed; Extrait liquide de Fruit de Ciguë, *Fr.;* Flüssiges Schierlingsfrucht-Extrakt, *G.*

"Conium (Fruit), in No. 40 powder, *one hundred grammes* [or fifty ounces av.]; Diluted Hydrochloric Acid, *three grammes* [or one and a half fluidounces]; Diluted Alcohol, *a sufficient quantity,* To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *thirty grammes* [or fifteen and a half fluidounces] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Conium is exhausted. Reserve the first *ninety cubic centimeters* [or forty-three fluidounces] of the percolate, and, having added the Diluted Hydrochloric Acid to the remainder, evaporate it, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

The fluid extract of conium of the U. S. Pharmacopœia of 1860 was prepared from the leaves, and was, therefore, of necessity a very uncertain, if not for the most part inert, preparation. The alkaloid conine is contained in very unequal proportions in the fresh leaves, and is so very volatile and destructible that in the dried leaves it may be altogether wanting. Dr. Wm. Manlius Smith (*A. J. P.*, xl. 459), as the result of an elaborate investigation, found that the immature fruits of conium are not only richer in the alkaloids than are the leaves, but are less variable in the proportion they contain, and have the conine in them in such form that drying does not dissipate it. The superiority of the fluid extract of conium seed over the same preparation of the leaves was shown by Dr. Smith, and has been since abundantly confirmed by experience. The revisers of the Pharmacopœia of 1870 acted very wisely in abandoning the old for the new preparation. The reservation of the first tincture is important, because it probably contains all or nearly all of the active principle, so that little or none of this is lost during the evaporation. In the present formula, a still greater improvement was made by abandoning glycerin as a portion of the officinal menstruum. The present fluid extract is a brownish green dark liquid having the mouse-urine odor and emitting a still stronger conium smell on the addition of potassa; any sample which fails to do this should be rejected as wanting in the alkaloid. Dr. Smith found sixteen minims (1 C.c.) of a fluid extract of the seed prepared by Dr. Squibb to produce violent symptoms. Dr. L. Wheeler, however, took thirty minims (1·9 C.c.) without experiencing any result. (*Boston Med. and Surg. Journ.*, June, 1870.) Dangerous results have followed from the administration of much smaller doses, and it would seem hardly safe to commence with a dose of more than five minims (0·3 C.c.), to be increased uutil a feeling of general weakness or some other manifest effect is produced.

EXTRACTUM CORNUS FLUIDUM. *U. S. Fluid Extract of Cornus.*

(ẸX-TRĂC′TỤM CŎR′NỤS FLŪ′Ị-DŬM.)

Extractum Cornûs Floridæ Fluidum, *U. S.* 1870; Fluid Extract of Dogwood; Extrait liquide de Cornouiller à grandes Fleurs, *Fr.;* Flüssiges Kornelrinden-Extrakt, *G.*

"Cornus, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Glycerin, *twenty grammes* [or seven and a half fluidounces]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix the Glycerin with *eighty grammes* [or forty-one fluidounces] of Diluted Alcohol. Moisten the powder with *thirty grammes* [or fifteen fluidounces] of the mixture, and pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterward, Diluted Alcohol, until the Cornus is exhausted. Reserve the first *eighty-five cubic centimeters* [or forty fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This preparation was improved at the late revision by greatly reducing the proportion of glycerin in the menstruum; the fluid extract, without doubt, represents whatever virtues the crude drug may contain, but it was scarcely worth introduction into the Pharmacopœia. The dose is half a fluidrachm (1·9 C.c.).

EXTRACTUM CUBEBÆ FLUIDUM. *U. S. Fluid Extract of Cubeb.*

(ẸX-TRĂC′TỤM CŪ-BĒ′BÆ FLŪ′Ị-DŬM.)

Extrait liquide de Cubèbe, *Fr.;* Flüssiges Cubeben-Extrakt, *G.*

"Cubeb, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *twenty-five grammes* [or fourteen and a half fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Cubeb is exhausted. Reserve the first *ninety cubic centimeters* [forty-three fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

Notwithstanding the fact that the oleoresin of cubeb thoroughly represents in a concentrated liquid form all of the virtue of this drug, the alcoholic fluid extract is a useful preparation; it permits the administration of cubeb in aqueous or hydroalcoholic mixtures where the oleoresin would not be admissible except in emulsion. It is a dark olive, translucent fluid, with the sensible properties of the drug. It may be given in doses of from ten to forty minims (0·6–2·5 C.c.).

EXTRACTUM CYPRIPEDII FLUIDUM. *U. S.* *Fluid Extract of Cypripedium.*

ẸX-TRĂC′TỤM ÇŸP-RỊ-PĒ′DỊ-Ī FLÛ′Ị-DŬM.)

Extrait liquide de Cypripède jaune, *Fr.;* Flüssiges Gelbfrauenschuh-Extrakt, *G.*

"Cypripedium, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol *a sufficient quantity,* To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *thirty-five grammes* [or twenty fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave the stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Cypripedium is exhausted. Reserve the first *eighty-five cubic centimeters* [or forty fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is one of the new officinal fluid extracts; it well represents the drug, although its use is at present very limited. It is very dark reddish brown in color. and may be given in doses of fifteen minims (0·9 C.c.).

EXTRACTUM DIGITALIS, *U. S.* *Extract of Digitalis.*

(ẸX-TRĂC′TỤM DĬÇ-Ị-TĀ′LĬS.)

Extrait alcoolique de Digitale, *Fr.;* Fingerhut-Extrakt, *G.*

"Digitalis, recently dried and in No. 60 powder, *one hundred parts* [or sixteen ounces av.]; Alcohol, *two hundred parts* [or two and a quarter pints]; Water, *one hundred parts* [or one pint]; Glycerin, Diluted Alcohol, each, *a sufficient quantity.* Mix the Alcohol and Water, and, having moistened the powder with *forty parts* [or six fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then, Diluted Alcohol, until *three hundred parts* [or three pints] of tincture are obtained, or the Digitalis is exhausted. By means of a water-bath, distil off the alcohol from the tincture, and, having placed the residue in a porcelain capsule, evaporate it on a water-bath, to a pilular consistence. Lastly, weigh the Extract, and thoroughly incorporate with it, while still warm, *five per cent.* of Glycerin." *U.S.*

This was a new officinal of the U. S. Pharmacopœia of 1860, though less needed than many others; because the dose of digitalis itself is small, and nothing is gained on the point of equability of strength, as the really active part of digitalis constitutes but a small proportion even of the extract, and might be altogether wanting without observably affecting the bulk. The same caution is used, in preparing this extract, against the injurious effects of heat as in the instance of the extract of conium. The extract now officinal does not differ essentially from that of U. S. P. 1870, with this exception, that instead of percolating first with alcohol and then with diluted alcohol, a menstruum of two parts alcohol and one part water is now used, finishing with diluted alcohol. The alcoholic extract of digitalis contains all the virtues and may be used for all the purposes of the powdered leaves. According to Messrs. Vielguth and Nentwich, the amount of alcoholic extract obtained from dried digitalis by cold displacement is 27·1 per cent. (See *A. J. P.*, May, 1859, p. 237.) The dose, therefore, of this extract to begin with should not exceed one-fourth of a grain (·016 Gm.).

EXTRACTUM DIGITALIS FLUIDUM. *U. S.* *Fluid Extract of Digitalis.*

(ẸX-TRĂC′TỤM DĬÇ-Ị-TĀ′LĬS FLÛ′Ị-DŬM.)

Extrait liquide de Digitale, *Fr.;* Flüssiges Fingerhut-Extrakt, *G.*

"Digitalis, recently dried and in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix *three parts* [or three and a half pints] of Alcohol with *one part* [or one pint] of Water, and, having moistened the powder with *thirty-five grammes* [or twenty fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, until the Digitalis is exhausted. Reserve the first *eighty-five cubic centimeters* [or forty fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

Glycerin was abandoned at the last revision, and there certainly was no necessity for its use. This fluid extract is dark, greenish black in color, and represents the drug thoroughly. The dose is one to two minims (0·06–0·12 C.c.).

EXTRACTUM DULCAMARÆ FLUIDUM. *U. S.* *Fluid Extract of Dulcamara.*

. ẸX-TRĂC′TỤM DŬL-CẠ-MĀ′RÆ FLÛ′Ị-DŬM.)

Extrait liquide de Douce-Amère, *Fr.;* Flüssiges Bittersüss-Extrakt, *G.*

"Dulcamara, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *forty grammes* [twenty fluidounces] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Dulcamara is exhausted. Reserve the first *eighty cubic centimeters* [or thirty-eight fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

The present formula differs from that of U. S. P. 1870 in the absence of glycerin. This fluid extract is a rather thick, dark brown liquid. The dose is from thirty minims to a fluidrachm (1·9–3·75 C.c.), three or four times a day, gradually increased if necessary.

EXTRACTUM ERGOTÆ. *U. S.* *Extract of Ergot.*

(ẸX-TRĂC′TỤM ẸR-GŌ′TÆ.)

Extrait de Seigle ergoté, *Fr.;* Mutterkornextrakt, *G.*

"Fluid Extract of Ergot, *five hundred parts* [or sixteen ounces av.], To make *one hundred parts* [or three ounces and eighty-eight grains av.]. Evaporate the Fluid Extract of Ergot in a porcelain capsule, by means of a water-bath, at a temperature not exceeding 50° C. (122° F.), constantly stirring, until it is reduced to *one hundred parts* [or three ounces and eighty-eight grains av.]." *U. S.*

This is a new officinal and a valuable addition to the list of extracts. It originated with Dr. E. R. Squibb, who, becoming dissatisfied with the so-called ergotins of the market, devised this simple process. (*Proc. A. P. A.*, 1873, p. 644.) The present preparation leaves little to be desired. The original formula made an extract slightly weaker; it was one-sixth of the weight of the fluid extract, instead of one-fifth, as it is now in the officinal formula; the acid present in the fluid extract was acetic, instead of hydrochloric as at present: these changes are, however, trifling. One of the great advantages of this extract is its adaptability for use in the *hypodermic injection of ergot;* all that is necessary is to dissolve it in five times its weight of water, to bring the whole to the original volume of fluid extract, and filter. It is also well adapted for suppositories, and has been applied topically to the os uteri, the desired dose being put on a dossil of absorbent cotton. (See *Ergota.*) Internally it is best given in gelatin capsules; although it may be made into pills, they soon flatten and lose their shape, unless combined with some inert powder. The dose is one-fifth that of the fluid extract or drug—*i.e.*, five grains to half a drachm.

EXTRACTUM ERGOTÆ FLUIDUM. *U. S. Fluid Extract of Ergot.*

(EX-TRĂC′TUM ER-GŌ′TÆ FLŪ′I-DŬM.)

Extractum Ergotæ Liquidum, *Br.;* Liquid Extract of Ergot; Extrait liquide de Seigle ergoté, *Fr.;* Flüssiges Mutterkornextrakt, *G.*

"Ergot, recently ground and in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Diluted Hydrochloric Acid, *six grammes* [or three fluidounces]; Alcohol, Water, each, *a sufficient quantity,* To make *one hundred cubic centimeters* [or three pints]. Mix *three parts* [or two and a half pints] of Alcohol with *four parts* [or two and three-quarter pints] of Water, and, having moistened the powder with *thirty grammes* [or fifteen and a half fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, until the Ergot is exhausted. Reserve the first *eighty-five cubic centimeters* [or forty fluidounces] of the percolate, and, having added the Diluted Hydrochloric Acid to the remainder, evaporate to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

"Take of Ergot, in coarse powder, *one pound* [avoirdupois]; Ether *one pint* [Imperial measure], or *a sufficiency;* Distilled Water *three pints and a half* [Imp. meas.]; Rectified Spirit *eight fluidounces.* Shake the Ether in a bottle with half a pint [Imp. meas.] of the Water, and after separation decant the Ether. Place the Ergot in a percolator, and free it from its oil by passing the washed Ether slowly through it. Remove the marc, and digest it in three pints [Imp. meas.] of the Water at 160° for twelve hours. Press out, strain, and evaporate the liquor, by the heat of a water-bath, to nine fluidounces; when cold, add the Spirit. Allow it to stand for an hour to coagulate, then filter. The product should measure sixteen fluidounces." *Br.*

This fluid extract was first suggested by Mr. Jos. Laidley, of Richmond, Va.; but the process has since been much modified. The improvement first suggested by Prof. Procter, of adding an acid to the menstruum to fix the alkaloids, and the selection of the proper menstruum, placed this important preparation at once on a permanent footing; and his original formula, published in 1857, and made officinal in 1860, is now practically adopted in 1880, notwithstanding the numerous changes of views concerning the active constituents of ergot. Practical experience has shown that it is not only a reliable, but, if carefully made, a permanent preparation. The use of glycerin in the menstruum is of no benefit whatever, and it would render the fluid extract unfit for use as a basis for the extract now officinal; as an addition, diluted hydrochloric probably answers as well as acetic acid for fixing alkaloids, although, if Dragendorff's researches were thoroughly accepted, there would seem to be no need of it, as the alkaloids are not now believed to be the active principles. (See *Ergota.*) Diluted alcohol dissolves all the active matter of ergot, leaving its oil behind, and the tincture first obtained, holding most of the active principles, is reserved without concentration. In the British process, the first step is to dissolve out the oil with ether previously deprived of alcohol by washing with water; because ordinary ether, in consequence of the alcohol it contains, dissolves a portion of the active matter along with the oil. The remainder of the process consists simply in forming an infusion with the residue of the ergot by digesting it with water, and then adding the spirit to preserve it. Why the ether should be used to dissolve out the oil it is difficult to understand, when it is considered that, if this menstruum were not employed, the oil would remain undisturbed in the ergot. It is also stated that when macerated in water of the temperature directed the ergot swells up into a sort of colloid mass, making straining very difficult, and the substitution of a large amount of cold water has been proposed.

The U. S. fluid extract of ergot is a clear, very dark reddish brown liquid, having the taste of ergot, but without its fishy odor, owing to the fixation of the trimethylamine, upon which that odor depends. On the addition, however, of solution of potassa, the odor is strongly developed, and the alkaloid escapes so largely that, if hydrochloric acid be held near it, a cloud of trimethylamine chloride will be perceived. This may be considered as a good test of the efficiency of the preparation; for, though the virtues of ergot do not depend on its volatile alkaloid, yet, if this be retained in the fluid extract, there can be little doubt that the other more fixed principles will be retained also. The preparation is an active one, but in large doses more apt to sicken the stomach than is the simple extract. The dose is from half a fluidrachm to half a fluidounce (1·9 to 15 C.c.).

Off. Prep. Extractum Ergotæ.

EXTRACTUM ERYTHROXYLI FLUIDUM. *U. S. Fluid Extract of Erythroxylon.* [*Fluid Extract of Coca.*]

(ẸX-TRĂC′TỤM ĔR-Ỵ-THRŎX′Ỵ-LĪ FLŪ′Ị-DŬM.)

Extrait liquide de Coca, *Fr.;* Flüssiges Cocablätter-Extrakt, *G.*

"Erythroxylon, in No. 40 powder, *one hundred grammes* [or fifty ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *forty-five grammes* [or twenty-three and a half fluidounces] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Erythroxylon is exhausted. Reserve the first *eighty cubic centimeters* [or thirty-eight fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This new officinal fluid extract is one of the most useful of the preparations of coca. It is of a dark greenish brown color, of an agreeable tea-like taste, but with little odor. The dose is from twenty minims to a fluidrachm (1·25–3·75 C.c.).

EXTRACTUM EUCALYPTI FLUIDUM. *U. S. Fluid Extract of Eucalyptus.*

(ẸX-TRĂC′TỤM EŪ-CẠ-LΫ́P′TĪ FLŪ′Ị-DŬM—yū-kạ-lĭp′tĭ.)

Extrait liquide d'Eucalyptus, *Fr.;* Flüssiges Eucalyptus-Extrakt, *G.*

"Eucalyptus, in No. 40 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *thirty-five grammes* [or twenty fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol until the Eucalyptus is exhausted. Reserve the first *eighty-five cubic centimeters* [or forty fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is another of the new fluid extracts admitted to the Pharmacopœia at the last revision. It well represents the drug, and is of a dark greenish brown color, having the peculiar odor and taste of eucalyptus very strongly developed, but for administration is much inferior to the volatile oil. The dose is from five to ten minims (0·3–0·6 C.c.).

EXTRACTUM EUONYMI. *U. S.* *Extract of Euonymus.*

(Ẹ̄X-TRĂC′TỤM EŪ-ŎN′Ỵ-MĪ—yū-ŏn′ị-mī.)

Extrait de Fusain, *Fr.;* Spindelbaum-Extrakt, *G.*

"Euonymus, in No. 30 powder, *one hundred parts* [or sixteen ounces av.]; Glycerin, Diluted Alcohol, each, *a sufficient quantity.* Moisten the powder with *forty parts* [or six fluidounces] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until *three hundred parts* [or three pints] of tincture are obtained, or the Euonymus is exhausted. By means of a water-bath distil off the Alcohol from the tincture, and, having placed the residue in a porcelain capsule, evaporate it, on a water-bath, to a pilular consistence. Lastly, weigh the Extract, and thoroughly incorporate with it, while still warm, *five per cent.* of Glycerin." *U. S.*

This is a new extract introduced in the U. S. P. 1880, with the view of affording to practitioners a convenient method of administering wahoo. The dose is from one to three grains (0·065–0·20 Gm.).

EXTRACTUM EUPATORII FLUIDUM. *U. S.* *Fluid Extract of Eupatorium.*

(Ẹ̄X-TRĂC′TỤM EŪ-PẠ-TŌ′RỊ-Ī FLŪ̂′Ị-DŬM—yū-pạ-tō′rẹ-ī.)

Extrait liquide d'Eupatoire, *Fr.;* Flüssiges Durchwachsener Wasserhanf-Extrakt, *G.*

"Eupatorium, in No. 40 powder, *one hundred grammes* [or fifty ounces av.]; Diluted Alcohol, *a sufficient quantity,* To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *forty grammes* [or twenty fluidounces] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Eupatorium is exhausted. Reserve the first *eighty cubic centimeters* [or thirty-eight fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This new officinal fluid extract will have but a limited use, although it well represents the drug, since boneset is chiefly employed in domestic medicine. It is of a dark greenish brown color, and the dose may be stated as from twenty minims to a fluidrachm (1·25–3·75 C.c.).

EXTRACTUM FILICIS LIQUIDUM. *Br.* *Liquid Extract of Fern.*

(Ẹ̄X-TRĂC′TỤM FĬL′Ị-CĬS LĬQ′UỊ-DŬM—lĭk′wẹ-dŭm.)

This, being properly an oleoresin, will be considered under the head of the *Oleoresinæ,* to which the reader is referred.

EXTRACTUM FRANGULÆ FLUIDUM. *U. S.* *Fluid Extract of Frangula.*

(Ẹ̄X-TRĂC′TỤM FRĂN′GU̇-LÆ FLŪ̂′Ị-DŬM.)

Extrait liquide de Bourdaine, *Fr.;* Flüssiges Faulbaumrinde-Extrakt, *G.*

"Frangula, in No. 40 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity,* To make *one hundred cubic centimeters* [or three pints]. Mix *one part* [or two and a quarter pints] of Alcohol with *two parts* [or four pints] of Water, and, having moistened the powder with *thirty-five grammes* [or seventeen fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, until the Frangula is exhausted. Reserve the first *eighty cubic centimeters* [or thirty-eight fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is another new fluid extract which has been quite largely used in this country during the last ten years. It is intended to be a laxative, but it is frequently disappointing, as the drug is rarely to be obtained of uniform good quality. The fluid extract is of a dark reddish brown color. The dose is ten to twenty minims.

EXTRACTUM GELSEMII FLUIDUM. *U. S.* *Fluid Extract of Gelsemium.*

(ẸX-TRĂC′TỤM ÇẸL-SĔM′Ị-Ī FLŪ′Ị-DŬM.)

Extrait liquide de Jasmine jaune, *Fr.;* Flüssiges Gelber Jasmin-Extrakt, *G.*

"Gelsemium, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *thirty grammes* [or seventeen fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Gelsemium is exhausted. Reserve the first *ninety cubic centimeters* [or forty-three fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is identical with the fluid extract formerly officinal, which has proved very useful. It is of a dark reddish brown color. The dose is from two to three minims (0·12–0·18 C.c.).

EXTRACTUM GENTIANÆ. *U. S., Br.* *Extract of Gentian.*

(ẸX-TRĂC′TỤM ÇĔN-TỊ-Ā′NÆ—jĕn-shẹ-ā′nē.)

Extrait de Gentiane, *Fr.;* Enzian-Extrakt, *G.*

"Gentian, in No. 20 powder, *one hundred parts* [or sixteen ounces av.]; Water, *a sufficient quantity.* Moisten the powder with *forty parts* [or six fluidounces] of Water, and let it macerate for twenty-four hours; then pack it in a conical percolator, and gradually pour Water upon it until the infusion passes but slightly imbued with the properties of the Gentian. Reduce the liquid to three-fourths of its weight by boiling, and strain; then, by means of a water-bath, evaporate to a pilular consistence." *U. S.*

"Take of Gentian Root, sliced, *one pound* [avoir.]; Boiling Distilled Water *one gallon* [Imp. measure]. Infuse the Gentian in the Water for two hours, boil for fifteen minutes; pour off, press, and strain. Then evaporate the liquor by a water-bath until the extract is of a suitable consistence for forming pills." *Br.*

The U. S. plan of percolation with cold water is admirably adapted to the extraction of the active matter of gentian, and even the British method of maceration with hot water is much better than the old plan of decoction. By the use of cold water, starch and pectic acid are left behind, while any albumen that may be taken up is disposed of by the subsequent boiling and straining.

The extract, however, may be advantageously made by macerating the root in two parts of water for thirty-six hours, then expressing in a powerful press, again macerating with additional water, and in like manner expressing, and evaporating the united expressed liquors. MM. Guibourt and Cadet de Vaux obtained by maceration in cold water an extract not only greater in amount, but more transparent, more bitter, and possessing more of the color and smell of the root than that prepared by decoction. Guibourt attributes this result to the circumstance that, as gentian contains little if any starch, it yields nothing to boiling which it will not also yield to cold water; while decoction favors the combination of a portion of the coloring matter with the lignin. But this opinion requires modification, now that it is understood that gentian contains pectic acid, which water will extract when boiling hot, but not when cold. Gentian, according to Brande, yields half its weight of extract by decoction.

As ordinarily procured, the extract of gentian has an agreeable odor, is very bitter, and of a dark brown color approaching to black, shining, and tenacious. It is frequently used as a tonic, in the form of pill, either alone or in connection with metallic preparations; but the practice of some pharmacists of using it indiscriminately as a pill excipient is very wrong and deserving of severe censure. The dose is from ten to thirty grains (0·65–1·95 Gm.).

EXTRACTUM GENTIANÆ FLUIDUM. *U.S.* *Fluid Extract of Gentian.*

(ẸX-TRĂC′TỤM ÇĔN-TỊ-Ā′NÆ FLŪ′Ị-DŬM—jĕn-shẹ-ā′nē.)

Extrait liquide de Gentiane, *Fr.;* Flüssiges Enzian-Extrakt, *G.*

"Gentian, in No. 30 powder, *one hundred grammes* [or fifty ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *thirty-five grammes* [or eighteen fluidounces] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Gentian is exhausted. Reserve the first *eighty cubic centimeters* [or thirty-eight fluidounces] of the percolate. By means of a water-bath, distil off the Alcohol from the remainder and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is a translucent, reddish brown fluid, with the smell and taste of the root. It may be questionable whether it was needed, though it has the advantage that we may obtain from it the tonic effects of the drug with less alcohol than in an equivalent quantity of the tincture; and pharmaceutically it affords a convenient method of giving to mixtures the tonic properties of gentian when required. The dose is from ten to thirty minims (0·6–1·9 C.c.).

EXTRACTUM GERANII FLUIDUM. *U. S.* *Fluid Extract of Geranium.*

(ẸX-TRĂC′TỤM ÇẸ-RĀ′NỊ-Ī FLŪ′Ị-DŬM.)

Extrait de Bec de Grue tacheté, *Fr.;* Flüssiges Fleckenstorchschnabel-Extrakt, *G.*

"Geranium, in No. 30 powder, *one hundred grammes* [or fifty ounces av.]; Glycerin, *ten grammes* [or three and three-quarter fluidounces]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix the Glycerin with *ninety grammes* [or forty-six and a half fluidounces] of Diluted Alcohol, and having moistened the powder with *thirty-five grammes* [or eighteen fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterward, Diluted Alcohol, until the Geranium is exhausted. Reserve the first *seventy cubic centimeters* [or thirty-four fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

The quantity of glycerin has been greatly diminished in this fluid extract, and the process is now unobjectionable. It is a dark reddish brown liquid, having little odor and a very astringent taste. The dose is from thirty minims to a fluidrachm (1·9–3·75 C.c.).

EXTRACTUM GLYCYRRHIZÆ. *U. S., Br. Extract of Glycyrrhiza.* [*Extract of Liquorice.*]

(ẸX-TRĂC′TỤM GLȲÇ-Ỵ̆R-RHĪ′ZÆ—glĭs-ịr-rī′zē.)

"The commercial extract of the root of Glycyrrhiza glabra. Linné. (*Nat. Ord.* Leguminosæ, Papilionaceæ.)" *U. S.*

Succus Liquiritiæ, *P. G.;* Liquorice, Licorice; Extrait de Réglisse, *Fr.;* Lakriz, Lakrizensaft, Süssholzsaft, *G.;* Sugo di Liquirizia, *It.;* Regaliza en Ballos, *Sp.*

Liquorice is an article of export from the north of Spain, particularly Catalonia, where it is obtained in the following manner. The roots of the *G. glabra*, having been dug up, thoroughly cleansed, and half dried by exposure to the air, are cut into small pieces, and boiled in water till the liquid is saturated. The decoction is then allowed to rest, and, after the dregs have subsided, is decanted, and evaporated to the proper consistence. The extract, thus prepared, is formed into rolls from five to six inches long by an inch in diameter, which are dried in the air, and wrapped in laurel leaves.

"In flattened cylindrical rolls, from six inches to six and three-quarter inches (150 to 175 mm.) long, and from five-eighths to one and one-sixteenth inch (15 to 30 mm.) thick; of a glossy black color. It breaks with a sharp, conchoidal, shining fracture, and has a very sweet, peculiar taste. Not less than 60 per cent. of it should be soluble in cold water." *U. S.*

Much liquorice is prepared in Calabria, according to M. Fée, from the *G. echinata*, which abounds in that country. The process is essentially the same as that just described, but conducted with greater care; and the Italian liquorice is purer and more valuable than the Spanish. It is in cylinders, generally somewhat smaller than the Spanish, and usually stamped with the manufacturer's brand. Most of the extract brought to this country comes from Messina and Catania in Sicily and Naples, from Seville and Saragossa in Spain, and from Smyrna in Turkey. Perhaps in no part of the world is more liquorice consumed than in this country, from four to five thousand tons having been imported annually before the war; but the article is now made on an extensive scale in this country, very successfully, with the best modern appliances, and of such good quality as to have almost driven the foreign article out of the market. The importation for 1881 was only about four hundred tons. The principal use of Extract of Liquorice is in the manufacture of chewing tobacco; that in the form of rolls as sold by the druggists being a comparatively small portion of the whole amount consumed.

Crude Liquorice, *Liquorice Paste*, or *Liquorice Mass*, as it is variously termed, is found in the market in cases ranging from two hundred and fifty to four hundred pounds, of a hard pilular consistence and, as its name implies, in a mass, which has been run into the case while hot and then allowed to cool.

The importation of liquorice paste for the year 1881 at the port of New York was valued at $96,207, of liquorice root at the same port for the same period $798,009.

Liquorice is usually in cylindrical rolls, somewhat flattened, and often covered with bay leaves. We have seen it in the London market in large cubical masses. When good, it is very black, dry, brittle, breaking with a shining fracture, of a very sweet, peculiar, slightly acrid or bitterish taste, and almost entirely soluble, when pure, in boiling water. Neumann obtained 460 parts of aqueous extract from 480 parts of Spanish liquorice. It is, however, considerably less soluble in cold water. It is often impure from accidental or fraudulent addition, or careless preparation. Starch, sand, the juice of prunes, etc., are sometimes added; and carbonaceous matter, and even particles of copper, are found in it, the latter arising from the boilers in which the decoction is evaporated. Four pounds of the extract have yielded two drachms and a half of metallic copper. (*Fée.*) In different commercial specimens examined by Chevallier, he found from 9 to 50 per cent. of insoluble matter. (*Journ. de Pharm.*, xxx. 429.) This is by no means, however, always impurity. In the preparation of the extract by decoction, a portion of matter originally insoluble, or rendered so by decoction, is taken up, and is, in fact, necessary to the proper constitution of the liquorice. When this is prepared with cold water, or even with hot water by simple displacement, the extract attracts moisture from the air, becomes soft, and loses the characteristic brittleness of the drug. The additional substances taken up in decoction serve to protect the extract against this change. M. Delondre has obtained the same result by using steam as the solvent. He prepares from the root an excellent liquorice, having all the requisite qualities of color, taste, and permanence, by passing steam, in suitable vessels, through the coarse powder of the root. The vapor thoroughly penetrates the powder, and is drawn off as it condenses. With about 500 lbs. of the root, this treatment is continued for 12 hours, and repeated at the end of 5 days. The liquors are collected, decanted, clarified with about 4 lbs. of gelatin, and quickly evaporated. After being put into the form of cylinders, the extract is kept for ten days in a drying room, at a temperature of 77°. (*Ibid.*, p. 433.) A bitter or empyreumatic taste is a sign of inferior quality in liquorice. As ordinarily found in commerce, it requires to be purified.* (See *Extractum Glycyrrhizæ Purum.*)

Liquorice contains glycyrrhizin, $C_{24}H_{36}O_9$, a glucoside, partly free and partly in combination with ammonia, to which combination the characteristic sweet taste of liquorice is due. The glycyrrhizin when boiled with dilute acids decomposes into *glycyrrhetin*, $C_{18}H_{26}O_4$, and a fermentable sugar.

The *refined liquorice*, found in commerce in small cylindrical pieces not thicker than a pipe stem, is prepared by dissolving the impure extract in water without boiling, straining the solution, and evaporating. The object of this process is to separate not only the insoluble impurities, but also the acrid oleoresinous substance, which is extracted by long boiling from the liquorice root, and is necessarily mixed with the unrefined extract. It is customary to add, during the process, a portion of sugar, gum, flour, starch, or perhaps glue. These additions, or something equivalent, are necessary to obviate the deliquescent property of the pure liquorice. According to M. Delondre, 15 per cent. of gum is the proper proportion, when this substance is used; Dr. Geisler has found sugar of milk to lessen the disposition of the extract to absorb moisture; but he considers the best addition, on the whole, to be very finely powdered liquorice root, which should be used in the proportion of one part to 16 of the purified extract. (*A. J. P.*, xxviii. 225.) The preparation is sometimes attacked by small worms, probably in consequence of the farinaceous additions. Excellent liquorice is prepared in some parts of England, from the root cultivated in that country. The *Pontefract cakes* are small lozenges of liquorice made in the vicinity of Pomfret.

Medical Properties and Uses. Liquorice is a useful demulcent, much employed in cough mixtures, and frequently added to infusions or decoctions, in order to cover the taste or obtund the acrimony of the principal medicine. A piece of it, held in the mouth and allowed slowly to dissolve, is often found to allay cough by sheathing the irritated membrane of the fauces. It is used in pharmacy to impart consistence to pills and troches, and to modify the taste of other medicines.

Off. Prep. Confectio Sennæ, *Br.;* Decoctum Aloes Compositum, *Br.;* Mistura Sennæ Composita, *Br.;* Pilulæ Ferri Iodidi, *U. S.;* Tinctura Aloes; Tinctura Rhei et Sennæ, *U. S.;* Trochisci Glycyrrhizæ et Opii, *U. S.;* Trochisci Cubebæ, *U. S.;* Trochisci Opii, *Br.*

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* The following results of an examination of different brands of liquorice in the market in relation to the proportion of matters soluble and those insoluble in cold water contained in them respectively, by Mr. Wm. N. Martindell, is published in the *A. J. P.* (1873, p. 151).

Brands.		Insoluble.	Soluble.	Loss.	Brands.		Insoluble.	Soluble.	Loss.
Corigliano,	Calabrian.	218 grs.	280 grs.	2 grs.	G. H.	Spanish,	233 grs.	210 grs.	57 grs.
Guzzolini,		175 "	284 "	41 "	Noel & Co.		253 "	176 "	71 "
P. & S.		248 "	248 "	27 "	M. & R.	American,	116 "	317 "	67 "

It will be seen from the above table that the American exceeds all the brands in solubility, as well as in that brilliancy of its fracture which is a highly valued indication of purity, and excellence of preparation.

EXTRACTUM GLYCYRRHIZÆ FLUIDUM. *U. S., Br.* *Fluid Extract of Glycyrrhiza.*

(ẸX-TRĂC'TỤM GLỸÇ-ỴR-RHĪ'ZÆ FLÛ'Ị-DŬM.)

Extractum Glycyrrhizæ Liquidum, *Br.;* **Liquid Extract of Liquorice; Extrait liquide de Réglisse,** *Fr.;* **Flüssiges Süssholz-Extrakt,** *G.*

"Glycyrrhiza, in No. 40 powder, *one hundred grammes* [or fifty ounces av.]; Water of Ammonia, Diluted Alcohol, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix *three parts* [or three fluidounces] of Water of Ammonia with *ninety-seven parts* [or six and a quarter pints] of Diluted Alcohol, and, having moistened the powder with *thirty-five grammes* [or eighteen fluidounces] of the mixture, pack it firmly in a cylindrical glass percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, until the Glycyrrhiza is exhausted. Reserve the first *seventy-five cubic centimeters* [or thirty-six fluidounces] of the percolate, and, having added *three grammes* [or one and a half fluidounces] of Water of Ammonia to the remainder, evaporate to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

"Take of Liquorice Root, in coarse powder, *one pound* [av.]; Distilled Water, *four pounds* [Imp. meas.]. Macerate the liquorice root with *two pints* [Imp. meas.] of the water for twelve hours, strain and press; again macerate the pressed marc with the remainder of the water for six hours, strain and press. Mix the strained liquors, heat them to 212° F., and then strain through flannel; then evaporate by a water-bath until it has acquired, when cold, a specific gravity of 1·160; add to this one-eighth of its volume of rectified spirit; let the mixture stand for twelve hours, and filter." *Br.*

The fluid extract of U. S. Pharm. 1880 differs from that officinal in 1870 in the absence of glycerin in the menstruum, and the presence of water of ammonia. The addition of the ammonia to the menstruum was suggested by Prof. J. P. Remington. (See *Proc. A. P. A.*, 1878, p. 757.) The formula for the liquid extract of liquorice of the British Pharmacopœia has several inconvenient manipulative features about it, such as the repeated macerations and expressions, evaporating to a certain specific gravity, etc. This preparation is now very largely used as an adjuvant, and for disguising the bitter taste of quinine, which should be added to the preparation of liquorice just before the dose is taken. It is a very convenient form for using liquorice, the objection to the former fluid extracts of the root being the slight acridity and the presence of too much alcohol. The ammonia not only renders the glycyrrhizin soluble, and thus materially adds to the power and sweetness of the fluid extract, but the acridity is greatly lessened through its influence. It is a very dark reddish brown liquid, having the well-known sweet taste of liquorice. A *syrup of liquorice* may be made by adding two parts of fluid extract to fourteen of simple syrup. An aromatic elixir of liquorice is treated of under Elixirs. (See page 538.)

EXTRACTUM GLYCYRRHIZÆ PURUM. *U. S.* *Pure Extract of Glycyrrhiza.*

(ẸX-TRĂC'TỤM GLỸÇ-ỴR-RHĪ'ZÆ PŪ'RŬM.)

Extractum Glycyrrhizæ Depuratum, Succus Liquiritiæ Depuratus; Extrait de Réglisse pur, *Fr.;* **Reines Lakriz,** *G.*

"Glycyrrhiza, in No. 20 powder, *one hundred parts* [or sixteen ounces av.]; Water of Ammonia, *fifteen parts* [or two and a half fluidounces]; Distilled Water, *a sufficient quantity.* Mix the Water of Ammonia with *three hundred parts* [or three pints] of Distilled Water, and, having moistened the powder with *one hundred parts* [or one pint] of the menstruum, let it macerate for twenty-four hours. Then pack it moderately in a cylindrical glass percolator, and gradually pour upon it, first, the remainder of the menstruum, and then, Distilled Water, until the Glycyrrhiza is exhausted. Lastly, by means of a water-bath, evaporate the infusion to a pilular consistence." *U. S.*

The British directions are to macerate *an avoirdupois pound* of liquorice root, in coarse powder, for twelve hours, in *two pints* of distilled water, strain and press; again to macerate the pressed marc with distilled water for six hours, strain and press; then to mix the strained liquors, heat to 212°, strain through flannel; and finally evaporate, by means of a water-bath, to a proper consistence for forming pills. The object in heating the infusion to 212° is to coagulate the albumen, and thus exclude it from the extract.

The necessity for a pure extract of liquorice must be apparent to every pharmacist; the very variable quality of the commercial extract has frequently led to disappointment; the officinal process affords a preparation which is unexceptionable, the ammonia rendering the glycyrrhizin soluble, yet care must be taken in its evaporation, as it is very easily injured by too much heat, which gives it an empyreumatic taste, destroying at once its usefulness as an agreeable adjuvant.

Off. Prep. Mistura Glycyrrhizæ Composita, *U. S.*

EXTRACTUM GOSSYPII RADICIS FLUIDUM. *U. S. Fluid Extract of Cotton Root.*

(ẸX-TRĂC′TỤM GỌS-SȲP′Ị-Ī RẠ-DĪ′CĬS FLŪ′Ị-DŬM.)

Extrait liquide d'Écorce de Catonnier, *Fr.;* Flüssiges Baumwollenwurzel-Extrakt, *G.*

Cotton Root, in No. 30 powder, *one hundred grammes* [or fifty ounces av.]; Glycerin, *thirty-five grammes* [or thirteen and a half fluidounces]; Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix the Glycerin with *sixty-five grammes* [or thirty-eight fluidounces] of Alcohol, and, having moistened the powder with *fifty grammes* [or twenty-six fluidounces] of the mixture, pack it firmly in a cylindrical percolator, and pour on the remainder of the menstruum. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, and, when the liquid in the percolator has disappeared from the surface, gradually pour on Alcohol, and continue the percolation until the Cotton Root is exhausted. Reserve the first *seventy cubic centimeters* [or thirty-three and a half fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is one of the fluid extracts which is improved by the use of glycerin; the menstruum here selected, it is believed, will prevent the gelatinization, which has been a troublesome objection to the fluid extract of the Pharmacopœia of 1870. Prof. J. U. Lloyd prefers a menstruum composed of ten fluidounces of alcohol and three fluidounces each of glycerin and water, and finishing the percolation with a mixture composed of ten fluidounces of alcohol and six fluidounces of water. It is a deep reddish liquid, and well represents the root. The dose is half a fluidrachm to a fluidrachm (1·9–3·75 C.c.).

EXTRACTUM GRINDELIÆ FLUIDUM. *U. S. Fluid Extract of Grindelia.*

(ẸX-TRĂC′TỤM GRĬN-DĒ′LỊ-Æ FLŪ′Ị-DŬM.)

"Grindelia, in No. 30 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix *three parts* [or three pints and six fluidounces] of Alcohol with *one part* [or one pint] of Water, and, having moistened the powder with *thirty grammes* [or seventeen and a half fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, until the Grindelia is exhausted. Reserve the first *eighty-five cubic* *centimeters* [or forty fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is a new officinal fluid extract which well represents the drug; owing to the large quantity of resinous matter present it does not mix well with aqueous liquids. It is a dark brown liquid having the peculiar odor of grindelia. The dose is half a fluidrachm to a fluidrachm (1·9–3·75 C.c.).

EXTRACTUM GUARANÆ FLUIDUM. *U. S.* *Fluid Extract of Guarana.*

(ẸX-TRĂC′TỤM GUẠ-RĀ′NÆ FLÛ′Ị-DŬM—gwạ-rā′nē.)

"Guarana, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix *three parts* [or three pints and six fluidounces] of Alcohol with *one part* [or one pint] of Water, and, having moistened the powder with *twenty grammes* [or twelve fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, until the Guarana is exhausted. Reserve the first *eighty cubic centimeters* [or thirty-eight fluidounces] of the percolate. By means of a water-bath, distil off the Alcohol from the remainder, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This new officinal fluid extract is of doubtful utility. The powdered drug itself is portable, not unpleasant to the taste, and is efficient when given diffused in water; nothing is gained by making it into a fluid extract. The fluid extract is of a deep reddish brown color. The dose is one to two fluidrachms (3·75–7·5 C.c.).

EXTRACTUM HÆMATOXYLI. *U.S., Br.* *Extract of Hæmatoxylon.* [*Extract of Logwood.*]

(ẸX-TRĂC′TỤM HÆ-MẠ-TŎX′Ỵ-LĪ—hē-mạ-tŏk′sẹ-lī.)

Extractum Ligni Campechiani, *P. G.;* **Extrait de Bois de Campêche,** *Fr.;* **Campecheholz-Extrakt,** *G.*

"Hæmatoxylon, rasped, *one hundred parts* [or sixteen ounces av.]; Water, *one thousand parts* [or ten pints]. Macerate the Hæmatoxylon with the Water for forty-eight hours. Then boil (avoiding the use of metallic vessels) until one-half of the Water has evaporated; strain the decoction, while hot, and evaporate to dryness." *U. S.*

"Take of Logwood, in fine chips, *one pound* [avoirdupois]; Boiling Distilled Water *one gallon* [Imperial measure]. Infuse the Logwood in the Water for twenty-four hours, then boil down to one-half, strain, and evaporate to dryness by a water-bath, stirring with a wooden spatula. Iron vessels should not be used." *Br.*

This is one of the few instances in which decoction in the preparation of extracts is not considered objectionable. Iron vessels should not be employed in the process, in consequence of the presence of tannic acid. The evaporation should be carried so far that the extract may be dry and brittle when cold. About 20 lbs. of it are obtained from one cwt. of logwood. (*Brande.*) It is of a deep ruby color, and an astringent, sweetish taste, and has all the medical virtues of the wood. If given in pills, these should be recently made, as, when long kept, they are said to become so hard as sometimes to pass unchanged through the bowels. The extract, however, is best administered in solution. The dose is from ten to thirty grains (0·65–1·95 Gm.). This extract is said to be prepared largely in Yucatan and other parts of Mexico.

EXTRACTUM HAMAMELIDIS FLUIDUM. *U. S. Fluid Extract of Hamamelis.*

(ẸX-TRĂC′TỤM HĂM-Ạ-MĔL′Ị-DĬS FLŪ′Ị-DŬM.)

"Hamamelis, in No. 40 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix *one part* [or two and a quarter pints] of Alcohol with *two parts* [or four pints] of Water, and, having moistened the powder with *thirty-five grammes* [or eighteen fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, until the Hamamelis is exhausted. Reserve the first *eighty-five cubic centimeters* [or forty fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is a new officinal fluid extract, which well represents the virtues of witch-hazel. It is a dark reddish brown color; the dose is half a fluidrachm (1·9 C.c.).

EXTRACTUM HYDRASTIS FLUIDUM. *U. S. Fluid Extract of Hydrastis.*

(ẸX-TRĂC′TỤM HȲ-DRĂS′TỊS FLŪ′Ị-DŬM.)

Extrait liquide de Hydrastis, *Fr.;* Flüssiges Hydrastis-Extrakt, *G.*

"Hydrastis, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix *three parts* [or three pints and six fluidounces] of Alcohol with *one part* [or one pint] of Water, and, having moistened the powder with *thirty grammes* [or seventeen fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, until the Hydrastis is exhausted. Reserve the first *eighty-five cubic centimeters* [or forty fluidounces] of the percolate. By means of a water-bath, distil off the Alcohol from the remainder, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This preparation does not differ materially from that officinal in 1870. The small proportion of glycerin directed in the former process has been dropped; the present menstruum is slightly more alcoholic. The fluid extract thoroughly represents the drug, is of a deep brownish yellow color, and the dose is from one to two fluidrachms (3·75–7·5 C.c.).

EXTRACTUM HYOSCYAMI. *Br. Extract of Hyoscyamus.*

(ẸX-TRĂC′TỤM HȲ-ỌS-CȲ′Ạ-MĪ.)

Extrait de Jusquiame, *Fr.;* Bilsenkraut-Extrakt, *G.*

The process of preparing this Extract from the fresh leaves is no longer officinal in U. S. P. (See *Alcoholic Extract of Hyoscyamus.*)

In the British Pharmacopœia this extract is prepared from "the fresh Leaves and young Branches of Hyoscyamus" in the same manner precisely as Extract of Aconite. (See *Extractum Aconiti.*)

MM. Solon and Soubeiran have shown that the insoluble matter separated from the expressed juice of henbane by filtering, and that coagulated by heat, are nearly if not quite inert; so that the juice may be usefully clarified before evaporation. (*A. J. P.*, viii. 228.) The retention of the chlorophyll, however, as provided for in the British formula, is thought to be advantageous. This kind of Extract of Henbane is chiefly derived from England. Mr. Brande says that one cwt. of the fresh herb affords between four and five pounds. M. Recluz obtained one part from sixteen.

The extract is of a dark olive color, of a narcotic rather unpleasant odor, and a bitterish, nauseous, slightly saline taste. It retains its softness for a long time, but at the end of three or four years becomes dry, and exhibits, when broken, small crystals of nitrate of potassium and chloride of sodium. (*Recluz.*) Like all the inspissated juices, it is of variable strength, according to its age, the care used in its preparation, and the character of the leaves. (See *Hyoscyamus.*)

Much depends on the choice of the leaves; and too little attention is paid to this point. In reference to the biennial plant, there seems to be no doubt that the leaves of the second year are much more efficacious than those of the first, and should, therefore, always be selected. It is stated under Hyoscyamus, that the leaves should be gathered soon after the plant has flowered. Mr. Charles Cracknell gives more particular directions. He thinks that the plant is in a fit state for collection only during a very short period, namely, when the flowers at the top are blown, but have not yet begun to fade, and the seed-vessels and seeds which have been formed are still soft and juicy. For other observations on the preparation of this extract, see a paper by Mr. Cracknell in *A. J. P.* (xxiii. 245).

An important contribution to our knowledge, as to the proper choice of the parts of this plant to be expressed, has been made by Mr. T. B. Groves, of England. Whatever may be the case with those plants, such as aconite, the roots of which are active, and in which the juice containing the active matter, on its way from the leaves to the root, might be supposed to exist in the young stems, this does not appear to be the case with the Hyoscyamus; and, accordingly, an extract obtained by inspissating the juice of the stems was found altogether inferior to another obtained in like manner from the leaves, being not only less in amount, but less bitter and odorous, and more saline, showing that it contained more of the ordinary salts of the plant, and less of its active matter. (*P. J. Tr.*, 1862, p. 376.)

In the use of the extract it is advisable to begin with a moderate dose, two or three grains (0·13–0·20 Gm.) for instance, and gradually to increase the quantity till some effect is experienced, and the degree of efficiency of the particular parcel employed is ascertained. It is usually given in pill. It is sometimes used externally for the same purpose as extract of belladonna.

Off. Prep. Pilula Colocynthidis et Hyoscyami, *Br.*

EXTRACTUM HYOSCYAMI ALCOHOLICUM. *U. S.* *Alcoholic Extract of Hyoscyamus.*

(ẸX-TRĂC′TỤM HȲ-ỌS-CȲ′Ạ-MĪ ĂL-CỌ-HŎL′Ị-CŬM.)

Extrait alcoolique de Jusquiame, *Fr.;* Spirituöses Bilsenkraut-Extrakt, *G.*

"Hyoscyamus, recently dried and in No. 60 powder, *one hundred parts* [or sixteen ounces av.]; Alcohol, *two hundred parts* [or two and a quarter pints]; Water, *one hundred parts* [or one pint]; Diluted Alcohol, *a sufficient quantity.* Mix the Alcohol and Water, and, having moistened the powder with *forty parts* [or six fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then, Diluted Alcohol, until *three hundred parts* [or three pints] of tincture are obtained, or the Hyoscyamus is exhausted. Reserve the first *ninety parts* [or fourteen fluidounces] of the percolate, evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to *ten parts* [or one fluidounce]; mix this with the reserved portion, and evaporate, at or below the before-mentioned temperature, to a pilular consistence." *U. S.*

This is a much more reliable and active preparation than the inspissated juice, or, as it is usually termed, English extract. It is of a dark olive color, with the peculiar odor of hyoscyamus. The dose is from one to two grains (0·065–0·13 Gm.).

EXTRACTUM HYOSCYAMI FLUIDUM. *U.S.* *Fluid Extract of Hyoscyamus.*

(ẸX-TRĂC′TỤM HỸ-Ọ̈S-CȲ′Ạ-MĪ FLÛ′Ị-DŬM.)

Extrait liquide de Jusquiame, *Fr.;* Flüssiges Bilsenkraut-Extrakt, *G.*

" Hyoscyamus, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix *three parts* [or three pints and six fluidounces] of Alcohol with *one part* [or one pint] of water, and, having moistened the powder with *forty grammes* [or twenty-three fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum until the Hyoscyamus is exhausted. Reserve the first *ninety cubic centimeters* [or forty fluidounces] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This fluid extract was improved in the last revision by abandoning the glycerin directed in the former process. It is of a very dark greenish brown color, and is given in the dose of five minims (0·3 C.c.) to commence with.

EXTRACTUM IPECACUANHÆ FLUIDUM. *U.S.* *Fluid Extract of Ipecac.*

(ẸX-TRĂC′TỤM ĬP-Ẹ-CĂC-Ů-ĂN′HÆ FLÛ′Ị-DŬM—ĭp-ẹ-kăk-yů-ăn′ē.)

Extrait liquide d'Ipécacuanha, *Fr.;* Flüssiges Ipecacuanha-Extrakt, *G.*

" Ipecac, in No. 80 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *thirty-five grammes* [or twenty fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed until the Ipecac is exhausted. By means of a water-bath distil off the Alcohol from the tincture until the residue measures *fifty cubic centimeters* [or one and a half pints], and add to it *one hundred cubic centimeters* [or three pints] of Water. Evaporate the mixture to *seventy-five cubic centimeters* [or two and a quarter pints], and, when cool, filter. Wash the precipitate upon the filter, with Water, until the latter passes through tasteless, evaporate the filtrate and washings to *fifty cubic centimeters* [or one and a half pints], allow to cool, and add enough Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]."

It is probable that a greater improvement will be noticed in this than in any of the other fluid extracts; indeed, the process of the Pharmacopœia of 1870 was almost inoperative; the preparation was turbid and unfit for its principal use, the making of syrup of ipecacuanha (*A. J. P.*, 1873, pp. 211, 481; 1876, p. 337; *N. R.*, 1880, p. 14), because no provision was made for the separation of the apothegmatic substance which causes the turbidity. The present formula closely resembles that officinal in 1860; in our opinion, it would have been better to have directed the mixture to stand undisturbed forty-eight hours before filtering. This would have allowed sufficient time for the insoluble apothegmatic substances to thoroughly separate out.

This fluid extract is a thin, dark reddish brown transparent liquid, of a bitterish slightly acrid taste, but without the nauseous flavor of the root. The emetic dose would be from fifteen to thirty minims (0·9–1·9 C.c.). It is a convenient preparation for adding to expectorant and diaphoretic mixtures, and is used officinally principally in preparing the syrup of ipecacuanha.

Off. Prep. Syrupus Ipecacuanhæ, *U. S.;* Tinctura Ipecacuanhæ et Opii, *U. S.;* Vinum Ipecacuanhæ, *U. S.*

EXTRACTUM IRIDIS. *U. S.* *Extract of Iris.*

(ẸX-TRĂC'TỤM ĬR'Ị-DĬS.)

Extrait d'Iris varié, *Fr.;* Verschiedenfarbige Schwertlilie-Extrakt, *G.*

"Iris in No. 60 powder, *one hundred parts* [or sixteen ounces av.]; Alcohol, *two hundred and twenty-five parts* [or two and a half pints]; Water, *seventy-five parts* [or twelve fluidounces]; Diluted Alcohol, *a sufficient quantity.* Mix the Alcohol and Water, and, having moistened the powder with *forty parts* [or six and a half fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then, Diluted Alcohol, until *three hundred parts* [or three pints] of tincture are obtained, or the Iris is exhausted. By means of a water-bath, distil off the Alcohol from the tincture, and, having placed the residue in a porcelain capsule, evaporate it, on a water-bath, to a pilular consistence." *U. S.*

This is a new officinal extract, which has been introduced to afford an opportunity of using blue flag in the pilular form. The drug appears to us to be too seldom used to merit this distinction. The dose is one to two grains (0·065 to 0·13 Gm.).

EXTRACTUM IRIDIS FLUIDUM. *U. S.* *Fluid Extract of Iris.*

(ẸX-TRĂC'TỤM ĬR'Ị-DĬS FLÛ'Ị-DŬM.)

Fluid Extract of Blue Flag; Extrait liquide d'Iris varié, *Fr.;* Flüssiges Verschiedenfarbige Schwertlilie-Extrakt, *G.*

"Iris, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix *three parts* [or three pints and six fluidounces] of Alcohol with *one part* [or one pint] of Water, and, having moistened the powder with *forty grammes* [or twenty-three fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum until the Iris is exhausted. Reserve the first *ninety cubic centimeters* [or forty fluidounces] of the percolate, and evaporate the remainder, on a water-bath, to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is a new officinal fluid extract. The menstruum used is practically the same as that employed in exhausting blue flag in making the extract, and it will no doubt make a representative fluid extract. The dose is five to ten minims (0·3 to 0·6 C.c.).

EXTRACTUM JALAPÆ. *Br.* *Extract of Jalap.*

(ẸX-TRĂC'TỤM JẠ-LĀ'PÆ.)

Extrait de Jalap, *Fr.;* Jalapen-Extrakt, *G.*

"Take of Jalap, in coarse powder, *one pound* [avoirdupois]; Rectified Spirit *four pints* [Imperial measure]; Distilled Water *one gallon* [Imp. meas.]. Macerate the Jalap in the Spirit for seven days; press out the tincture, then filter, and distil off the Spirit, leaving a soft extract. Again macerate the residual Jalap in the Water for four hours, express, strain through flannel, and evaporate, by a water-bath, to a soft extract. Mix the two extracts, and evaporate, at a temperature not exceeding 140°, until it has acquired a suitable consistence for forming pills." *Br.*

This extract has been replaced in the present U. S. Pharmacopœia by the abstract.

Jalap contains a considerable quantity of starch, which is extracted by decoction, but left behind by cold water; and, as this principle serves only to impede the filtration or straining, and augment the bulk of the extract, without adding to its virtues, cold water is very properly used in the process. The use both of alcohol and of water was deemed necessary, in order to extract all the medicinal qualities of the drug; and they are employed successively, under the impression that the previous removal of the resin by the former facilitates the action of the latter; but Mr. A. B. Taylor satisfactorily determined that the substance which water will extract from jalap, previously exhausted by alcohol, has no observable influence on the system; having taken 240 grains of the matter thus extracted without effect. (*Proc. A. P. A.*, 1864, p. 215.) And it was shown, moreover, that the aqueous extract of jalap is hygroscopic, and that it is the cause of the inconvenient hardening of the powdered extract. The substitution of dried sugar of milk for the inert, hygroscopic, aqueous extract is certainly an improvement. (See *Abstractum Jalapæ.*) The use of percolation, as directed by the U. S. Pharmacopœia of 1870, enabled the cold water to extract the soluble parts without the long maceration which would otherwise have been necessary. According to Cadet de Gassicourt, water at ordinary temperatures, and in the old mode, acts so slowly that fermentation takes place before the active matter is all dissolved. Hence, if the extract be prepared without percolation, the residuum, after the tincture has been decanted, should be digested with water at a heat of about 90° or 100° F., which, while it is insufficient for the solution of the starch, enables the solvent to take up the active matter with sufficient rapidity.

One cwt. of jalap affords, according to Mr. Brande, about fifty pounds of aqueous extract and fifteen of resin. The product of the former is somewhat less by infusion than by decoction; and the extract is proportionately stronger.

There is reason to believe, as we have been informed on good authority, that what is sold for extract of jalap is sometimes prepared from tubers which have been previously exhausted of their resin by alcohol; and a spurious substance has been offered in considerable quantities in our markets for extract of jalap, which Messrs. Chas. Bullock and Prof. Parrish proved to owe its purgative property to 42 per cent. of gamboge. (*A. J. P.*, 1862, p. 113.)

Extract of jalap is of a dark brown color, slightly translucent at the edges, and tenacious when not perfectly dry. It contains the resin and gummy extractive, and, consequently, has all the medical properties of the root; but it is not often exhibited alone, being chiefly used as an ingredient of purgative pills, for which it is adapted by its comparatively small bulk. It is most conveniently kept for use in the form of powder, which, however, is apt to attract moisture and to aggregate into a solid mass, unless carefully excluded from the air. The dose is from ten to twenty grains (0·65–1·3 Gm.), or rather more than half that of jalap.*

EXTRACTUM JUGLANDIS. *U. S.* *Extract of Juglans.*

(ẸX-TRĂC′TỤM JỤG-LĂN′DỊS.)

Extrait d'Écorce de Noyer gris, *Fr.*; Butternussrinden-Extrakt, *G.*

"Juglans, in No. 30 powder, *one hundred parts* [or sixteen ounces av.]; Glycerin, Alcohol, each, *a sufficient quantity.* Moisten the powder with *forty parts* [or six fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until *three hundred parts* [or three pints] of tincture are obtained, or the Juglans is exhausted. By means of a water-bath, distil off the Alcohol from the tincture, and, having placed the residue in a porcelain capsule, evaporate it, on a water-bath, to a pilular consistence. Lastly, weigh the Extract and thoroughly incorporate with it, while still warm, *five per cent.* of Glycerin." *U. S.*

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* *Fluid Extract of Jalap.* The following process has been proposed by Prof. Procter. Take of jalap, in coarse powder, ℥xvi; sugar, ℥viij; carbonate of potassium, ℥ss; alcohol, water, each, *q. s.* Add to the jalap one pint of a mixture consisting of two parts of alcohol and one of water, and set aside for twenty-four hours. Then put the mixture into a percolator, and pour on it diluted alcohol until half a gallon has passed. Evaporate the filtered liquid one-half, add the sugar and carbonate of potassium, and evaporate to 12 fluidounces. Put the liquid, while warm, into a pint bottle, add four fluidounces of alcohol, and mix. The carbonate of potassium renders the resin soluble in water, and probably favorably qualifies the irritating properties of the jalap. A fluidrachm of this extract would represent a drachm of jalap, so that the dose should be from 15 to 30 minims (0·9 to 1·9 C.c.). (*A. J. P.*, xxix. 108.)

This extract was formerly for the most part prepared by the country people, who are said to have used the bark of the branches, and even the branches themselves, instead of the inner bark of the root; and to have injured the preparation by too much heat. That it should have proved uncertain in the hands of many physicians is, therefore, not a matter of surprise. It should be prepared by the apothecary, and from the inner bark of the root gathered in May or June. Experiments made by B. F. Moise (*A. J. P.*, 1881, p. 153) prove that alcohol and diluted alcohol are better menstrua than water for the bark. Prof. Procter found an extract of the fresh bark prepared with diluted alcohol to have much more of the pungency of the bark than the officinal; on account of these results, the process for the extract was changed at the last revision, and alcohol substituted for water as a menstruum.

The extract of butternut is of a black color, sweetish odor, and bitter astringent taste. In the dose of five or ten grains (0·33–0·65 Gm.), it acts as a mild cathartic.

EXTRACTUM KRAMERIÆ. *U. S., Br.* *Extract of Krameria. Extract of Rhatany.*

(ẸX-TRĂC'TỤM KRẠ-MĒ'RỊ-Æ.)

Extractum Ratanhæ, *P.G.;* Extrait de Ratanhia, *Fr.;* Ratanha-Extrakt, *G.*

"Krameria, in No. 40 powder, *one hundred parts* [or sixteen ounces av.]; Water, *a sufficient quantity.* Moisten the powder with *thirty parts* [or four and a half fluidounces] of Water, pack it in a conical glass percolator, and gradually pour Water upon it, until the infusion passes but slightly imbued with the astringency of the Krameria. Heat the liquid to the boiling point, strain, and, by means of a water-bath, at a temperature not exceeding 70° C. (158° F.), evaporate to dryness." *U. S.*

"Take of Rhatany Root, in coarse powder, *one pound* [avoirdupois]; Distilled water *a sufficiency.* Macerate the Rhatany in a pint and a half [Imperial measure] of the Water for twenty-four hours; then pack in a percolator, and add more Distilled Water, until twelve pints [Imp. meas.] have been collected, or the Rhatany is exhausted. Evaporate the liquor by a water-bath to dryness." *Br.*

In selecting a plan for the preparation of this extract, it was undoubtedly wise to adopt the mode of displacement, with cold water as the menstruum. It is absolutely necessary to the success of the process, that the root should be well and uniformly comminuted; and the "No. 30 powder" of the U. S. Pharmacopœia is, therefore, preferable to the "coarse powder" of the British. The wood of the root yielded to Prof. Procter only 6·8 per cent. of extract, while the bark separated from the wood yielded 33 per cent. As the wood is of difficult pulverization, the inference is obvious, that, in powdering the roots, the ligneous portion may be rejected with advantage. (*A. J. P.*, xiv. 270.) As a prolonged exposure of the infusion to the air is attended with the absorption of oxygen, and the production of insoluble apotheme, it is desirable that the evaporation should be conducted rapidly, or in a vacuum. There scarcely appears to be occasion, in the case of rhatany, for heating and filtering the infusion before evaporation, the only use of which is to get rid of albumen, which is not among the recognized ingredients of the root.

Very inferior extracts of rhatany are often sold. Such is the South American extract, which has been occasionally imported. As the product obtained by decoction is greater than that afforded by the officinal plan, the temptation to substitute the former is not always resisted, although it has been shown to contain nearly 50 per cent. of insoluble matter. Some druggists prepare the extract with an alcoholic menstruum, with a view to the greater product; but the extract thus prepared has from 20 to 30 per cent. less of the active principle than the officinal. A substance has been shown to us, said to have been imported as extract of rhatany from Europe, which was nearly tasteless, and was plausibly conjectured to be the dried coagulated matter of old tincture of kino. Indeed, we are informed that very little of the genuine extract, prepared according to the officinal directions, is to be found in the drug stores.

Extract of rhatany should have a reddish brown color, a smooth shining fracture, and a very astringent taste, and should be almost entirely soluble in water. Its virtues may be considered as in proportion to its solubility. It is much used for all the purposes for which the astringent extracts are employed. The dose is from ten to twenty grains (0·65–1·3 Gm.).

Off. Prep. Trochisci Krameriæ.

EXTRACTUM KRAMERIÆ FLUIDUM. *U.S.* *Fluid Extract of Krameria.*

(ẸX-TRĂC'TỤM KRẠ-MĒ'RỊ-Æ FLŪ'Ị-DŬM.)

Extrait liquide de Ratanhia, *Fr.;* Flüssiges Ratanha-Extrakt, *G.*

"Krameria, in No. 30 powder, *one hundred grammes* [or fifty ounces av.]; Glycerin, *twenty grammes* [or seven and a half fluidounces]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix the Glycerin with *eighty grammes* [or forty-one fluidounces] of Diluted Alcohol, and, having moistened the powder with *forty grammes* [or twenty fluidounces] of the mixture, pack it firmly in a cylindrical glass percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterward, Diluted Alcohol, until the Krameria is exhausted. Reserve the first *seventy cubic centimeters* [or thirty-three fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U.S.*

This process does not differ essentially from that formerly officinal; the fluid extract well represents the root, and is of a deep red color and very astringent taste. The dose is from ten minims to a fluidrachm (0·6–3·75 C.c.).

Off. Prep. Syrupus Krameriæ.

EXTRACTUM LACTUCÆ. *Br.* *Extract of Lettuce.*

(ẸX-TRĂC'TỤM LĂC-TŪ'ÇÆ.)

Extractum Lactucæ Virosæ, *P.G.;* Thridacium; Extrait de Tiges de Laitue, Thridace, *Fr.;* Giftlattich-Extrakt, *G.*

In the British Pharmacopœia, this extract is prepared from "the Flowering Herb of Lettuce," in the same manner precisely as Extract of Aconite. (See *Extractum Aconiti.*) For the medical properties and uses of extract of lettuce the reader is referred to the article on Lactucarium. The dose is from five to fifteen grains (0·33–1 Gm.).

EXTRACTUM LACTUCARII FLUIDUM. *U.S.* *Fluid Extract of Lactucarium.*

(ẸX-TRĂC'TỤM LĂC-TU̇-CĀ'RỊ-Ī FLŪ'Ị-DŬM.)

Extrait liquide de Tiges de Laitue (Thridace), *Fr.;* Flüssiges Giftlattich-Extrakt, *G.*

"Lactucarium, in coarse pieces, *one hundred grammes* [or twelve and a half ounces av.]; Ether, *one hundred grammes* [or one pint]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or twelve fluidounces]. Add the Lactucarium to the Ether contained in a tared flask having the capacity of *six hundred cubic centimeters* [or about four and a half pints], and let it macerate for twenty-four hours; then add *three hundred grammes* [or two and a quarter pints] of Water, and shake the mixture well. Fit a bent glass tube into the neck of the flask, and, having immersed the flask in hot water, recover the Ether by distillation. When all the Ether has distilled over, remove the tube, and, after thoroughly shaking the contents of the flask, continue the heat for half an hour. Let the mixture cool, add *one hundred grammes* [or fourteen and a half fluidounces] of Alcohol, and enough Water to make the whole mixture weigh *five hundred grammes* [or sixty-four ounces av.]; after maceration for twenty-four hours, with occasional agitation, express and filter the liquid. Return the dregs to the flask and macerate them with *two hundred grammes* [or twenty-eight fluidounces] of a mixture of Alcohol and Water made in the proportion of *one part* [or eight fluidounces] of Alcohol to *three parts* [or twenty fluidounces] of Water; repeat the maceration two or three times successively with fresh portions of the mixture, until the dregs are tasteless, or nearly so. Mix, and filter the liquids thus obtained, and concentrate them, by means of a water-bath (the first expressed liquid by itself), until the combined weight of the liquids is *sixty grammes* [or seven and a half ounces av.]; mix the liquids, add *forty grammes* [or six fluidounces] of Alcohol, and let the mixture cool in the evaporating vessel, stirring the mixture frequently, and during the intervals keeping the vessel well covered. When cool, add enough Alcohol to make the mixture weigh *one hundred grammes* [or twelve and a half ounces av.], transfer the liquid to a flask, and add enough Water to make the mixture measure *one hundred cubic centimeters* [or twelve fluidounces], using the Water so required to rinse the evaporating vessel. Shake the mixture occasionally, during several hours (and frequently, if a portion of the precipitate is found to be tenacious), and, when a uniform mixture results, set it aside for twenty-four hours, so that any precipitate formed may subside. Decant the clear liquid, transfer the precipitate to a filter, and, after thoroughly draining it into the decanted liquid, wash it with a mixture of Alcohol and Water made in the proportion of *three parts* [or ten fluiddrachms] of Alcohol to *four parts* [or eleven fluidrachms] of Water, until the washings pass tasteless. Concentrate the washings, by evaporation, to a syrupy consistence, mix with the decanted liquid, and add enough of the last-named mixture of Alcohol and Water to make the whole measure *one hundred cubic centimeters* [or twelve fluidounces]. Lastly, after twenty-four hours, having meanwhile shaken the Fluid Extract occasionally, filter it through paper." *U. S.*

This is a new officinal fluid extract, the process being that recommended by Prof. C. Lewis Diehl. Lactucarium is one of the most difficult substances to operate upon with the view of obtaining and retaining in a soluble form all of the active principles. In this process the object of the preliminary treatment with ether and water is to secure the fine division of the particles by dissolving the lactucerin and resin and to keep them from coalescing, through the presence of water. This pasty mass is subsequently treated with alcohol and water by repeated maceration with expression and decantation; taking care to wash the precipitate with alcohol and water in order thoroughly to retain all the soluble active ingredients; the washings are subsequently concentrated by evaporation, mixed with the decanted liquid, and brought up to the standard strength. Jos. L. Lemberger recommends the previous extraction of the lactucerin from the lactucarium by treatment with benzin; he then mixes the dried lactucarium with an equal bulk of clean sand, introduces it into a percolator, macerates, and afterward percolates with diluted alcohol, reserving the first fourth of the percolate, and continuing the percolation to exhaustion, and evaporating the weak percolate to three-fourths, as is usual in making fluid extracts. The object of these processes is to secure a fluid extract which will form with syrup a clear liquid and at the same time retain its efficiency. The dose would be five to thirty minims (0·3–1·9 C.c.).

Off. Prep. Syrupus Lactucarii, *U.S.*

EXTRACTUM LEPTANDRÆ. *U. S.* *Extract of Leptandra.*

(ẸX-TRĂC′TỤM LẸP-TĂN′DRÆ.)

Extract of Culver's Root; Extrait de Leptandra, *Fr.;* Leptandra-wurzel-Extrakt, *G.*

"Leptandra, in No. 40 powder, *one hundred parts* [or sixteen ounces av.]; Alcohol, *two hundred parts* [or two and a quarter pints]; Water, *one hundred parts* [or one pint]; Glycerin, Diluted Alcohol, each, *a sufficient quantity.* Mix the Alcohol and Water, and, having moistened the powder with *forty parts* [or six fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then, Diluted Alcohol, until *three hundred parts* [or three pints] of tincture are obtained or the Leptandra is exhausted. By means of a water-bath, distil off the Alcohol from the tincture, and, having placed the residue in a porcelain capsule, evaporate it, on a water-bath, to a pilular consistence. Lastly, weigh the Extract, and thoroughly incorporate with it, while still warm, *five per cent.* of Glycerin." *U. S.*

This is a new officinal extract, which will furnish those practitioners who have been in the habit of prescribing the so-called *leptandrin*, with a preparation of uniform character. The dose is twenty to thirty minims (1·26–1·9 C.c.).

EXTRACTUM LEPTANDRÆ FLUIDUM. *U. S.* *Fluid Extract of Leptandra.*

(ẸX-TRĂC'TỤM LẸP-TĂN'DRÆ FLÛ'Ị-DŬM.)

Fluid Extract of Culver's Root; Extrait liquide de Leptandra, *Fr.;* Flüssiges Leptandra-Extrakt, *G.*

"Leptandra, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Glycerin, *fifteen grammes* [or five and a half fluidounces]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix the Glycerin with *eighty-five grammes* [or forty-four fluidounces] of Diluted Alcohol, and, having moistened the powder with *forty grammes* [or twenty-three fluidounces] of the mixture, pack moderately in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding first the remainder of the menstruum and afterward Diluted Alcohol, until the Leptandra is exhausted. Reserve the first *eighty cubic centimeters* [or thirty-eight fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is a new officinal fluid extract, which has been considerably used in the West. It thoroughly represents the root, is of a deep reddish brown color, and is given in the dose of twenty minims to a fluidrachm (1·25–3·75 C.c.).

EXTRACTUM LOBELIÆ FLUIDUM. *U. S.* *Fluid Extract of Lobelia.*

(ẸX-TRĂC'TỤM LỌ-BĒ'LỊ-Æ FLÛ'Ị-DŬM.)

Extrait liquide de Lobélie enflée, *Fr.;* Flüssiges Lobelienkraut-Extrakt, *G.*

"Lobelia, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *thirty-five grammes* [or eighteen fluidounces] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Lobelia is exhausted. Reserve the first *eighty-five cubic centimeters* [or forty fluidounces] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is another new fluid extract. It is of a dark olive color, having the acrid taste of lobelia very marked. The dose as an expectorant is from one to five minims (0·06–0·3 C.c.); as an emetic, from ten to twenty minims (0·6–1·25 C.c.).

EXTRACTUM LUPULI. *Br.* *Extract of Hop.*

(ẸX-TRĂC′TỤM LÛ′PU̇-LĪ.)

Extractum Humuli; Extrait de Houblon, *Fr.;* Hopfenextrakt, *G.*

"Take of Hop *one pound* [avoirdupois]; Rectified Spirit *one pint and a half* [Imperial measure]; Distilled Water *one gallon* [Imp. meas.]. Macerate the Hop in the Spirit for seven days; press out the tincture, filter, and distil off the spirit, leaving a soft extract. Boil the residual Hop with the Water for one hour, press out the liquor, strain, and evaporate by a water-bath to the consistence of a soft extract. Mix the two extracts, and evaporate at a temperature not exceeding 140° until it has acquired a suitable consistence for forming pills." *Br.*

This is a great improvement on the old Lond. and Ed. process by maceration with water and evaporation. Alcohol is necessary for the exhaustion of the hop, and very cautious evaporation, to preserve the aroma in the extract. But since the discovery of the fact that the active properties of hops reside chiefly in the lupulin, the extract has been to a great extent superseded by that substance in this country, and has been little used. Lupulin may be advantageously substituted for it in all cases in which it was formerly employed. Mr. Brande says that the average yield of one cwt. of hops is 40 lbs. of the extract. The dose is from ten to thirty grains (0·6–1·9 Gm.).

Under the inappropriate name of *humuline*, an extract has been prepared by first treating hops with alcohol and subsequently with water, evaporating the tincture and infusion separately, and mixing the products. (*P. J. Tr.*, xiii. 231.)

EXTRACTUM LUPULINÆ FLUIDUM. *U. S.* *Fluid Extract of Lupulin.*

(ẸX-TRĂC′TỤM LÛ-PU̇-LĪ′NÆ FLÛ′Ị-DŬM.)

Extrait liquide de Lupuline, *Fr.;* Flüssiges Lupulin-Extrakt, *G.*

"Lupulin, *one hundred grammes* [or fifty ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the Lupulin with *twenty grammes* [or twelve fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the Lupulin and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Lupulin is exhausted. Reserve the first *seventy cubic centimeters* [or thirty-three fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This fluid extract is identical with that formerly officinal. It is of a very dark brown color, having the odor and taste of hops very distinctly. Owing to its resinous character, it is not miscible with aqueous liquids, and if desired in combination, it is necessary to use gum arabic or other emulsifying agent. The dose is ten or fifteen minims (0·6–0·9 C.c.).

EXTRACTUM MALTI. *U.S.* *Extract of Malt.*

(ẸX-TRĂC′TỤM MÂL′TĪ.)

Extrait de Malt d'Orge, *Fr.;* Gerstenmalz-Extrakt, *G.*

"Malt, in coarse powder, not finer than No. 12, *one hundred parts* [or eighty ounces av.]; Water, *a sufficient quantity*. Upon the powder, contained in a suitable vessel, pour *one hundred parts* [or five pints] of Water, and macerate for six hours. Then add *four hundred parts* [or twenty pints] of Water, heated to about 30° C. (86° F.), and digest for an hour at a temperature not exceeding 55° C. (131° F.). Strain the mixture with strong expression. Finally, by means of a water-bath, or vacuum apparatus, at a temperature not exceeding 55° C. (131° F.), evaporate the strained liquid rapidly to the consistence of thick honey.

"Keep the product in well-closed vessels, in a cool place." *U. S.*

Under the name of extract of malt, two distinct preparations have been put upon the market; the one being a very strong beer, the other an extract prepared from malt, and chiefly composed of dextrin and glucose, with some albumen and phosphates. The object of this officinal process is to obtain all of the soluble principles of malt in a permanent form. To secure this, strict attention to the details of the process is necessary. The changes effected in the starch granules of barley by the process of malting are described under *Hordeum* and *Maltum*. Good extract of malt should contain no starch, have the consistence of thick honey, a brown color, and should be free from empyreumatic taste. A great deal of commercial extract of malt is adulterated with glucose to a surprising extent.

The officinal process does not differ materially from that of M. L. W. Jassoy (*Journ. de Pharm.*, 4e sér., xvi. 440), who recommends the following method. Macerate malt for three hours in its weight of cold water, then add four times its weight of water, and carefully raise the temperature to 65° C. during one hour. Filter, boil the residue with three parts of water for a quarter of an hour, remove from the fire, and allow to cool to 75° C., filter, and express the residue. Mix the liquids, maintain for some time at a temperature of 50° C., until the starch is converted into sugar. Reduce to one-third the volume by gentle boiling, allow to stand overnight, filter through a woollen strainer, and evaporate upon a water-bath to the consistence of an extract. A *dry extract of malt* is coming into extensive use as an infants' food, made by artificially drying the thick syrupy extract. It is in the form of straw-colored, coarse powder, and is given dissolved in milk or water. O. F. Romer and H. R. Randoll, of Brooklyn, have patented several improvements in the process of making extract of malt, namely: 1, the properly ground malt is treated with an alkaline solution, in order to neutralize the fatty acids which usually impart a bad taste to the product; 2, the extract is separated from the solid matters by pressing in press-cloths, whereby it is obtained as a clear liquid with scarcely any loss. (*N. R.*, 1880, p. 179.) Pharmaceutically, extract of malt has been used as an emulsifying agent; it makes a good basis for a cod-liver oil emulsion, for which purpose it is admirably adapted therapeutically. The dose is one to four drachms.

EXTRACTUM MATICO FLUIDUM. *U.S. Fluid Extract of Matico.*

(ẸX-TRĂC'TỤM MẠ-TÎ'CŌ FLǕ'Ị-DŬM—mạ-tē'kō.)

Extrait liquide de Matico, *Fr.*; Flüssiges Matico-Extrakt, *G.*

"Matico, in No. 40 powder, *one hundred grammes* [or fifty ounces av.]; Glycerin, *ten grammes* [or three and three-quarter fluidounces]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix the Glycerin with *seventy-five grammes* [or forty-four fluidounces] of Alcohol and *twenty-five grammes* [or twelve fluidounces] of Water, and, having moistened the powder with *thirty grammes* [or fifteen fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterward, a mixture of Alcohol and Water, made in the proportion of *three parts* [or three and a half pints] of Alcohol to *one part* [or one pint] of Water, until the Matico is exhausted. Reserve the first *eighty-five cubic centimeters* [or forty fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough of a mixture of Alcohol and Water, using the same proportions as before, to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is probably the best liquid preparation of matico; the present formula does not differ materially from that of 1870. It is a greenish black liquid, which probably contains all of the virtues of matico, and affords an excellent form for internal administration. The dose is from a half to one fluidrachm (1·9–3·75 C.c.).

EXTRACTUM MEZEREI. *U. S.* *Extract of Mezereum.*

(ẸX-TRĂC′TỤM MẸ-ZĒ′RẸ-Ī.)

Extrait alcoolique de Mézéréon, *Fr.;* Spirituöses Seidelbast-Extrakt, *G.*

"Mezereum, in No. 30 powder, *one hundred parts* [or sixteen ounces av.]; Alcohol, *a sufficient quantity.* Moisten the powder with *forty parts* [or six fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until *three hundred parts* [or three pints] of tincture are obtained, or the Mezereum is exhausted. Reserve the first *ninety parts* [or thirteen fluidounces] of the percolate; evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to *ten parts* [or two fluidounces]; mix this with the reserved portion, and evaporate at or below the before-mentioned temperature in a porcelain capsule, on a water-bath, to a pilular consistence." *U. S.*

This is a good preparation, yet differing from the ethereal extract of the British Pharmacopœia in not being quite so powerful. It is used as an irritant. (See next article.)

Off. Prep. Linimentum Sinapis Compositum, *U. S.*

EXTRACTUM MEZEREI ÆTHEREUM. *Br.* *Ethereal Extract of Mezereon.*

(ẸX-TRĂC′TỤM MẸ-ZĒ′RẸ Ī Æ-THĒ′RẸ-ŬM—ē-thē′rẹ-ŭm.)

Extrait éthéré de Mézéréon (de Garou), *Fr.;* Ætherisches Seidelbast-Extrakt, *G.*

"Take of Mezereon Bark, cut small, *one pound* [avoirdupois]; Rectified Spirit *eight pints* [Imperial measure]; Ether *one pint* [Imp. meas.]. Macerate the Mezereon in six pints of the Spirit for three days, with frequent agitation; strain and press. To the residue of the Mezereon add the remainder of the Spirit, and again macerate for three days, with frequent agitation; strain and press. Mix and filter the strained liquors; recover the greater part of the Spirit by distillation, evaporate what remains to the consistence of a soft extract; put this into a stopped bottle with the Ether, and macerate for twenty-four hours, shaking them frequently. Decant the ethereal solution; recover part of the Ether by distillation, and evaporate what remains to the consistence of a soft extract." *Br.*

This is the process of the present French Codex, with slight modifications, which do not affect the result. In the Codex the mezereon is exhausted by means of percolation, instead of by a double maceration; and in this respect the process is, we think, preferable, in the hands of a skilful operator. With those not experienced in percolation, it may be better to follow the British Pharmacopœia.

By the method of proceeding in the preparation of this extract the irritating properties of mezereon are concentrated in a small bulk; all the ingredients of the bark not soluble both in alcohol and in ether being excluded. For external use this is probably desirable; and the extract is therefore chiefly useful as an external irritant; for which purpose it is brought into the state of an ointment, as in the French "*pommade épispastique au garou,*" or used in liniments, as in the British "*compound liniment of mustard.*" The French "pommade," which might properly be designated as *Unguentum Mezerei*, or *Ointment of Mezereon*, is prepared in the following manner.

"Take of Ethereal Extract of Mezereon *forty parts;* Lard *nine hundred parts;* White Wax *one hundred parts;* Alcohol *ninety parts.* Dissolve the Extract in the Alcohol, add the Lard and Wax, and heat moderately, with continual agitation, until the alcohol is evaporated. Pass through linen; pour into a pot, and shake until the ointment is partly cooled." (*Fr. Codex.*)

The object of this preparation is to act as an irritant agent, and especially as a dressing for issues and blistered surfaces to keep them open. For this purpose it is preferable to the ointment of cantharides, in all cases in which the latter is disposed to cause strangury.

Off. Prep. Linimentum Sinapis Compositum, *Br.*

EXTRACTUM MEZEREI FLUIDUM. *U. S.* *Fluid Extract of Mezereum.*

(ẸX-TRĂC′TỤM MẸ-ZĒ′RẸ-Ī FLÛ′Ị-DŬM.)

Extrait liquide de Mézéréon (de Garou) *Fr.;* Flüssiges Seidelbast-Extrakt, *G.*

"Mezereum, in No. 30 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, *a sufficient quantity,* To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *forty grammes* [or twenty-three fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Mezereum is exhausted. Reserve the first *ninety cubic centimeters* [or forty-three fluidounces] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This fluid extract is identical with that formerly officinal. It is too acrid for internal administration; its principal use is as the active ingredient in the stimulating ointment of mezereon.

Off. Prep. Unguentum Mezerei, *U. S.*

EXTRACTUM NUCIS VOMICÆ. *U. S., Br.* *Extract of Nux Vomica.*

(ẸX-TRĂC′TỤM NŪ′CĬS VŎM′Ị-ÇÆ—vŏm′ẹ-sē.)

Extractum Strychni Spirituosum, *P. G.;* Extractum Nucum Vomicarum Spirituosum (vel Alcoholicum); Extrait de Noix vomique, *Fr.;* Weingeistiges Krähenaugen-Extrakt, *G.*

"Nux Vomica, in No. 60 powder, *one hundred parts* [or sixteen ounces av.]; Alcohol, Water, each, *a sufficient quantity.* Mix Alcohol and Water in the proportion of *eight parts* [or four and a half pints] of Alcohol and *one part* [or half a pint] of Water, and, having moistened the powder with *one hundred parts* [or fifteen fluidounces] of the mixture, let it macerate in a closed vessel, in a warm place, for forty-eight hours. Then pack it in a cylindrical percolator, and gradually pour menstruum upon it, until the tincture passes but slightly imbued with bitterness. By means of a water-bath, distil off the Alcohol from the tincture, and, having placed the residue in a porcelain capsule, evaporate it, on a water-bath, to a pilular consistence." *U. S.*

"Take of Nux Vomica *one pound* [avoirdupois]; Rectified Spirit *a sufficiency.* Apply steam to the Nux Vomica until it is thoroughly softened, then dry rapidly, and reduce to fine powder. Exhaust the powder by boiling it with successive portions of the Spirit until the latter comes off nearly free from bitterness. Strain, distil off the Spirit, and evaporate by a water-bath to the consistence of a soft extract." *Br.*

In both the U. S. and Br. Pharmacopœias the nux vomica is directed in fine powder; but in the latter only are we told how to reduce it to that state. Another method, formerly employed by the Ed. College, was to grind it in a coffee-mill. The method of percolation in the U. S. process is preferable to that of decoction in the British, for exhausting the drug. This is one of the few instances in which the U. S. Pharmacopœia deems a preliminary maceration advisable. When the extract is kept in powder, it is apt to agglutinate into a tough mass. According to Zippel, this may be prevented by adding a little water before the close of the evaporation, and then continuing the evaporation to dryness. (*Arch. der Pharm.*, July 24, 1859.)

The fixed oil which is found in this extract in the proportion of from 2 to 3 per cent. should be separated, shaken with a little alcohol to dissolve out the alkaloids taken up by the oil, and the solution evaporated and added to the extract. The abstract is to be preferred to this extract, which is an active preparation, though not always of uniform strength, owing to the variable proportion of strychnia in the nux vomica. M. Recluz obtained from sixteen ounces of nux vomica the average product of one ounce and a quarter. The dose of the extract is from half a grain to two grains (0·03–0·13 Gm.), to be repeated three times a day.

EXTRACTUM NUCIS VOMICÆ FLUIDUM. *U. S.* *Fluid Extract of Nux Vomica.*

(ẸX-TRĂC′TỤM NŪ′CĬS VŎM′Ị-ÇÆ FLŪ′Ị-DŬM.)

Extrait liquide de Noix Vomique, *Fr.;* Flüssiges Krähenangen-Extrakt, *G.*

"Nux Vomica, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix *eight parts* [or nine pints] of Alcohol with *one part* [or one pint] of Water, and, having moistened the powder with *one hundred cubic centimeters* [or three pints] of the mixture, let it macerate in a closed vessel, in a warm place, for forty-eight hours. Then pack it firmly in a cylindrical percolator, and gradually pour menstruum upon it, until the tincture passes but slightly imbued with bitterness. Reserve the first *ninety cubic centimeters* [or forty-three fluidounces] of the percolate. By means of a water-bath, distil off the Alcohol from the remainder, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is a new officinal fluid extract; its usefulness is not very apparent. The drug is a difficult one to exhaust at best; the dose of the best known liquid preparation, the tincture, is small enough, and, in our opinion, there was no necessity for introducing a fluid extract which will, in the majority of cases, not thoroughly represent the drug. The dose is three to five minims (0·18 to 0·3 C.c.).

EXTRACTUM OPII. *U. S., Br.* *Extract of Opium.*

(ẸX-TRĂC′TỤM Ō′PỊ-Ī.)

Extrait d'Opinm, Extrait thébaïque, *Fr.;* Opiumextrakt, *G.*

"Opium, *one hundred parts* [or sixteen ounces av.]; Water, *seven hundred ana fifty parts* [or seven and a half pints]; Glycerin, *a sufficient quantity.* Cut the Opium into small pieces, let it macerate for twenty-four hours in *one hundred and fifty parts* [or one and a half pints] of the Water, and reduce it to a soft mass by trituration. Express the liquid from it, and treat the residue again in the same manner with *one hundred and fifty parts* [or one and a half pints] of the Water. Repeat the maceration and expression three times more, using a fresh portion of the Water each time. Having mixed the liquids, filter the mixture, and evaporate, by means of a water-bath, to a pilular consistence. Lastly, weigh the Extract and thoroughly incorporate with it, while still warm, *five per cent.* of Glycerin." *U. S.*

"Take of Opium, in thin slices, *one pound* [avoirdupois]; Distilled Water *six pints* [Imperial measure]. Macerate the Opium in two pints of the water for twenty-four hours, and express the liquor. Reduce the residue of the Opium to a uniform pulp, macerate it again in two pints of the Water for twenty-four hours, and express. Repeat the operation a third time. Mix the liquors, strain through flannel, and evaporate by a water-bath until the extract has acquired a suitable consistence for forming pills." *Br.*

The U. S. and Br. processes are essentially the same.

As purely aqueous preparations of opium have been found to agree better with certain individuals than opium alone or its alcoholic preparations, there is reason to believe that there are in the crude drug one or more principles, capable of causing nausea, headache, nervous disturbance, etc., which are insoluble in water, though extracted by alcohol or ether. (See *Opium Denarcotisatum.*) The aqueous extract of opium formerly officinal became hard and friable on keeping, and the addition of glycerin is now made to cause it to retain its pilular consistence. Some pharmacists prefer to evaporate the extract to dryness, and keep it in a powdered condition. If carefully evaporated by water-bath there can be no objection to this. M. Guibourt states that this extract, when kept, is apt to swell up, owing, as he at first supposed, to the fermentation of glucose; but he now ascribes the phenomenon to the change of meconic acid into the parameconic, with the escape of carbonic acid. (*Journ. de Pharm.*, Août, 1860, p. 138.)

Recluz obtained from sixteen ounces of opium an average product of nine ounces by hot water and six by cold; and the U. S. formula usually yields about seven and a half ounces from the same quantity. The dose of the extract of opium is half a grain to one grain (0·031–0·065 Gm.).

Off. Prep. Emplastrum Opii, *U. S.;* Extractum Opii Liquidum, *Br.;* Trochisci Opii, *Br.;* Vinum Opii, *Br.;* Trochisci Glycyrrhizæ et Opii, *U. S.*

EXTRACTUM OPII LIQUIDUM. *Br.* *Liquid Extract of Opium.*

(ẸX-TRĂC'TỤM Ō'PỊ-Ī LĬQ'UỊ-DŬM—lĭk'wẹ-dŭm.)

Extrait liquide d'Opium, *Fr.;* Flüssiges Opiumextrakt, *G.*

"Take of Extract of Opium *one ounce* [avoirdupois]; Distilled Water *sixteen fluidounces* [Imperial measure]; Rectified Spirit *four fluidounces* [Imp. meas.]. Macerate the Extract of Opium in the Water for an hour, stirring frequently; then add the Spirit, and filter. The product should measure *one pint* [Imp. meas.]." *Br.*

This is a good preparation, one which has long been needed, and in the absence of which from the Pharmacopœia empirical preparations have obtained a certain vogue. It is well known that in opium there are principles soluble in alcohol but not in water, which often produce various disagreeable effects, not experienced from the watery extract. What was wanted was a liquid preparation meeting this demand. All that was required was to make an aqueous solution of the watery extract, and to add something to preserve it. The British Pharmacopœia uses alcohol for the purpose, and in the original formula employed it in such proportion that an Imperial pint of the liquid should contain three fluidounces of the spirit, or between one-sixth and one-seventh by measure. But this amount of alcohol, according to Mr. Squire, is insufficient for its preservation, and should be doubled. In the present Pharmacopœia the spirit has been increased to four fluidounces, and the water diminished from seventeen to sixteen fluidounces; but even with this increase the spirit constitutes only one-fifth, which is considerably short of the proportion recommended by Mr. Squire. A preparation similar to the British was made some years since by Mr. Eugene Dupuy, of New York. (See *Opium.*) In the *Deodorized Tincture of Opium* of the U. S. Pharmacopœia, the advantages of the preparation have, we think, been still better secured. The dose of the liquid extract, equivalent to a grain of opium, would be about ten minims (0·6 C.c.).

EXTRACTUM PAPAVERIS. *Br.* *Extract of Poppies.*

(ẸX-TRĂC'TỤM PẠ-PĀ'VẸ-RĬS.)

Extrait de Pavot, *Fr.;* Mohnextrakt, *G.*

"Take of Poppy Capsules, dried, freed from the seeds, and coarsely powdered, *one pound* [avoirdupois]; Rectified Spirit *two ounces* [av.]; Boiling Distilled Water *a sufficiency.* Mix the Poppy Capsules with two pints [Imperial measure] of the Water, and infuse for twenty-four hours, stirring them frequently; then pack them in a percolator, and, adding more of the Water, allow the liquid slowly to pass until about a gallon [Imp. meas.] has been collected, or the Poppies are exhausted. Evaporate the liquor by a water-bath until it is reduced to a pint [Imp. meas.], and, when cold, add the Spirit. Let the mixture stand for twenty-four hours; then separate the clear liquor by filtration, and evaporate this by a water-bath, until the extract has acquired a suitable consistence for forming pills." *Br.*

The Extract of Poppy Capsules was an officinal of the Lond. and Edin. Colleges, but was abandoned in the formation of the first British Pharmacopœia. It has, however, been introduced into the last edition of that work, though with a process somewhat modified. It possesses the virtues of opium, but is inferior, and much less uniform in strength. The dose is from five to ten grains (0·33–0 65 Gm.).

EXTRACTUM PAREIRÆ. *Br.* *Extract of Pareira.*

(ẸX-TRĂC'TỤM PẠ-REI'RÆ—pạ-rā'rē.)

Extrait de Pareira Brava, *Fr.;* Pareira-Extrakt, *G.*

"Take of Pareira Root, in coarse powder, *one pound* [avoirdupois]; Boiling Distilled Water *one gallon* [Imperial measure], or *a sufficiency.* Digest the Pareira with a pint [Imp. meas.] of the Water for twenty-four hours, then pack in a percolator, and, adding more of the Water, allow the liquor slowly to pass until a gallon [Imp. meas.] has been collected, or the Pareira is exhausted. Evaporate the liquor by a water-bath until the extract has acquired a suitable consistence for forming pills." *Br.*

This was formerly directed by the London and Edinburgh Colleges, was omitted in the first British Pharmacopœia, and has been adopted again in the last edition. By the formula of the London College, it was prepared by boiling the root in water, straining while hot, and then evaporating to dryness. The British Pharmacopœia more wisely exhausts the root by percolation, and evaporates by a water-bath, thus avoiding the bad effects of long-continued heat. The dose is from ten to thirty grains (0·65–1·95 Gm.).

EXTRACTUM PAREIRÆ FLUIDUM. *U.S., Br.* *Fluid Extract of Pareira.*

(ẸX-TRĂC′TỤM PẠ-REI′RÆ FLŪ′Ị-DŬM—pạ-rā′rē.)

Extractum Pareiræ Liquidum, *Br.;* Liquid Extract of Pareira; Extrait liquide de Pareira Brava, *Fr.;* Flüssiges Pareira-Extrakt, *G.*

"Pareira, in No. 40 powder, *one hundred grammes* [or fifty ounces]; Glycerin, *twenty grammes* [or seven and a half fluidounces]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix the Glycerin with *eighty grammes* [or forty-one fluidounces] of Diluted Alcohol, and, having moistened the powder with *forty grammes* [or twenty fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterward, Diluted Alcohol, until the Pareira is exhausted. Reserve the first *eighty-five cubic centimeters* [or forty fluidounces] of the percolate. By means of a water-bath, distil off the Alcohol from the remainder, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

"Take of Pareira Root, in coarse powder, *one pound* [avoirdupois]; Boiling Distilled Water *one gallon* [Imperial measure], or *a sufficiency;* Rectified Spirit *three fluidounces.* Digest the Pareira with a pint [Imp. meas.] of the Water for twenty-four hours, then pack in a percolator, and, adding more of the Water, allow the liquor slowly to pass until a gallon [Imp. meas.] has been collected, or the Pareira is exhausted. Evaporate the liquor by a water-bath to thirteen fluidounces, and, when it is cold, add the Spirit, and filter through paper." *Br.*

The British preparation is a concentrated infusion, preserved by adding somewhat less than one-fourth of its measure of alcohol, and is said by those who have used it to have all the virtues of the root. The American fluid extract is made with diluted alcohol and glycerin, is practically identical with that of 1870, and is probably the better preparation. The dose is one or two fluidrachms (3·75–7·5 C.c.).

EXTRACTUM PHYSOSTIGMATIS. *U.S., Br.* *Extract of Physostigma.*

(ẸX-TRĂC′TỤM PHȲ-SỌ-STĬG′MẠ-TĬS.)

Extractum Fabæ Calabaricæ, *P.G.;* Extract of Calabar Bean; Extrait de Fève de Calabar, *Fr.;* Kalabarbohnen-Extrakt, *G.*

"Physostigma, in No. 40 powder, *one hundred parts* [or sixteen ounces av.]; Alcohol, *a sufficient quantity.* Moisten the powder with *forty parts* [or six fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until *three hundred parts* [or three pints] of tincture are obtained, or the Physostigma is exhausted. Reserve the first *ninety parts* [or fourteen fluidounces] of the percolate; evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to *ten parts* [or two fluidounces], mix this with the reserved portion, and evaporate at or below the before-mentioned temperature in a porcelain capsule, on a water-bath, to a pilular consistence." *U. S.*

"Take of Calabar Bean, in coarse powder, *one pound* [avoirdupois]; Rectified Spirit *four pints* [Imperial measure]. Macerate the Bean for forty-eight hours with *one pint* [Imp. meas.] of the Spirit in a close vessel, agitating occasionally, then transfer to a percolator, and, when the fluid ceases to pass, add the remainder of the Spirit so that it may slowly percolate through the powder. Subject the residue of the Bean to pressure, adding the pressed liquor to the product of the percolation; filter, distil off most of the Spirit, and evaporate what is left in the retort by a water-bath to the consistence of a soft extract." *Br.*

As alcohol is a much better solvent than water of the active principles of the bean, it is preferred in making the extract. For the uses of the extract, see *Physostigma*. The dose for internal use is from one-sixteenth to one-sixth of a grain (0·004–0·01 Gm.).

EXTRACTUM PILOCARPI FLUIDUM. *U. S.* *Fluid Extract of Pilocarpus.* [*Fluid Extract of Jaborandi.*]

(ẸX-TRĂC′TỤM PĪ-LỌ-CÄR′PĪ FLŨ′Ị-DŬM.)

"Pilocarpus, in No. 40 powder, *one hundred grammes* [or fifty ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *thirty-five grammes* [or eighteen fluidounces] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Pilocarpus is exhausted. Reserve the first *eighty-five cubic centimeters* [or forty fluidounces] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is undoubtedly the most valuable of the new officinal fluid extracts. It represents jaborandi leaves thoroughly. Of the liquid preparations, the infusion and tincture are both open to objection, the former on account of the bulkiness of the dose, and the latter from the amount of alcohol it contains. The dose of the fluid extract is fifteen minims to half a fluidrachm (0·9 to 1·9 C.c.).

EXTRACTUM PODOPHYLLI. *U. S.* *Extract of Podophyllum.*

(ẸX-TRĂC′TỤM PŎD-Ọ-PHȲL′LĪ.)

Extrait de Podophylle, *Fr.;* Fussblattwurzel-Extrakt, *G.*

"Podophyllum, in No. 60 powder, *one hundred parts* [or sixteen ounces av.]; Alcohol, Water, each, *a sufficient quantity*. Mix Alcohol and Water in the proportion of *three parts* [or three and a half pints] of Alcohol and *one part* [or one pint] of Water, and, having moistened the powder with *thirty parts* [or four and a half fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, until *five hundred parts* [or five pints] of tincture have passed. By means of a water-bath, distil off the Alcohol from the tincture, and evaporate the residue to a pilular consistence." *U. S.*

This is possessed of the purgative properties of the root, and may be given in the dose of from one to three grains (0·06–0·2 Gm.). From experiments made by Mr. John R. Lewis, it is probable that the alcoholic extract would be much more powerful as a purgative than the officinal preparation; but it does not follow that it would be more serviceable. (See *A. J. P.*, xix. 170.)

EXTRACTUM PODOPHYLLI FLUIDUM. *U.S.* *Fluid Extract of Podophyllum.*

(ẸX-TRĂC′TỤM PŎD-Ọ-PHȲL′LĪ FLŪ′Ị-DŬM.)

Extrait liquide de Podophylle, *Fr.;* Flüssiges Fussblattwurzel-Extrakt, *G.*

"Podophyllum, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix *three parts* [or three and a half pints] of Alcohol with *one part* [or one pint] of Water, and, having moistened the powder with *thirty grammes* [or one pint] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, until the Podophyllum is exhausted. Reserve the first *eighty-five cubic centimeters* [or forty fluidounces] of the percolate; by means of a water-bath, distil off the Alcohol from the remainder; dissolve the residue in the reserved portion, and add enough menstruum to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is another new officinal fluid extract. It well represents the root, but is of very little use. The dose is from five to fifteen minims (0·3 to 0·9 C.c).

EXTRACTUM PRUNI VIRGINIANÆ FLUIDUM. *U.S.* *Fluid Extract of Wild Cherry.*

(ẸX-TRĂC′TỤM PRŪ′NĪ VĬR-ǤĬN-Ị-Ā′NÆ FLŪ′Ị-DŬM.)

Extrait liquide de Cerisier de Virginie, *Fr.;* Flüssiges Wildkirschenrinden-Extrakt, *G.*

"Wild Cherry, in No. 20 powder, *one hundred grammes* [or fifty ounces av.]; Diluted Alcohol, Glycerin, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix *two parts* [or seventeen fluidounces] of Water with *one part* [or seven fluidounces] of Glycerin, and, having moistened the powder with *fifty grammes* [or twenty-four fluidounces] of the mixture, pack it loosely in a cylindrical percolator, cover the latter well, and set it aside for forty-eight hours. Then pack the damp powder firmly in the percolator, and pour on enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Wild Cherry is exhausted. Reserve the first *eighty cubic centimeters* [or thirty-eight fluidounces] of the percolate and set it aside; collect the next *one hundred and twenty cubic centimeters* [or forty-eight fluidounces] separately, and evaporate to a thin syrup. By means of a water-bath, distil off the Alcohol from the remainder of the percolate and evaporate the residue to a thin syrup. Unite the two syrupy liquids, and evaporate them, on a water-bath, to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This preparation has been practically more troublesome than any of the other fluid extracts. We had first Prof. Procter's original process, then his modified one, in which almonds were used to supply emulsin to assist in the development of hydrocyanic acid.* This was abandoned as too cumbersome in 1870, and we had the glycerin experiment. The fluid extract of 1870 deposited heavily soon after being made, and was immiscible with aqueous liquids without precipitation. These were fatal objections. The present formula is the result of much careful work on the part of the Committee, and it is believed to be an improvement over all its predecessors. It is of a very dark wine color, of a rough astringent taste, with a decided odor and taste of hydrocyanic acid. The dose is thirty minims to a fluidrachm (1·9–3·75 C.c.).

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* *Procter's Fluid Extract of Wild-cherry Bark.* "Take of Wild-cherry Bark, in fine powder, *sixteen troyounces*; Sweet Almond *two troyounces*; Sugar, in coarse powder, *twenty-four troyounces*; Alcohol, Water, each, *a sufficient quantity*. Introduce the Bark, previously mixed with four fluidounces of Alcohol, into a cylindrical percolator, press it firmly, and gradually pour Alcohol upon it until three pints of tincture have slowly passed. From this distil off two pints and a half of Alcohol, and, having mixed the residue with a pint of Water, evaporate, by means of a water-bath, to half a pint.

EXTRACTUM QUASSIÆ. *U.S., Br.* *Extract of Quassia.*

(ẸX-TRĂC′TỤM QUAS′SỊ-Æ—kwŏsh′ẹ-ē.)

Extrait de Quassie (Bois amer), *Fr.;* Quassia-Extrakt, *G.*

"Quassia, in No. 20 powder, *one hundred parts* [or sixteen ounces av.]; Glycerin, Water, each, *a sufficient quantity.* Moisten the powder with *forty parts* [or six fluidounces] of Water, pack it firmly in a conical percolator, and gradually pour Water upon it until the infusion passes but slightly imbued with bitterness. Reduce the liquid to three-fourths of its weight, by boiling, and strain; then, by means of a water-bath, evaporate to a pilular consistence. Lastly, weigh the Extract, and thoroughly incorporate with it, while still warm, *five per cent.* of Glycerin." *U. S.*

"Take of Quassia Wood, rasped, *one pound* [avoirdupois]; Distilled Water, *a sufficiency.* Macerate the Quassia with eight fluidounces of the Water for twelve hours; then pack in a percolator, and, adding more of the Water, allow the liquor slowly to pass until the Quassia is exhausted. Evaporate the liquor; filter before it becomes too thick; and again evaporate by a water-bath until the extract is of a suitable consistence for forming pills" *Br.*

According to M. Recluz, sixteen ounces of quassia yield by infusion in water seven drachms of extract; by maceration in alcohol of 19° Baumé, two ounces five drachms and a half. The difference between these quantities is so great that we suspect some mistake in the Dictionnaire des Drogues, from which we quote.

The extract of quassia is dark brown or black, and excessively bitter. It is apt to become dry and disposed to crumble by time. It concentrates a greater amount of tonic power within a given weight than any other extract of the simple bitters, and may, therefore, be given with great advantage in cases in which it is desirable to administer this class of substances in as small a bulk as possible. The dose is one to two grains (0·065 to 0·13 Gm.), to be given in pill. The alcoholic extract is a better preparation, and the yield is greater; but it is probably wisest to adhere to the aqueous extract, on account of its cheapness.

EXTRACTUM QUASSIÆ FLUIDUM. *U.S.* *Fluid Extract of Quassia.*

(ẸX-TRĂC′TỤM QUAS′SỊ-Æ FLÛ′Ị-DŬM—kwŏsh′ẹ-ē.)

Extrait liquide de Quassie, *Fr.;* Flüssiges Quassia-Extrakt, *G.*

"Quassia, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Diluted Alcohol, *a sufficient quantity,* To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *forty grammes* [or twenty fluidounces] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradu-

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"Beat the Almond into a paste, and rub this with successive portions of Water until, after straining through a coarse sieve or cloth, nearly all the substance of the Almond has been converted into an emulsion, and twelve fluidounces of liquid have been obtained. Mix this with the liquid first obtained, in a suitable bottle, and, having closely stopped it, agitate occasionally during twenty-four hours. Then express quickly and strongly through a cloth; and if the expressed liquid measure less than eighteen fluidounces, add Water to the residue, and again express until that quantity is obtained. Filter the expressed liquid through cotton flannel, in a covered funnel, into a bottle containing the Sugar. Shake the bottle occasionally during the process until the Sugar is dissolved, and continue the filtration until the syrupy liquid measures two pints. Lastly, mix the whole thoroughly together."

ally adding Diluted Alcohol, until the Quassia is exhausted. Reserve the first *ninety cubic centimeters* [or forty-three fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is another new officinal fluid extract. It is exceedingly bitter, and will probably never be given by itself internally, but used to form the basis for infusions, mixtures, etc. The dose would be five to ten minims (0·3 to 0·6 C.c.).

EXTRACTUM RHEI. *U. S., Br.* *Extract of Rhubarb.*

(Ẹ̄X-TRĂC′TỤM RHĒ′Ī—rē′ī.)

Extractum Rhei Alcoholicum; Extrait de Rhubarbe, *Fr.;* Rhubarber-Extrakt, *G.*

"Rhubarb, in No. 30 powder, *one hundred parts* [or sixteen ounces av.]; Alcohol, Water,* each, *a sufficient quantity.* Mix Alcohol and Water in the proportion of *three parts* [or three and a half pints] of Alcohol and *one part* [or one pint] of Water, and having moistened the powder with *forty parts* [or half a pint] of the mixture, pack it firmly in a conical percolator; then gradually pour the menstruum upon it until the tincture passes nearly tasteless. Reserve the first *one hundred parts* [or fifteen fluidounces] of the percolate, and set it aside in a warm place, until it is reduced by spontaneous evaporation to *fifty parts* [or eight ounces av.]. Evaporate the remainder of the percolate, in a porcelain vessel, by means of a water-bath, at a temperature not exceeding 70° C. (158° F.), to the consistence of syrup. Mix this with the reserved portion, and continue the evaporation until the mixture is reduced to a pilular consistence." *U. S.*

"Take of Rhubarb Root, sliced or bruised, *one pound* [avoirdupois]; Rectified Spirit *ten fluidounces* [Imperial measure]; Distilled Water *five pints* [Imp. meas.]. Mix the Spirit and the Water, and macerate the Rhubarb in the mixture for four days; then decant, press, and set by that the undissolved matter may subside; pour off the clear liquor, filter the remainder, mix the liquors, and evaporate by a water-bath, at a temperature not exceeding 160° F., until the extract has acquired a suitable consistence for forming pills." *Br.*

Rhubarb yields all its active matter to water and alcohol; but, unless the evaporation is performed with great care and with a moderate heat, it is certain that the purgative principle is, to a greater or less extent, injured or dissipated in the process; and the extract may thus become even less efficient than the root. Among other consequences which result from the boiling temperature, is the formation of a compound of the tannin and starch, which is insoluble in cold water, and upon its precipitation probably carries with it a portion of the purgative principle. There is, moreover, reason to believe that this principle is volatilizable by heat, and that a portion of it escapes with the vapor. When properly prepared, the extract has decidedly the peculiar odor of rhubarb. The dose of the extract is from five to ten grains (0·3–0·65 Gm.).

EXTRACTUM RHEI FLUIDUM. *U. S.* *Fluid Extract of Rhubarb.*

(Ẹ̄X-TRĂC′TỤM RHĒ′Ī FLÛ′Ị-DŬM—rē′ī.)

Extrait liquide de Rhubarbe, *Fr.;* Flüssiges Rhubarber-Extrakt, *G.*

"Rhubarb, in No. 30 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity,* To make *one hundred cubic centimeters* [or three pints]. Mix *three parts* [or three and a half pints] of Alcohol with *one part* [or one pint] of Water, and, having moistened the powder with *forty grammes* [or one pint] of the mixture, pack it firmly in a conical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, until the Rhubarb is exhausted. Reserve the first *seventy-five cubic centimeters* [or thirty-six fluidounces] of the percolate, and evaporate the remainder, at a temperature not exceeding 70° C. (158° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

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* There is evidently an editorial oversight in the U. S. Pharm. 1880, in the insertion of the words after Alcohol of "*one hundred and twenty parts,*" and the succeeding line, "Diluted Alcohol, *a sufficient quantity.*" They have no connection with the succeeding directions.

Although the process for the fluid extract of rhubarb of U. S. P. 1870 was an improvement on its predecessors, on the addition of water the fluid extract precipitated heavily, so that syrups or mixtures made with it were very unsightly. As the chief use of the fluid extract is in making such preparations, this is very unfortunate, and constitutes sufficient grounds for the abandonment of an officinal formula in favor of one which will exhaust the root of its purgative properties, and yet afford an extract that remains clear when water is added to it. Mr. Geo. Bille claims that all that is necessary is to exhaust the sixteen troyounces of rhubarb with cold water, evaporate, by means of a water-bath, to twelve fluidounces, and add four fluidounces of glycerin. The present process affords a fluid extract which thoroughly represents the root, but it has the same objection that the former preparation had, immiscibility with syrups and water, with loss of transparency. The dose for an adult may be twenty or thirty minims (1·25–1·9 C.c.) as a purgative, and from five to ten minims (0·3–0·6 C.c.) as a laxative.

Off. Prep. Mistura Rhei et Sodæ, *U. S.*

EXTRACTUM RHOIS GLABRÆ FLUIDUM. *U. S.* *Fluid Extract of Rhus Glabra.*

(ẸX-TRĂC′TỤM RHŌ′ĬS GLĀ′BRÆ FLȖ′Ị-DŬM.)

Extrait liquide de Sumac, *Fr.;* Flüssiges Sumach-Extrakt, *G.*

"Rhus Glabra, in No. 40 powder, *one hundred grammes* [or fifty ounces av.]; Glycerin, *ten grammes* [or three and three-quarter fluidounces]; Diluted Alcohol, *a sufficient quantity,* To make *one hundred cubic centimeters* [or three pints]. Mix the Glycerin with *ninety grammes* [or forty-six and a half fluidounces] of Diluted Alcohol, and, having moistened the powder with *thirty-five grammes* [or eighteen fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterward, Diluted Alcohol, until the Rhus Glabra is exhausted. Reserve the first *eighty cubic centimeters* [or thirty-eight fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is a new officinal fluid extract. A formula for this preparation was proposed by Prof. J. P. Remington (*A. J. P.*, 1874, p. 7) which differs from that at present officinal, merely in containing a larger proportion of glycerin in the menstruum. Experience has shown that this is a valuable preparation of sumach berries, and is a useful addition to mouth and throat washes, gargles, etc.

EXTRACTUM ROSÆ FLUIDUM. *U. S.* *Fluid Extract of Rose.*

(ẸX-TRĂC′TỤM RŌ′ṢÆ FLȖ′Ị-DŬM.)

Extrait liquide de Rose rouge, *Fr.;* Flüssiges Essigrosenblätter-Extrakt, *G.*

"Red Rose, in No. 30 powder, *one hundred grammes* [or fifty ounces av.]; Glycerin, *ten grammes* [or three and three-quarter fluidounces]; Diluted Alcohol, *a sufficient quantity,* To make *one hundred cubic centimeters* [or three pints]. Mix the glycerin with *ninety grammes* [or forty-six and a half fluidounces] of Diluted Alcohol, and, having moistened the powder with *forty grammes* [or twenty fluidounces] of the mixture, pack it firmly in a cylindrical glass percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it.

When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterward, Diluted Alcohol, until the Red Rose is exhausted. Reserve the first *seventy-five cubic centimeters* [or thirty-six fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is another new officinal fluid extract, which will be found very useful as an adjuvant and elegant astringent. It is of a deep red color, with the agreeable flavor of rose. It may be given in the dose of one or two fluidrachms (3·75 or 7·5 C.c.).

EXTRACTUM RUBI FLUIDUM. *U. S.* *Fluid Extract of Rubus.*

(ẸX-TRĂC′TỤM RŪ′BĪ̇ FLÛ′Ị-DŬM.)

Extrait liquide d'Écorce de Ronce, *Fr.;* Flüssiges Brombeerrinden-Extrakt, *G.*

"Rubus, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Glycerin, *twenty grammes* [or seven and a half fluidounces]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix the Glycerin with *forty-five grammes* [or twenty-six fluidounces] of Alcohol and *thirty-five grammes* [or one pint] of Water, and, having moistened the powder with *thirty-five grammes* [or seventeen fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterward, a mixture of Alcohol and Water, made in the proportion of *nine parts* [or twenty-six fluidounces] of Alcohol to *seven parts* [or one pint] of Water, until the Rubus is exhausted. Reserve the first *seventy cubic centimeters* [or thirty-three fluidounces] of the percolate; by means of a water-bath, distil off the Alcohol from the remainder, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough of a mixture of Alcohol and Water, using the last-named proportions, to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This fluid extract does not differ essentially from that formerly officinal. It is a very dark, reddish brown, translucent fluid, having the properties of the root in a marked degree. The dose is a half fluidrachm to a fluidrachm (1·9–3·75 C.c.).

Off. Prep. Syrupus Rubi, *U. S.*

EXTRACTUM RUMICIS FLUIDUM. *U.S.* *Fluid Extract of Rumex.*

(ẸX-TRĂC′TỤM RŪ′MỊ-CĬS FLÛ′Ị-DŬM)

Fluid Extract of Yellow Dock; Extrait liquide de Patience frisée, *Fr.;* Flüssiges Grindwurzel-Extrakt, *G.*

"Rumex, in No. 40 powder, *one hundred grammes* [or fifty ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *thirty-five grammes* [or eighteen fluidounces] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Rumex is exhausted. Reserve the first *eighty cubic centimeters* [or thirty-eight fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

A new officinal fluid extract having a dark yellowish brown color, and the peculiar odor and taste of rumex. The dose is a fluidrachm (3·75 C.c.).

EXTRACTUM SABINÆ FLUIDUM. *U.S.* *Fluid Extract of Savine.*

(ẸX-TRĂC′TỤM SẠ-BĪ′NÆ FLÛ′Ị-DŬM.)

Extrait liquide de Sabine, *Fr.;* Flüssiges Sadebaum-Extrakt, *G.*

"Savine, in No. 40 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *twenty-five grammes* [or fifteen fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Savine is exhausted. Reserve the first *ninety cubic centimeters* [or forty-three fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is identical with the fluid extract formerly officinal. It is a dark greenish black fluid, not mixing well with aqueous liquids without the use of an emulsifying agent. It is rarely given internally; the dose is three to eight minims (0·18–0·5 C.c.).

Off. Prep. Ceratum Sabinæ.

EXTRACTUM SANGUINARIÆ FLUIDUM. *U.S.* *Fluid Extract of Sanguinaria.*

(ẸX-TRĂC′TỤM SĂN-GUỊ-NĀ′RỊ-Æ FLÛ′Ị-DŬM—săng-gwẹ-nā′rẹ-ē.)

Fluid Extract of Blood Root; Extrait liquide de Sanguinaire, *Fr.;* Flüssiges Blutwurzel-Extrakt, *G.*

"Sanguinaria, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *thirty grammes* [or seventeen fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Sanguinaria is exhausted. Reserve the first *eighty-five cubic centimeters* [or forty fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

The liquid preparations of sanguinaria all have an unfortunate tendency to precipitate, and this new fluid extract will not prove an exception. It is of a very deep red color. The dose is three to five minims (0·15 to 0·3 C.c.).

EXTRACTUM SARSAPARILLÆ COMPOSITUM FLUIDUM. *U.S.* *Compound Fluid Extract of Sarsaparilla.*

(ẸX-TRĂC′TỤM SÄR-SẠ-PẠ-RĬL′LÆ CỌM-PŎṢ′Ị-TŬM FLỤ̂′Ị-DŬM.)

Extrait liquide de Salsepareille composé, *Fr;* Zusammengesetztes flüssiges Sarsaparilla-Extrakt, *G.*

"Sarsaparilla, in No. 30 powder, *seventy-five grammes* [or thirty-seven and a half ounces av.]; Glycyrrhiza, in No. 30 powder, *twelve grammes* [or six ounces av.]; Sassafras Bark, in No. 30 powder, *ten grammes* [or five ounces av.]; Mezereum, in No. 30 powder, *three grammes* [or one and a half ounces av.]; Glycerin, *ten grammes* [or three and three-quarter fluidounces]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix the Glycerin with *thirty grammes* [or seventeen fluidounces] of Alcohol and *sixty grammes* [or thirty fluidounces] of Water, and, having moistened the mixed powders with *forty grammes* [or twenty fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterward, a mixture of Alcohol and Water, made in the proportion of *one part* [or two and a quarter pints] of Alcohol to *two parts* [or four pints] of Water, until the powder is exhausted. Reserve the first *eighty cubic centimeters* [or thirty-eight fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough of a mixture of Alcohol and Water, using the last-named proportions, to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

Everything depends in the process upon having the several ingredients equably powdered, mixing them well and duly moistening them, and then packing them properly in the percolator. The moistening of the mixed powders is more easily effected, as they are less disposed to form lumps than is the sarsaparilla powder alone. The preparation is intended to represent, in a concentrated state, the compound decoction of sarsaparilla, having all its ingredients with the exception of the guaiacum wood, which probably adds little to the efficacy of the decoction. It was originally proposed by Wm. Hodgson, Jr. (*Journ. of the Phila. Col. of Pharm.*, ii. 285); and the officinal process differs from his mainly in the omission of the guaiacum wood, the resin of which, separating during the evaporation, somewhat embarrassed the process, without adding to the virtues of the extract. The dose is from thirty minims to a fluidrachm (1·9–3·75 C.c.), three or four times a day.

EXTRACTUM SARSAPARILLÆ FLUIDUM. *U. S., Br.* *Fluid Extract of Sarsaparilla.*

(ẸX-TRĂC'TỤM SÄR-SẠ-PẠ-RĬL'LÆ FLŪ'Ị-DŬM.)

Extractum Sarsæ Liquidum, *Br.;* Liquid Extract of Sarsaparilla; Extrait liquide de Salsepareille, *Fr.;* Flüssiges Sarsaparilla-Extrakt, *G.*

"Sarsaparilla, in No. 30 powder, *one hundred grammes* [or fifty ounces av.]; Glycerin, *ten grammes* [or three and three-quarter fluidounces]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix the Glycerin with *thirty grammes* [or seventeen fluidounces] of Alcohol and *sixty grammes* [or thirty fluidounces] of Water, and, having moistened the powder with *forty grammes* [or twenty fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterward, a mixture of Alcohol and Water, made in the proportion of *one part* [or two and a quarter pints] of Alcohol to *two parts* [or four pints] of Water, until the Sarsaparilla is exhausted. Reserve the first *eighty cubic centimeters* [or thirty-eight fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough of a mixture of Alcohol and Water, using the last-named proportions, to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

"Take of Jamaica Sarsaparilla, cut transversely, *one pound* [avoirdupois]; Distilled Water, at 160°, *fourteen pints* [Imperial measure]; Rectified Spirit *one fluidounce.* Digest the Sarsaparilla in one-half of the Water for six hours, and decant the liquor. Digest the residue in the remainder of the Water for the same time, express, and filter the mixed liquors, and evaporate them by a water-bath to seven fluidounces, or until the sp. gr. of the liquid is 1·13. When cold, add the Spirit. The sp. gr. should be about 1·095." *Br.*

Of these two processes, that of the U. S. Pharmacopœia, except in respect to the high price of alcohol, is greatly preferable; and this objection will be in great measure obviated by recovering the alcohol, which can be done by using a distillatory apparatus in the evaporation. There can be no doubt that Sarsaparilla is more thoroughly exhausted when submitted, in the state of powder, to percolation with a mixture of diluted alcohol and glycerin, than it can be by maceration and subsequent digestion of the whole root in water, even though continued for twelve hours. The non-use of heat in the U. S. process is also a great advantage; and the glycerin is preferable as a preservative to alcohol, even admitting, what is scarcely probable, that the quantity of spirit directed in the Br. formula is sufficient to prevent decomposition, especially in our hot summer weather. There is some difficulty in properly mixing the powder with the menstruum, as it is apt to agglutinate in lumps; but this can be obviated by suitable manipulation, and a uniformly moistened mass obtained. The introduction of a simple fluid extract of sarsaparilla into our Pharmacopœia was judicious; as it enables the physician to associate this medicine with others at his pleasure, and in such proportions as he may deem expedient. He may rely upon the efficiency of the preparation, if made with sufficient care and skill, and from good parcels of the root. The U. S. fluid extract is a somewhat thickish, scarcely translucent liquid, of a very dark reddish brown color, and of a sweetish and a slightly, though persistently, acrid taste. The dose is from thirty to sixty minims (1·9–3·75 C.c.), equivalent to the same number of grains of sarsaparilla in substance. The dose of the British preparation is stated in the Pharmacopœia to be from two to four fluidrachms (7·5–15 C.c.).

EXTRACTUM SCILLÆ FLUIDUM. *U. S.* *Fluid Extract of Squill.*

(ẸX-TRĂC′TỤM SÇĬL′LÆ FLÛ′Ị-DŬM—sĭl′lē.)

Extrait liquide de Scille, *Fr.;* Flüssiges Meerzwiebel-Extrakt, *G.*

"Squill, in No. 20 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *twenty grammes* [or twelve fluidounces] of Alcohol, and pack it in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Squill is exhausted. Reserve the first *seventy-five cubic centimeters* [or thirty-six fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This fluid extract differs from the one formerly officinal in containing no glycerin in the menstruum. It is a beautifully clear dark red liquid, which is especially useful for combining with stimulant expectorants, such as carbonate of ammonium, which are incompatible with the officinal syrup of squill. The dose as an expectorant is two to three minims (0·12 to 0·18 C.c.).

EXTRACTUM SCUTELLARIÆ FLUIDUM. *U. S.* *Fluid Extract of Scutellaria.*

(ẸX-TRĂC′TỤM SCU̇-TẸL-LĀ′RỊ-Æ FLÛ′Ị-DŬM.)

Fluid Extract of Skullcap; Extrait liquide de Scutellaire, *Fr.;* Flüssiges Helmkraut-Extrakt, *G.*

"Scutellaria, in No. 40 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix *one part* [or two and a quarter pints] of Alcohol with *two parts* [or four pints] of Water, and, having moistened the powder with *thirty-five grammes* [or one pint] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, until the Scutellaria is exhausted. Reserve the first *eighty cubic centimeters* [or thirty-eight fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

A new fluid extract in the Pharmacopœia, but thoroughly representing the activity of Scutellaria. It is of a dark greenish brown color, and is given in the dose of one-half to one fluidrachm (1·9 to 3·75 C.c.).

EXTRACTUM SENEGÆ FLUIDUM. *U. S. Fluid Extract of Senega.*

(ẸX-TRĂC′TỤM SĔN′Ẹ-ĢÆ FLŪ′Ị-DŬM.)

Extrait liquide de Polygale de Virginie, Extrait liquide de Sénéca, *Fr;* Flüssiges Senega-Extrakt, *G.*

"Senega, in No. 40 powder, *one hundred grammes* [or fifty ounces av.]; Water of Ammonia, *two grammes* [or one fluidounce]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix *two parts* [or four and a half pints] of Alcohol with *one part* [or two pints] of Water, and, having moistened the powder with *forty-five grammes* [or twenty-six fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, until the Senega is exhausted. Reserve the first *eighty-five cubic centimeters* [or forty fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add, first, the Water of Ammonia, and afterward, enough menstruum to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

Fluid Extract of Senega was very frequently the cause of annoyance to the pharmacist through gelatinization. This was due to the presence of pectinous bodies in the root. The addition of an alkali to the menstruum effectually prevents this, and in this respect the present preparation is a great improvement over the former one. It is a blackish brown moderately thin liquid, which may be used for the same purposes as the crude drug, in doses of from one to five minims (0·06–0·3 C.c.).

Off. Prep. Syrupus Senegæ.

EXTRACTUM SENNÆ FLUIDUM. *U. S. Fluid Extract of Senna.*

(ẸX-TRĂC′TỤM SĔN′NÆ FLŪ′Ị-DŬM.)

Extrait liquide de Séné, *Fr.;* Flüssiges Senna-Extrakt, *G.*

"Senna, in No. 30 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix *three parts* [or three pints and six fluidounces] of Alcohol with *four parts* [or four pints] of Water, and, having moistened the powder with *forty grammes* [or twenty fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, until the Senna is exhausted. Reserve the first *eighty cubic centimeters* [or thirty-eight fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

The officinal fluid extract of senna of 1870 differed materially from that of the Pharmacopœias of 1850 and 1860, containing neither sugar, oil of fennel, nor Hoffmann's anodyne. It was deemed better to leave to the prescriber the choice of the volatile oil, and to depend for the preservation of the fluid extract upon the glycerin and what might remain of the alcohol after the evaporation. The present officinal fluid extract is again very different from that of 1870, which contained 50 per cent. of glycerin. There is no glycerin in the menstruum now, and there really seems no occasion for its use. The fluid extract is a dark, blackish, thickish, and somewhat turbid liquid, with a strong flavor of senna. The dose is from one to four fluidrachms (3·75–15 C.c.) for an adult. In consequence of its griping tendency, it should be mixed with one of the volatile oils, as of fennel, anise, or caraway, in the proportion of about two minims (0·12 C.c.) to the fluidounce (30 C.c.). It is well adapted for exhibition with saline cathartics, such as Epsom salt or cream of tartar, which also obviate its griping. In this case not more than one-half of the full dose of the fluid extract should be given at once.

EXTRACTUM SERPENTARIÆ FLUIDUM. *U. S. Fluid Extract of Serpentaria.*

(ẸX-TRĂC′TỤM SĔR-PẸN-TĀ′RỊ-Æ FLŨ′Ị-DŬM.)

Fluid Extract of Virginia Snake Root; Extrait liquide de Serpentaire, *Fr.;* Flüssiges Schlangenwurz-Extrakt, *G.*

"Serpentaria, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix *three parts* [or three pints and six fluidounces] of Alcohol with *one part* [or one pint] of Water, and, having moistened the powder with *thirty grammes* [or seventeen fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, until the Serpentaria is exhausted. Reserve the first *ninety cubic centimeters* [or forty-three fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This, though simply a concentrated tincture, is a good preparation, containing the virtues of the root within a small bulk. The fluid extract of serpentaria originated with Mr. J. C. Savery, whose formula was published in the eleventh edition of the U. S. Dispensatory (page 713). It was afterwards modified by Mr. A. B. Taylor (*A. J. P.*, xxv. 206). In the present preparation the alcoholic strength of menstruum is slightly less than that of the fluid extract of U. S. P. 1870. The fluid extract is thin, reddish brown, and transparent, with the peculiar bitterness of the root in perfection, but its odor less obviously. The dose is twenty or thirty minims (1·25 or 1·9 C.c.), to be frequently repeated.

EXTRACTUM SPIGELIÆ FLUIDUM. *U. S. Fluid Extract of Spigelia.*

(ẸX-TRĂC′TỤM SPỊ-ÇĒ′LỊ-Æ FLŨ′Ị-DŬM.)

Fluid Extract of Pink Root; Extrait liquide de Spigélie, *Fr.;* Flüssiges Spigelien-Extrakt, *G.*

"Spigelia, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *thirty grammes* [or fifteen fluidounces] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Spigelia is exhausted. Reserve the first *eighty-five cubic centimeters* [or forty fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This preparation differs from that formerly officinal in having no glycerin in the menstruum; the U. S. P. 1870 fluid extract had 50 per cent.

The fluid extract of spigelia is a dark brown, translucent liquid, with the flavor of the root. The dose of it is one or two fluidrachms (3·75–7·5 C.c.) for an adult, from ten to twenty minims (0·6–1·25 C.c.) for a child two or three years old, to be repeated morning and evening for three or four days, and then followed by a brisk cathartic. It is, however, most used in connection with the fluid extract of senna; the fluid extract of spigelia and senna formerly officinal being an excellent combination, which should not have been dropped from the Pharmacopœia.*

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* *Extractum Spigeliæ et Sennæ Fluidum,* U. S. 1870. *Fluid Extract of Spigelia and Senna.* "Take of Fluid Extract of Spigelia *ten fluidounces;* Fluid Extract of Senna *six fluidounces;* Oil of Anise, Oil of Caraway, each, *twenty minims.* Mix the Fluid Extracts, and dissolve the Oils in the mixture." *U. S.*

It combines the cathartic property of senna with the anthelmintic virtues of pinkroot, and is a

EXTRACTUM STILLINGIÆ FLUIDUM. *U. S.* *Fluid Extract of Stillingia.*

(ẸX-TRĂC'TỤM STỊL-LĬN'ǤỊ-Æ FLÛ'Ị-DŬM.)

Extrait liquide de Stillingie, *Fr.;* Flüssiges Stillingia-Extrakt, *G.*

"Stillingia, in No. 40 powder, *one hundred grammes* [or fifty ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *thirty grammes* [or fifteen fluidounces] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Stillingia is exhausted. Reserve the first *eighty-five cubic centimeters* [or forty fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

The glycerin in the menstruum has been abandoned in the last revision of the formula for this fluid-extract, which is of a dark reddish brown color: and the dose is from fifteen to forty-five minims (0·9–2·8 C.c.).

EXTRACTUM STRAMONII. *U.S., Br.* *Extract of Stramonium.*

(ẸX-TRĂC'TỤM STRẠ-MŌ'NỊ-Ī.)

Extractum Stramonii Seminis, *U. S.* 1870; Extract of Stramonium Seed; Extrait de Semences de Stramoine, *Fr.;* Stechapfelsamen-Extrakt, *G.*

"Stramonium Seed, in No. 40 powder, *one hundred parts* [or sixteen ounces av.]; Diluted Alcohol, *a sufficient quantity*. Moisten the powder with *thirty parts* [or five fluidounces] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until *three hundred parts* [or three pints] of tincture are obtained, or the Stramonium Seed is exhausted. Reserve the first *ninety parts* [or fourteen fluidounces] of the percolate, evaporate the remainder, at a temperature not exceeding 50° C. (122 F.), to *ten parts* [or two fluidounces], mix the residue with the reserved portion in a porcelain capsule, and, by means of a water-bath, evaporate, at or below the before-mentioned temperature, to a pilular consistence." *U. S.*

"Take of Stramonium Seeds, in coarse powder, *one pound* [avoirdupois]; Ether *one pint* [Imperial measure], or *a sufficiency;* Distilled Water, Proof Spirit, of each, *a sufficiency*. Shake the Ether in a bottle with half a pint of the Water, and after separation decant the Ether. Pack the Stramonium in a percolator, and free it from its oil by passing the washed Ether slowly through it. Having removed and rejected the ethereal solution, pour the Spirit over the residue of the Stramonium in the percolator and allow it to pass through slowly until the powder is exhausted. Distil off most of the Spirit from the tincture, and evaporate the residue by a water-bath until the extract has acquired a suitable consistence for forming pills." *Br.*

This preparation was omitted from the U. S. Pharmacopœia of 1860, but, in accordance with suggestions made in the U. S. Dispensatory, was reinstated at the revision of 1870. It is an excellent preparation, not only stronger, but more uniform, and therefore more to be relied on than any other officinal extract of stramonium. As the seeds yield their virtues more freely to spirit than to water alone, the Pharmacopœias have very properly adopted diluted alcohol as the menstruum. The use of the ether is to separate inert fatty matter, and consequently to make the extract stronger than when prepared according to the Br. process of 1864, in which ether was not used; and the ether is washed, in order to separate any alcohol contained

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very good vermifuge, being generally acceptable to the stomach, and not offensive to the taste. The dose is from two fluidrachms to half a fluidounce (7·5–15 C.c.) for an adult, from thirty minims to a fluidrachm (1·9–3·75 C.c.) for a child two years old.

in it, which might dissolve the active matter. According to the table of Recluz, sixteen ounces of the seed afford two ounces and two drachms of extract by maceration in diluted alcohol, and one ounce and a half by decoction. The dose to begin with is the quarter or half of a grain (0·016–0·03 Gm.), twice a day, to be gradually increased.

Off. Prep. Unguentum Stramonii, *U. S.*

EXTRACTUM STRAMONII FLUIDUM. *U. S.* *Fluid Extract of Stramonium.*

(Ẹ̆X-TRĂC′TỤM STRẠ-MŌ′NỊ-Ī FLŪ′Ị-DŪM.)

Extrait liquide de Semences de Stramoine, *Fr.;* Flüssiges Stechapfelsamen-Extrakt, *G.*

"Stramonium Seed, in No. 40 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix *three parts* [or three pints and six fluidounces] of Alcohol with *one part* [or one pint] of Water, and, having moistened the powder with *twenty grammes* [or twelve fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, until the Stramonium Seed is exhausted. Reserve the first *ninety cubic centimeters* [or forty-three fluidounces] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is a new officinal fluid extract. The menstruum is well adapted for thoroughly exhausting the seed. It is of a dark brown color, and the dose is one to two minims (0·06 to 0·12 C.c.).

EXTRACTUM TARAXACI. *U. S., Br.* *Extract of Taraxacum.*

(Ẹ̆X-TRĂC′TỤM TẠ-RĂX′Ạ-CĪ.)

Extract of Dandelion; Extrait de Dent-de-Lion, *Fr.;* Löwenzahn-Extrakt, *G.*

"Fresh Taraxacum, gathered in September, *a convenient quantity;* Water, *a sufficient quantity.* Slice the Taraxacum, and bruise it in a stone mortar, sprinkling on it a little Water, until reduced to a pulp; then express and strain the juice, and evaporate it in a vacuum-apparatus, or in a shallow porcelain dish, by means of a water-bath, to a pilular consistence." *U. S.*

"Take of Fresh Dandelion Root *four pounds* [avoirdupois]. Crush the Root; press out the juice, and allow it to deposit; heat the clear liquor to 212°, and maintain the temperature for ten minutes; then strain, and evaporate by a water-bath, at a temperature not exceeding 160°, until the extract has acquired a suitable consistence for forming pills." *Br.*

This extract is undoubtedly stronger, prepared from the root alone than from the whole plant. It is important that the root should be collected at the right season. The juice expressed from it in the spring is thin, watery, and of a feeble flavor; in the latter part of the summer, and in autumn, thick, opaque, cream-colored, very bitter, and abundant, amounting to one-third or one-half its weight. It may be collected in August, and afterwards until severe frost. According to Mr. Squire, frost has the effect of diminishing the bitterness and increasing the sweetness of the root. An extract prepared by inspissating the juice, as in the present U. S. and Br. processes, is much more efficient than that prepared in the old way by decoction. The inspissation should be effected by exposing the juice in shallow vessels to a current of warm dry air, or by evaporation in a vacuum, and should not be unnecessarily protracted. Long exposure, during evaporation, changes the bitterness of the juice into sweetness, which is a sign of inferiority. In the British process, it is wisely directed that, before the evaporation of the juice, it shall be exposed for a short time to a heat sufficient to coagulate the albumen, which is then separated and rejected as useless, and indeed injurious by favoring decomposition. As often found in the shops, the extract is dark-colored, sweet, and in all probability nearly inert. Mr. Houlton took more than an ounce of it in a day, without any sensible effect. (*P. J. Tr.*, i. 421.) When prepared from the root and leaves together, it has a greenish color. Mr. Brande states that one cwt. of the fresh root affords from twenty to twenty-five pounds of extract by decoction in water. The expressed juice yields from 11 to 25 per cent. of extract, the greatest product being obtained in November, and the least in April and May. This extract deteriorates by keeping, and should, therefore, be renewed annually. It is conveniently given in an aromatic water. The dose is from a scruple to a drachm (1·3–3·95 Gm.) three times a day.

EXTRACTUM TARAXACI FLUIDUM. *U. S.* *Fluid Extract of Taraxacum.*

(ẸX-TRĂC′TỤM TẠ-RĂX′Ạ-CĪ FLŪ′Ị-DŬM.)

Fluid Extract of Dandelion; Extrait liquide de Pissenlit, *Fr.;* Flüssiges Löwenzahn-Extrakt, *G.*

"Taraxacum, in No. 30 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix *two parts* [or four and a half pints] of Alcohol with *three parts* [or six pints] of Water, and, having moistened the powder with *thirty grammes* [or seventeen fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradully adding menstruum, until the Taraxacum is exhausted. Reserve the first *eighty-five cubic centimeters* [or forty fluidounces] of the percolate; by means of a water-bath, distil off the Alcohol from the remainder, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

The activity of this preparation depends more upon the proper selection of the root than anything else. The process of exhausting the drug is not difficult, and one of the best tests of this fluid extract is its bitter taste. It is a blackish, moderately thick liquid, which may be given in doses of from one to three fluidrachms (3·75–11·25 C.c.). It is said to be an excellent vehicle for quinine.

EXTRACTUM TRITICI FLUIDUM. *U. S.* *Fluid Extract of Triticum.*

(ẸX-TRĂC′TỤM TRĬT′Ị-CĪ FLŪ′Ị-DŬM.)

Fluid Extract of Couch-grass Root; Extrait liquide de petit Chiendent, *Fr.;* Flüssiges Queckenwurzel-Extrakt, *G.*

"Triticum, finely cut, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Pack the Triticum in a cylindrical percolator, and pour Boiling Water upon it until it is exhausted. Evaporate the percolate to *eighty cubic centimeters* [or thirty-eight fluidounces], and, having added to it *twenty cubic centimeters* [or ten fluidounces] of Alcohol, mix well and set it aside for forty-eight hours. Then filter the liquid and add to the filtrate enough of a mixture composed of *four parts* [or four fluidounces] of Water and *one part* [or one and one-eighth fluidounces] of Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is a new officinal fluid extract, and it is a valuable preparation. The German Pharmacopœia directs an *Extractum Graminis*, made by digesting 1 part of Triticum with 6 parts of hot water, for six hours, straining, evaporating to a syrup; mixing 1 part of this extract with 4 parts of cold distilled water, filtering, and evaporating to an extract. The fluid extract is preferable, as the excessive use of heat is avoided. The dose is from three to six fluidrachms (11·25–22·5 C.c.).

EXTRACTUM UVÆ URSI FLUIDUM. *U.S.* *Fluid Extract of Uva Ursi.*

(ẸX-TRĂC′TỤM Ū′VÆ ŬR′SĪ FLÛ′Ị-DŬM.)

Extrait liquide de Busserole, *Fr.;* Flüssiges Bärentraubenblätter-Extrakt, *G.*

"Uva Ursi, in No. 30 powder, *one hundred grammes* [or fifty ounces av.]; Glycerin, *ten grammes* [or three and three-quarter fluidounces]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix the Glycerin with *ninety grammes* [or forty-six fluidounces] of Diluted Alcohol, and, having moistened the powder with *thirty-five grammes* [or eighteen fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterward, Diluted Alcohol, until the Uva Ursi is exhausted. Reserve the first *seventy cubic centimeters* [or thirty-three fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U.S.*

This preparation has been improved by diminishing the glycerin. It is a thickish, black liquid, of a sweet, bitterish, astringent, but not very disagreeable taste. The dose is from thirty minims to a fluidrachm (1·9–3·75 C.c.), three times a day.

EXTRACTUM VALERIANÆ FLUIDUM. *U. S.* *Fluid Extract of Valerian.*

(ẸX-TRĂC′TỤM VẠ-LĒ-RỊ-Ā′NÆ FLÛ′Ị-DŬM.)

Extrait liquide de Valériane, *Fr.;* Flüssiges Baldrian-Extrakt, *G.*

"Valerian, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix *two parts* [or four and a half pints] of Alcohol with *one part* [or two pints] of Water, and, having moistened the powder with *thirty grammes* [or seventeen fluidounces] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, until the Valerian is exhausted. Reserve the first *eighty-five cubic centimeters* [or forty fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is a concentrated tincture, strong both in alcohol and the virtues of valerian. It is probable that all or nearly all the volatile ingredients of the root are extracted by the reserved portion which first passes, and which, not being exposed to evaporation, loses none of the volatile oil and acid that have been dissolved; while the soluble matter subsequently extracted, consisting chiefly of the fixed principles, will not be dissipated by the concentration ordered. The fluid extract may, therefore, be considered as fully representing the virtues of the root. The formula is, with some modification, that of Prof. Grahame (*A. J. P.*, xxi. 379). The preparation is a dark brownish red liquid, transparent in thin layers, with the smell and taste of valerian. The dose is about a fluidrachm (3·75 C.c.).

EXTRACTUM VERATRI VIRIDIS FLUIDUM. *U.S.* *Fluid Extract of Veratrum Viride.*

(ẸX-TRĂC′TỤM VẸ-RĀ′TRĪ VĬR′Ị-DĬS FLÛ′Ị-DŬM.)

Extrait liquide de Vératre américain, *Fr.;* Flüssiges Grüngermerwurz-Extrakt, *G.*

"Veratrum Viride, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *thirty grammes* [or seventeen fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Veratrum Viride is exhausted. Reserve the first *ninety cubic centimeters* [or forty-three fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

It may be doubted whether this fluid extract is among those demanded by the wants of the profession. We have already a tincture, which, supposing none of the virtues of the medicine to be lost in preparing the fluid extract, will be at least half as strong, and at all events is quite strong enough. It is true that the proportion of alcohol is somewhat less in the fluid extract; but, in so powerful a preparation, this is of little consequence. The tincture itself purports to be saturated; and, though it is probable that, by the concentration of the alcoholic solution, more of the active matter is held by it in the same measure of alcohol than by the tincture, the necessity of multiplying the number of preparations of a powerful drug where the dose is small is not apparent. It would be injudicious to prescribe more of it, as a commencing dose, than from one to two minims (0·06–0·12 C.c.).

EXTRACTUM VIBURNI FLUIDUM. *U. S.* *Fluid Extract of Viburnum.*

(ẸX-TRĂC′TỤM VĪ-BÜR′NĪ FLÛ′Ị-DŬM.)

Fluid Extract of Black Haw: Extrait liquide de Viburné, *Fr.*

"Viburnum, in No. 60 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Mix *two parts* [or four and a half pints] of Alcohol with *one part* [or two pints] of Water, and, having moistened the powder with *thirty grammes* [or seventeen fluidounces] of the mixture, pack it moderately in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, until the Viburnum is exhausted. Reserve the first *eighty-five cubic centimeters* [or forty fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This is a new officinal fluid extract, which well represents the drug. It is of a dark reddish brown color. The dose is one-half to one fluidrachm (1·9–3·75 C.c.).

EXTRACTUM XANTHOXYLI FLUIDUM. *U. S.* *Fluid Extract of Xanthoxylum.*

(ẸX-TRĂC′TỤM XẠN-THŎX′Ỵ-LĪ FLÛ′Ị-DŬM—zạn-thŏk′sẹ-lī.)

Fluid Extract of Prickly Ash; Extrait liquide de Frêne épineux, *Fr.;* Flüssiges Zahnwehholz-Extrakt, *G.*

"Xanthoxylum, in No. 40 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *twenty-five grammes* [or fourteen fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Xanthoxylum is exhausted. Reserve the first *ninety cubic centimeters* [or forty-three fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough

Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

This new officinal fluid extract thoroughly represents the virtues of the drug. The dose is one-half to one fluidrachm (1·9–3·75 C.c.).

EXTRACTUM ZINGIBERIS FLUIDUM. *U. S.* *Fluid Extract of Ginger.*

(EX-TRĂC′TUM ZIN-ĢĬB′E-RĬS FLŪ′I-DŬM.)

Extrait liquide de Gingembre, *Fr.;* Flüssiges Ingwer-Extrakt, *G.*

"Ginger, in No. 40 powder, *one hundred grammes* [or fifty ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred cubic centimeters* [or three pints]. Moisten the powder with *twenty-five grammes* [or fourteen fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Ginger is exhausted. Reserve the first *ninety cubic centimeters* [or forty-three fluidounces] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure *one hundred cubic centimeters* [or three pints]." *U. S.*

The fluid extract of ginger is a highly concentrated alcoholic solution of the active principles of ginger. It is transparent, and of a reddish color. The dose is from ten to twenty minims (0·6–1·25 C.c.).

Off. Prep. Syrupus Zingiberis, *U. S.*

FARINA TRITICI. *Br.* *Wheaten Flour.*

(FA-RĪ′NA TRĬT′I-CĪ.)

Wheat Flour; Farine de Froment, *Fr.;* Weizenmehl, *G.;* Farina di Frumento, *It.;* Flor del Trigo, Acemite, *Sp.*

"The grain of wheat, Triticum vulgare, ground and sifted." *Br.* *Nat. Ord.* Graminaceæ.

Gen. Ch. *Calyx* two-valved, solitary, transverse, many-flowered, on a flexuose, toothed receptacle. *Rees's Cyclopædia.*

Triticum hybernum. Willd. *Sp. Plant.* i. 477.—*T. vulgare*, var. *β. hybernum.* Kunth, *Gramin.* 438. The *common winter wheat* has a fibrous root and one or more erect, round, smooth, jointed, stems, which rise from three to five feet in height, and are furnished with linear, pointed, entire, flat, many-ribbed, rough, somewhat glaucous leaves, and jagged bearded stipules. The flowers are in a solitary, terminal, dense, smooth spike, two or three inches long. The calyx is four-flowered, tumid, imbricated, abrupt, with a short compressed point. In the upper part of the spike it is more elongated; and in this situation the corolla is more or less awned. The grain is imbricated in four rows.

The native country of wheat is unknown; but its cultivation is supposed to have spread from Sicily over Europe. It is now an object of culture in almost all countries having a temperate climate. Sown in the autumn, it stands the winter, and ripens its seeds in the following summer. Numerous varieties have been produced by cultivation, some of which are usually described as distinct species. Among these may perhaps be ranked *T. æstivum*, or spring wheat, distinguished by its long beards, and *T. compositum*, or Egyptian wheat, by its compound spikes. The seeds are too well known to need description. They are prepared for use by grinding and sifting, by which the interior farinaceous part is separated from the husk. The former is divided according to its fineness into different portions, but so far as regards its medical relations may be considered under one head, that of *farina* or *flour*. The latter is called *bran*, and constitutes from 25 to 33 per cent.

Flour is white, inodorous, and nearly insipid. Its chief constituents are starch, gluten, albumen, saccharine matter, and gum, the proportions of which are not constant. Vauquelin obtained, as an average product, from eight varieties of flour which he examined, 10·25 per cent. of water, 10·80 of gluten (including coagulated albumen), 68·08 of starch, 5·61 of sugar, and 4·11 of gum. According to Christison, subsequent experiments have given an average of 16 or 17 per cent. of gluten and albumen. The ashes of wheat, which amount only to about 0·15 per cent., contain, according to Henry, superphosphates of sodium, calcium, and magnesium.* The gummy substance found in wheat flour is not precisely identical with ordinary gum; as it contains nitrogen, and does not yield mucic acid by the action of nitric acid. The starch, which is by far the most abundant ingredient, is much employed in a separate state. (See *Amylum.*) The gluten, however, is not less important; as it is to the large proportion of this principle in wheat flour that it owes its superiority over that from other grains for the preparation of bread. The gluten here alluded to is the substance first noticed as a distinct principle by Beccaria. It is the soft, viscid, fibrous mass which remains, when wheat flour, enclosed in a linen bag, is exposed to the action of a stream of water, and at the same time pressed with the fingers till the liquor comes away colorless. But this has been ascertained to consist, in fact, of two different substances. When boiled in alcohol, one portion of it is dissolved, while another remains unaffected. Einhof ascertained that the part of the glutinous mass left behind by alcohol is identical with *vegetable albumen*, while the dissolved portion only is strictly entitled to the name of *gluten*, which had been previously applied to the whole mass. As these two principles are contained in numerous vegetable products, and as they are frequently referred to in this work, it is proper that they should be briefly noticed. They both contain nitrogen, and both, when left to themselves in a moist state, undergo putrefaction. From these circumstances, and from close resemblance to certain proximate animal principles in chemical habitudes and relations, they are sometimes called, in old works on chemistry, *vegeto-animal substances.* They are separated from each other by boiling the gluten of Beccaria, above referred to, with successive portions of alcohol, till the liquid, filtered while yet hot, ceases to become turbid on cooling. The proper gluten dissolves, and may be obtained by adding water to the solution, and distilling off the alcohol. Large cohering flakes float in the liquor, which, when removed, form a viscid elastic mass, consisting of the substance in question with slight impurity. The part left behind by the alcohol is coagulated albumen.

Pure *gluten*, sometimes called *vegetable fibrin*, is a pale yellow, adhesive, elastic substance, which, by drying, becomes more deeply yellow and translucent. It is almost insoluble in water, and quite insoluble in ether, and in the oils both fixed and volatile. Hot alcohol dissolves it much more readily than cold; and from its solution in boiling alcohol it separates unchanged when the liquor cools. It is soluble in the dilute acids, and in caustic alkaline solutions, in consequence of forming soluble compounds with the acids and alkalies. With the earths and metallic oxides it forms nearly insoluble compounds, which are precipitated when earthy or metallic salts are added to the solution of gluten in liquor potassæ. Corrosive sublimate precipitates it from its acid as well as alkaline solutions, and, added in solution to moist gluten, forms a compound with it, which, when dry, is hard, opaque, and incorruptible. Gluten is precipitated by infusion of galls. Its name originated in its adhesive property. It exists in most farinaceous grains, and in the seeds of some leguminous plants.

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* A very elaborate investigation into the phosphates in wheat grain, as to their bases, the relative proportion of the soluble and insoluble phosphates, the relative quantity in which they exist in different parts of the grains, and other interesting points, has been made by F. Crace Calvert, and published in the *Chemical News* (Sept. 10, 1869, p. 121), to which the reader is referred. We have space for a very few only of the facts developed. One of the facts, which had been previously shown by Fresenius, is that almost the whole of the ashes of wheat consists of phosphates. Of these, nearly two-thirds are soluble in water, and are mainly phosphates of potassium and magnesium; the insoluble salts being phosphates of calcium and iron, with a little of the insoluble magnesian phosphate $Mg_3(PO_4)_2$. Another highly important fact is that by far the larger proportion of the phosphates exists in the parts separated in the sifting of the flour; and our fine white bread is, therefore, greatly deficient in one of the most essential elements of nutrition. Besides this reason for preferring brown or bran-bread to the whitest, another exists: there is a peculiar ferment, discovered by M. Mège-Mouriès, in the inner cortical part of the wheat, which is rejected in the fine white flour, which rapidly changes starch into sugar, and thus greatly promotes the panary fermentation.

Vegetable albumen is destitute of adhesiveness, and, when dried, is opaque, and of a white, gray, or brown color. Before coagulation, it is soluble in water, but insoluble in alcohol. By heat it coagulates and becomes insoluble in water. It is dissolved by solutions of the caustic alkalies. Most of the acids, if added to its solution in excess, precipitate compounds of the acids respectively with the albumen, which, though soluble in pure water, are insoluble in that liquid when acidulated. It is not, however, precipitated by an excess of phosphoric or acetic acid. Its relations to the earthy and metallic salts are similar to those of gluten. Corrosive sublimate precipitates it from its solutions, except from those in phosphoric and acetic acids, and, when added in a state of solution to moist albumen, forms with it a hard, opaque compound. It is also precipitated by infusion of galls. This principle derived its name from its very close resemblance to animal albumen. It is associated with gluten in most of the farinaceous grains, is a constituent of all the seeds which form a milky emulsion with water, and exists in all the vegetable juices which coagulate by heat.

The mixture of vegetable fibrin and albumen which constitutes the gluten of Beccaria, exercises an important influence over starch, which, with the presence of water, and the aid of a moderate heat, it converts partly into gum and partly into sugar. The production of saccharine matter in the germination of seeds and in malting, which is an example of germination, is thus explained. The gluten becomes acid in the process, and loses the property of reacting on starch.

It is thought by many chemists that *vegetable albumen* is identical in all respects with *animal albumen*, and the *gluten* of vegetables with animal *fibrin*; and that both these principles, as well as another named *casein*, found also both in the animal and vegetable kingdoms, belong to a class of compounds termed *proteids*. *Proteids* consist of nitrogen, carbon, hydrogen, oxygen, and sulphur, and their average composition may be expressed by the empirical formula $C_{72}H_{112}N_{18}O_{22}S$.

It is scarcely necessary to state that bread is formed by making flour into a paste with water, with the addition of yeast, setting it aside to ferment, and then exposing it to the heat of an oven. The fermentation excited by the yeast is accompanied with the extrication of carbonic acid gas, which, being retained by the tenacity of the gluten, forms innumerable little cells throughout the mass, and thus renders the bread light.[*] Alcohol is also generated during the fermentation, most of which is driven off from the bread in baking; but a small portion remains, averaging, according to Mr. Thos. Polas, 0·314 per cent. (*Chem. News*, May 30, 1873, p. 271.)

Medical Properties and Uses. Wheat flour in its unaltered state is seldom used in medicine. It is sometimes sprinkled on the skin in erysipelatous inflammation, and various itching or burning eruptions, particularly the nettlerash; though rye flour is generally preferred for this purpose.

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[*] *Purity of flour.* So early as the year 1847, M. Bessner, a French pharmaceutist, ascertained that, while pure white flour remains unaffected, as to its color, by the action of alkalies, the meal of Indian-corn or maize becomes of a fine sulphur-yellow under the same circumstances, whether the alkali employed be ammoniacal vapor, or watery solution of caustic ammonia, potassa, or soda. It was thought that a test had thus been discovered of the adulteration of wheat flour with maize; but subsequent experiments by MM. Pierre and Lepetit, professors at Caen, have shown that while the pure flour of wheat, as well as of rye, barley, and buckwheat, remains unaffected by the alkalies, these same flours are rendered yellow by the alkalies, when mixed with the refuse of the siftings of the several flours ground over again; so that it is not the impurity of maize meal that is indicated by yellow coloration caused by the alkalies, but also the powdered bran and other siftings of the flours mentioned. (*Journ. de Pharm.*, Sept. 1868, p. 184.)

Adulteration of bread. Among the adulterations of bread practised by the bakers, alum, employed to cause whiteness, and thus cover defects in the flour, is perhaps the one which has most attracted notice, and which, being sometimes noxious, it is most important to be able to test. One of the means of detection recommended, is that of incineration, by which the bread is consumed, while the alum, if there be any, is left behind. But this method is somewhat tedious; and logwood has been recommended as being at once most convenient, and, according to Mr. John Horsley, "*perfectly reliable,*" if applied as he directs. The following is Mr. Horsley's method, by which in the county of Gloucester, England, alone, in the course of two surveys, he succeeded in obtaining 200 convictions out of some thousands of cases examined by him. He first makes a tincture of logwood by digesting, for 8 hours, two drachms of freshly cut chips in 5 oz. of methylated spirit and filtering; next makes a saturated solution of carbonate of ammonium in distilled water; then mixes a teaspoonful of each solution with a wineglass of water in a white-ware dish, thus forming a pink-colored liquid; and lastly immerses a portion of the suspected bread, "for five minutes or so," in the mixed fluids. If alum be present, the bread, placed on a plate to drain, will in the course of an hour or two assume a blue color; if not present, the pink color fades away. The appearance of a greenish color on drying will indicate the presence of copper. (*Chem. News*, May 17, 1872, p. 1872.)

Bread is more employed. An infusion of toasted bread in water is a nutritive drink, well adapted to febrile complaints. Within our experience, no drink has been found more grateful in such cases than this infusion, sweetened with a little sugar, and flavored by lemon-juice. Boiled with milk, bread forms a good emollient poultice, which may be improved by the addition of a little perfectly fresh lard. Slices of it steeped in lead-water, and the crumb mixed with the fluid and confined within gauze, afford convenient modes of applying this preparation to local inflammations. The crumb (*mica panis*) is, moreover, frequently used to give bulk to minute doses of very active medicines, administered in the form of pill. It should be recollected that it always contains common salt, which is incompatible with certain substances, as, for example, nitrate of silver.

Bran is sometimes used in decoction, as a demulcent in catarrhal affections and complaints of the bowels. When taken in substance, it is laxative, and may be used with advantage to prevent costiveness. Bran bread, made from the unsifted flour, is an excellent laxative article of diet in some dyspeptic cases. The action of the bran is probably mechanical, consisting in the irritation produced upon the mucous membrane of the bowels by its coarse particles. Bran also forms an excellent demulcent bath.

Off. Prep. Cataplasma Fermenti, *Br.*

FEL BOVIS. *U. S.* *Ox Gall.*

(FĔL BŌ'VĬS.)

"The fresh gall of Bos Taurus. Linné. (*Class*, Mammalia. *Order*, Ruminantia.)" *U. S.*

Recent researches of a very thorough character have thrown more light on the subject of the constituents of gall. The most characteristic constituents of all galls of whatever origin are, first, the sodium or potassium salts of certain resinous acids known collectively as the "gall-acids," and, secondly, certain coloring matters known as "gall-pigments." The gall-acids thus far made known are *glycocholic acid*, $C_{26}H_{43}NO_6$; *taurocholic acid*, $C_{26}H_{45}NSO_7$; *hyoglycocholic acid*, $C_{27}H_{43}NO_5$; *hyotaurocholic acid*, $C_{27}H_{45}NSO_6$; and *chenotaurocholic acid*, $C_{29}H_{49}NSO_6$. Of these, the first two occur in ox gall as sodium salts, although sometimes (in green galls) the first one is absent. The bilicholic acid and bilifellinic acid of Berzelius, as well as fellic and fellinic acids, appear to have been mixtures. The solutions of these gall-acids, as well as their alkaline salts, give on addition of sugar and a drop of sulphuric acid a clear and strong purplish red color (Pettenkofer's gall test). They are also decomposed by the action of baryta water into non-nitrogenous acids and amido-compounds, as will be seen in the following reactions:

$$\underset{\text{Glycocholic acid.}}{C_{26}H_{43}NO_6} + H_2O = \underset{\text{Cholic acid.}}{C_{24}H_{40}O_5} + \underset{\text{Glycine.}}{C_2H_5NO_2}$$

$$\underset{\text{Taurocholic acid.}}{C_{26}H_{45}NO_7S} + H_2O = \underset{\text{Cholic acid.}}{C_{24}H_{40}O_5} + \underset{\text{Taurine.}}{C_2H_7NO_3S}.$$

The gall-pigments are very unstable organic coloring matters, so that their individuality cannot be said to be very thoroughly established. The recent researches of Staedeler (*Verhand. d. Naturf. Ges. in Zürich*, S) and R. Maly (*Ann. Ch. und Pharm.*, 132, p. 129) have, however, given us a better knowledge of them. They are *bilirubin*, $C_{32}H_{36}N_4O_6$; *biliverdin*, $C_{32}H_{36}N_4O_9$; *bilifuscin*, $C_{16}H_{20}N_2O_4$ (?); and *biliprasin*, $C_{16}H_{22}N_2O_6$ (?). Of these, the first two seem to exist originally in the gall, and the others are probably derived from them. Hoppe-Seyler (*Deut. Chem. Ges. Ber.*, 7, p. 1065) has shown that the hæmoglobin and hæmatin of the blood can be changed into hydrobilirubin, a derivative of bilirubin, so that the origin of these gall-pigments seems to be clearly shown.

Ox gall contains in addition *cholesterine*, *choline*, *urea*, fats, which are the *gly-*

cerides of acetic and propionic acids, mucus, and some inorganic salts, such as sodium and potassium chlorides, sodium, potassium, calcium, and magnesium phosphates.

The *sodium glycocholate* and *taurocholate* may be separated in the following manner. Dry ox-bile is treated with absolute alcohol, and the tincture precipitated by ether in excess. Both salts are deposited, and the glycocholate crystallizes upon standing, the taurocholate remaining in an amorphous form, resembling oily or resinous matter. They may be separated more completely by taking advantage of their different relations to the acetate and subacetate of lead. Both the acids are precipitated by the subacetate, the glycocholate only by the acetate. If the deposit above referred to be dissolved in water, solution of acetate of lead will throw down a glycocholate of lead, while the addition of the subacetate of lead to the remainder will precipitate the taurocholate. The acids may be separated from the salts of lead by sulphuric acid, and then recombined with soda.

Properties. "A brownish green or dark green, somewhat viscid liquid, having a peculiar odor, a disagreeable, bitter taste, and a neutral or faintly alkaline reaction. Sp. gr. 1·018–1·028. A mixture of 2 drops of Ox Gall and 10 C.c. of Water, when treated, first with a drop of freshly prepared solution of 1 part of sugar in 4 parts of water, and afterward with sulphuric acid, cautiously added, until the precipitate first formed is redissolved, gradually acquires a cherry-red color, changing successively to carmine, purple, and violet." *U. S.*

Off. Prep. Fel Bovis Inspissatum, *U. S.* Fel Bovis Purificatum, *U. S.*, *Br.*

FEL BOVIS INSPISSATUM. *U. S.* *Inspissated Ox Gall.*

(FĔL BŌ′VĬS ĬN-SPỊS-SĀ′TŬM.)

"Fresh Ox Gall, *one hundred parts* [or twenty ounces av.], To make *fifteen parts* [or three ounces av.]. Heat the Ox Gall to a temperature not exceeding 80° C. (176° F.), strain it through muslin, and evaporate the strained liquid, on a water-bath, in a porcelain capsule, to *fifteen parts* [or three ounces av.]." *U. S.*

FEL BOVIS PURIFICATUM. *U. S., Br.* *Purified Ox Gall.*

(FĔL BŌ′VĬS PŪ-RỊ-FỊ-CĀ′TŬM.)

Fel Bovinum Purificatum, *Br.;* Fel Tauri Depuratum, *P.G.;* Extractum Fellis Bovini; Fiel de Bœuf purifiée, *Fr.;* Gereinigte Ochsengalle (Rindsgalle), *G.*

"Fresh Ox Gall, *three parts* [or sixteen ounces av.]; Alcohol, *one part* [or six fluidounces]. Evaporate the Ox Gall in a porcelain capsule, on a water-bath, to *one part* [or five and a half ounces av.], then add to it the Alcohol, agitate the mixture thoroughly, and let it stand, well covered, for twenty-four hours. Decant the clear solution, filter the remainder, and, having mixed the liquids and distilled off the Alcohol, evaporate to a pilular consistence." *U. S.*

"Take of fresh Ox Bile, *one pint;* Rectified Spirit, *two pints.* Mix the Bile and the Spirit by agitation in a bottle, and set aside for twelve hours until the sediment subsides. Decant the clear solution, and evaporate it in a porcelain dish, by the heat of a water-bath, until it acquires a suitable consistence for forming pills." *Br.*

The object of this preparation is to furnish purified concentrated Ox Gall in a condition fitted for internal administration. The addition of Alcohol to the concentrated liquid is for the purpose of separating mucilaginous matter.

Properties. The U. S. Pharmacopœia describes Purified Ox Gall, and requires it to respond to the following tests. "A yellowish green, soft solid, having a peculiar odor, and a partly sweet and partly bitter taste. It is very soluble in water and in alcohol. A solution of 1 part of Purified Ox Gall in about 100 parts of water, behaves towards sugar and sulphuric acid as the solution mentioned under Ox Gall. (See *Fel Bovis.*) The aqueous solution of Purified Ox Gall should yield no precipitate on the addition of alcohol." *U. S.*

Medical Properties and Uses. Bile was formerly highly valued as a remedy in numerous complaints, and was considered peculiarly applicable to cases attended with deficient biliary secretion. It is supposed to be tonic and laxative. The dose of purified Ox Gall is from five to ten grains (0·33 to 0·65 Gm.). Dr. Bonorden has found the most extraordinary effects, in the resolution of hypertrophies, from bile applied directly to the parts affected. Hypertrophy of the mammæ and that of the tonsils are particularly mentioned as yielding with surprising facility to this application; but good may be expected from it in all cases of the affection in which the part can be reached. He employs a mixture of 3 parts of inspissated bile, 1 part of extract of conium, 2 of soda soap, and 8 of olive oil, to be rubbed on the part four times a day. He has also found advantage in similar affections of the eye, as opacity of the cornea, pannus, and staphyloma, from bile dropped into the eye, or applied by a hair pencil, several times a day. (*Med. Times and Gaz.*, Oct. 1858, p. 353.)

Refined ox gall, much used by limners and painters, is prepared, according to Gray, in the following manner. Take of "fresh ox gall, one pint; boil, skim, add one ounce of alum, and keep it on the fire for some time; to another pint, add one ounce of common salt in the same manner; keep them bottled up for three months; then decant off the clear; mix them in an equal proportion; a thick yellow coagulum is immediately formed, leaving the refined gall clear and colorless."

FERRI ARSENIAS. *Br.* *Arseniate of Iron.*

(FĔR'RĪ ĂR-SĒ'NI̦-ĂS.)

Ferrous Arseniate; Arséniate de Fer, *Fr.;* Arsensaures Eisen, *G.*

"Take of Sulphate of Iron *nine ounces* [avoirdupois]; Arseniate of Soda, dried at 300°, *four ounces* [avoird.]; Acetate of Soda *three ounces* [avoird.]; Boiling Distilled Water *a sufficiency*. Dissolve the Arseniate and Acetate of Soda in *two pints* [Imperial measure], and the Sulphate of Iron in *three pints* [Imp. meas.] of the Water, mix the two solutions, collect the white precipitate, which forms, on a calico filter, and wash until the washings cease to be affected by a dilute solution of chloride of barium. Squeeze the washed precipitate between folds of strong linen in a screw press, and dry it on porous bricks, in a warm chamber whose temperature shall not exceed 100°." *Br.*

This is an officinal of the first British Pharmacopœia, which as yet is the only one that has adopted it. The washed precipitate described in the process, made by mixing solutions of sodium arseniate and sodium acetate with ferrous sulphate, is ferrous arseniate ($Fe_3As_2O_8$). The object of using the sodium acetate is to prevent the precipitation of ferrous hydrarseniate, owing to the liberation of some sulphuric acid, which would be thrown down with the precipitated ferrous arseniate if the acetate were not present. The reaction may be explained as follows:

$$2Na_2HAsO_4 + 3FeSO_4 + 2NaC_2H_3O_2 = Fe_3As_2O_8 + 2HC_2H_3O_2 + 3Na_2SO_4.$$

Arseniate of iron is white when first formed, but quickly turns green on exposure to the air during the process of washing and drying, and finally becomes a ferroso-ferric arseniate, of the probable composition $2Fe_3As_2O_8.4FeAsO_4.Fe_2O_3.32H_2O$. It is an amorphous powder, without smell or taste, insoluble in water, but readily dissolved by hydrochloric acid. The British Pharmacopœia gives the following characters of the salt. Its solution in hydrochloric acid causes a copious light blue precipitate with the yellow prussiate of potash (ferrocyanide of potassium), and a still more abundant one, of a deeper color, with the red prussiate of potash (ferridcyanide of potassium). A small quantity, boiled with an excess of soda, and filtered, gives, when exactly neutralized by nitric acid, a brick-red precipitate on the addition of solution of nitrate of silver. The former test proves the presence both of the ferrous and ferric oxides, the latter, of arsenic acid. The solution in hydrochloric acid, when diluted, gives no precipitate with chloride of barium, showing the absence of any sulphate. "Twenty grains dissolved in an excess of hydrochloric acid diluted with water continue to give a blue precipitate with the red prussiate of potash (ferridcyanide of potassium), until at least 170 grain-measures of the volumetric solution of bichromate of potash have been added." *Br.* This test proves that there is a due proportion of ferrous oxide present; for the bichromate of potassium oxidizes the ferrous oxide, and until this is wholly converted into ferric oxide, a blue precipitate continues to be produced, ceasing, however, when the conversion is complete.

Medical Properties. The arseniate of iron is said to unite the virtues of the two metals which enter into its composition; but the quantity of iron in any permissible dose is so small as to be nearly or quite insignificant; and the activity of the medicine is in fact due to the arsenic alone. The complaints in which it has been found efficient are those in which arsenic in other forms has proved to be a most valuable remedy; and, judging from our own observation, there is no one of them in which the common solution of arsenite of potassium will not produce all the effects that can be obtained from the arsenical preparations, with which this ought undoubtedly to be ranked rather than with the chalybeates. Should the coexistence of an anæmic state of the system with any disease requiring the use of arsenic, indicate the joint use of iron, it would be unsafe to depend on the arseniate of iron, alone. This remedy is peculiarly useful in chronic affections of the skin, especially those of a scaly character, as lepra, psoriasis, and the advanced stage of eczema and impetigo. It is useful also in lupus, and, mixed with twelve times its weight of simple cerate, may be employed externally in cancerous ulcers, though much caution is requisite. The dose is from the eighth to the tenth of a grain (0·008–0·006 Gm.), of which about one-half only is ferrous oxide; given in pill, three times a day.

FERRI CARBONAS SACCHARATUS. *U. S.*, *Br.* *Saccharated Carbonate of Iron.* [*Saccharated Ferrous Carbonate.*]

(FĔR′RĪ CÄR-BŌ′NĂS SĂC-ȻHẠ-RĀ′TŬS.)

Ferri Carbonas Saccharata, *Br.;* Ferrum Carbonicum Saccharatum, *P.G.;* Carbonas Ferrosus Saccharatus; Saccharure de Carbonate ferreux, *Fr.;* Zuckerhaltiges Kohlensaures Eisen, *G.*

"Sulphate of Iron, *ten parts* [or five ounces av.]; Bicarbonate of Sodium, *seven parts* [or three and a half ounces av.]; Sugar, in fine powder, *sixteen parts* [or eight ounces av.]; Distilled Water, *a sufficient quantity.* Dissolve the Sulphate of Iron in *forty parts* [or twenty fluidounces] of hot Distilled Water, and the Bicarbonate of Sodium in *one hundred parts* [or three pints] of warm Distilled Water, and filter the solutions separately, and allow them to cool. Add the solution of Sulphate of Iron gradually to the solution of Bicarbonate of Sodium contained in a capacious flask, and mix thoroughly by shaking. Fill up the flask with boiling Distilled Water, and set the mixture aside for two hours. Draw off the supernatant liquid from the precipitate by means of a siphon, and then fill the flask again with hot Distilled Water and shake it. Pour off the clear liquid and repeat the operation until the decanted liquid gives but a slight turbidity with test-solution of chloride of barium. Transfer the drained precipitate to a porcelain capsule containing the Sugar, and mix intimately; evaporate the mixture to dryness, by means of a water-bath, and reduce the product to powder. Keep the powder in small, well-stopped vials." *U. S.*

"Take of Sulphate of Iron *two ounces* [avoirdupois]; Carbonate of Ammonia *one ounce and a quarter* [avoird.]; Boiling Distilled Water *two gallons* [Imperial measure]; Refined Sugar *one ounce* [avoird.]. Dissolve the Sulphate of Iron and the Carbonate of Ammonia each in half a gallon [Imp. meas.] of the Water, and mix the two solutions with brisk stirring in a deep cylindrical vessel, which is then to be covered as accurately as possible. Set the mixture by for twenty-four hours, and from the precipitate which has subsided separate the supernatant solution by a siphon. Pour on the remainder of the Water, stir well, and, after subsidence, again remove the clear solution. Collect the resulting carbonate on a calico filter, and, having first subjected it to expression, rub it with the Sugar in a porcelain mortar. Finally dry the mixture at a temperature not exceeding 212°." *Br.*

This is a new U. S. officinal preparation; the process is identical with that of the former German Pharmacopœia. It is to be regretted that the author of the formula did not adopt the expedient of adding sugar or syrup to the solutions of the two salts, to protect the precipitate as soon as it was formed, as was recommended by Vallet. When solutions of ferrous sulphate and sodium carbonate are mixed together, there are formed, by double decomposition, sodium sulphate which remains in solution, and ferrous carbonate which falls as a pale blue precipitate. This precipitate begins immediately to alter in nature by the absorption of oxygen, and, if washed and dried in the ordinary way, becomes ferric oxide, associated with a small quantity of the ferrous carbonate, which has escaped change. As the preparations of iron containing ferrous oxide are the most esteemed, the change which this precipitate undergoes has always been a matter of regret, and various attempts have been made to prevent it. Saccharine matter has been ascertained to possess the required preservative properties; and, in the preparation under consideration, it is used to prevent the ferrous carbonate as first precipitated from passing into the ferric modification.

Dr. Becker, a German physician, was the first to suggest the use of saccharine matter as a means of protection against the absorption of oxygen; and the idea was carried out by Klauer, a German chemist, who first made the saccharated carbonate of iron. The use of boiling distilled water in the process is to avoid the action of the air contained in unboiled water. The washed precipitate is pressed so as to free it from water as far as possible, and then incorporated with the sugar in fine powder. The mode of treating the precipitate unnecessarily exposes it to the action of the air; and the late London method of incorporating it with the sugar immediately after washing, was on this account preferable. The final drying heat should not exceed 54·5° C. (130° F.) (See *Archiv d. Pharm.*, Jan. 1878; *N. R.*, 1878, p. 116; 1881, pp. 69, 285.)

Properties. "A greenish gray powder, gradually oxidized by contact with air, odorless, having at first a sweetish, afterward a slightly ferruginous taste, and a neutral reaction. It is only partially soluble in water; but completely soluble, with copious evolution of carbonic acid gas, in diluted hydrochloric acid, forming a clear, yellow liquid. This solution affords a blue precipitate with test-solution either of ferrocyanide or of ferricyanide of potassium, but should not be rendered more than slightly turbid by test-solution of chloride of barium (limit of sulphate). If 8 Gm. of the Saccharated Carbonate of Iron be dissolved in water with an excess of hydrochloric acid, and the solution mixed with 33 C.c. of the volumetric solution of bichromate of potassium, the mixture should still afford a blue color or precipitate with test-solution of ferricyanide of potassium (presence of at least 15 per cent. of ferrous carbonate)."* *U. S.*

Saccharated carbonate of iron is in small coherent lumps, usually of a grayish brown color, permanent in the air, having a sweet, styptic taste, and wholly and readily soluble in hydrochloric acid with brisk effervescence. According to the British Pharmacopœia, it is a "carbonate of iron (FeO,CO_2), mixed with peroxide of iron and sugar, and forming at least 57 per cent. of the mixture." The presence of sesquioxide of iron is a defect, which is avoided in Vallet's ferruginous mass.

Its solution in dilute hydrochloric acid is but slightly affected by ferrocyanide of potassium, showing the presence of the ferric salt in only small proportion, but yields a copious blue precipitate with the ferricyanide, proving the abundance of the ferrous compound. The same solution should give but a very slight precipitate with chloride of barium, evincing that very little sulphate either of iron or of soda has escaped the washing process. "Twenty grains dissolved in excess of hydrochloric acid, and diluted with water, continue to give a blue precipitate with red prussiate of potash until at least 330 grain-measures of the volumetric solution of bichromate of potash have been added." *Br.* This test, like the present officinal one, determines the quantity of ferrous salt present, requiring the stated amount of the bichromate to convert it into the ferric chloride.

Medical Properties. This preparation is an excellent chalybeate, possessing the advantages of having nearly all the iron in it in the ferrous state, and of being readily soluble in acids. Originally introduced into the officinal list by the Edinburgh College, it appeared for the first time in the Dublin and London Pharmacopœias of 1850 and 1851. It is undoubtedly more active than the subcarbonate of iron, and must be used in a smaller dose. It is, however, inferior to Vallet's ferruginous mass, in the preparation of which the anti-oxidizing influence of saccharine matter is more fully applied. The dose of the saccharated carbonate of iron is from five to thirty grains (0·33 to 1·95 Gm.), given in the form of pill.

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* *Saccharated Oxide of Iron. Saccharum Ferrugineum.* This is a combination of sugar and ferric oxide. It is soluble and of a pure sweet taste. According to the method of Siebert, to prepare it dissolve two parts of iron in twenty-four parts of nitric acid, sp. gr. 1·2; evaporate the filtrate to fifteen parts; when *quite cool* dissolve twelve parts of sugar in the filtrate, and add an excess of a solution of twelve parts of sugar in twelve parts of 20 per cent. water of ammonia. After setting aside for twenty-four hours, precipitate this with four or five times its volume of strong alcohol; collect the precipitate, partially dry with bibulous paper, intimately mix the moist mass with its own weight of powdered sugar, dry by a moderate heat. It is a good antidote for arsenic. (*A. J. P.*, xl. 324, 326. See also *Neues Repertor. für Pharm.*, xviii. 36.)

Off. Prep. Pilula Ferri Carbonatis, *Br.*

FERRI CHLORIDUM. *U.S.* *Chloride of Iron.* [*Ferric Chloride.*]

$Fe_2Cl_6.12H_2O$; 540·2. (FĔR'RĪ ȻHLŌ'RỊ-DŬM.) $Fe_2Cl_3.12HO$; 270·1.

Ferrum Sesquichloratum, *P.G.;* Ferrum Muriaticum Oxydatum, Chloridum vel Chloruretum Ferricum, Ferri Perchloridum; Ferric Chloride; Perchlorure de Fer, Chlorure ferrique, *Fr.;* Eisenchlorid, *G.*

"Iron, in the form of fine wire and cut into small pieces, *fifteen parts* [or two ounces av.]; Hydrochloric Acid, *eighty-six parts* [or nine and a half fluidounces]; Nitric Acid, Distilled Water, each, *a sufficient quantity.* Put the Iron Wire into a flask capable of holding double the volume of the intended product, pour upon it *fifty-four parts* [or six fluidounces] of Hydrochloric Acid previously diluted with *twenty-five parts* [or three fluidounces] of Water, and let the mixture stand until effervescence ceases; then heat it to the boiling point, filter through paper, and, having rinsed the flask and Iron Wire with a little boiling Distilled Water, pass the rinsings through the filter. To the filtered liquid add *twenty-seven parts* [or three fluidounces] of Hydrochloric Acid, and pour the mixture slowly and gradually, in a stream, into *eight parts* [or six fluidrachms] of Nitric Acid, contained in a capacious porcelain vessel. After effervescence ceases, apply heat, by means of a sand-bath, until the liquid is free from nitrous odor; then test a small portion with freshly-prepared test-solution of ferricyanide of potassium. Should this reagent produce a blue color, add a little more Nitric Acid and evaporate off the excess. Then add the remaining *five parts* [or half a fluidounce] of Hydrochloric Acid, and enough Distilled Water to make the whole weigh *sixty parts* [or eight ounces av.], and set this aside, covered with glass, until it forms a solid, crystalline mass. Lastly, break it into pieces, and keep the fragments in a glass-stoppered bottle, protected from light." *U. S.*

This formula of the U. S. Pharmacopœia has been adopted with but little alteration from that of Wittstein. (*Pract. Pharm. Chem.*, *Darby's Transl.*, p. 265.) When iron is heated with hydrochloric acid, water is decomposed, the hydrogen escapes with effervescence, and the oxygen uniting with the iron forms ferrous oxide, which reacts with the hydrochloric acid to form water and ferrous chloride.* The next step of the process is to convert the ferrous chloride into the ferric salt. This is effected by treating it with hydrochloric and nitric acids, and heating till red fumes no longer escape. The following reaction explains this: $6FeCl_2 + 2HNO_3 + 6HCl = 3Fe_2Cl_6 + 2NO + 4H_2O$. The solution is then evaporated, and, on cooling, concretes into a crystalline mass. The relative proportions of iron and the two acids are adjusted very nearly to the production of these results.

Properties. It is in fragments of a crystalline structure, an orange-yellow color, inodorous, and of a strong chalybeate and styptic taste and an acid reaction. It is deliquescent, very soluble in water, and soluble also in alcohol and ether. "On ignition the salt suffers partial decomposition. The dilute aqueous solution yields a brown-red precipitate with water of ammonia, a blue one with test-solution of ferrocyanide of potassium, and a white one, insoluble in nitric acid, with test-solution of nitrate of silver. If the iron be completely precipitated from a solution of the salt by an excess of water of ammonia, the filtrate should not yield either a white or a dark colored precipitate with hydrosulphuric acid (zinc, copper), nor should it leave a fixed residue on evaporation and gentle ignition (fixed alkalies). On adding a clear crystal of ferrous sulphate to a cooled mixture of equal volumes of concentrated sulphuric acid and a moderately dilute solution of the salt, the crystal should not become colored brown, nor should there be a brownish black zone developed around it (abs. of nitric acid). A few drops of a solution of the salt, added to freshly prepared test-solution of ferricyanide of potassium, should impart to the latter a pure greenish brown color without a trace of blue (abs. of ferrous salt). A one per cent. solution of the salt in Distilled Water, when boiled in a test-tube, should remain clear (abs. of oxychloride)." *U. S.* It contains a variable proportion of water according to the crystalline forms it is made to assume, having about 40 per cent. or twelve mols. when in fine acicular crystals, and only 22 per cent. or five mols. when in the form of larger tables. (*Brande and Taylor.*) Its solution in water gives with ammonia a brown precipitate of ferric oxide, and does not yield a blue one with ferricyanide of potassium, proving the absence of ferrous chloride.*

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* The Paris Pharmaceutical Society have adopted the following preparations of ferrous chloride, made by dissolving iron in hydrochloric acid, and evaporating the filtered solution rapidly to dryness.

Syrup of Ferrous Chloride. Dissolve 5 grammes of dry ferrous chloride in 20 grammes of orange-flower water, and add 800 grammes syrup of gum and 175 grammes syrup of orange-flower.

Pills of Ferrous Chloride. Dry ferrous chloride, powdered marshmallow-root, each 10 grammes, mucilage sufficient. Make into 100 pills, which are to be silvered.

The sesquichloride of iron is used almost exclusively in the form of tincture or liquor; and in reference to its effect and application we refer to the *Tinctura Ferri Chloridi* and *Liquor Ferri Chloridi.* It is kept in the solid state, because, when dissolved, it is apt to deposit ferric oxide (oxychloride of iron, *Brurin du Buisson*) in an insoluble condition, whereby an excess of acid is produced, which renders the preparation too irritant for many of the purposes for which it is used. (Squibb, *N. Y. Journ. of Med.*, 1860, p. 170.) As a solid, it keeps indefinitely without change. When used, it may be dissolved in water in such proportions as may be required. Six, three, two, and one and a half drachms to a fluidounce of water have been recommended; the stronger solutions being used in the treatment of varices, the weaker for injection into aneurisms, and for application to bleeding surfaces, etc. Mr. J. Z. Lawrence, of England, has used it as a styptic in a semi-deliquesced state and found it extremely efficient. He keeps it in a bottle, in which it gradually deliquesces; and, while it is in this condition, he applies the thick liquid portion, by means of a brush of spun-glass, to the bleeding surface. He has employed it in arresting hemorrhage after excision of the tonsils, and from the deeper-seated gums. (*Med. Times and Gaz.*, 1859, p. 219.) Chloride of iron has been employed internally by Messrs. Jodin and Aubrun, of Paris, and with great asserted success, in the treatment of pseudo-membranous croup, in quantities varying, according to the severity of the disease and the age of the patient, from ninety grains to half an ounce (5·9–15·5 Gm.) in divided doses, in the twenty-four hours, and continued for three or four days. (*Ann. de Thérap.*, 1861, p. 201.)

FERRI CITRAS. *U.S.* *Citrate of Iron.* [*Ferric Citrate.*]

(FĔR'RĪ CĪ'TRĂS.)

$Fe_2(C_6H_5O_7)_2.6H_2O$; 597·8. $Fe_2O_3, C_{12}H_5O_{11}.6HO$; 298·9.

Ferrum Citricum Oxydatum, *P.G.;* Citras Ferricus; Ferric Citrate, *E.;* Citrate de Sesquioxyde de Fer, Citrate ferrique, *Fr.;* Citronensaures Eisenoxyd, Eisencitrat, *G.*

"Solution of Citrate of Iron, *a convenient quantity.* Evaporate the Solution, at a temperature not exceeding 60° C. (140° F.), to the consistence of syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales." *U. S.*

Properties. Citrate of iron is in "transparent, garnet-red scales, permanent in the air, odorless, having a very faint, ferruginous taste, and an acid reaction. Slowly but completely soluble in cold water, and readily so in boiling water; insoluble in alcohol. When strongly heated, the salt emits fumes having the odor of burnt sugar, and finally leaves a residue amounting to 26 per cent. of the original weight, which should not have an alkaline reaction (abs. of fixed alkalies). The aqueous solution of the salt is not precipitated, but is rendered darker by water of ammonia. If heated with solution of potassa, it affords a brown-red precipitate, without evolving any vapor of ammonia. On adding test-solution of ferrocyanide of potassium to an aqueous solution of the salt, a bluish green color or precipitate is produced, which is increased and rendered dark blue by the subsequent addition of hydrochloric acid (difference from citrate of iron and ammonium). If a solution of the salt be deprived of its iron by boiling with an excess of solution of potassa, the concentrated and cooled filtrate precipitated with test-solution of chloride of calcium, and the new filtrate heated to boiling, a white, granular precipitate will be produced." *U. S.*

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* *Incompatibles with Ferric Chloride.* The following list is given (*L'Union Pharmaceutique,* 1872) by M. Bouilhon. Salts of silver; mercurous salts; alkalies, their carbonates and bicarbonates; the arsenites and arseniates; borate of sodium; tannin and vegetable astringents; gums; vegetable extracts and vegetable infusions; albumen; casein.

Medical Properties. Citrate of iron was introduced to the notice of the profession, in 1831, by M. Béral, of Paris. It is a pleasant chalybeate, and is best given in solution. Prof. Procter found that a solution of this salt in distilled water, containing 240 grains in a fluidounce, keeps perfectly, and is very convenient for dispensing. It may be given in the dose of ten minims (0·6 C.c.), containing five grains (0·33 Gm.) of the salt, several times a day. (See *Liquor Ferri Citratis.*)

Off. Prep. Ferri et Quininæ Citras, *U. S.*

FERRI ET AMMONII CITRAS. *U. S., Br.* *Citrate of Iron and Ammonium.* [*Ammonio-Ferric Citrate.*]

(FĔR'RĪ ĔT ẠM-MŌ'NỊ-Ī CĪ'TRĂS.)

Ferri et Ammoniæ Citras, *Br.;* Ferrum Citricum Ammoniatum, *P.G.;* Ferri Ammonio-Citras, Ferro-Ammonium Citricum; Ammonio-Citrate of Iron, Soluble Citrate of Iron, *E.;* Citrate de Fer et d'Ammoniaque (de Fer ammoniacal), Citrate ferrique ammoniacal, *Fr.;* Citronensaures Eisenoxyd-Ammonium (Ammoniak), *G.*

"Solution of Citrate of Iron, *three parts* [or one pint]; Water of Ammonia, *one part* [or seven fluidounces]. Mix the Solution of Citrate of Iron with the Water of Ammonia, evaporate the mixture, at a temperature not exceeding 60° C. (140° F.), to the consistence of syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales. Keep the product in well-stopped bottles in a dark place." *U. S.*

"Take of Solution of Persulphate of Iron *eight fluidounces;* Solution of Ammonia *nineteen and a half fluidounces;* Citric Acid *four ounces* [avoirdupois]; Distilled Water *a sufficiency.* Mix fourteen fluidounces of the Solution of Ammonia with two pints [Imperial measure] of Distilled Water, and to this add gradually the Solution of Persulphate of Iron, previously diluted with two pints [Imp. meas.] of Distilled Water, stirring them constantly and briskly. Let the mixture stand for two hours, stirring it occasionally, then put it on a calico filter, and when the liquid has drained away, wash the precipitate with Distilled Water until that which passes through the filter ceases to give a precipitate with chloride of barium. Dissolve the Citric Acid in eight [fluid]ounces of Distilled Water, and having applied the heat of a water-bath, add the oxide of iron, previously well drained, and stir them together until the whole or nearly the whole of the oxide has dissolved. Let the solution cool, then add five and a half fluidounces of Solution of Ammonia. Filter through flannel, evaporate to the consistence of syrup and dry it in thin layers on flat porcelain or glass plates at a temperature not exceeding 100°. Remove the dry salt in flakes, and keep it in a stoppered bottle." *Br.**

In the U. S. Pharmacopœia, the process consists simply in evaporating a mixture of solution of citrate of iron and water of ammonia. In the British, ferric hydrate is first precipitated from a solution of the ferric sulphate, then digested at a boiling heat with a solution of citric acid, and lastly neutralized by ammonia. It has, however, been found by Dr. Squibb that a heat above 82·1° C. (180° F.) acts injuriously in the preparation of the citrate of iron; and the boiling heat directed in the British Pharmacopœia of 1864 was, therefore, improper. (*A. J. P.*, xxvii. 297.) This error has been corrected in the present Br. Pharmacopœia, which directs that the salt should be dried at a heat not above 38° C. (100° F.). In the U. S. formula the citrate of iron is used already prepared, in the British it is prepared in the process. The direction as to the evaporation, at the close of the original British process, was not sufficiently explicit. The solution should be concentrated to a syrupy consistence, as ordered in the U. S. and existing British formulas, before being poured out on porcelain or glass to dry; and it is important that the heat employed in the concentration should not exceed 60° C. (140° F.).

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* For a formula for *citrate of iron and bismuth,* see *P. J. Tr.*, 3d ser., v. 832.

Prof. J. U. Lloyd (*N. R.*, 1879, p. 323) states that it is usually difficult to adjust accurately the quantity of the ammonia in this process, and proposes to use a definite quantity of a fixed salt, like citrate of ammonium, instead. His process will be found in the foot-note.*

Off. Prep. Ferri et Strychninæ Citras; Liquor Ferri et Quininæ Citratis; Vinum Ferri Citratis, *U. S.;* Vinum Ferri Citratis, *Br.*

Properties. Ammonio-citrate of iron is more soluble than the citrate. It is in "transparent, garnet-red scales, deliquescent on exposure to damp air, odorless, having a saline, mildly ferruginous taste, and a neutral reaction. Readily and wholly soluble in water; insoluble in alcohol. When strongly heated, the salt emits fumes having the odor of burnt sugar, and finally leaves a residue amounting to about 25 per cent. of the original weight, which should not have an alkaline reaction (abs. of fixed alkalies). The aqueous solution of the salt is not precipitated, but is rendered darker by water of ammonia. If heated with solution of potassa, it affords a brown-red precipitate, and vapor of ammonia is evolved. On adding test-solution of ferrocyanide of potassium to an aqueous solution of the salt, no blue color or precipitate is produced unless the solution is acidulated with hydrochloric acid (difference from citrate of iron). If a solution of the salt be deprived of its iron by boiling with an excess of solution of potassa, the concentrated and cooled filtrate precipitated with test-solution of chloride of calcium, and the new filtrate heated to boiling, a white, granular precipitate will be produced." *U. S.* It is almost insoluble in alcohol. It is neutral to test-paper ("feebly reddens litmus paper," *Br.*); an alkaline solution from which the iron has been thrown down, if acidulated with hydrochloric acid in slight excess, does not yield a crystalline deposit, showing that the acid is not the tartaric. When incinerated in the air, it leaves not less than 27 per cent. of peroxide of iron, *Br.* Its precise chemical constitution is not determined; but Méhu (*Jahresb.*, 1873, p. 570), on evaporating a solution of ferrous citrate in ammonia to dryness, obtained a salt of the formula $Fe_2(NH_4)_2.C_6H_5O_7)_2 + 3H_2O$. This salt is a pleasant chalybeate, in doses of five grains (0·33 Gm.). According to Dr. Paris, it may be mixed with the carbonated alkalies without decomposition, and given in a state of effervescence with citric acid. It should be prescribed when the citrate of iron is desired in solution, as it is not suited for administration in the form of pills, owing to the presence of ammonia, which renders it too soluble, and causes the pills to flatten after they have been made, and frequently to cohere in one solid mass. The officinal citrate of iron should always be used for pills, as it is more slowly dissolved.

FERRI ET AMMONII SULPHAS. *U. S.* *Sulphate of Iron and Ammonium.* [*Ammonio-Ferric Sulphate. Ammonio-Ferric Alum.*]

(FĔR′RĪ ĔT ẠM-MŌ′NỊ-Ī SŬL′PHĂS.)

$Fe_2(NH_4)_2(SO_4)_4.24H_2O$; 963·8. $Fe_2O_3, 3SO_3. NH_4O, SO_3. 24HO$; 481·9.

Ferrum Sulfuricum Oxydatum Ammoniatum, *P.G.;* Ferrum Ammonio-Sulphuricum, Ferri Ammonio-Sulphas, Sulphas Ammonico-Ferricus; Sulfate de Fer et d'Ammoniaque, Sulfate de Fer (ferrique) ammoniacal, Alum de Fer ammoniacal, *Fr.;* Schwefelsaures Eisenoxyd-Ammonium, Ammoniakalischer Eisenalaun, *G.*

"Sulphate of Iron and Ammonium should be kept in well-stopped bottles." *U. S.*

The present Pharmacopœia does not give a process for preparing this salt; that of U. S. P. 1870 will be found below.†

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* Prepare a solution of citrate of ammonium from citric acid 8 oz. av., and ammonia water q. s. Add the ammonia water to the citric acid until in slight excess, then evaporate the solution until it measures sixteen fluidounces.

Then take of solution of tersulphate of iron 16 fluidounces; citric acid 4 ounces avoir.; distilled water and ammonia water, each, a sufficient quantity; solution of citrate of ammonium 5 fluidounces. Prepare hydrated oxide of iron from the solution of tersulphate of iron. Having drained it, place in an evaporating dish and add the citric acid, warm upon a steam or water-bath, and stir until the citric acid is dissolved, then add the solution of citrate of ammonium and stir until the hydrated oxide is dissolved, filter and evaporate to the consistence of thick syrup, and spread upon glass with a brush, and dry. The yield will be 4234 grains.

† *Ferri et Ammonii Sulphas.* "Take of Solution of Tersulphate of Iron *two pints;* Sulphate of

This is an ammonia iron-alum, in which the place of the aluminium oxide (alumina) is occupied by the ferric oxide. It is prepared by heating the solution of tersulphate of iron with sulphate of ammonium until the latter salt is dissolved, and then allowing the solution to cool. The two salts unite to form the sulphate of iron and ammonium, which, being insoluble in the amount of liquid employed, crystallizes when it cools. The process is based on that of Wm. Hodgson (*A. J. P.*, 1856, p. 305).

"Ammonio-ferric alum is in octohedral crystals, of a pale violet color, and sour astringent taste, slowly efflorescent on exposure, and having a slightly acid reaction. Soluble in three parts of water at 15° C. (59° F.), and in 0·8 part of boiling water; insoluble in alcohol. When strongly heated, the crystals fuse, lose their water of crystallization, swell up, and finally leave a pale brown residue. The aqueous solution of the salt yields a blue precipitate with test-solution of ferrocyanide of potassium. With solution of potassa it affords a brown-red precipitate, and if the mixture be heated, vapor of ammonia is evolved. With test-solution of chloride of barium it produces a white precipitate insoluble in hydrochloric acid. If all the iron be precipitated from a solution of the salt by heating with an excess of solution of potassa, the resulting filtrate, when mixed and heated with test-solution of chloride of ammonium in excess, should not yield a white, gelatinous precipitate (abs. of aluminium)." *U. S.* According to H. Rose, the pure salt is white, and gives a colored solution with water, in consequence of the formation of a basic ferruginous salt. This decomposition is prevented by dissolving it in dilute sulphuric acid, when the solution is colorless.

Instead of sulphate of ammonium, sulphate of potassium may be employed with the solution of tersulphate of iron, in which case a potassa iron-alum is produced, called *potassio-ferric alum*, which has all the properties, physical and remedial, of the ammonio-ferric salt; and the two appear to have been indiscriminately used.

The iron-alums were brought to the notice of the Pharmaceutical Society of London, in Dec. 1853, by Mr. Lindsley Blyth, as a new remedy, prescribed in St. Mary's Hospital. Dr. Tyler Smith found them to be more astringent than common alum, and devoid of the stimulating effects of the other salts of iron. Ferric alum is certainly useful in passive leucorrhœas, and its saturated solution has been strongly recommended as a styptic. The dose is from five to ten grains (0·33–0·65 Gm.), to be repeated twice or three times a day.

FERRI ET AMMONII TARTRAS. *U. S.* *Tartrate of Iron and Ammonium.* [*Ammonio-Ferric Tartrate.*]

(FĔR'RĪ ĔT ẠM-MŌ'NỊ-Ī TÄR'TRĂS.)

Ferri Ammonio-Tartras; Ammonio-Tartrate of Iron; Tartrate de Fer et d'Ammoniaque, Tartrate ferrique ammoniacal, *Fr.;* Weinsaures Eisenoxyd-Ammonium, *G.*

"Solution of Tersulphate of Iron, *ninety parts* [or thirteen fluidounces]; Tartaric Acid, *sixty parts* [or twelve ounces av.]; Water of Ammonia, *seventy-two parts* [or fourteen and a half fluidounces]; Carbonate of Ammonium, Distilled Water, Water, each, *a sufficient quantity.* To the Water of Ammonia, previously diluted with *one hundred and eighty parts* [or two and a quarter pints] of cold Water, add, constantly stirring, the Solution of Tersulphate of Iron, previously diluted with *nine hundred parts* [or ten pints] of cold Water. Pour the whole on a wet muslin strainer, allow the precipitate to drain, then return it to the vessel and mix it intimately with *one thousand parts* [or twelve pints] of cold Water. Again drain it on the strainer and repeat the operation once, or oftener, until the washings cause but a slight cloudiness with test-solution of chloride of barium. Then allow the precipitate to drain completely. Dissolve one half of the Tartaric Acid in *one hundred and thirty parts* [or one and a half pints] of Distilled Water, neutralize the solution exactly with Carbonate of Ammonium, then add the other half of the Tar-

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Ammonium *four troyounces and a half.* Heat the Solution of Tersulphate of Iron to the boiling point, add the Sulphate of Ammonium, stirring until it is dissolved, and set the liquid aside to crystallize. Wash the crystals quickly with very cold water, wrap them in bibulous paper, and dry them in the open air." *U. S.* 1870.

taric Acid and dissolve by the application of a gentle heat. Then, while continuing the heat, which should not exceed 60° C. (140° F.), add the magma of hydrated oxide of iron, in small portions at a time, until it is no longer dissolved. Filter the solution, evaporate it, at the before-mentioned temperature, to the consistence of syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales. Keep the product in well-stopped bottles, in a dark place." *U. S.*

This process does not differ essentially from that of Prof. Procter. (*A. J. P.*, 1841, p. 276.) Tartrate of ammonium is prepared, which is converted into bitartrate by the addition of tartaric acid; and the excess of acid is then combined with hydrated oxide of iron freshly prepared from the officinal solution of the tersulphate. A double salt of tartrate of ammonium and iron is thus made in solution, which is obtained by filtering and concentrating the solution. The salt, theoretically, must be considered as consisting of one mol. of tartaric acid and two mol. of base, one consisting of ammonia and the other of ferric oxide, $2(FeO)NH_4,C_4H_4O_6.3H_2O$. It is hardly probable that the salt has exactly this chemical composition, as the scaled salts cannot be said to be definite compounds.

This salt is in "transparent scales varying in color from garnet-red to yellowish brown, only slightly deliquescent, without odor, having a sweetish and slightly ferruginous taste, and a neutral reaction. Very soluble in water, but insoluble in alcohol. When strongly heated, the salt emits fumes having the odor of burnt sugar, and finally leaves a residue amounting to about 25 per cent. of the original weight, which should not have an alkaline reaction (abs. of fixed alkalies). The aqueous solution of the salt is not precipitated, but is rendered darker by water of ammonia. If heated with solution of potassa, it yields a brown-red precipitate, and vapor of ammonia is evolved. On adding test-solution of ferrocyanide of potassium to an aqueous solution of the salt, no blue color or precipitate is produced unless the solution is acidulated with hydrochloric acid. If a solution of the salt be deprived of iron, by boiling with an excess of solution of soda, the concentrated and cooled filtrate, when supersaturated with acetic acid, affords a white, crystalline precipitate." *U. S.*

It is a mild chalybeate, and may be given in a dose of from ten to thirty grains (0·65–1·95 Gm.).

FERRI ET POTASSII TARTRAS. *U. S., Br.* *Tartrate of Iron and Potassium.* [*Potassio-Ferric Tartrate.*]

(FĔR′RĪ ĔT PO̩-TĂS′SI̩-Ī TÄR′TRĂS.)

Ferrum Tartaratum, *Br.;* Tartarated Iron; Tartarus Ferratus, *P. G.;* Ferri Potassio-Tartras, Ferrum Tartarizatum, Tartras Ferrico-Potassicus, s. Potassico-Ferricns, s. Ferrico-Kalicus; Ferro-Tartrate of Potassium; Tartrate de Fer et de Potasse, Tartrate ferrico-potassique, Tartare chalybé, Tartre martial, *Fr.;* Weinsaures Eisenoxyd-Kali, Eisenweinstein, *G.*

"Solution of Tersulphate of Iron, *twelve parts* [or thirteen fluidounces]; Bitartrate of Potassium, *four parts* [or six ounces av.]; Distilled Water, *thirty-two parts* [or three pints]; Water of Ammonia, Water, each, *a sufficient quantity.* To *ten parts* [or fifteen fluidounces] of Water of Ammonia, diluted with *twenty parts* [or two pints] of cold Water, add, constantly stirring, the Solution of Tersulphate of Iron, previously diluted with *one hundred parts* [or nine pints] of cold Water. Pour the whole on a wet muslin strainer, allow the precipitate to drain, then return it to the vessel and mix it intimately with *one hundred and twenty parts* [or eleven pints] of cold Water. Again drain it on the strainer, and repeat the operation once, or oftener, until the washings produce but a slight cloudiness with test-solution of chloride of barium. Put the drained precipitate into a stone-ware or porcelain vessel, add to it *thirty-two parts* [or three pints] of Distilled Water, heat the mixture, on a water-bath, to a temperature not exceeding 60° C. (140° F.), add the Bitartrate of Potassium, and stir until the hydrated oxide of iron is dissolved. Filter while hot, and let the filtrate stand in a cool, dark place for twenty-four hours; then stir it well with a porcelain or glass spatula, so that the precipitate which has formed in it may be thoroughly incorporated with the liquid. Now add, very cautiously, just enough Water of Ammonia to dissolve the precipitate, evaporate the solution, in a porcelain vessel, to the consistence of thick syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales. Keep the product in well-stopped bottles, in a dark place." *U. S.*

"Take of Solution of Persulphate of Iron *five and a half fluidounces* [Imperial measure]; Solution of Ammonia *ten fluidounces* [Imp. meas.]; Acid Tartrate of Potash, in powder, *two ounces* [avoirdupois]; Distilled Water *a sufficiency.* Mix the Solution of Ammonia with *three pints* [Imp. meas.] of Distilled Water, and to this add gradually the Solution of Persulphate of Iron previously diluted with two pints [Imp. meas.] of Distilled Water, stirring constantly and briskly. Let the mixture stand for two hours, stirring it occasionally, then put it on a calico filter, and, when the liquid has drained away, wash the precipitate with Distilled Water until that which passes through the filter ceases to give a precipitate with chloride of barium. Mix the washed and drained precipitate intimately with the Acid Tartrate of Potash in a porcelain dish, and let the mixture stand for twenty-four hours; then, having applied a gentle heat, not exceeding 140°, add gradually a pint [Imp. meas.] of Distilled Water, and stir constantly until nothing more will dissolve. Filter; evaporate at a temperature not exceeding 140° to the consistence of syrup, and dry it in thin layers on flat porcelain or glass plates in a drying closet at 120°. Remove the dry salt in flakes and keep it in stoppered bottles." *Br.*

The object of these processes is to combine the excess of acid in the bitartrate of potassium with oxide of iron. In both, the plan of Soubeiran in the main is adopted; namely, that of dissolving the moist hydrated oxide to saturation in a mixture of the bitartrate and water, aided by a moderate heat. The oxide is obtained from the solution of tersulphate of iron, which is precipitated by ammonia. Potassa, which was used in the former British process, is not a good precipitant; because the alkali adheres obstinately to the precipitated oxide, and cannot be completely separated even by repeated washings. The oxide should be gradually added to the bitartrate and water, heated to 60° C. (140° F.), as recommended by Soubeiran, at which temperature the oxide dissolves more readily and in larger quantity than when a higher temperature is employed. Besides, in the latter case, a portion of the ferric oxide is converted into ferrous oxide. (*Gmelin's Handbook*, x. 315.) In the U.S. process the addition of water of ammonia to the cooled filtrate dissolves the precipitated insoluble ferric tartrate, and is in accordance with the recommendation of Prof. J. U. Lloyd (*N. R.*, 1879, p. 324), who asserts that this modification renders the salt more soluble without interfering with its stability. G. H. Chas. Klie suggested this improvement in *A. J. P.*, 1876, p. 170. (See also *N. R.*, 1878, p. 21.) In both formulas, the liquid is poured out on a plane surface, so as to dry in scales. When duly carried into effect, they yield a product at all times identical, and having all the required qualities of the salt.*

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* *Another method of preparing this salt.* M. Roger, having found the tartrate of iron and potassium, as existing in the shops of Paris, a very variable salt, seldom presenting perfect identity of composition in any two specimens, and ascribing this result to the imperfection of the prevalent mode of preparing it, which requires a large amount of water, and consequently a prolonged evaporation, resulting in the reduction of the oxide, and the production of a yellowish insoluble ferrous salt, and which is attended besides with various other inconveniences, proposes the following method, which he conceives to be free from these objections, and to present in all instances an identical product. The newly-proposed method consists in causing, as a first step, strongly hydrated oxide of iron to be dissolved in tartaric acid to complete saturation, for which purpose the water of hydration of the oxide is sufficient at a temperature of 38° C. to 49° C. (100° to 120° F.). The solution takes place completely and quickly; and the point of saturation is known when the liquid, at first clear, becomes turbid, thickens, and at last concretes in the form of a jelly. No more of the oxide, which is in slight excess, is now to be added. Upon this jelly is to be poured, little by little, a very concentrated solution of *pure* carbonate of potassium, of which the quantity to be used should be the proper molecular weight to correspond with that of the tartaric acid employed. But this precision as to the quantity of the carbonate is not absolutely necessary; as the cessation of effervescence is a sufficient criterion of saturation. Should, however, the solution, upon testing it, be found slightly acid, the solution of carbonate of potassium should be cautiously added till the liquid becomes slightly alkaline. The vessel is then to be removed from the water-bath, and the whole allowed to cool. Twelve hours afterwards, the liquid is decanted, filtered, and evaporated by means of a water-bath, with constant agitation, to a syrupy consistence. It is then to be spread by means of a brush, in thin layers, on plates of glass, which are to be placed in the drying room. The salt is thus obtained in beautiful spangles, of a deep garnet-red. Or it may be dried in moulds of tinned iron with a large surface; but in this case, instead of scales, it forms little

The late Dr. Ure proposed the *tartrate of iron* for medical use. He made it by acting on clean iron filings, or bits of iron wire, with a solution of tartaric acid. It is a pulverulent salt, insoluble in water, and possessing a mild chalybeate taste.

Properties. Tartrate of iron and potassium, as obtained by the above formulas, is in "transparent, garnet-red scales, only slightly deliquescent, without odor, having a sweetish, slightly ferruginous taste, and a neutral reaction. Very soluble in water, but insoluble in alcohol [" sparingly soluble in spirit," *Br.*]. When strongly heated, the salt emits fumes having the odor of burnt sugar, and finally leaves a dark brown residue, having a strongly alkaline reaction and effervescing with acids. The aqueous solution of the salt is not precipitated, but is rendered darker by water of ammonia. If heated with solution of potassa, it affords a brown-red precipitate, and a slight odor of ammonia is evolved. On adding test-solution of ferrocyanide of potassium to an aqueous solution of the salt, no blue color or precipitate is produced, unless the solution is acidulated with hydrochloric acid. If a solution of the salt be deprived of its iron by boiling with an excess of solution of soda, the concentrated and cooled filtrate, when supersaturated with acetic acid, will afford a white, crystalline precipitate." *U. S.* It has a sweetish slightly chalybeate taste. Its solution does not change the color of litmus, and at common temperatures is not precipitated by potassa, soda, or ammonia. In boiling solution, soda precipitates oxide of iron, without evolution of ammonia; and the filtered solution, acidulated with hydrochloric acid, deposits a crystalline substance when it cools; the latter test showing the presence of tartrate of potassium, the former that of the sesquioxide of iron without ammonia, and both together the character of the salt. According to the view of its nature taken in the U. S. Pharmacopœia, it is a double salt, consisting of one mol. of tartrate of iron and one of tartrate of potassium ($Fe_2(C_4H_4O_6)_3 + K_2C_4H_4O_6 + H_2O$). "By incinerating 50 grains at a red heat, washing what is left with distilled water, and again incinerating, a residue of peroxide is obtained, weighing 15 grains." (*Br.*) The salt is incompatible with astringent vegetable infusions, which give rise to a dark-colored precipitate.

Medical Properties. Tartrate of iron and potassium is an agreeable chalybeate, and is preferred by M. Mialhe, who conceives that it is more readily absorbed than any other ferruginous preparation. It is also well borne by the stomach, whether taken fasting, or with the food. From its slight taste and ready solubility, it is one of the best ferruginous preparations for children. The dose for an adult is from ten grains to half a drachm (0·65–1·95 Gm.), given preferably in solution.

FERRI ET QUININÆ CITRAS. *U. S.* *Citrate of Iron and Quinine.*

(FĔR'RĪ ĔT QUỊ-NĪ'NÆ CĪ'TRĂS—kwẹ-nī'nē.)

Ferri et Quiniæ Citras, *Br.*, also *U. S.* 1870; Citrate of Iron and Quinia; Citrate de Fer et de Quinine, *Fr.;* Chininum Ferro-Citricum, *P. G.;* Citronensaures Eisen-Chinin, *G.*

"Citrate of Iron, *eighty-eight parts* [or twenty-two ounces av.]; Quinine, dried at 100° C. (212° F.), until it ceases to lose weight, *twelve parts* [or three ounces av.]; Distilled Water, *a sufficient quantity*, To make *one hundred parts* [or about twenty-five ounces av.]. Dissolve the Citrate of Iron in *one hundred and sixty parts* [or thirty-eight fluidounces] of Distilled Water, by heating on a water-bath, at a temperature not exceeding 60° C. (140° F.). To this solution add the Quinine and stir constantly until it is dissolved. Lastly, evaporate the solution, at a temperature not exceeding 60° C. (140° F.), to the consistence of syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales. Keep the product in well-stopped bottles, in a dark place." *U. S.*

"Take of Solution of Persulphate of Iron *four and a half fluidounces;* Sulphate of Quinia *one ounce* [avoirdupois]; Diluted Sulphuric Acid *twelve fluidrachms* [Imperial measure]; Citric Acid *three ounces* [avoird.]; Solution of Ammonia, Distilled

black masses not unlike jet. Thus prepared, it always presents the same composition, dissolves in water without residue, and, besides, is little disposed to deliquescence, so that it may be readily employed in pills. The solution, however, is slow in forming, as the salt at first agglomerates at the bottom of the vessel; but in half an hour it is complete, and may be kept long unchanged. (*Journ. de Pharm.*, Juin, 1861, p. 401.)

Water, of each, *a sufficiency*. Mix eight fluidounces [Imp. meas.] of the Solution of Ammonia with two pints [Imp. meas.] of Distilled Water, and to this add the solution of Persulphate of Iron previously diluted with two pints of Distilled Water, stirring them constantly and briskly. Let the mixture stand for two hours, stirring it occasionally, then put it on a calico filter, and, when the liquid has drained away, wash the precipitate with Distilled Water until that which passes through the filter ceases to give a precipitate with chloride of barium.

"Mix the Sulphate of Quinia with eight [fluid]ounces of Distilled Water, add the Diluted Sulphuric Acid, and when the salt is dissolved precipitate the quinia with a slight excess of Solution of Ammonia. Collect the precipitate on a filter, and wash it with a pint and a half of Distilled Water.

"Dissolve the Citric Acid in five [fluid]ounces of Distilled Water, and, having applied the heat of a water-bath, add the oxide of iron previously well drained; stir them together, and, when the oxide has dissolved, add the precipitated quinia, continuing the agitation until this also has dissolved. Let the solution cool, then add in small quantities at a time twelve fluidrachms of Solution of Ammonia diluted with two fluidounces of Distilled Water, stirring the solution briskly, and allowing the quinia which separates with each addition of ammonia to dissolve before the next addition is made. Filter the solution, evaporate it to the consistence of a thin syrup, then dry it in thin layers on flat porcelain or glass plates at a temperature of 100°. Remove the dry salt in flakes, and keep it in a stoppered bottle." *Br.*

The present process differs in several particulars from that formerly officinal; the solution of citrate of iron has been replaced by a definite weight of citrate of iron, and, instead of using freshly precipitated quinine, the moisture is driven off entirely, and the perfectly dry alkaloid is used. There has been very little gain in saving time by the change, because of the slow solubility both of the citrate of iron and quinine, and this is particularly so if the temperature is strictly adhered to. The *officinal* citrate of iron and quinine has never been very largely used, because of its slow solubility, the manufacturers supplying a salt which is readily soluble, due to the presence of ammonia. By the introduction of a solution of citrate of iron and quinine (see *Liquor Ferri et Quininæ Citratis*) the salt is now furnished in a very convenient liquid form for use in solutions, whilst the above comparatively insoluble salt is retained for use in pills, for which it is much better adapted than the soluble salt of the manufacturers.

The British process of 1864 was more complicated. First, a mixture of ferrous and ferric oxides was obtained by precipitating a mixture of the sesquisulphate and sulphate in solution by means of soda. Secondly, the mixed oxides thus obtained were digested with a solution of citric acid, so as to produce a citrate in solution. Thirdly, sulphate of quinine, dissolved by means of dilute hydrochloric acid, was precipitated by chloride of barium so as to separate the sulphuric acid, and from the solution of the hydrochlorate of quinine remaining, the quinine was thrown down by ammonia. Lastly, the quinine thus procured was digested with the solution of citrate of iron, and the resulting citrate of iron and quinine was obtained by evaporation. This process has been much altered, and, we think, amended, in the present Pharmacopœia. Indeed, M. Fleurot, after trying the former process, came to the conclusion that it was fallacious. (*P. J. Tr.*, 1864, p. 21.) He has proposed a formula of his own, which appears to have served as the basis of the amended British process, especially in reference to the addition of ammonia to the solution of the oxide of iron and the quinine to the citric acid. (*Journ. de Pharm.*, 4e sér., i. 443.) The use of the two sulphates of iron was abandoned, and only the solution of the persulphate retained. From this the freshly precipitated hydrate of iron is obtained by precipitation with ammonia. The next step is to separate quinine from the sulphate, by simply dissolving the salt in water with the aid of sulphuric acid, and then precipitating by ammonia. Thirdly, the hydrate and quinine are dissolved successively, aided by the heat of a water-bath, in solution of citric acid, whereby a citrate of iron and of quinine is obtained. The ammonia is added in order to render the citrate of iron and quinine more soluble by the agency of a portion of citrate of ammonium. It is important that the ammonia should not be added in excess; on the contrary, the solution should retain a slight acid reaction. (*Fleurot.*) After evaporation, the salt is dried, as in the other process, on glass or porcelain, so as to be obtained in thin scales.

The U. S. and Br. preparations are essentially different; both consist of citric acid, ferric oxide, and quinine; the British, however, containing the important addition of citrate of ammonium. No analysis of either salt has been made that determines precisely its chemical composition. Both are undoubtedly mere mixtures of the citrates of iron and quinine, the British containing citrate of ammonium.

The characters of the U. S. salt, as given in the Pharmacopœia, are the following. "Transparent, thin scales, varying in color from reddish brown to yellowish brown, slowly deliquescent on exposure to air, odorless, having a bitter and mildly ferruginous taste, and a slightly acid reaction. Slowly but wholly soluble in cold water, more readily so in hot water, and but slightly soluble in alcohol. When strongly heated, the salt emits fumes having the odor of burnt sugar, and finally leaves a residue which should not have an alkaline reaction (abs. of fixed alkalies). On supersaturating the aqueous solution of the salt with a slight excess of water of ammonia, the color of the liquid is deepened and a white, curdy precipitate is thrown down, which is soluble in ether and answers to the reactions of quinine. (See *Quinina.*) A small portion of the filtrate, when mixed with test-solution of ferrocyanide of potassium, does not produce a blue color or precipitate unless it is acidulated with hydrochloric acid. If another portion of the filtrate be deprived of its iron by boiling with an excess of potassa, the concentrated and cooled filtrate precipitated by test-solution of chloride of calcium, and the new filtrate heated to boiling, a white, granular precipitate will be produced. On heating the solution of the salt with potassa, no vapor of ammonia should be evolved. The salt contains 12 per cent. of dry quinine. It may be assayed as follows: Dissolve 4 Gm. of the scales in 30 C.c. of water, in a capsule, with the aid of heat. Cool, and transfer the solution to a glass separator, rinsing the capsule; add an aqueous solution of 0·5 Gm. of tartaric acid, and then solution of soda in decided excess. Extract the alkaloid by agitating the mixture with four successive portions of chloroform, each of 15 C.c. Separate the chloroformic layers, mix them, evaporate them in a weighed capsule, on a water-bath, and dry the residue at a temperature of 100° C. (212° F.). It should weigh 0·48 Gm." *U. S.*

Amorphous quinine or chinoidine is sometimes substituted for the crystallizable alkaloid. Dr. de Vrij proposes a method of detecting this fraud, which depends upon the fact that oxalic acid forms with crystallizable quinine, in a chloroformic solution, white crystals of oxalate of quinine without discoloration. (See *N. R.*, 1881, p. 10.)

The British citrate is described as in thin scales of a greenish golden-yellow color, of a bitter and chalybeate taste, somewhat deliquescent (which does not seem to be the case with our officinal salt), and entirely soluble in cold water. "The solution is very slightly acid, and is precipitated reddish brown by solution of soda, white by solution of ammonia, blue by the red and yellow prussiates* of potash, and grayish black by tannic acid." *Br.* The following additional tests are given in the Br. Pharmacopœia. "When burned with exposure to air, it leaves a residue which when moistened with water is not alkaline to test paper [oxide of iron]. Fifty grains, dissolved in a fluidounce of water, and treated with a slight excess of ammonia, give a white precipitate [quinine] which, when collected on a filter and dried, weighs 8 grains. The precipitate is almost entirely soluble in pure ether [showing the absence of cinchonine and quinidine] and when burned leaves but a minute residue." *Br.* Mr. Umney states (*P. J. Tr.*, 3d ser., iv.) that the salt prepared according to the British formula will not stand this test, and that fifty grains of it will not yield more than 7·1 grains of quinine. When dissolved by the aid of an acid, it forms a solution which, decolorized by a little purified animal charcoal, turns the plane of polarization strongly to the left; a character of quinine; cinchonine turning it to the right. (*Squire.*) The salt is said to be sometimes adulterated by cinchonine, which would be at once detected by the test of solubility in ether and the effect on polarized light, above given. Oscar Zinn (*A. J. P.*, 1877, p. 550) examined six commercial samples, two of which contained no quinine, but cinchonine. H. G. Drueding found three out of six samples deficient in quinine. As it occurs in the British market, it is of exceedingly variable composition, containing, according to Mr. J. C. Braithwaite, who examined 35 different specimens, a proportion of quinine varying from 1·5 to 17 per cent. (*P. J. Tr.*, 1868, p. 157.) The proportion of alkaloid appears to be usually below the standard. (A. W. Gerrard, *Ibid.*, March, 1873, p. 763.) According to Mr. C. H. Wood (*Ibid.*, 2d ser., x. 644), this salt undergoes a rapid change of composition when exposed to the direct rays of the sun. The new officinal process of assay will doubtless bring to light all shortcomings.

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* Has not this test been retained by inadvertence, from the former British Pharmacopœia? It indicates the presence of both ferrous and ferric salts, which was true of the preparation of 1864, but is not so of the present, which contains only the ferric oxide.

Citrate of iron and quinine combines the virtues of its two bases, and may be given in all cases in which they are jointly indicated, preferably in pill form. The dose, as a tonic, is five or six grains (0·33–0·4 Gm.), containing about a grain (0·065 Gm.) of quinine, three or four times a day. This dose may be increased, if deemed advisable. (See *Liquor Ferri et Quininæ Citratis.*)

FERRI ET STRYCHNINÆ CITRAS. *U. S.* *Citrate of Iron and Strychnine.*

(FĔR′RĪ ĔT STRȲCH-NĪ′NÆ CĪ′TRĂS.)

Ferri et Strychniæ Citras, *U. S.* 1870; Citrate de Fer et de Strychnine, *Fr.;* Citronensaures Eisen-Strychnin, *G.*

"Citrate of Iron and Ammonium, *ninety-eight parts* [or four hundred and ninety grains]; Strychnine, *one part* [or five grains]; Citric Acid, *one part* [or five grains]; Distilled Water, *one hundred and twenty parts* [or eleven fluidrachms], To make *one hundred parts.* Dissolve the Citrate of Iron and Ammonium in *one hundred parts* [or nine fluidrachms] of Distilled Water, and the Strychnine, together with the Citric Acid, in *twenty parts* [or two fluidrachms] of Distilled Water. Mix the two solutions, evaporate the mixture, by means of a water-bath, at a temperature not exceeding 60° C. (140° F.), to the consistence of syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales. Keep the product in well-stopped bottles, in a dark place." *U. S.*

Citrate of iron and strychnine, although long used in medicine, was first recognized in 1870. The present formula does not differ essentially from that of 1870.

Properties. "Transparent, garnet-red scales, deliquescent on exposure to air, odorless, having a bitter and slightly ferruginous taste, and a slightly acid reaction. Readily and wholly soluble in water, and but slightly soluble in alcohol. When strongly heated, the salt emits fumes having the odor of burnt sugar, and finally leaves a residue which should not have an alkaline reaction (fixed alkalies). On heating the aqueous solution of the salt with solution of potassa, a brown-red precipitate is produced and vapor of ammonia is evolved. If 1 Gm. of the salt be dissolved in 4 C.c. of water, in a small test-tube, then 1 C.c. of solution of potassa added, and the mixture shaken with 2 C.c. of chloroform, the residue left on evaporating the chloroform will answer to the reactions of strychnine. (See *Strychnina.*) On adding test-solution of ferrocyanide of potassium to a dilute aqueous solution of the salt, no blue color or precipitate is produced unless the solution is acidulated with hydrochloric acid. If a solution of the salt be deprived of its iron by boiling with an excess of solution of potassa, the concentrated and cooled filtrate precipitated with test-solution of chloride of calcium, and the new filtrate heated to boiling, a white, granular precipitate will be produced." *U. S.*

Medical Properties. It is an efficient tonic, but has no advantages over the two active substances it contains when given conjointly in an uncombined state, and has the great disadvantage that the dose of one principle cannot be varied independently of that of the other. It occurs in beautiful red scales, of an intensely bitter, scarcely ferruginous taste, and is very soluble in water. It contains one per cent. of strychnine, there being in five grains one-twentieth of a grain of the alkaloid. The dose is three to five grains (0·20–0·33 Gm.) in pill or solution.

FERRI HYPOPHOSPHIS. *U.S.* *Hypophosphite of Iron.* [*Ferric Hypophosphite.*]

$Fe_2(H_2PO_2)_6$; 501·8. (FĔR'RĪ HȲ-PỌ-PHŎS'PHỊS.) $Fe_2O_3(2HO, PO)_3$; 250·9.

Ferrum Hypophosphorosum, Hypophosphis Ferricus; Hypophosphite de Fer, *Fr.;* Unterphosphorigsaures Eisenoxyd, *G.*

This is among the hypophosphites brought into notice in consequence of their recommendation by Dr. Churchill in the treatment of phthisis, in which they were thought to be useful by the introduction of phosphorus into the system. This particular salt may be considered preferable to others, when a marked condition of anæmia indicates a deficiency of iron in the tissues. It may be made by the action of hypophosphorous acid on carbonate of iron formed by precipitation from the sulphate; but as some difficulty has been found in obtaining this acid perfectly pure, Mr. C. H. Wood, of London, prefers the plan of double decomposition. He proposes that sulphate of iron and hypophosphite of calcium be made to react on each other in molecular proportions, represented by 480 grains of crystallized sulphate of iron and 326 grains of commercial hypophosphite; in the latter an allowance of 10 per cent. being made for impurities ordinarily found in that salt. These quantities will yield 320 grains of the hypophosphite of iron; and the reaction will be represented by the following formula: $Ca(H_2PO_2)_2 + FeSO_4 = CaSO_4 + Fe(H_2PO_2)_2$. Sulphate of calcium is precipitated, and ferrous hypophosphite is held in solution. (*P. J. Tr.*, 1868, p. 342.) In this condition the salt is a ferrous compound; but on evaporation the ferrous salt becomes ferric, and acquires the properties as detailed in the Pharmacopœia. Of this the following description is given in the late edition of that work.

Properties. "A white or grayish white powder, permanent in the air, odorless and nearly tasteless, only slightly soluble in water, more readily so in presence of hypophosphorous acid, freely soluble in hydrochloric acid or in solution of citrate of sodium, forming with the latter a green solution. When strongly heated in a dry test-tube, the salt evolves a spontaneously inflammable gas (phosphoretted hydrogen), and, on ignition, leaves behind ferric pyrophosphate. The salt is readily oxidized by nitric acid or other oxidizing agents. It should be completely soluble in acetic acid (abs. of ferric phosphate). This solution, when mixed with test-solution of oxalate of ammonium, should not afford a white precipitate soluble in hydrochloric acid (abs. of calcium)." *U. S.*

This salt may be given in states of system where deficient powers of the cerebral centres are attended with an anæmic state of the blood. The phosphorus is supposed to serve as a nutrient to the brain, and the iron supplies red corpuscles to the circulation. It may be given in pill or powder in the dose of from five to ten grains; but a more eligible form, and one generally preferred, is that of syrup.

Syrup of hypophosphite of iron may be prepared by simply adding syrup to the solution of the hypophosphite, remaining after the separation of the sulphate of calcium, in the process of Mr. Wood above given. If two and a half ounces of water are used in the process, and the paste resulting from the precipitation of the sulphate of calcium be pressed out, the remaining liquid, after filtration, will form with seven times its volume of syrup a liquid containing two grains of the hypophosphite in a fluidrachm. (*P. J. Tr.*, April, 1868.) But in this form, if the syrup be not thoroughly enclosed, it quickly absorbs oxygen, and in a few hours begins to exhibit the formation of a precipitate, rendering it in a short time unfit for use. A little phosphoric or citric acid added to the syrup will obviate this result; but it is better perhaps at once to form a syrup from materials which will not be liable to this objection. Mr. Wood employs the following process. "Take of granulated sulphate of iron 480 grs., hypophosphite of lime 326 grs., diluted phosphoric acid f℥i, water f℥iss, syrup q. s. Dissolve, without heat, the sulphate of iron in the phosphoric acid, previously mixed with the water. Rub the hypophosphite to fine powder, and pour on it the solution of the sulphate. Triturate together for two or three minutes, then pour the mixture on a piece of damp calico, and squeeze out the liquid with the hands. Filter this solution, and add to it seven times its volume of strong syrup. The resulting syrup will contain two grains of the hypophosphite of iron in each fluidrachm." The dose may be from 2 to 6 fluidrachms (7·5–22·50 C.c.).

FERRI IODIDUM. *Br.* *Iodide of Iron.* [*Ferrous Iodide.*]

(FĔR'RĪ Ī-ŎD'Ị-DŬM.)

Ferrum Iodatum, *P.G.;* Iodure de Fer, *Fr.;* Eisenjodur, Jodeisen, *G.*

"Take of Fine Iron Wire *one ounce and a half* [avoirdupois]; Iodine *three ounces* [avoird.]; Distilled Water *fifteen fluidounces.* Put the Iodide, Iron, and twelve [fluid]ounces of the Water into a flask, and, having heated the mixture gently for about ten minutes, raise the heat and boil until the froth becomes white. Pass the solution as quickly as possible through a wetted calico filter into a dish of polished iron, washing the filter with the remainder of the Water, and boil down until a drop of the solution taken out on the end of an iron wire solidifies on cooling. The liquid should now be poured out on a porcelain dish, and, as soon as it has solidified, should be broken into fragments, and enclosed in a well-stoppered bottle." *Br.*

The solid iodide of iron in its unprotected state is omitted in the present edition of the U. S. Pharmacopœia, which directs it in the form of pills and syrup prepared immediately from the materials, and as *Ferri Iodidum Saccharatum.* The simple iodide is very liable to spontaneous change, and its preservation for any length of time unaltered is almost impossible.

In the Br. process, which is a modification of that of the late Dublin Pharmacopœia, iron is made to unite with iodine by the intervention of water, and the combination takes place readily and quickly. The liquid at first is red or orange-colored, from the circumstance that all the iodine has not united with the iron; but, after the application of heat, it becomes fully saturated and limpid, and assumes a greenish color. It is now a solution of iodide of iron, and yields the solid salt by evaporation. The proportion of the iron taken is half the weight of the iodine. Fine iron wire, recently cleaned, is directed on account of its purity; but iron filings dissolve more readily, and, if carefully selected, will be sufficiently pure. It is exceedingly difficult to obtain the salt in the solid state perfectly pure, so great is the proneness of its solution to absorb oxygen, whereby the iodide becomes, in part, converted into sesquioxide. This change is prevented to a certain extent by evaporating to dryness in an *iron* vessel.

The Messrs. T. & H. Smith, of Edinburgh, recommend the following improved process, which more effectually excludes atmospheric air. Boil, in a Florence flask, six drachms of pure iron filings with two ounces and a quarter of iodine, in four and a half ounces of distilled water, until the liquid loses its dark color. Then filter the liquid rapidly into another flask, and evaporate it, at a boiling heat, until its green shade passes into black. After this period, the heat is kept up as long as the evaporation of moisture continues, which may be ascertained by its condensation on a cold piece of glass, placed, from time to time, over the mouth of the flask. When this ceases, the flask contains pure, anhydrous, spongy iodide of iron, which, when cold, is to be removed by breaking the flask, bruised coarsely in a warm dry mortar, and enclosed immediately in small well-corked bottles. If it is wished to obtain the iodide as a crystallized hydrate, the heat is to be withdrawn as soon as the liquid is sufficiently concentrated to congeal, in a dry and hard crust, on the end of an iron wire dipped into it. A modification of this process by Dr. Squibb will be found in *A. J. P.*, 1859 (p. 52). *Iodates of Iron* have been used to some extent as therapeutic agents in Dublin. For formulas for their preparation, see *P. J. Tr.*, i. 624.

Properties. Iodide of iron is a crystalline substance, exceedingly deliquescent, of a greenish black color, and styptic, chalybeate taste. Its solution, by evaporation with as little contact of air as possible, affords transparent, green, tabular crystals. When heated moderately it fuses, and, on cooling, becomes an opaque crystalline mass, having an iron-gray color and metallic lustre. At a higher temperature it emits violet-colored vapors, and the iron is left in the state of sesquioxide. It is very soluble both in water and alcohol. When recently prepared it is wholly soluble in water, forming a pale green solution; but, if made for some time, it almost unavoidably contains some sesquioxide of iron, from a partial decomposition, and will not entirely dissolve. M. Lecocq, of Saint-Quentin, has proposed to preserve it in a wide-mouthed, ground-stoppered bottle, covered with a layer of reduced iron, which cannot decompose it, and protects it from the action of the air. When the iodide is wanted, the iron is removed with a bone spatula, or a little brush. The aqueous solution is very liable to spontaneous decomposition, becoming at last orange-red from the generation of free iodine, and depositing ferric oxide. According to Mr. Richard Phillips, Jr., the first step in this change is the formation of ferrous oxide and hydriodic acid, from the decomposition of water. As the ferrous oxide immediately begins to be converted into ferric oxide by absorbing oxygen from the air, and in this state is precipitated, the hydriodic acid is set free; and hence is explained the acidity of the solution from the first moment the ferric oxide is deposited. Afterwards, the hydriodic acid is decomposed by the air, and iodine liberated. When the solution is prevented from generating free iodine, by placing in it a coil of iron wire, according to the plan of Mr. Squire, the iron acts by combining with the iodine of nascent hydriodic acid, and not with nascent iodine. (*P. J. Tr.*, iv. 19.) The plan of Mr. Squire does not prevent the deposition of sesquioxide, and has, therefore, been superseded by the use of saccharine matter, which affords a better protection to the solution. (See *Syrupus Ferri Iodidi.*) Iodide of iron is incompatible with alkalies and their carbonates, with lime-water, and with all other substances by which sulphate of iron is decomposed. When crystallized, it has the composition $FeI_2.5H_2O$. "Mixed with mucilage of starch, it acquires a blue color on the addition of a minute quantity of solution of chlorine" (*Br.*); showing the presence of iodine, which is separated by the chlorine.[*]

Medical Properties and Uses. Iodide of iron was first employed in medicine by Dr. Pierquin in 1824. It was first used in the United States in 1832 by the late Professor Samuel Jackson. Its powers are those of a tonic, alterative, diuretic, and emmenagogue. It acts more like the preparations of iron than like those of iodine. It sometimes sharpens the appetite and promotes digestion, and occasionally proves laxative. When it does not operate on the bowels, it generally augments the urine. Its use blackens the stools and lessens their fetor. It is chiefly employed in scrofulous complaints, swellings of the cervical glands, visceral obstructions attended with deficient action, chlorosis, atonic amenorrhœa, and leucorrhœa. In the two diseases last mentioned, Dr. Pierquin employed it with success. In obstinate syphilitic ulcers, M. Baumes, of Lyons, used it with satisfactory results. He gave it in the form of pill, conjoined with extract of opium, and sometimes increased the dose to 20 grains in the course of twenty-four hours. In secondary syphilis, occurring in debilitated and scrofulous subjects, Ricord has found it a valuable remedy. The dose is a grain (0·065 Gm.), gradually increased to eight grains (0·52 Gm.) or more.

This salt, on account of its deliquescent property, and proneness to decomposition, should not be given in pill, unless protected from change by saccharine matter, or other means. (See *Pilulæ Ferri Iodidi* and *Ferri Iodidum Saccharatum.*) The most convenient form of exhibition is that of syrup or glycerate.[†]

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[*] *Tasteless Salts of Iron.* A class of preparations of iron have been introduced by Mr. J. L. A. Creuse, of Brooklyn, N. Y. (*A. J. P.*, xlv. 214). It has long been known that the citrate of ammonium has the property of rendering soluble many ordinarily insoluble preparations of iron. Mr. Creuse believes that all the salts of ferric oxide form chemical combinations with all the alkaline (ammonium, sodium, potassium, lithium) citrates, which combinations are all greenish, soluble in water, nearly insoluble in alcohol, free from ferruginous taste, perfectly stable, and so resisting decomposition as to form no precipitate with Peruvian bark; indeed, chemical reagents do not reveal the iron in them unless strong acids or sulphuretted hydrogen be used. None of these salts coagulate the blood; they cannot be used as styptics.

Tasteless Iodide of Iron is prepared in the following manner: 126·3 grains of iodine are combined with iron in the usual way to obtain the solution of ferrous iodide; this is filtered and 63 grains of iodine dissolved in it; a solution of 201 grains of citric acid is exactly saturated with potassa and then added gradually to the first solution. When the apple-green color has been developed the solution is evaporated, with gentle stirring, to dryness, when cauliflower-like masses of acicular crystals will be obtained. These are stable except in direct sunlight.

Tasteless Chloride of Iron is made by adding an alkaline citrate in solution to a solution of sesquichloride of iron, in such proportion that there shall be two molecules of the former to three molecules of chlorine. Usually from 120 to 140 grains of citric acid saturated with soda, potassa, or ammonia are required for the preparation of an ounce of a tincture of corresponding strength to the officinal tincture. The addition should be made to the liquor, and the final solution must not contain more than 40 per cent. of alcohol. R. Rother affirms that these so-called salts are mere mixtures of citrate of iron and iodide or chloride of the alkali used. (*A. J. P.*, 1876, p. 171.)

[†] *Glycerate of Iodide of Iron.* Glycerin has the property at once of dissolving and preserving iodide of iron, and therefore makes an excellent excipient. M. Veza proposes the following for-

For forming enemata, injections for the vagina, and lotions for ulcers, one or two drachms (3·9 or 7·8 Gm.) of the iodide may be dissolved in a pint (472 C.c.) of water.

FERRI IODIDUM SACCHARATUM. *U.S.* *Saccharated Iodide of Iron.* [*Saccharated Ferrous Iodide.*]

(FĔR′RĪ Ī-ŎD′Ị-DŬM SĂC-ÇHẠ-RĀ′TŬM.)

Ferrum Iodatum Saccharatum, *P.G.;* Zuckerhaltiges Jodeisen, *G.*

"Iron, in the form of fine wire, and cut into small pieces, *six parts* [or thirty grains]; Iodine, *seventeen parts* [or eighty-five grains]; Distilled Water, *twenty parts* [or one and a half fluidrachms]; Sugar of Milk, *eighty parts* [or four hundred grains]. Mix the Iron, Iodine, and Distilled Water in a flask of thin glass, shake the mixture occasionally until the reaction ceases, and the solution has acquired a green color and lost the smell of Iodine; then filter it through a wetted filter into a porcelain capsule containing *forty parts* [or two hundred grains] of Sugar of Milk. Rinse the flask and Iron Wire with a little Distilled Water, pass the rinsings through the filter into the capsule, and evaporate, on a water-bath, constantly stirring, until a dry mass remains. Transfer the mass quickly to a heated iron mortar containing the remainder of the Sugar of Milk, and reduce the whole to powder. Transfer the powder at once to small, well-dried bottles, which must be securely stopped, and kept in a cool and dark place." *U. S.*

This is a new officinal preparation; it is identical with the Saccharated Iodide of Iron of the German Pharmacopœia, and consists of ferrous iodide preserved by contact with sugar of milk. It is a more stable form of administering ferrous iodide than the salt in its pure state. (See *Ferri Iodidum.*)

Properties. The Pharmacopœia gives the following description. "A yellowish white or grayish powder, very hygroscopic, odorless, having a sweetish, ferruginous taste, and a slightly acid reaction. Soluble in 7 parts of water at 15° C. (59° F.), forming an almost clear solution; only partially soluble in alcohol. When strongly heated, the compound swells up, chars, evolves the odor of iodine and of burnt sugar, and, on ignition, leaves a residue which should yield nothing soluble to water (abs. of salts of alkalies). The aqueous solution yields a blue precipitate with test-solution of ferricyanide of potassium. If mixed with some gelatinized starch and afterward with a little chlorine water, the solution assumes a deep blue color. This color should not be developed in the aqueous solution by gelatinized starch alone (abs. of free iodine). On mixing an aqueous solution of 5 Gm. of Saccharated Iodide of Iron with a solution of 1 Gm. of nitrate of silver, and filtering, the filtrate should still produce a precipitate or cloudiness with test-solution of nitrate of silver (presence of at least 20 per cent. of ferrous iodide)." *U. S.*

Medical Properties. The medical properties of this preparation are identical with those of the iodide of iron. The dose is two to five grains (0·13 to 0.33 Gm.).

FERRI LACTAS. *U.S.* *Lactate of Iron.* [*Ferrous Lactate.*]

(FĔR′RĪ LĂC′TĂS.)

$Fe\,(C_3H_5O_3)_2 . 3H_2O$; 287·9. $FeO, C_6H_5O_5 . 3HO$; 143·95.

Ferrum Lacticum, *P.G.;* Lactas Ferrosus; Lactate de Fer, *Fr.;* Milchsäures Eisenoxydul, Eisenlactat, *G.*

A formula for this salt was omitted in the late U. S. P. revision. In the process of U. S. P. 1870,* the lactic acid unites with the iron, forming lactate of iron, a part of which crystallizes when the solution cools, and the remainder is obtained by evap-

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mula. "Take of Iodine 70 parts, Iron, in powder, 35 parts, and Glycerin 400 parts. Mix them." The color of the solution is an emerald-green; its taste is bitter and astringent; and tests do not detect in it the presence of free iodine. It may be used for preparing the syrup or pills. Five grains of it contain one of the iodide of iron.

* "Take of Lactic Acid *a fluidounce;* Iron, in the form of filings, *half a troyounce;* Distilled Water *a sufficient quantity.* Mix the Acid with a pint of Distilled Water in an iron vessel, add the Iron, and digest the mixture on a water-bath, supplying Distilled Water, from time to time, to preserve the measure. When the action has ceased, filter the solution, while hot, into a porcelain capsule, and set it aside to crystallize. At the end of forty-eight hours, decant the liquid, wash the crystals with a little alcohol, and dry them on bibulous paper. By evaporating the mother-water in an iron vessel to one-half, filtering while hot, and setting the liquid aside, more crystals may be obtained." *U. S.* 1870.

oration and crystallization. It may be more cheaply prepared, on the large scale, by digesting the impure acid first obtained in M. Louradour's process, with iron filings, or by reaction between sulphate of iron and the lactate of calcium or lactate of zinc prepared as a step in obtaining lactic acid. The following is M. Gobley's process for making lactate of calcium, preparatory to its conversion into lactate of iron. Add to 2 pints of skim-milk, diluted with twice its bulk of water, and contained in an earthen pan, 64 drachms of powdered lactose, and 51 drachms of powdered chalk. Allow the whole to ferment for eleven or twelve days, at a temperature of from 26·6° C. to 32·2° C. (80° to 90° F.), supplying water as it evaporates. Transfer the liquor to a capsule, heat it gradually to boiling, and stir it constantly. Boil for a quarter of an hour to coagulate casein, allow the insoluble matters to subside, and strain the liquid through flannel. The clear liquid is a solution of lactate of calcium. In this process the casein of the milk, acting as a ferment, converts not only the lactose of the milk, but the lactose added, into lactic acid; a result which would not take place were it not for the presence of the chalk, which saturates the lactic acid as it is formed, and prevents it from uniting with the casein, whereby the power of the latter as a ferment would be destroyed. (*Journ. de Pharm.*, 3e sér., vi. 54.) (See also other methods under *Acidum Lacticum*, p. 79.) Lactate of calcium may be expeditiously converted into lactate of iron by the following process of M. Lepage. Dissolve 100 parts of lactate of calcium, obtained by M. Gobley's process, in 500 parts of boiling water; dissolve also 68 parts of pure crystallized sulphate of iron in 500 parts of cold distilled water. Mix the filtered solutions in a matrass, acidulate slightly with lactic acid, and heat in a water-bath, stirring frequently until the double decomposition is completed. Then filter to separate the sulphate of calcium, and evaporate rapidly to one-half, either in an iron vessel, or in a porcelain capsule containing a few turnings of iron. Filter again, and set aside to crystallize; and, having washed the crystals in a funnel with a little alcohol, dry them on bibulous paper. (*Journ. de Pharm.*, 3e sér., ix. 272.) In relation to the precautions to be observed in preparing this lactate, so as to prevent the partial oxidation of the iron, see *A. J. P.*, 1853, p. 556.*

Lactate of iron is in "pale, greenish white, crystalline crusts or grains, permanent in the air, odorless, having a mild, sweetish, ferruginous taste, and a slightly acid reaction. Soluble in 40 parts of water at 15° C. (59° F.), and in 12 parts of boiling water; almost insoluble in alcohol, but freely soluble in solution of citrate of sodium, yielding a green solution. When heated on platinum foil, the salt froths up, gives out thick, white acrid fumes, and chars, a brown-red residue being finally left. The aqueous solution yields a blue precipitate with test-solution of ferricyanide of potassium. If the salt be boiled for fifteen minutes with nitric acid of the sp. gr. 1·200, white, granular mucic acid will be deposited on cooling the liquid. An aqueous solution of the salt should not be rendered more than faintly opalescent by test-solution of acetate of lead (limit of sulphate, citrate, tartrate, etc.)." *U. S.* It has an acid reaction, and possesses a mild, sweetish, ferruginous taste. The aqueous solution quickly becomes yellow, in consequence of the iron passing to a higher state of oxidation. M. Louradour has seen several samples of this lactate, variously adulterated; as with effloresced sulphate of iron, starch, and lactin; the sophistication being concealed by the sale of the salt in powder. These impurities may be detected by appropriate reagents; but M. Louradour recommends, as a simpler way of avoiding them, the rejection of the salt when not in crystalline crusts.

Medical Properties. Lactate of iron has the general medical properties of the ferruginous preparations, and has been especially used in chlorosis by Andral, Fouquier, Bouillaud, and other Parisian doctors. As much as 12 or even 20 grains

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* *Ferric Lactate.* Instead of the officinal ferrous lactate, Louis P. Carbonell recommends the ferric lactate, which he succeeded in obtaining in light brown transparent scales by following the process for the other scale preparations of iron, taking particular care fully to saturate the acid and to avoid high temperature during the whole operation. If the first precaution be overlooked, a more or less pasty mass will be the result, and if the temperature rise too high, a pulverulent salt will be obtained. The scaled salt is freely soluble in water and alcohol.

Lactate of iron and quinine and *lactate of iron and strychnine* may also be obtained in brown scales, have a bitter ferruginous taste, and are soluble in alcohol and water. (*A. J. P.*, 1876, p. 489.)

(0·80–1·3 Gm.) may be given in the course of a day. It may be administered in lozenge, pill, or syrup. The *lozenge* may be made of one grain (0·065 Gm.) of the lactate to twelve (0·80 Gm.) of sugar; and the *pill*, of one grain (0·065 Gm.) of the salt, with an equal weight of some inert powder free from astringent matter, and sufficient honey. The following is the formula for a *syrup* proposed by M. Cap. Take of lactate of iron *a drachm;* white sugar *twelve ounces and a half;* boiling distilled water *six fluidounces and a half.* Rub the salt to powder with half an ounce of the sugar; and dissolve the mixture quickly in the boiling water. Pour the solution into a matrass placed on a sand-bath, and add to it the rest of the sugar in small pieces. When the sugar is dissolved, filter the syrup, and, as soon as it is cold, transfer it to bottles which must be well stopped. This syrup has a very light amber color, and contains about four grains of the salt to the fluidounce. The dose is from two to four fluidrachms (7·5–15 C.c.). Bread, called *chalybeate bread*, containing lactate of iron in the proportion of about a grain (0·065 Gm.) to the ounce (31·1 Gm.), has been used with advantage by chlorotic patients in one of the hospitals of Paris. The bread is not injured in taste or quality.

Off. Prep. Syrupus Hypophosphitum cum Ferro, *U. S.*

FERRI OXALAS. *U. S.* *Oxalate of Iron.* [*Ferrous Oxalate.*]

$Fe\,C_2\,O_4.\,H_2\,O$; 161·9. (FĔR′RĪ ŎX′A̤-LĂS.) $FeO, C_2\,O_3.\,HO$; 80·95.

Ferrum Oxalicum, Oxalas Ferrosas; Oxalate de Fer, *Fr.;* Oxalsaures Eisenoxydul, *G.*

No process for this salt is given in the present Pharmacopœia; that of U. S. of 1870 will be found in the foot-note.*

Oxalate of iron was officinal for the first time in 1870. It is "a pale yellow, or lemon-yellow, crystalline powder, permanent in the air, odorless and nearly tasteless, very slightly soluble in cold or hot water, but soluble in cold, concentrated hydrochloric acid, and in hot diluted sulphuric acid. When heated in contact with air, it decomposes with a faint combustion, and, on ignition, leaves a residue, amounting to not less than 49·3 per cent. of the original weight. On heating the salt with excess of test-solution of carbonate of sodium, it is decomposed, yielding a precipitate, which, when dissolved in diluted hydrochloric acid, affords a blue precipitate with test-solution of ferricyanide of potassium, and a filtrate which, when supersaturated with acetic acid, yields, with test-solution of chloride of calcium, a white precipitate soluble in hydrochloric acid." *U. S.*

It is no doubt capable of acting as a feeble chalybeate, but possesses no advantages over other iron preparations. The dose is two to three grains (0·13–0·20 Gm.).

FERRI OXIDUM HYDRATUM. *U. S.* *Hydrated Oxide of Iron.* [*Ferric Hydrate.*]

$Fe_2\,(HO)_6$; 213·8. (FĔR′RĪ ŎX′I̤-DŬM HȲ-DRĀ′TŬM.) $Fe_2\,O_3.\,3HO$; 106·9.

Ferri Peroxidum Humidum, *Br.;* Ferrugo; Hydrated Peroxide of Iron, Hydrated Sesquioxide of Iron, Moist Peroxide of Iron; Hydras Ferricus; Sesquioxide (Peroxyde) de Fer hydraté humide, Hydrate de Peroxyde de Fer gélatineux, *Fr.;* Feuchtes Eisenoxydhydrat, Gegengift der Arsenigensäure, *G.*

"Solution of Tersulphate of Iron, *ten parts* [or three fluidounces]; Water of Ammonia, *eight parts* [or three and a quarter fluidounces]; Water, *a sufficient quantity.* To the Water of Ammonia, previously diluted with *twenty parts* [or eight fluidounces] of cold Water, add, constantly stirring, the Solution of Tersulphate of Iron, previously diluted with *one hundred parts* [or two and a half pints] of cold Water. Pour the whole on a wet muslin strainer, and allow the precipitate to drain; then return it to the vessel and mix it intimately with *one hundred and twenty parts* [or three pints] of cold Water. Again drain it on the strainer and repeat the operation. Lastly, mix the precipitate with enough cold Water to make the mixture weigh *twenty parts* [or eight ounces av.]. When Hydrated Oxide of Iron is to be made in haste for use as an antidote, the washing may be performed more quickly, though less perfectly, by pressing the strainer forcibly with the hands until no more liquid passes, and then adding enough Water to make the whole weigh about *twenty parts* [or eight ounces av.].

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* "Take of Sulphate of Iron *two troyounces;* Oxalic Acid *four hundred and thirty-six grains;* Distilled Water *a sufficient quantity.* Dissolve the Sulphate of Iron in thirty fluidounces, and the Oxalic Acid in fifteen fluidounces of Distilled Water. Filter the solutions, and, having mixed them with agitation, set aside the mixture until the precipitate is deposited. Decant the clear liquid, wash the precipitate until the washings cease to redden litmus, and dry it with a gentle heat." *U. S.*

"*Note.* The ingredients for preparing Hydrated Oxide of Iron, as an antidote, should always be kept on hand, in bottles holding, respectively, about *ten troy ounces* or *three hundred grammes* of Solution of Tersulphate of Iron, and about *eight troy ounces* or *two hundred and forty grammes* of Water of Ammonia." *U. S.*

The British Pharmacopœia defines this preparation to be hydrated peroxide of iron with about 86 per cent. of uncombined water, and gives the following formula.

"Take of Solution of Persulphate of Iron *four fluidounces;* Solution of Soda *thirty-three fluidounces;* Distilled Water *a sufficiency.* Mix the Solution of Persulphate of Iron with a pint [Imperial measure] of the Distilled Water, and add this gradually to the Solution of Soda, stirring them constantly and briskly. Let the mixture stand two hours, stirring it occasionally, then put it on a calico filter, and, when the liquid has drained away, wash the precipitate with Distilled Water, until what passes through the filter ceases to give a precipitate with chloride of barium. Lastly, enclose the precipitate, without drying it, in a stoppered bottle or other suitable vessel from which evaporation cannot take place. This preparation, when used, should be recently made." *Br.*

This preparation was introduced into the officinal catalogues on account of its importance as an antidote to arsenious acid. It is frequently used in the officinal processes as the source of iron, when it is desired to produce a ferric compound, but the directions for making it always accompany the preparation in which it is used, because of the difficulty of preserving the ferric hydrate. In the former processes the first step was to convert the sulphate of iron into the tersulphate; but in the present the officinal solution of tersulphate of iron (persulphate, *Br.*) is taken already containing the iron in the proper state of oxidation. This is simply treated with water of ammonia (*U. S.*), or diluted solution of soda (*Br.*), which throws down the oxide combined with water, constituting the hydrated oxide required.

It is the duty of the apothecary to be always prepared to make this antidote, by keeping the necessary solutions for its precipitation. Magnesia is probably a better precipitant than either of those officinal. (See next article.) In most cases of arsenical poisoning minutes are of immense importance, and time must be lost in washing the precipitated iron if the officinal process is adhered to. Magnesia is not only not irritant, but is itself antidotal to arsenic; so that the precipitated mass may be given at once to the patient. The oxide should not be kept in stock, but when ordered as an antidote should be made fresh.

Properties. Hydrated oxide of iron, as directed to be kept by the U. S. formula, "is a brown-red magma, wholly soluble in hydrochloric acid, without effervescence." *U. S.* If dried at a heat not exceeding 82·2° C. (180° F.), and afterwards pulverized, it forms a reddish brown powder, not attracted by the magnet, being the sesquioxide in the state of hydrate, containing about 18 per cent. of water. In this state it is wholly and readily soluble in hydrochloric acid without effervescence; and the solution gives a copious blue precipitate with the yellow but not with the red prussiate of potash. "A little of it dried at 212°, until it ceases to lose weight, gives off moisture when heated to dull redness in a test-tube." *Br.* If exposed to a red heat it loses the combined water, and becomes the anhydrous sesquioxide, less easily soluble in acids, improper for medicinal use, and altogether without effect as an antidote. Kept for some time in the pulpy state, it loses half its combined water, and becomes less soluble in acids, and less efficient as an antidote.

Medical Properties and Uses. The hydrated oxide of iron is not an eligible ferruginous preparation for medical use. Its antidotal powers in poisoning by arsenic, the manner in which it acts, the circumstances which impair its efficiency, and the mode of using it, are fully explained under *Acidum Arseniosum.* Its power of rendering arsenious acid insoluble is readily shown by agitating a solution of the acid with a considerable excess of the moist oxide, filtering, and then testing the filtered solution for the acid; not a trace of the metal can be detected, even by sulphuretted hydrogen. It is stated, however, to be inferior as an antidote to the saccharated oxide of iron. The hydrated oxide, as obtained by the U. S. formula, contains a little ammonia, which is thought by some to assist its antidotal powers. At least it has been ascertained that the sesquioxide, when precipitated by potassa as formerly directed by the Dublin College, is less efficient than when precipitated by ammonia, and must be employed in quantities three or four times as large to produce the same effect. The dry hydrate, rubbed up with water, is in the same proportion weaker than the pulpy hydrate. Subcarbonate of iron (formerly officinal) possesses antidotal powers to arsenic, though in an inferior degree; but this statement will not apply to it, after it has been exposed to a red heat, to which it is improperly subjected by some manufacturing chemists. By ignition it becomes anhydrous, and altogether inefficient as an antidote.

Off. Prep. Emplastrum Ferri, *U. S.;* Trochisci Ferri, *U. S.;* Ferri Peroxidum Hydratum, *Br.*

FERRI OXIDUM HYDRATUM CUM MAGNESIA. *U. S.*

Hydrated Oxide of Iron with Magnesia.

(FĔR'RĪ ŎX'Ị-DŬM HȲ-DRĀ'TŬM CŬM MĂG-NĒ'ṢỊ-Ạ.)

Antidotum Arsenici, *P.G.;* Antidote to Arsenious Acid; Gegengift der Arsenigensäure, *G.*

"Solution of Tersulphate of Iron, *one thousand grains* (65·00 Gm.); Magnesia, *one hundred and fifty grains* (10 Gm.); Water, *a sufficient quantity.* Mix the Solution of Tersulphate of Iron with twice its weight of Water, and keep the mixture in a well-stopped bottle. Rub the Magnesia with Water to a smooth and thin mixture, transfer this to a bottle capable of holding *thirty-two fluidounces* or about *one liter*, and fill it up with Water. When the preparation is wanted for use, mix the two liquids by adding the Magnesia mixture, gradually, to the Iron solution, and shake them together until a homogeneous mass results.

"*Note.* The diluted Solution of Tersulphate of Iron and the mixture of Magnesia with Water, should always be kept on hand, ready for immediate use." *U. S.*

This is a new officinal preparation. It has been introduced for the purpose of furnishing a ready and efficient antidote against Arsenious Acid. It is almost identical with the *Antidotum Arsenici* of the German Pharmacopœia, and experience has shown its effectiveness. Ferric hydrate is produced when the mixture of magnesia is added to the diluted solution of tersulphate of iron, and as the magnesia is in excess and acidity thus prevented, no harm can result from not separating the by-products of the reaction. When mixed as officinally directed, and ready for use, it contains ferric hydrate with magnesium sulphate and hydrate. It has been shown that no soluble compound with arsenic is formed when it is used as an antidote, and the presence of the magnesium salts, from a therapeutical point of view, is not at all objectionable. (See *Acidum Arseniosum*, p. 36.)

FERRI OXIDUM MAGNETICUM. *Br.* *Magnetic Oxide of Iron.*

(FĔR'RĪ ŎX'Ị-DŬM MẠG-NĔT'Ị-CŬM.)

Martial Ethiops; Ferrum Oxydatum Magneticum, Oxydum Ferroso-Ferricum; Black Oxide of Iron; Oxide de Fer noir (magnétique), *Fr.;* Magneteisen, Eisenoxyd-Oxydul, *G.*

"Take of Solution of Persulphate of Iron *five and a half fluidounces* [Imperial measure]; Sulphate of Iron *two ounces* [avoirdupois]; Solution of Soda *four pints* [Imp. meas.]; Distilled Water *a sufficiency.* Dissolve the Sulphate of Iron in two pints [Imp. meas.] of the Water, and add to it the solution of Persulphate of Iron, then mix this with the Solution of Soda, stirring them well together. Boil the mixture, let it stand for two hours, stirring it occasionally, then put it on a calico filter, and, when the liquid has drained away, wash the precipitate with Distilled Water, until what passes through the filter ceases to give a precipitate with chloride of barium. Lastly, dry the precipitate at a temperature not exceeding 120°." *Br.*

Though the object of this formula is the same as that of the Br. Pharmacopœia of 1864, the proceeding is different. The point aimed at is to get an oxide of iron containing one mol. of the ferrous oxide and one of the ferric oxide (FeO,Fe_2O_3 or

Fe_3O_4, *Br.*). This was attained in the former process by converting a portion of ferrous sulphate by boiling with nitric acid into ferric sulphate, and then, having mixed this in solution with solution of ferrous sulphate, precipitating the two oxides conjointly with solution of soda. In the present formula the two sulphates are taken already formed; and the process consists essentially in precipitating, as before, their joint solutions by solution of soda; the proportion of the ferruginous salts being so adjusted as to yield a molecule each of the ferrous and ferric oxide. The solution of the salts of iron is directed to be added to that of the alkali; because, if the alkaline be added to the ferruginous solution, as there would be a great excess of the salt of iron, an insoluble basic sulphate would be precipitated, and might wholly or partially escape decomposition. (Redwood, *P. J. Tr.*, 1868, p. 464.) Such a compound oxide corresponds in composition with the native magnetic black oxide. The precipitate is washed to remove sulphate of sodium, and the washings are known to be completed when chloride of barium ceases to give a precipitate with them.

Properties. The artificial magnetic oxide of iron is a brownish black powder, without taste, and strongly magnetic. According to the Br. Pharmacopœia, it consists of a 3-4 oxide of iron, Fe_3O_4, with about 20 per cent. of water of hydration, and a portion of peroxide (sesquioxide) of iron. It dissolves without effervescence in hydrochloric acid diluted with half its bulk of water; and the solution gives a blue-precipitate both with the ferrocyanide and ferridcyanide of potassium, showing the presence of ferrous and ferric oxide.

The Br. Pharmacopœia gives the following tests. "When a small quantity is heated in a dry test-tube by the flame of a lamp, a deposit of moisture takes place on the cool part of the tube. Twenty grains dissolved in hydrochloric acid continue to give a blue precipitate with the red prussiate of potash (ferricyanide of potassium) until 83 grain-measures of the *volumetric solution of bichromate of potash* have been added." The former test simply indicates the presence of water in the oxide; the second the quantity of ferrous oxide present, which must be such as to require the indicated quantity of the bichromate for its conversion into ferric oxide. The dose is from five to twenty grains (0·33–1·3 Gm.), given several times a day.

Scales of iron (*ferri squamæ*) were formerly officinal with the Dublin College under the name of black oxide. They were prepared from the scales found at the blacksmith's anvil, by washing them with water, separating them from impurities by means of a magnet, and reducing them to a fine powder. They are of variable composition; being mixtures of the two oxides of iron with metallic iron.

FERRI PEROXIDUM HYDRATUM. *Br.* *Hydrated Peroxide of Iron.*

(FĔR'RĪ PĔR-ŎX'Ị-DŬM HȲ-DRĀ'TŬM.)

Peroxide of Iron, Sesquioxide of Iron, Ferric Oxide; Ferrum Oxydatum Fuscum, *P.G.;* Ferrum Hydricum, Ferri Oxidum Rubrum, Oxydum Ferri cum Hydratum, Ferrugo, Rubigo, Crocus Martis Aperiens; Sesquioxide de Fer hydraté, Hydrate de Sesquioxide de Fer sec, *Fr.;* Eisenoxydhydrat, *G.*

"Take of Moist Peroxide of Iron *one pound* [avoirdupois]. Dry it at a temperature not exceeding 212° until it ceases to lose weight, then reduce it to fine powder." *Br.*

The hydrated oxide ($Fe_2O_3.2H_2O$) loses, by the above process, one-half of its combined water, and is converted into the monohydrated sesquioxide (Fe_2O_3,H_2O), which is the present officinal preparation. As prepared by the Dublin process, in which it was heated to redness, it lost the second molecule of water, and became the anhydrous sesquioxide (Fe_2O_3), identical with the *colcothar* of commerce.

Properties. This oxide is a reddish brown, tasteless, insoluble powder, differing from colcothar in containing a molecule of water. Hence, "heated to dull redness in a test-tube it gives off moisture." *Br.* It should not be deliquescent, and should dissolve entirely in hydrochloric acid without effervescence. Its solution in diluted hydrochloric acid yields a copious blue precipitate with the ferrocyanide of potassium, but none with the ferricyanide; showing that it contains ferric oxide but no ferrous oxide. If it contain copper, its hydrochloric solution will deposit this metal on a bright piece of iron. M. Dawies states that, if the hydrated oxide recently prepared be kept for four or five days in boiling water, it loses a large proportion of its water, containing at the end of that time only 5·77 per cent. The larger portion of the oxide has, therefore, become dehydrated; and the same thing happens at a lower temperature, 41·1° C. (106° F.), in two or three months. It becomes of a brick-red color, and is but slightly soluble in nitric acid. (*Journ. de Pharm.*, 4e sér., iv. 400.) This oxide is not used as a medicine. It is employed in making iron plaster and reduced iron, for which purposes other forms of oxidized iron would answer as well. The former Dublin *rubigo ferri* or *rust of iron*, formed by exposing moistened iron wire to the air till converted into rust, is essentially the sesquioxide, containing a little carbonate of iron, and does not differ very essentially from the subcarbonate of iron formerly officinal.*

Off. Prep. Emplastrum Ferri, *Br.;* Ferrum Redactum, *Br.*

FERRI PHOSPHAS. *U. S.*, *Br.* *Phosphate of Iron.* [*Ferric Phosphate.*]

(FĔR′RĪ PHŎS′PHĂS.)

Ferrum Phosphoricum, *P.G.;* Phosphas Ferroso-Ferricus; Ferroso-Ferric Phosphate; Phosphate de Fer, Phosphate ferroso-ferrique, *Fr.;* Phosphorsaures Eisenoxydul (Eisenoxydul-Oxyd), *G.*

"Citrate of Iron, *five parts* [or ten ounces av.]; Phosphate of Sodium, *six parts* [or twelve ounces av.]; Distilled Water, *ten parts* [or nineteen fluidounces]. Dissolve the Citrate of Iron in the Distilled Water by heating on a water-bath. To this solution add the Phosphate of Sodium and stir constantly, until it is dissolved. Evaporate the solution, at a temperature not exceeding 60° C. (140° F.), to the consistence of thick syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales. Keep the product in well-stopped bottles, in a dark place." *U. S.*

"Take of Sulphate of Iron *three ounces* [avoirdupois]; Phosphate of Soda *two ounces and a half* [avoird.]; Acetate of Soda *one ounce* [avoird.]; Boiling Distilled Water *four pints* [Imperial measure]. Dissolve the Sulphate of Iron in one-half the Water, and the Phosphate and Acetate of Soda in the remaining half. Mix the two solutions, and, after careful stirring, transfer the precipitate to a calico filter, and wash it with hot distilled water, till the filtrate ceases to give a precipitate with chloride of barium. Finally dry the precipitate at a temperature not exceeding 120°." *Br.*

It is to be regretted that another title was not chosen for this preparation by the Committee of Revision; for the phosphate of iron made by the U. S. Pharm. 1880 is altogether different from the salt formerly officinal, not only in appearance and solubility, but in chemical composition. As obtained by the present process, it is not a definite chemical compound, but a mixture, which should probably be called sodio-ferric citro-phosphate, and bears a resemblance to the pyrophosphate, which is now directed to be made by a similar process. (See *Ferri Pyrophosphas.*)

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* *Ferri Subcarbonas.* U. S. 1870; *Subcarbonate of Iron; Sesquioxide of Iron; Red Oxide of Iron; Precipitated Carbonate of Iron; Aperitive Saffron of Mars.* "Take of Sulphate of Iron *eight troyounces;* Carbonate of Sodium *nine troyounces;* Water *eight pints.* Dissolve the salts separately, each in four pints of the Water; then mix the solutions thoroughly, and set aside the mixture until the precipitate has subsided. Then pour off the supernatant liquid, wash the precipitate with water until the washings pass nearly tasteless, and dry it on bibulous paper without heat." *U. S.* 1870.

When the solutions of carbonate of sodium and sulphate of iron are mixed together, a hydrated ferrous carbonate, of a pale blue color, is thrown down, and sulphate of sodium remains in solution. The precipitate, during the washing and drying, absorbs oxygen, and loses nearly all its carbonic acid, whereby it is converted almost entirely into ferric oxide. The direction to dry the precipitate without heat is important: as even a moderate elevation of temperature has been shown, by the experiments of Mr. J. A. Rex, to modify the resulting product unfavorably, diminishing its solubility in hydrochloric acid in proportion to the heat employed. (*A. J. P.*, May, 1862, p. 193.)

Properties. Subcarbonate of iron is a reddish brown powder, of a disagreeable, slightly styptic taste; insoluble in water, and not readily dissolved by any acid except hydrochloric, with which it effervesces slightly. When of a bright red color it should be rejected, as this color shows that it has been injured by exposure to heat. After precipitation from its hydrochloric solution by ammonia or potassa, either of which throws down the sesquioxide of iron, the supernatant liquor should give no indications of containing any metal in solution by the test of sulphuretted hydrogen or ferrocyanide of potassium. It is incompatible with acids and acidulous salts. In composition it is a hydrated ferric oxide, containing a little ferrous carbonate. By exposure to a red heat, it absorbs oxygen, and loses water and carbonic acid, being converted into the *astringent saffron of Mars* of the French Codex. After ignition it is no longer a subcarbonate, but is converted into the pure sesquioxide, which is less soluble in acids, and less efficient as a medicine than the preparation in its original state. Hence it is wrong to expose the subcarbonate to a red heat, as some manufacturing chemists are in the habit of doing, in order to give it a bright red color.

Medical Properties and Uses. Subcarbonate of iron is a rather feeble ferruginous tonic, nearly free from astringency, and causing, even in the largest doses, no obvious effects save only a very slight gastric disturbance. It has been especially commended in neuralgia in doses of a teaspoonful (3·75 C.c.). The ordinary chalybeate dose is five grains (0·33 Gm.).

The British phosphate of iron is a very different salt. Supposing double decomposition to have occurred between sulphate of iron and hydro-disodium phosphate, the reaction would be as follows: $FeSO_4 + HNa_2PO_4 = HFePO_4 + Na_2SO_4$; the reaction next takes place between the acid phosphate of iron just formed, a mol. of additional sulphate of iron, and two of sodium acetate, as follows: $2(HFePO_4) + FeSO_4 + 2NaC_2H_3O_2 = Fe_3(PO_4)_2 + Na_2SO_4 + (HC_2H_3O_2)_2$; the products thus being neutral ferrous phosphate, sodium sulphate, and free acetic acid. This latter result arises from the strong disposition of the tribasic phosphoric acid to combine with three atoms of base, which could only be satisfied by the liberation of the acetic acid of the acetate. This salt, when first formed, is represented by the formula $Fe_3(PO_4)_2$; but the strong affinity of its ferrous oxide for oxygen causes the gradual production of sesquisalt, which, therefore, to a certain extent always exists in the preparation.

Phosphate of iron, as made by the U. S. Pharmacopœia, is in "thin, bright green, transparent scales, permanent in dry air when excluded from light, odorless, having an acidulous, slightly saline taste, and a slightly acid reaction. Freely and completely soluble in water, but insoluble in alcohol. The aqueous solution of the salt is rendered blue by test-solution of ferrocyanide of potassium, but does not yield a blue precipitate with this reagent, unless it has been acidulated with hydrochloric acid. When heated with solution of potassa in excess, a brown-red precipitate is thrown down, and the filtrate, after being supersaturated with acetic acid, yields a light yellow precipitate with test-solution of nitrate of silver (difference from pyrophosphate). 100 parts of the salt represent about 13·5 parts of metallic iron." *U. S.* When made by the British process, it is in the form of a powder of a bright slate color, insoluble in water, but soluble in acids. The solution in dilute hydrochloric acid gives a blue precipitate with both ferricyanide and ferrocyanide of potassium, but much the more copiously with the former, proving the presence both of ferrous and ferric oxide, but a great preponderance of ferrous oxide. With ammonia the same solution yields a precipitate insoluble in an excess of the alkali. If the preparation contain arsenic, it will be detected by producing a dark precipitate on the surface of a slip of pure copper introduced into the solution. "Twenty grains dissolved in hydrochloric acid, continue to give a blue precipitate with red prussiate of potash until at least two hundred and fifty grain-measures of the *volumetric solution of bichromate of potash* have been added." *Br.* This shows the presence of 44·75 per cent. of phosphate of iron.

Phosphate of iron, dissolved to saturation in a boiling solution of metaphosphoric acid (HPO_3), under the name of *superphosphate of iron*, was proposed as a new remedy, in Jan. 1851, by Dr. Routh, of London. Mr. Thomas Greenish, of the same city, states that the solution of the salt, on cooling, hardens into a mass of pilular consistence, soluble in water in all proportions, and free from any disagreeable or inky taste.

Medical Properties. Phosphate of iron possesses the general properties of the ferruginous preparations, and has been given with advantage in amenorrhœa and dyspepsia. The dose is from five to ten grains (0·33–0·65 Gm.).*

Off. Prep. Syrupus Ferri, Quininæ et Strychninæ Phosphatum, *U. S.*

* *Compound Syrup of Phosphate of Iron. Chemical Food.* For a formula for a compound syrup of phosphate of iron by Mr. Wiegand, made by introducing into it the phosphates of calcium, potassium, and sodium, and for remarks on the pharmacy of the phosphates by Prof. Procter, see *A. J. P.*, 1854 (pp. 111 and 112). A formula similar to Mr. Wiegand's, communicated by Mr. Edward Parrish, as probably representing the process for a secret preparation considerably used in this city, may be found in *A. J. P.*, 1857 (p. 573). These formulas are too complicated to have any therapeutic value. Nevertheless, as the preparations have had much vogue, under the name of *chemical food*, we give the formula of Mr. Parrish from the journal referred to. "Take of Sulphate of Iron ʒx; Phosphate of Soda ʒxii; Phosphate of Lime ʒxii; Glacial Phosphoric Acid ℥xx; Carbonate of Soda ℈ij; Carbonate of Potassa ʒi; Hydrochloric Acid, Water of Ammonia,

FERRI PYROPHOSPHAS. *U.S.* *Pyrophosphate of Iron.* [*Ferric Pyrophosphate.*]

(FĔR'RĪ PȲ-RỌ-PHŎS'PHĂS.)

Ferrum Pyrophosphoricum cum Ammonio Citrico, *P.G.;* Pyrophosphas Ferricus cum Citrate Ammonico; Pyrophosphate of Iron with Ammonium Citrate; Pyrophosphate de Fer citro-ammoniacal, *Fr.;* Pyrophosphorsaures Eisenoxyd mit Citronensauren Ammonium, *G.*

"Citrate of Iron, *nine parts* [or nine ounces av.]; Pyrophosphate of Sodium, *ten parts* [or ten ounces av.]; Distilled Water, *eighteen parts* [or two and a quarter pints]. Dissolve the Citrate of Iron in the Distilled Water by heating, on a water-bath. To this solution add the Pyrophosphate of Sodium and stir constantly until it is dissolved. Evaporate the solution, at a temperature not exceeding 60° C. (140° F.), to the consistence of thick syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales. Keep the product in well-stopped bottles, in a dark place." *U. S.*

The process now officinal differs very materially from that of the U. S. Pharmacopœia, 1870. In the latter, phosphate of sodium was converted into the pyrophosphate by moderately igniting it; this was dissolved in water, and the solution mixed with a diluted solution of tersulphate of iron, when ferric pyrophosphate was precipitated; this was washed with cold water and dissolved in a solution of citrate of ammonium. The process was completed by evaporating the solution sufficiently, and then spreading it out to dry on glass or porcelain, so that the salt was obtained in scales.* This formula was based upon a method, proposed by M. E. Robiquet

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each, q. s.; Powdered Cochineal ʒij; Water q. s. to make f℥xx; Sugar ℔iij (troy); Oil of Orange ♏x. Dissolve the Sulphate of Iron in f℥ij, and the Phosphate of Soda in f℥iv of boiling Water. Mix the solutions, and wash the precipitated phosphate of iron till the washings are tasteless. Dissolve the Phosphate of Lime in f℥iv of boiling Water with sufficient Hydrochloric Acid to make a clear solution, precipitate it with Water of Ammonia, and wash the precipitate. To the freshly precipitated phosphates add the Phosphoric Acid previously dissolved in Water. When clear, add the Carbonates of Soda and Potassa, and afterwards sufficient Hydrochloric Acid to dissolve the precipitate. Now add Cochineal mixed with the Sugar, apply heat, and, when the syrup is formed, strain and flavor it. Each teaspoonful contains about one grain of phosphate of iron and two and a half grains of phosphate of lime, with smaller quantities of the alkaline phosphates, all in perfect solution." The objection to such preparations as this is not that each of the ingredients may not be useful, but that they are so numerous that a morbid state of system must be extremely rare in which they can all be indicated, and every medicine is more or less noxious if given when it is not needed. The probability is that the therapeutic value of the preparation depends mainly on its ferruginous ingredient, and that, as a general rule, its therapeutic effects may be equally well if not better obtained from a simple syrup of phosphate of iron.

Simple Syrup of Phosphate of Iron. Subsequently, Mr. Wiegand gave a formula for a simple syrup of phosphate of iron, made by dissolving the recently precipitated salt in hydrochloric acid, and adding the requisite quantity of sugar. By a misprint the phosphate of sodium taken is double what it should be. The same writer has proposed to make a syrup of the phosphates of iron and calcium, by dissolving in the above a definite quantity of recently precipitated phosphate of calcium, made by double decomposition between solutions of chloride of calcium and phosphate of sodium. See his formulas in *A. J. P.*, 1855 (p. 104).

* This ferruginous pyrophosphate is soluble in pyrophosphate of sodium; and hence, if an excess of pyrophosphate of sodium is used in the double decomposition, the ferruginous pyrophosphate, first thrown down, is redissolved. This solution was proposed as a medicine by M. Persoz in 1848, and by M. Leras in 1849. M. Leras conceives that pyrophosphate of iron, rendered soluble by pyrophosphate of sodium, is the only ferruginous preparation which is not precipitated in the stomach by the agency of the food or gastric juice. Mr. Alex. Ure, of London, tried this solution, calling it *soda-pyrophosphate of iron*, in scrofula, and found it a mild and efficient chalybeate. The same solution, as prepared by M. Leras, has been employed with marked success in anæmic diseases, by MM. Follet and Baume, who found it easily administered and rapidly absorbed. In the preparation used by him, the sulphate of sodium, resulting from the double decomposition, was allowed to remain. The same solution, including the sulphate of sodium, has been prepared as a syrup by M. Soubeiran.

Syrup of Pyrophosphate of Iron. M. Soubeiran's formula is as follows. Add 55 *grains* of tersulphate of iron, dissolved by a gentle heat in two *fluidounces* of water, to 462 grains of crystallized pyrophosphate of sodium, dissolved in 7½ *fluidounces* of water and 3½ *fluidounces* of mint water, and mix. So soon as the precipitate formed redissolves, filter the solution, and add to the filtrate 19 *troyounces* of white sugar, which must be allowed to dissolve without heat. The dose of this pleasant syrup is a tablespoonful, containing about a third of a grain of iron.

An equivalent preparation may be made from the U. S. pyrophosphate of iron by dissolving 2·6 grains in a fluidounce of syrup; but this would be a feeble preparation; and, besides, the quantity of sugar might be embarrassing to the stomach. A better plan would probably be to dissolve 20 grains in a fluidounce of syrup, giving 2·5 grains of the salt to each fluidrachm, and making the dose from one to two teaspoonfuls. The salt may be dissolved in a little water before being incorporated with the syrup, care being taken that the resulting liquid should contain 20 to the Academy of Medicine at Paris, in Feb. 1857, of preparing pyrophosphate of iron for use, by dissolving a gelatinous precipitate of the salt in a solution of citrate of ammonium, and forming a syrup with the solution.

The view which obtained when this process was first made officinal was, that a double salt was formed, consisting of ferric pyrophosphate and ammonium citrate, which might be called ammonio-ferric citro-ortho phosphate. According to R. Rother (*A. J. P.*, 1876, p. 174), there was an excess of ferric citrate in the pyrophosphate of iron of the U. S. P. 1870, and it was believed to be a complex mixture of the colloid salts, ammonio-ferric pyrophosphate, ammonio-ferric citrate, and free ferric citrate, as shown in the reaction $2(Fe_4 3P_2O_7) + 6(NH_4)_3C_6H_5O_7 = Fe_4 3P_2O_7 . 3(NH_4)_4P_2O_7 + 2(FeC_6H_5O_7 . (NH_4)_3C_6H_5O_7) + 2(FeC_6H_5O_7)$. By mixing two molecules of ferric citrate and one of ammonium pyrophosphate a compound analogous to the officinal preparation was obtained, containing the same proportion of ammonio-ferric pyrophosphate, but mixed with twice as much ammonio-ferric citrate and free ferric citrate. Rother's views have been adopted by the Committee of Revision, as well as the salt which he recommended, in which ammonia was replaced by soda, because of the greater stability of the latter. Pyrophosphate of Iron, U. S. P. 1880, consists probably of sodio-ferric pyrophosphate, sodio-ferric citrate, and free ferric citrate.

Properties. "Thin, apple-green, transparent scales, permanent in dry air when excluded from light, but turning dark on exposure to light, odorless, having an acidulous, slightly saline taste, and a slightly acid reaction. Freely and completely soluble in water, but insoluble in alcohol. The aqueous solution of the salt is rendered blue by test-solution of ferrocyanide of potassium, but does not yield a blue precipitate with this reagent, unless it has been acidulated with hydrochloric acid. When heated with solution of potassa in excess, a brown-red precipitate is thrown down, and the filtrate, after being supersaturated with acetic acid, yields a white precipitate with test-solution of nitrate of silver (difference from phosphate). 100 parts of the salt represent about 11·5 parts of metallic iron." *U. S.*

Medical Properties. It is a very good chalybeate, mild yet efficient in its action on the system, without disagreeable taste, and, from its solubility, readily administered in any form that may be desirable, whether that of pill, simple solution in water, or syrup. The dose is from two to five grains (0·13–0·33 Gm.). A syrup may be readily prepared by dissolving it in water, and adding simple syrup.

FERRI SULPHAS. *U. S., Br.* *Sulphate of Iron.* [*Ferrous Sulphate.*]

$FeSO_4 . 7H_2O$; 277·9. (FĔR'RĪ SŬL'PHĂS.) $FeO, SO_3 . 7HO$; 138·95.

Green Vitriol; Ferrum Sulfuricum Purum, *P.G.;* Sulfas Ferrosus, Ferrum Vitriolatum Purum, Vitriolum Martis Purum; Ferrous Sulphate; Sulfate (Protosulfate) de Fer, Sulfate ferreux, *Fr.;* Schwefelsaures Eisenoxydul, *G.*

"Take of Iron Wire *four ounces* [avoirdupois]; Sulphuric Acid *four fluidounces* [Imperial measure]; Distilled Water *one pint and a half* [Imp meas.]. Pour the Water on the Iron placed in a porcelain dish, add the Sulphuric Acid, and, when the disengagement of gas has nearly ceased, boil for ten minutes. Filter now through paper, and, after the lapse of twenty-four hours, separate the crystals which have been deposited from the solution. Let these be dried on filtering paper placed on porous bricks, and preserved in a stoppered bottle." *Br.*

The object of this process is to make a pure sulphate of iron by direct combination. Sulphuric acid, in a concentrated state, acts but imperfectly on iron; but when diluted, a vigorous action takes place, the oxygen of the water converts the metal into an oxide, with which the sulphuric acid unites, and hydrogen is evolved. The theoretical quantities for mutual reaction are 56 of iron to 98 of acid. This proportion is one part of iron to one and three-quarters of acid. The *British Council* uses an excess of acid, the weight of acid taken being 7·38 avoirdupois ounces, instead of 7. An excess of iron, however, is desirable, as it tends to secure the production of a perfect ferrous sulphate. A process for this salt was given in the

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grains to the fluidounce. Dr. Squibb prepares a syrup of the pyrophosphate by adding to 24 parts of the solution of the formula, after filtration, 248 parts of Syrup, and thus obtains a preparation containing about two grains of the officinal salt, in a fluidrachm.

U. S. P. 1870, which was based upon the method of Bonsdorff. This chemist found that, when a perfect sulphate of iron was formed in solution by heating dilute sulphuric acid with an excess of iron, it might be crystallized free from sesquioxide, provided a little excess of sulphuric acid were added to the liquid before filtration, in order to prevent the formation of any sesquioxide during the process; at the same time avoiding, as much as possible, the contact of the air. Hence the directions in the former U. S. formula to acidulate with sulphuric acid, to cause the funnel to touch the bottom of the receiving vessel, which avoids the dropping of the liquid through the air, and to cover the vessel containing the concentrated liquid, when it is set aside to crystallize.

Properties. Sulphate of iron is in the form of "large, pale, bluish green, monoclinic prisms, efflorescent and absorbing oxygen on exposure to air, without odor, having a saline, styptic taste, and an acid reaction. Soluble in 1·8 parts of water at 15° C. (59° F.), and in 0·3 part of boiling water; insoluble in alcohol. When quickly heated, the crystals fuse. When slowly heated to 115° C. (239° F.), they fall to powder and lose 38·86 per cent. of their weight (water of crystallization). The aqueous solution of the salt affords a blue precipitate with test-solution of ferricyanide of potassium, and a white precipitate, insoluble in hydrochloric acid, with test-solution of chloride of barium. When acidulated with sulphuric acid, the solution should yield no colored precipitate (copper), and not more than a faint white turbidity with hydrosulphuric acid (limit of ferric salt). If 4·167 Gm. of Sulphate of Iron are dissolved in water acidified with diluted sulphuric acid, and the solution treated with volumetric solution of bichromate of potassium, until a drop no longer gives a blue color with test-solution of ferricyanide of potassium, the required number of C.c. of the volumetric solution multiplied by *two* (2), equals the percentage of unoxidized ferrous sulphate in crystals." *U. S.* As prepared by Bonsdorff's method, ferrous sulphate is blue verging to green. When it becomes more green than blue, or entirely green, an indication is afforded that it contains some sesquioxide. By exposure to the air the crystals absorb oxygen, and become first green, and ultimately covered with a yellow efflorescence of subsulphate, insoluble in water. Sometimes the crystals are quite permanent when made by Bonsdorff's method, owing to the slight excess of acid which they contain. The aqueous solution is bluish green; but by standing it attracts oxygen, and becomes first green and then reddish, depositing, in the mean time, a portion of sesquisulphate, having the composition $Fe_2(SO_4)_3 + Fe_2O_3 + 8H_2O$. (Wittstein, *Chem. Gaz.*, May 15, 1849; from *Buchner's Repert.*) At a red heat it loses its acid, and is converted into the anhydrous sesquioxide of iron called *colcothar*. It is incompatible with the alkalies and their carbonates, soaps, lime-water, the chlorides of calcium and barium, the borate and phosphate of sodium, nitrate of silver, and the acetate and subacetate of lead. It is decomposed also by astringent vegetable infusions, the tannic and gallic acids of which form, if any sesquioxide be present, a black compound of the nature of ink. The extent to which this change lessens the activity of the salt is not well ascertained. Sulphate of iron, as kept in the shops, is often the impure commercial sulphate, which is not fit for medicinal use.* The perfectly pure salt is precipitated white by ferrocyanide of potassium; but that of ordinary purity gives a greenish precipitate, more or less deep, with this test, owing to the presence of some sesquioxide of iron. Copper may be detected by immersing in the solution a bright piece of iron, on which a cupreous film will be deposited. Both copper and zinc may be discovered by sesquioxidizing the iron by boiling the solution of the salt with nitric acid, and then precipitating the iron by an excess of ammonia. If the filtered solution is blue, copper is present; and if it contains zinc, this will be separated in flakes of white oxide, on expelling the excess of ammonia by ebullition.

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* *Commercial Sulphate of Iron. Copperas.* This was formerly officinal in the London Pharmacopœia, in which it was employed for preparing the pure sulphate. It is manufactured on a large scale for the purposes of the arts, from the native sulphide of iron, or iron pyrites, by roasting, oxidation by exposure to air and moisture, and lixiviation. The constituents of the mineral become sulphuric acid and ferrous oxide, which, by their union, form the salt. Sulphate of iron is also obtained in many chemical processes as a collateral product, as in the manufacture of alum, in the precipitation of copper from solutions of sulphate of copper by scraps of iron, etc.

Commercial sulphate of iron is far from being pure. Besides containing some sesquioxide of iron, it is generally contaminated with metallic and earthy salts; such as those of copper, zinc, alumina, and magnesia. Two principal kinds occur in the market; one in large grass-green crystals, the surface of which is studded with ochreous spots; the other, of a bluish green color, and ordinarily mixed with the powder of the effloresced salt. The commercial sulphate should never be dispensed by the pharmacist until it has undergone purification by recrystallization from a slightly acid solution.

It is often desirable to protect the sulphate of iron against the oxidation to which it is liable on exposure. Sugar acts as a preservative in the case of this salt, as in that of protiodide of iron. It may be added to the solution, or incorporated with the sulphate in substance. M. E. Latour has given a formula for crystallizing the salt with sugar. Mr. Geo. Welborn has found a small lump of camphor, wrapped in tissue paper, and placed in the bottle with the sulphate, to prevent its oxidation. (*P. J. Tr.*, May, 1868, p. 537.) M. Pavesi, of Mortara, effects the same object by incorporating it with an equal weight of gum arabic, by evaporating a joint solution of the two substances with a gentle heat. (*Journ. de Pharm.*, 4e sér., iii. 49.)

Medical Properties and Uses. Sulphate of iron is a very astringent chalybeate. In overdoses it produces nausea, vomiting, griping, and purging, and other evidences of gastro-enteric irritation or inflammation. Its astringency fits it especially for use when anæmia is conjoined with marked relaxation, or a tendency to immoderate discharges; such as passive hemorrhages, colliquative sweats, diabetes, chronic mucous catarrh, leucorrhœa, gleet, etc. Externally, the solution is used in chronic ophthalmia, leucorrhœa, and gleet, made of various strengths, from one or two to eight or ten grains of the salt to the fluidounce of water. M. Velpeau has found it an excellent remedy in erysipelas, applied topically in the form of solution or ointment. In forty cases in which it was tried, it cut short the disease in from 24 to 48 hours. The solution was made of three and a half drachms of the salt to a pint of water, and applied by compresses, kept constantly wet. In a few cases convenience required the application of the ointment, made of eight parts of the salt to thirty of lard. An ointment, made of one or two parts of the sulphate to sixty of lard, was found by M. Devergie to be particularly efficacious in certain skin diseases, especially in the different forms of eczema. In scaly affections it had no effect. The dose is one or two grains (0·065–0·13 Gm.), in the form of pill, which should be made from the dry sulphate. (See *Ferri Sulphas Exsiccata.*)

The sulphate of iron has very decided disinfecting properties, and in the impure form (copperas) is very largely used for purifying water-closets, slaughter-houses, etc. When a rapid action is desired, it should be used in solution.

Off. Prep. Ferri Arsenias, *Br.;* Ferri Carbonas Saccharata, *Br.;* Ferri Oxidum Magneticum, *Br.;* Ferri Sulphas Exsiccatus; Ferri Sulphas Præcipitatus, *U. S.;* Liquor Ferri Persulphatis, *Br.;* Liquor Ferri Subsulphatis, *U. S.;* Liquor Ferri Tersulphatis, *U. S.;* Mistura Ferri Composita; Pilula Aloes et Ferri, *Br.;* Massa Ferri Carbonatis, *U. S.;* Pil. Ferri Compositæ, *U. S.*

FERRI SULPHAS EXSICCATUS. *U. S., Br.* *Dried Sulphate of Iron.* [*Dried Ferrous Sulphate.*]

$Fe SO_4. H_2 O$; 169·9. (FĔR'RĪ SŬL'PHĂS ĔX-SĬC-CĀ'TŬS.) $FeO, SO_3. HO$; 84·95.

Ferri Sulphas Exsiccata, *Br.;* Ferrum Sulfuricum Siccum, *P.G.;* Sulfate de Fer desséché, *Fr.;* Entwässertes Schwefelsaures Eisenoxydul, *G.*

"Sulphate of Iron, in coarse powder, *a convenient quantity.* Expose the Sulphate of Iron, in an unglazed earthen vessel, to a moderate heat, occasionally stirring, until it has effloresced. Then increase the heat to 149° C. (300° F.), and maintain it at that temperature until the salt ceases to lose weight. Lastly, reduce the residue to fine powder, and keep it in well-stopped bottles." *U. S.*

"Take of Sulphate of Iron *four ounces.* Expose it in a porcelain or iron dish to a heat commencing at 212°, but which may be finally raised to 400°, until aqueous vapor ceases to be given off. Reduce the residue to a fine powder, and preserve it in a stoppered bottle." *Br.*

Properties. "A grayish white powder, soluble in water with the exception of a small residue, and answering to the reactions and tests of sulphate of iron. (See

Ferri Sulphas.) 100 parts of crystallized sulphate of iron yield about 61 per cent. of the dried salt." *U. S.*

In these processes six mols. out of seven of the water of crystallization of the salt are driven off. The heat should not exceed 149° C. (300° F.), otherwise the salt itself would suffer decomposition. Dried sulphate of iron is used for making pills, the crystallized sulphate not being adapted to that purpose. In prescribing the dried sulphate it is necessary to recollect that three grains are equivalent to five of the crystallized salt.

Off. Prep. Pilulæ Aloes et Ferri, *U. S.*

FERRI SULPHAS PRÆCIPITATUS. *U. S., Br.* *Precipitated Sulphate of Iron.* [*Precipitated Ferrous Sulphate.*]

(FĔR′RĪ SŬL′PHĂS PRÆ-CĬP-Ị-TĀ′TŬS.)

$Fe\,SO_4.\,7H_2O$; 277·9. $FeO,\,SO_3.\,7HO$; 138·95.

Ferri Sulphas Granulata, *Br.;* Granulated Sulphate of Iron.

"Sulphate of Iron, *one hundred parts* [or sixteen ounces av.]; Distilled Water, *one hundred and seventy parts* [or twenty-six fluidounces]; Sulphuric Acid, *four parts* [or two and a half fluidrachms]; Alcohol, *a sufficient quantity.* Dissolve the Sulphate of Iron in the Distilled Water, previously mixed with the Sulphuric Acid, and filter the solution. Allow the filtrate to become cold, pour it gradually, with constant stirring, into an equal volume of Alcohol [or two pints], and set the mixture aside for one day in a well-covered vessel. Drain the crystalline powder, which has settled in a funnel, wash it with Alcohol, until the washings cease to redden blue litmus paper, fold it in a piece of muslin and press it gently. Finally, spread the powder on bibulous paper and dry it quickly in the sunlight, or in a dry-room, at the ordinary temperature, and keep it in well-stopped bottles." *U. S.*

"Take of Iron Wire *four ounces* [avoirdupois]; Sulphuric Acid *four fluidounces* [Imperial measure]; Distilled Water *one pint and a half* [Imp. meas.]; Rectified Spirit *eight fluidounces* [Imp. meas.]. Pour the Water on the Iron placed in a porcelain capsule, add the Sulphuric Acid, and, when the disengagement of gas has nearly ceased, boil for ten minutes, and then filter the solution into a jar containing the Spirit, stirring the mixture so that the salt shall separate in minute granular crystals. Let these, deprived by decantation of adhering liquid, be transferred on filtering paper to porous tiles, and dried by exposure to the atmosphere. They should be preserved in a stoppered bottle." *Br.*

This preparation is officinal for the first time. The product is identical with the granulated sulphate of iron of the British Pharmacopœia. The process of the U. S. Pharmacopœia has the advantage of being more manageable and convenient, sulphate of iron being used directly instead of being made by the action of sulphuric acid on the metal. The directions given in the first part of the British process are precisely the same as those laid down by the British Council for making Sulphate of Iron; but the hot solution of the iron in the sulphuric acid, instead of being allowed to filter into an empty vessel, is made to drop into a portion of rectified spirit, the mixture being stirred while it cools. The acid directed is in excess; and the filtrate is consequently an acid solution of ferrous sulphate mixed with spirit. The stirring as the mixture cools, finely granulates the salt, which separates perfectly pure; the spirit holding in solution any tersulphate of iron which may have been formed, and the excess of acid dissolving any free sesquioxide. This process, in its main features, is that of M. Berthemot. (See 8th ed. U. S. D.)

Properties. Precipitated sulphate of iron is a "very pale bluish green, crystalline powder, efflorescent in dry air, but, when in contact with moisture, becoming gradually oxidized, without odor, having a saline and styptic taste, and an acid reaction. Soluble in 1·8 parts of water at 15° C. (59° F.) and in 0·3 part of boiling water; insoluble in alcohol. It should respond to the same reactions and tests as Sulphate of Iron. (See *Ferri Sulphas.*) If 4·167 Gm. of precipitated sulphate of iron are dissolved in water acidified with diluted sulphuric acid, and the solution treated with volumetric solution of bichromate of potassium, until a drop no longer gives a blue color with test-solution of ferricyanide of potassium, the required number of C.c. of the volumetric solution, multiplied by *two* (2), equals the percentage of unoxidized ferrous sulphate in crystals." *U. S.* When carefully dried it undergoes no change by keeping. It appears to have been introduced into the catalogue of the Dublin Pharmacopœia of 1850, as the best form of the sulphate for conversion into the officinal dried salt; and its peculiar state of aggregation would seem to fit it for that purpose; yet this intention, if it existed, seems to have been overlooked in the revision of the British Pharmacopœia, in which the granulated salt is not directed in the formula for the dried sulphate. The reason for its retention was probably that it is less liable to oxidation on exposure than the sulphate in its ordinary form, and experience has shown that it is admirably adapted for dispensing.

Off. Prep. Syrupus Ferri Phosphatis, *Br.*

FERRI VALERIANAS. *U.S.* *Valerianate of Iron.* [*Ferric Valerianate.*]

(FĔR'RĪ VẠ-LĒ-RỊ-Ā'NĂS.)

$Fe_2(C_5H_9O_2)_6$; 717·8. $Fe_2O_3.3C_{10}H_9O_3$; 358·9.

"Valerianate of Iron should be preserved in small, well-stopped vials, in a cool and dark place." *U. S.*

This preparation, which was officinal in the old Dublin Pharmacopœia, has been introduced into the new United States Pharmacopœia. It is rarely used, because of its insolubility. For process for making it, and other information, see Part II.

Properties. It is officinally described as "a dark tile-red, amorphous powder, permanent in dry air, having a faint odor of valerianic acid, and a mildly styptic taste. Insoluble in cold water, but readily soluble in alcohol. Boiling water decomposes it, setting free the valerianic acid and leaving ferric hydrate. When slowly heated, the salt parts with its acid without fusing, but when rapidly heated, it fuses and gives off inflammable vapors having the odor of butyric acid. On ignition, ferric oxide remains. Mineral acids decompose the Valerianate, forming the respective ferric salts and liberating valerianic acid." *U. S.*

FERRUM. *U.S.*, *Br.* *Iron.*

Fe; 55·9. (FĔR'RŬM.) Fe; 27·95.

"Metallic Iron, in the form of fine, bright, and non-elastic wire." *U. S.* "Wrought iron in the form of wire or nails, free from oxide." *Br.*

Fer, *Fr.;* Eisen, *G.;* Ferro, *It.;* Hierro, *Sp.;* Mars, *Fr.*

In the U. S. Pharmacopœia, this metal is employed in different preparations, in the form of wire; it was officinal in 1850 as *Ferri Ramenta*, Iron Filings.

Iron is the most abundant and useful of the metals, and so interwoven with the wants of mankind that the extent of its consumption by a nation may be taken as an index of progress in civilization. It is universally diffused in nature, not only in the mineral but also in the vegetable and animal kingdoms. There are very few minerals in which traces of it are not to be found, and it is an essential constituent in many parts of animals, but particularly in the blood. It is one of the few metals which are not deleterious to the animal economy.

Iron occurs, 1, native (almost exclusively, however, of meteoric origin); 2, sulphuretted in the minerals, pyrites (simple ferric sulphide), pyrrotine or magnetic pyrites, and arsenopyrite or mispickel (a sulph-arsenide of iron); 3, oxidized, embracing the magnetic, specular, red, brown, and argillaceous oxides of iron, together with chromite (mixed oxides of iron, chromium, and magnesium), and franklinite (mixed oxides of iron, manganese, and zinc); 4, in saline combination, forming carbonate, sulphate, phosphate, and arseniate of iron. Those minerals of iron which admit of being worked to advantage are called iron ores. These include the different native oxides, and the carbonate (sparry iron). The best iron is obtained from varieties of the native oxide, usually called magnetic iron ore and specular iron ore. These occur abundantly in Sweden, and furnish the superior iron of that country. As a general rule, those ores yield the best iron which occur in primitive formations.

Extraction. The mode of extracting iron from its ores varies somewhat with the nature of the ore; but the general principles of the operation are the same for all.

The ore, previously broken into small pieces and roasted, is exposed to the action of an intense heat, in contact with carbonaceous matter, such as charcoal, coke, or anthracite, and in connection with some flux, capable of fusing with the impurities of the ore. The flux varies with the nature of the ore, and is generally either limestone or clay; limestone being employed when the ore is argillaceous, clay when it is calcareous. The flux, whatever it may be, enters into fusion with the impurities, and forms what is called the slag, which is a fusible silicate of lime chiefly; while the carbonaceous matter, acting on the oxide of iron, reduces it to the metallic state. The reduced metal, from its density, occupies the lower part of the furnace, and is protected from the action of the air by the melted slag which floats on its surface. When the reduction is completed, the slag is allowed to run out by a hole in the side of the furnace, and the melted metal by an aperture at the bottom, the latter being received into long triangular moulds, where it solidifies in masses, known in commerce by the name of *pig* or *cast iron.* In this state the metal is brittle and far from being pure; as it contains from 3 to 6 per cent. of carbon, with silicon, phosphorus, sulphur, and manganese. It is purified, and brought to the state of *malleable iron*, by being fused and subjected, while stirred, to the action of a current of air on its surface. By these means the carbon is nearly burnt out, and the other impurities are oxidized and made to rise to the surface as a slag. Instead of this process, called "refining," usage in this country and England substitutes what is termed "pig-boiling," that is, the pig iron is at once submitted to the operation of puddling without previous refining. The "puddling" process consists in heating the charge of pig iron on the hearth of a reverberatory furnace in contact with ferric oxide and in a reducing flame. The silicon is first burnt out, and then the carbon gradually disappears; the phosphorus goes into the "tap cinder" as phosphide and phosphate; the sulphur also in part does so as sulphur dioxide and in part remains in the cinder as ferrous sulphide. As the metal approaches to purity, it becomes tough and less liquid, and its particles agglutinate so as to form semi-fused lumps, though the temperature of the furnace continues the same. These lumps are then taken out of the furnace, and their particles, by means of ponderous hammers moved by steam or water power, or by great pressure, are forced together so as to form one tenacious mass. The metal is finally rolled out into bars of a convenient size, when it constitutes the malleable iron of commerce.

The third form of commercial iron, known as "steel," is made either by the *cementation* process, or by the *Bessemer* process. In the former case, wrought iron is packed with charcoal and heated until combination takes place, and the resulting steel is cast into ingots. In the latter case, cast-iron is melted in large vessels called converters, when a blast of air is blown through the mass, burning out the requisite amount of carbon, and then, after addition of a small amount of *spiegeleisen*, or of manganiferous cast-iron, the finished product is run into moulds. Steel contains from one-half to one per cent. of carbon.

Iron mines occur in most countries, but more particularly in northern ones. In Spain, the principal mines furnish sparry iron and the red oxide. The chief iron ores of France are the sparry iron, and the specular, brown, and argillaceous oxides; of Germany, the sparry iron and brown oxide. The island of Elba is celebrated for its rich and abundant specular iron ore.

In the United States iron is abundant. The principal ores that are worked are the magnetic, red, and brown oxides. The magnetic oxide is found in large beds in Essex Co., N. Y., on the borders of Lake Champlain, and in the Lake Superior district; the red oxide in New York, New Jersey, Pennsylvania, and especially in a very pure state in Missouri, at Iron Mountain and Pilot Knob; the brown oxide in Eastern Pennsylvania.

Properties. Iron is a hard, malleable, ductile, and tenacious metal, of a grayish white color and fibrous texture, a slightly styptic taste, and a sensible odor when rubbed. In tenacity it yields only to nickel and cobalt. (*Deville.*) Its sp. gr. is about 7·7 (7·8, *U. S.*), and its fusing point very high. It possesses the magnetic and welding properties. It is combustible, and, when heated to whiteness, burns in atmospheric air, and with brilliant scintillations in oxygen gas. At a red heat, its surface is converted into black oxide, and at common temperatures, by the combined agency of air and moisture, it becomes covered with a reddish matter, called *rust*, which is the hydrated sesquioxide. It combines with all the non-metallic elements, except hydrogen and nitrogen, and with most of the metals. It forms three compounds with oxygen, a monoxide and sesquioxide, which, by their union, form the native magnetic oxide, and a teroxide, possessing acid properties, called ferric acid. The *monoxide*, or ferrous oxide, is of a dark blue color, attracted by the magnet, and spontaneously combustible in the air, being converted into sesquioxide. It is the base of green vitriol, and of the green salts of iron generally. It is very prone to absorb oxygen; and hence the salts which contain it are soon partially converted, when in solution, into salts of the sesquioxide. Its formula is FeO, consisting of one atom of iron, Fe, and one of oxygen, O, making its mol. wt. $56 + 16 = 72$. The *sesquioxide*, or ferric oxide, is readily obtained by dissolving iron in hydrochloric acid, precipitating by ammonia, and igniting the precipitate. It is of a red color, not attracted by the magnet, and forms salts, which for the most part have a reddish color. Its formula is Fe_2O_3, consisting of two atoms of iron, Fe, and three atoms of oxygen, O, making its mol. wt. $112 + 48 = 160$. An allotropic variety of the sesquioxide, soluble in water, and not responding to the ordinary tests of iron, has been discovered by M. Pean de Saint-Gilles. The *native black oxide*, the magnetic oxide of mineralogists, consists of one molecule of FeO, and one molecule of Fe_2O_3, making its mol. wt. $72 + 160 = 232$. Under the name of *Ferri Oxidum Magneticum*, the British Pharmacopœia has a preparation consisting of this oxide with three mols. of water. The *teroxide* or *ferric acid*, discovered by Frémy, may be obtained, in union with potassa, by passing chlorine through a very concentrated solution of the alkali, holding the hydrated sesquioxide in suspension, or by fusing iron filings with nitre. This acid consists of one atom of iron 56, and three of oxygen $48 = 104$. Iron forms a number of important salts.

Iron is readily detected, even in minute quantities, by bringing it to the state of sesquioxide in solution, and adding ferrocyanide of potassium or tincture of galls; the former of which will strike a deep blue, the latter a black color. The object of bringing it to the state of sesquioxide is readily effected by boiling the solution containing it with a little nitric acid.

General Therapeutic Effects of Iron. The preparations of iron are pre-eminently tonic, and peculiarly well fitted to improve the quality of the blood, when impoverished from any cause. Hence they are useful in diseases characterized by debility, especially when the consequence of inordinate discharges. The diseases in which they are usually employed are chronic anæmia or chlorosis, hysteria, fluor albus, scrofula, rickets, passive hemorrhages, dyspepsia when dependent on deficient energy of the digestive function, and neuralgia. They are contraindicated in all inflammatory diseases, producing, when injudiciously employed, heat, thirst, headache, difficulty of breathing, and other symptoms of an excited circulation. In order to understand their effect in improving the blood, it must be borne in mind that this fluid always contains iron, as an essential constituent of the red corpuscles. The amount in ten thousand parts of blood, according to different authorities, is 2·3 parts (Le Canu), 2·4 (Denis), 5·5 (Becquerel and Rodier), 8·7 (Poggiale), mean 4·7. In anæmia the blood is deficient in iron, not because the red corpuscles contain less of the metal, for they, individually considered, always contain the normal quantity; but because there are fewer of them. (*Becquerel and Rodier.*) The question here arises, which are the preparations of iron best adapted to promote the formation of the red constituent of the blood, and what are the conditions of their administration most favorable to their efficient action? According to M. Bouchardat, the preparations most easily assimilated are metallic iron and the ferrous oxide; and, when the latter is in saline combination, it should be united either with carbonic acid, or with some organic acid. He holds that, when the iron is combined with a mineral acid, such as the sulphuric or phosphoric, the preparation acts solely as an astringent. Quevenne did not go so far as this, but believed that the mineral acid salts were not well adapted for assimilation, and that they were less so in proportion to their astringent power.

Quevenne laid it down as a rule, that, when the iron preparations are given with the view of improving the blood, they should be taken with the meals, and not on an empty stomach. Doses, thus given, are well borne, which often cause uneasiness and pain, when taken fasting. The gastric juice of the empty stomach is usually alkaline; and Quevenne proved that reduced iron, introduced, through a fistulous opening, into the stomach of fasting dogs, was not acted on, and was without effect in exciting the secretion. The juice, during digestion, is acid, and has been shown by the experiments of Quevenne to be in a favorable state for dissolving iron. The ferruginous preparations, it is true, were found to be unequally soluble; for, while iron filings were freely soluble, the subcarbonate of iron was but slightly attacked. It was observed that the acidity of the gastric juice was but little diminished by the solution of the iron; which fact can be explained only by supposing that the presence of the metal caused a nearly proportional increase of the acid secretion. Assuming these observations to be accurate, it is easy to perceive why the ferruginous preparations should be taken with the food, selecting of course those most soluble in the gastric juice. The digested iron, being intimately blended with the digested food, is in a favorable state for secondary assimilation. In the use of ferruginous preparations, it is necessary to persevere for several months, in order to reap the fullest benefit. Even after the cure appears to be accomplished, it is safest to continue them, in diminishing doses, for a considerable time.

The following table embraces all the preparations of iron to be found in the United States and British Pharmacopœias, together with their synonymes.

Iron is officinal—

I. IN THE METALLIC STATE.
- Ferrum, *U. S.*, *Br.—Iron.*
  - Mistura Ferri Aromatica, *Br.—Aromatic Mixture of Iron.*
  - Vinum Ferri, *Br.—Wine of Iron.*
- Ferrum Reductum, *U. S.;* Ferrum Redactum, *Br.—Reduced Iron. Powder of Iron.*
  - Trochisci Ferri Redacti, *Br.—Reduced Iron Lozenges.*

II. OXIDIZED.
- Ferri Oxidum Hydratum, *U. S.;* Ferri Peroxidum Humidum, *Br.—Hydrated Oxide of Iron. Moist Peroxide of Iron.*
- Ferri Oxidum Hydratum cum Magnesia.—*Hydrated Oxide of Iron with Magnesia.*
- Ferri Oxidum Magneticum, *Br.—Magnetic Oxide of Iron.*
- Ferri Peroxidum Hydratum, *Br.—Hydrated Peroxide of Iron.*
  - Emplastrum Ferri, *Br.—Chalybeate Plaster.*

III. IN SALINE COMBINATION.
- Liquor Ferri Acetatis, *U. S.—Solution of Acetate of Iron.*
- Tinctura Ferri Acetatis, *U. S.*, *Br.—Tincture of Acetate of Iron.*
- Ferri Arsenias, *Br.—Arseniate of Iron.*
- Ferri Carbonas Saccharatus, *U. S.—Saccharated Carbonate of Iron.*
- Ferri Carbonas Saccharata, *Br.—Saccharated Carbonate of Iron.*
  - Pilula Ferri Carbonatis, *Br.—Pill of Carbonate of Iron.*
- Massa Ferri Carbonatis, *U. S.—Mass of Carbonate of Iron.*
- Pilulæ Ferri Compositæ, *U. S.—Compound Pills of Iron.*
- Ferri Chloridum, *U. S.—Chloride of Iron.*
  - Liquor Ferri Chloridi, *U. S.—Solution of Chloride of Iron.*
  - Tinctura Ferri Chloridi, *U. S.—Tincture of Chloride of Iron.*
- Ferri Citras, *U. S.—Citrate of Iron.*
  - Liquor Ferri Citratis, *U. S.—Solution of Citrate of Iron.*
  - Vinum Ferri Amarum, *U. S.—Bitter Wine of Iron.*
  - Vinum Ferri Citratis, *U. S.*, *Br.—Wine of Citrate of Iron.*
- Ferri et Ammonii Citras, *U. S.;* Ferri et Ammoniæ Citras, *Br.—Citrate of Iron and Ammonium.*

Ferri et Ammonii Sulphas, *U. S.—Sulphate of Iron and Ammonium. Ammonio-ferric Alum.*
Ferri et Ammonii Tartras, *U. S.—Tartrate of Iron and Ammonium.*
Ferri et Potassii Tartras, *U. S.;* Ferrum Tartaratum, *Br.—Tartrate of Iron and Potassium. Tartarated Iron.*
Ferri et Quininæ Citras, *U. S.;* Ferri et Quiniæ Citras, *Br.—Citrate of Iron and Quinine. Citrate of Iron and Quinia.*
Liquor Ferri et Quininæ Citratis, *U. S.—Solution of Citrate of Iron and Quinine.*
Ferri et Strychninæ Citras, *U. S.—Citrate of Iron and Strychnine.*
Ferri Hypophosphis, *U. S.—Hypophosphite of Iron.*
Potassii Ferrocyanidum, *U. S.;* Potassæ Prussias Flava, *Br.—Ferrocyanide of Potassium. Yellow Prussiate of Potassa.*
Pilula Ferri Iodidi, *Br.—Pill of Iodide of Iron.*
Pilulæ Ferri Iodidi, *U. S.—Pills of Iodide of Iron.*
Syrupus Ferri Iodidi, *U. S., Br.—Syrup of Iodide of Iron.*
Ferri Iodidum, *Br.—Iodide of Iron.*
Ferri Iodidum Saccharatum, *U. S.—Saccharated Iodide of Iron.*
Ferri Lactas, *U. S.—Lactate of Iron.*
Liquor Ferri Nitratis, *U. S.—Solution of Nitrate of Iron.*
Liquor Ferri Pernitratis, *Br.—Solution of Nitrate of Iron.*
Ferri Oxalas, *U. S.—Oxalate of Iron.*
Liquor Ferri Perchloridi Fortior, *Br.—Strong Solution of Perchloride of Iron.*
  Liquor Ferri Perchloridi, *Br.—Solution of Perchloride of Iron.*
  Tinctura Ferri Perchloridi, *Br.—Tincture of Perchloride of Iron.*
Ferri Phosphas, *U. S., Br.—Phosphate of Iron.*
Syrupus Ferri Phosphatis, *Br.—Syrup of Phosphate of Iron.*
Ferri Pyrophosphas, *U. S.—Pyrophosphate of Iron.*
  Emplastrum Ferri, *U. S.—Plaster of Iron. Strengthening Plaster.*
  Trochisci Ferri, *U. S.—Troches of Iron.*
Liquor Ferri Subsulphatis, *U. S.—Solution of Subsulphate of Iron.*
Ferri Sulphas, *U. S., Br.—Sulphate of Iron.*
  Ferri Sulphas Exsiccatus, *U. S.;* Ferri Sulphas Exsiccata, *Br.—Dried Sulphate of Iron.*
  Mistura Ferri Composita, *U. S., Br.—Compound Mixture of Iron.*
Ferri Sulphas Præcipitatus.—*Precipitated Sulphate of Iron.*
Ferri Sulphas Granulata, *Br.—Granulated Sulphate of Iron.*
Liquor Ferri Tersulphatis, *U. S.;* Liquor Ferri Persulphatis, *Br.—Solution of Tersulphate of Iron. Solution of Persulphate of Iron.*
Ferri Valerianas, *U. S.—Valerianate of Iron.*

IRON WIRE. *Ferri Filum. U. S.* 1850.

Fil de Fer, *Fr.;* Eisendraht, *G.;* Fil di Ferro, *It.;* Hilo de Hierro, *Sp.*

IRON FILINGS. *Ferri Ramenta. U. S.* 1850. *Limatura Ferri.*

Limailles de Fer, *Fr.;* Eisenfeilicht, *G.;* Limatura di Ferro, *It.;* Limatura de Hierro, *Sp.*

Iron, when employed in pharmaceutical operations, should be of the purest kind; and hence the Pharmacopœias generally direct it, when wanted in small masses, to be in the form of *iron wire*, which is necessarily made from the purest, because the softest and most ductile, iron, and is readily cut into pieces. The wire is very flexible and without elasticity.

Iron filings are usually obtained from the workshops of the blacksmith; but, as furnished from this source, they are generally very impure, and unfit for medicinal use. M. Gobley, upon examining thirty-six samples of iron filings, found but three exempt from copper. The rest, besides wood, sand, and oxide of iron, contained as high as 2 per cent. of this metal. Iron filings cannot be completely purified by the magnet; as they often have adhering to them bits of foreign matter, which are carried up with them. The only way to obtain them pure, is to file a piece of pure iron with a clean file. The French Codex directs iron in an *impalpable powder*, prepared by porphyrizing bright and clean iron filings without water. A dull black powder is formed, which must be carefully preserved from moisture. An impalpable powder of the metal, *Ferrum Reductum*, is officinal.

FERRUM REDUCTUM. *U. S.* *Reduced Iron.*

(FĔR′RŬM RẸ-DŬC′TŬM.)

Ferrum Redactum, *Br., P.G.*, U. S. P. 1870; Ferri Pulvis, *U. S.* 1850; Powder of Iron; Ferrum Hydrogenio Reductum, Ferrum Ope Hydrogenii Paratum; Iron reduced by Hydrogen, Iron by Hydrogen; Fer réduit par l'Hydrogène, *Fr.;* Reducirtes Eisen, *G.*

A process for this form of iron is no longer officinal; that of U. S. P. 1870 will be found in the foot-note.*

"Take of Hydrated Peroxide of Iron *one ounce* [avoirdupois]; Zinc, granulated, Sulphuric Acid, Chloride of Calcium, each, *a sufficiency.* Introduce the Hydrated Peroxide of Iron into a gun-barrel, confining it to the middle part of the tube by plugs of asbestos. Pass the gun-barrel through a furnace, and, when it has been raised to a strong red heat, cause it to be traversed by a stream of hydrogen gas, developed by the action on the Zinc of some of the Sulphuric Acid diluted with eight times its volume of water. The gas before entering the gun-barrel must be rendered quite dry by being made to pass first through the remainder of the Sulphuric Acid, and then through a tube eighteen inches long, packed with small fragments of the Chloride of Calcium. The farther end of the gun-barrel is to be connected by a cork with a bent tube dipping under water; and when the hydrogen is observed to pass through the water at the same rate that it bubbles through the Sulphuric Acid, the furnace is to be allowed to cool down to the temperature of the atmosphere, the current of hydrogen being still continued. The reduced iron is then to be withdrawn, and enclosed in a dry stoppered bottle." *Br.*

This preparation was introduced into the United States and Dublin Pharmacopœias of 1850, and is retained in the present edition of our own, although the process for it has been abandoned. It consists of metallic iron in fine powder, obtained by reducing the sesquioxide by hydrogen at a dull red heat. The subcarbonate of the U. S. Pharm. 1870, which is essentially the sesquioxide of iron, is deprived of water by calcination, and then subjected to the reducing influence of a stream of hydrogen, purified from sulphuretted hydrogen and other acid by passing successively through a solution of subacetate of lead and milk of lime. The hydrogen unites with the oxygen of the sesquioxide to form water, and leaves the iron in the metallic state. The subcarbonate should be perfectly free from sulphate of sodium, which it is apt to contain when imperfectly washed. If this salt be present, it will be reduced by the hydrogen to the state of sulphide of sodium, which will contaminate and spoil the metallic iron formed, and cause the preparation, when taken, to give rise to unpleasant eructations. The heat should be carefully regulated; for if it fall below dull redness, part of the oxide will escape reduction; and, if it exceed that point considerably, the particles of reduced iron will agglutinate, and the preparation will be heavy and not readily pulverizable. The British process is not so well fitted for practical purposes as that of the U. S. Pharm. 1870. The direction to dry the hydrogen is unnecessary. On the subject of powder of iron, manufacturing chemists will find it useful to consult the paper of MM. Soubeiran and Dublanc, in which full directions are given for purifying the hydrogen, constructing the furnace, regulating the heat, and avoiding explosions. (*A. J. P.*, xviii., p. 303. For improvements by Prof. Procter, see *A. J. P.*, xix., p. 11.)

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* *Ferrum Redactum.* "Take of Subcarbonate of Iron *thirty troyounces.* Wash the Subcarbonate thoroughly with water until no traces of sulphate of sodium are indicated by the appropriate tests, and calcine it in a shallow vessel until free from moisture. Then spread it upon a tray, made by bending an oblong piece of sheet-iron in the form of an incomplete cylinder, and introduce this into a wrought-iron reduction-tube, of about four inches in diameter. Place the reduction-tube in a charcoal furnace; and, by means of a self-regulating generator of hydrogen, pass through it a stream of that gas, previously purified by bubbling successively through solution of subacetate of lead, diluted with three times its volume of water, and through milk of lime, severally contained in four-pint bottles, about one-third filled. Connect with the further extremity of the reduction-tube a lead tube bent so as to dip into water. Make all the junctions air-tight by appropriate lutes; and, when the hydrogen has passed long enough to fill the whole of the apparatus to the exclusion of atmospheric air, light the fire, and bring that part of the reduction-tube, occupied by the Subcarbonate, to a dull-red heat, which must be kept up so long as the bubbles of hydrogen, breaking from the water covering the orifice of the lead tube, are accompanied by visible aqueous vapor. When the reduction is completed, remove the fire, and allow the whole to cool to the ordinary temperature, keeping up, during the refrigeration, a moderate current of hydrogen through the apparatus. Withdraw the product from the reduction-tube, and, should any portion of it be black instead of iron-gray, separate such portion for use in a subsequent operation. Lastly, having powdered the Reduced Iron, keep it in a well-stopped bottle. When thirty troyounces of Subcarbonate of Iron are operated on, the process occupies from five to eight hours." *U. S.* 1870.

Since the tenth edition of this work was published, several processes have been proposed for obtaining powder of iron. Mr. Arthur Morgan, of Dublin, recommended the use of dried ferrocyanide of potassium, thoroughly mixed with anhydrous red oxide of iron, and calcined with pure carbonate of potassium at a low red heat. The product contains all the iron in a reduced state, mixed with soluble matters, which are carefully washed away. (See *A. J. P.*, 1854, p. 450.) A similar process to the above has been proposed by a German chemist, named Zängerle; the oxalate of iron being substituted for the red oxide. (See *P. J. Tr.*, 1857, p. 565.) Prof. Wöhler recommended the use of the same oxalate, not in connection with ferrocyanide of potassium, but as a suitable compound of iron for reduction by hydrogen. W. Müller found that oxide of iron obtained by heating the metal in the air is reduced when moist at 293° C. (559·4° F.); when quite dry, at 305° to 339° C. (581° to 642·2° F.); the oxalate moist, at 278° C. (532·4° F.). Another eligible compound for reduction is the crystalline powder of oxide of iron, prepared by fusing, in a clay crucible, pure dried sulphate of iron with three times its weight of chloride of sodium, and then washing the melted mass when cold, until everything soluble is removed. (*Wöhler.*) M. Crolas prepares a pure oxide of iron by adding chloride of barium to the solution of the chloride of iron to precipitate the contaminating sulphate, getting rid of the chloride of barium by crystallization and precipitating by solution of ammonia. The chloride of ammonium is driven off by heat. (*Journ. de Pharm.*, 4e sér., xx. 30.) The process of M. Eugène Fegueux consists in reducing the oxide of iron by carbonic oxide, formed by passing a stream of carbonic acid over red-hot charcoal in the reduction-tube, before it reaches the oxide of iron. The carbonic acid, thus reduced to carbonic oxide, is formed again by the deoxidizing of the ferruginous oxide.

Under the name of "*alcoholized iron*," a powder of iron has been introduced into this country, said to be prepared, in the eastern parts of Germany, by attrition of iron filings with honey, by some cheap method, as by attachment to a saw-mill or steam machinery. It has the appearance of powdered plumbago, but under the magnifying glass is seen to contain particles with the metallic lustre, and rounded as if by friction. It is soluble in diluted sulphuric acid, with the escape of hydrogen free or nearly so from sulphur; but a small quantity of a black powder remains undissolved. (*A. J. P.*, 1867, p. 11.) The relation of the epithet "alcoholized" to this powder is not very obvious, as this name was given originally to iron obtained by passing alcohol vapor over oxide of iron. It is not much inferior to reduced iron, and is better than some preparations sold by that name.

Properties. Powder of iron, called by the French *fer reduit*, is a light, tasteless powder, soft to the touch, of an iron-gray color, and without metallic lustre. If black, the preparation is to be rejected as not being fully deoxidized. When thrown into a dilute acid, it causes a lively effervescence of hydrogen without odor. A small portion of it, struck on an anvil with a smooth hammer, forms a scale having a brilliant metallic lustre. It takes fire upon the application of a burning body. On account of its great liability to oxidation, it should be kept in a dry bottle, well stopped. A black powder, having a composition corresponding with that of the magnetic oxide of iron, has been sold in London and Edinburgh under the name of Quevenne's iron. The spurious powder may be known by its having a black instead of an iron-gray color, and by its effervescing but slightly with acids. In the process for making reduced iron, part of the sesquioxide almost always escapes full deoxidation, and comes out of the tube a black color. This part should be rejected, instead of being sold as reduced iron, as appears to have been done by some manufacturing chemists. If the preparation has been very badly made, its solution in dilute sulphuric acid will produce an intensely red color with sulphocyanide of potassium. It is officinally described as "a very fine, grayish black, lustreless powder, permanent in dry air, without odor or taste, and insoluble in water or alcohol. When ignited in contact with air, it is converted into ferric oxide. When treated with diluted sulphuric acid, it causes the evolution of nearly odorless hydrogen gas, and, on being warmed, it is dissolved without leaving a residue." *U. S.*

Tests of Purity. The Pharmacopœia gives a quantitative test, which is based on Carles's method[*] and that of the British Pharmacopœia. "If 1 Gm. of Reduced Iron be digested with 3·5 Gm. of iodine, 2·5 Gm. of iodide of potassium, and 50 C.c. of distilled water for two hours, the resulting filtrate should have a green color, and should not be rendered blue by gelatinized starch (presence of at least 80 per cent. of metallic iron)." *U. S.* Schacht (*Pharm. Zeitung; N. R.*, 1877, p. 207) proposes the following tests of purity. "It should be completely soluble in warm, diluted, pure hydrochoric acid, and the evolved gas (hydrogen) must be entirely indifferent against paper impregnated with lead acetate. When treated for half an hour with 25 parts of a solution of ferric chloride of spec. grav. 1·300, in a glass-stoppered vial, under repeated shaking, it is entirely disssolved."

J. Creuse communicated a valuable paper to the Amer. Pharm. Association in 1874, in which he showed the deficiencies of many brands of commercial iron by hydrogen, and recommended a test based on an estimation of the amount of hydrogen liberated from a definite weight of the reduced iron. O. Wilner (*Farmaceutisk Tiddskrift*, Aug. 1880; *A. J. P.*, 1881, p. 15) states that, 1. The amount of metallic iron in reduced iron can be accurately determined by treatment with mercuric chloride and titration with potassium permanganate. 2. If metallic iron is treated by the aid of a gentle heat with an excess of a concentrated solution of mercuric chloride, mercurous chloride and metallic mercury are separated, and the metallic iron passes as ferrous chloride into solution; the ferrous and ferric oxides which may be present remain undissolved, and therefore do not prevent the estimation of the amount of metallic iron in the reduced iron. 3. The amount of ferrous oxide in the preparation may be estimated by treating the same portion with hydrochloric acid, digesting the mixture in a closed vessel until the finely divided ferrous oxide becomes dissolved, and titrating with potassium permanganate. 4. The ferric chloride which is thus formed at the same time has no appreciable action upon the precipitated metallic mercury and mercurous chloride.

Medical Properties. Powder of iron, reduced from the oxide by hydrogen, was first prepared for medicinal purposes by Quevenne and Miquelard, of Paris. It is one of the best of chalybeate tonics, nearly free from astringency, and, according to Quevenne and M. Costes, of Bordeaux, yields the largest proportion of iron into the gastric juice. The chief objection to it is the difficulty of obtaining it well prepared. Much of the powder of iron found in the shops is not to be depended on, in consequence of imperfect reduction. Observations to determine its therapeutic value, compared with that of the other ferruginous preparations, were made by M. Costes, for nearly four years, at the Saint-André hospital, of Bordeaux, and with results highly favorable to it. The dose is from three to six grains (0·20–0·40 Gm.) several times a day, given in powder or pill. It is sometimes prepared with chocolate in the form of lozenges.

Off. Prep. Pilulæ Ferri Iodidi, *U. S.*

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[*] P. Carles estimates the proportion of iron by the use of a titrated solution of iodine, containing 4·53 grammes of iodine and 5 grammes of iodide of potassium in a hundred cubic centimetres; one cubic centimetre of this solution is equivalent to ·01 gramme of iron. 0·1 gramme of the iron to be tested should be put in 5 grammes of water in a matrass and heated. Then the solution should be added from a burette. Sometimes a little continuance of the heat is necessary for the perfection of the reaction, which changes the color of the liquid persistent yellow. Before accepting the readings of the burette the residue should be tested with hydrochloric acid. Any effervescence shows that the iron has not fully combined with the iodine. (*Journ. de Pharm.*, 4e sér., xx. 178.)

FICUS. *U.S., Br.* *Fig.*

(FĪ'CŬS.)

"The fleshy receptacle of Ficus Carica, Linné (*Nat. Ord.* Urticaceæ, Artocarpeæ), bearing fruit upon its inner surface." *U.S.* "The dried fruit of Ficus Carica." *Br.*

Caricæ, *P.G.;* Ficus Passa, Fici, Fructus Caricæ; Figues, *Fr.;* Feigen, *G.;* Fichi, *It.;* Higos, *Sp.*

Gen. Ch. *Common receptacle* turbinate, fleshy, converging, concealing the florets in the same or distinct individuals. MALE. *Calyx* three-parted. *Corolla* none. *Stamens* three. FEMALE. *Calyx* five-parted. *Corolla* none. *Pistil* one. *Seed* one, covered with the closed, persistent, somewhat fleshy calyx. *Willd.*

Ficus Carica. Willd. *Sp. Plant.* iv. 1131; Woodv. *Med. Bot.* p. 714, t. 244. The fig-tree, though often not more than twelve feet high, sometimes rises in warm climates twenty-five or even thirty feet. Its trunk, which seldom exceeds seven inches in diameter, is divided into numerous spreading branches, covered with a brown or ash-colored bark. Its large, palmate leaves, usually divided into five obtuse lobes, are deep green and shining above, pale green and downy beneath, and stand alternately on strong, round footstalks. The flowers are situated within a common receptacle, placed upon a short peduncle in the axils of the upper leaves. This receptacle, the walls of which become thick and fleshy, constitutes what is commonly called the fruit; though this term is, strictly speaking, applicable to the small seed-like bodies found in great numbers on the internal surface of the receptacle, to which they are attached by fleshy pedicels. Cultivation has produced in the fig, as in the apple and peach, a great diversity in shape, size, color, and taste. It is usually, however, turbinate, or top-shaped, umbilicate at the large extremity, of the size of a small pear, of a whitish, yellowish, or reddish color, and of a mild, mucilaginous, saccharine taste. The dried figs can be partially restored to their original shape by soaking.

The fig-tree is supposed to have come originally from the Levant. It was introduced at a very early period into various parts of the south of Europe, and is now very common throughout the whole basin of the Mediterranean, particularly in Italy and France. To hasten the ripening of the fruit, it is customary to puncture it with a sharp-pointed instrument covered with olive oil. The ancient process of *caprification* is still practised in the Levant. It consists in attaching branches of the wild fig-tree to the cultivated plant. The fruit of the former contains great numbers of the eggs of an insect of the genus Cynips, the larvæ of which, as soon as they are hatched, spread themselves over the cultivated fruit, and, by conveying the pollen of the male organs over which they pass to the female florets, hasten the impregnation of the latter, and cause the fig to come quickly to perfection, which might otherwise ripen very slowly, or wither and drop off before maturity. Some authors attribute the effect to the piercing of the fruit by the young insects. According to Landerer, the unripe fig contains an irritant juice, which inflames the skin, and may even disorganize it. (See *A. J. P.*, xxxiii. 215.)

The figs, when perfectly ripe, are dried by the heat of the sun, or in ovens. Those imported into this country come chiefly from Smyrna, packed in drums or boxes. They are more or less compressed, and are usually covered in cold weather with a whitish saccharine efflorescence, which melts in the middle of summer, and renders them moist. The best are yellowish or brownish, somewhat translucent when held to the light, and filled with a sweet viscid pulp, in which are lodged numerous small yellow seeds. They are much more saccharine than the fresh fruit. Their chief constituents are grape sugar, which is present in the dried fruit to the amount of 60–70 per cent., and gum or mucilage.

Medical Properties and Uses. Figs are nutritious, laxative, and demulcent. In the fresh state they are considered, in the countries where they grow, a wholesome and agreeable aliment, and have been employed from time immemorial. They are apt, however, when eaten freely, to produce flatulence, pain in the bowels, and diarrhœa. Their chief medical use is as a laxative article of diet in constipation. They occasionally enter into demulcent decoctions; and, when roasted or boiled, and split open, are sometimes applied as a cataplasm to the gums.

Off. Prep. Confectio Sennæ.

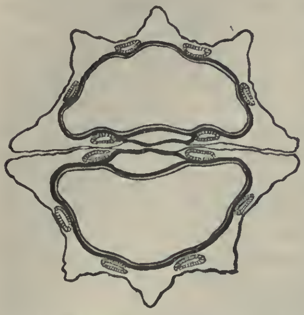
FŒNICULUM. *U. S.* *Fennel.*

(FŒ-NĬC′Ú-LŬM—fe-nĭk′yú-lŭm.)

"The fruit of Fœniculum vulgare. Gaertner. (*Nat. Ord.* Umbelliferæ, Orthospermæ.)" *U. S.* "The fruit of Fœniculum dulce. D. C. Imported from Malta." *Br.*

Fœniculi Fructus, *Br.;* Fructus Fœniculi, *P. G.;* Fennel Fruit (Seed), Sweet Fennel Fruit; Fenouil, Fruits (Semences) de Fenouil, *Fr.;* Fenchel, Fenchelsamen, *G.;* Finnocchio, *It.;* Hinojo, *Sp.*

The plant producing fennel-seed was attached by Linnæus to the genus *Anethum*, but was separated from it by De Candolle, and placed, with three or four others, in a new genus styled *Fœniculum*, which has been generally adopted by botanists. The *Anethum Fœniculum* of Linnæus embraced two varieties, the *common* or *wild fennel*, and the *sweet fennel;* the latter being the plant usually cultivated in the gardens of Europe. These are considered by De Candolle as distinct species, and named respectively *Fœniculum vulgare* and *Fœniculum dulce*, but the correctness of the opinion of the great Swedish botanist is now generally admitted.


Transverse section of Fennel, magnified to show the oil-tubes.

Gen. Ch. *Calyx* a tumid obsolete rim. *Petals* roundish, entire, involute, with a squarish blunt lobe. *Fruit* nearly taper. *Half-fruits* with five prominent bluntly keeled ridges, of which the lateral are on the edge, and rather broadest. *Vittæ* single in the channels, 2 on the commissure. *Involucre* none. *Lindley.*

Fœniculum vulgare. De Cand. *Prodrom.* iv. 142.—*Anethum Fœniculum.* Linn.; Woodv. *Med. Bot.* p. 127, t. 49. *Common Fennel* has a biennial or perennial tapering root, and an annual, erect, round, striated, smooth, green, and copiously branching stem, which usually rises three or four feet in height. The leaves, which stand alternately at the joints of the stem, upon membranous striated sheaths, are many times pinnate, with long, linear, pointed, smooth, deep green leaflets. The flowers are in large, flat, terminal umbels, with from thirteen to twenty rays, and destitute both of general and partial involucres. The corolla consists of five petals, which, as well as the stamens, are golden-yellow. The fruit is ovate, rather less than two lines in length by about a line in breadth, and of a dark color, especially in the channels. The plant is a native of Europe, growing wild upon sandy and chalky ground throughout the continent, and is also abundant in Asia, possibly extending as far as China. The variety *F. officinale* of Merat and De Lens is chiefly characterized by its fruit being twice as long as that of the ordinary plant, and also a little curved, of a less dark color, with prominent ridges, and a persistent peduncle. It is sweeter and more aromatic than common fennel-seed.

F. dulce. De Cand. *Prodrom.* iv. 142. *Sweet Fennel* bears a general resemblance to *F. vulgare*, but differs in having its stem somewhat compressed at the base, its radical leaves somewhat distichous, and the number of rays in the umbel only from 6 to 8. It is also a much smaller plant, being only about a foot high; its flowers appear earlier; and its young shoots or turiones are sweeter and edible. In Italy it is cultivated as a garden vegetable, the shoots being eaten boiled or as a salad.

The roots of fennel were formerly employed in medicine, but are generally inferior in virtues to the fruit, which is now the only officinal portion. It is stated that manufacturers of the oil usually distil the whole plant. Commerce is partly supplied from the product of our own gardens; but much the larger portion of the medicine is imported from Europe, and chiefly, as we have been informed, from Germany. During the winter of 1879 much of the seed in the German market was adulterated with fennel-seed partially deprived of its oil. The fennel-seed cultivated here is sweeter and more aromatic than that from abroad, probably in consequence of its greater freshness.

Fennel-seeds (half-fruits) are oblong oval, from one to three or four lines in length, flat on one side, convex on the other, not unfrequently connected by their flat surfaces, straight or slightly curved, brownish or of a dark grayish green color, with fine prominent, obtuse, yellowish ridges on the convex surface. On section the vittæ or oil-tubes are seen to be very well developed, and to be situated one between each pair of ridges and two upon the flat face of each mericarp. There are two varieties of fennel seed; one which is probably the product of the wild fennel growing in the south of France, is from one to two lines long, dark-colored, rather flat, almost always separate, and without footstalks: the other is from three to five lines in length, lighter-colored, with much more prominent ridges, often conjoined by their flat surface, and very frequently provided with a footstalk. They do not differ essentially in aromatic properties. The odor of fennel-seed is fragrant, its taste warm, sweet, and agreeably aromatic. It yields its virtues to hot water, but more freely to alcohol. The essential oil may be separated by distillation with water. (See *Oleum Fœniculi.*) From 960 parts of the seed, Neumann obtained 20 parts of volatile and 120 of fixed oil.

Medical Properties and Uses. Fennel-seed was used by the ancients. It is one of our most grateful aromatics, and in this country is much employed as a carminative, and as a corrigent of other less pleasant medicines, particularly senna and rhubarb. It is recommended for these purposes by the absence of any highly excitant property. An infusion may be prepared by introducing two or three drachms of the seeds into a pint of boiling water. The dose of the bruised or powdered seeds is from a scruple to half a drachm (1·3–1·95 Gm.). In infants the infusion is frequently employed as an enema for the expulsion of flatus.

Off. Prep. Aqua Fœniculi, *Br.;* Pulvis Glycyrrhizæ Compositus, *U. S.*

FRANGULA. *U.S.* *Frangula.* [*Buckthorn.*]

(FRĂN'GU̇-LẠ.)

"The bark of Rhamnus Frangula, Linné (*Nat. Ord.* Rhamnaceæ), collected at least one year before being used." *U. S.*

Alder Buckthorn; Cortex Frangulæ, *P.G.;* Bourdaine, Bourgène, *Fr.;* Faulbaumrinde, *G.*

Gen. Ch. *Calyx* four- to five-cleft, the tube campanulate lined with the disk. *Petals* small, short-clawed, notched at the end, wrapped around the short stamens, or sometimes none. *Ovary* from two- to four-celled. *Drupe* berry-like, containing two to four separated seed-like nutlets. *Gray's Manual.*

R. frangula. Linn. *B. & T.* 65.—*Frangula vulgaris.* Reichert. The *Alder Buckthorn* is an erect glabrous shrub ten to fifteen feet high, without thorns, with broadly ovate obtuse leaves, with the margins entire or slightly sinuate, the under side sometimes slightly downy, and the rather numerous lateral veins diverging equally almost from the whole length of the midrib. Flowers all hermaphrodite, two or three together in each axil, with the calyx, teeth, petals, and stamens in fives. Fruit dark purple, the size of a pea. This plant grows in hedges and bushy places throughout Europe and Russian Asia, except in the far north.

It is probable that most of the species of the genus Rhamnus have cathartic properties. An article upon *R. Purshiana*, D. C., will be found in Part II., under the heading of *Cascara Sagrada.* The *R. catharticus*, Linn., or common buckthorn, grows in Europe along with the officinal species, and has become naturalized in this country. Its bark is probably often sold for the officinal article. It is distinguished by its more spreading, thorny habit, and its diœcious flowers, which are thickly clustered in the axils and have their parts in fours. The leaves also are more acute, have their margins finely serrate and their lateral veins mostly proceeding from the proximal half of the midrib. The fruit is black.

Properties. This bark is officinally described as "quilled, about one twenty-fifth of an inch (1 mm.) thick; outer surface gray-brown, or blackish brown, with numerous, small, whitish, transversely-elongated, suberous warts; inner surface smooth, pale brownish yellow; fracture in the outer layer short, of a purplish tint; in the inner layer fibrous and pale yellow; nearly inodorous; taste sweetish and bitter."

It is not certainly known which of the several bodies isolated from frangula bark is the purgative principle. The most important body, *frangulin*, the *rhamnoxanthin* ($C_{20}H_{20}O_{10}$) of Buchner and Binswanger, may be obtained by Phipson's process by macerating the bark for three or four days in carbon disulphide, then permitting the liquid to evaporate, exhausting the residue with alcohol, which leaves the fatty matter behind, evaporating the alcoholic liquid to dryness, and recrystallizing from ether. As thus obtained it is in fine yellow crystals, melting at about 249° C. (480·2° F.), and subliming in golden-yellow needles. It is insoluble in water, soluble in 160 parts of warm 80 per cent. alcohol, nearly insoluble in cold alcohol, soluble in hot fixed oils, benzin, and oil of turpentine. It communicates its color to cotton, silk, and wool. Kubly obtained an amorphous glucoside, *avornin*, $C_{16}H_{18}O_8$, from the bark, and Liebermann and Waldstein obtained from old frangula bark the glucoside *emodin*, and proved its identity with the same principle found in rhubarb.

Medical Properties. In its fresh state this drug is very irritant to the gastrointestinal mucous membrane, producing, when taken in sufficient quantity, violent catharsis, accompanied by vomiting, and much pain. During drying it is said to lose much of its irritant powers, and the dried bark is affirmed to resemble rhubarb in its action. In this country it is gradually coming into use. A *decoction* (half ounce to the half pint) may be used in tablespoonful doses, or a dessertspoonful of an *elixir*, four fluidounces of the fluid extract to twelve of elixir of orange, or the officinal fluid extract in doses of fifteen to thirty minims (0·9 to 1·9 C.c.).

Off. Prep. Extractum Frangulæ Fluidum, *U. S.*

GALBANUM. *U. S.*, *Br.* *Galbanum.*

(GĂL′BẠ-NŬM.)

"A gum-resin obtained from Ferula galbaniflua, Boissier et Buhse, and probably from other allied plants. (*Nat. Ord.* Umbelliferæ, Orthospermæ.)" *U. S.* "A gum-resin, derived from an unascertained umbelliferous plant. Imported from India and the Levant." *Br.*

Gummi-Resina Galbanum; Galban, Mutterharz, *G.;* Galbano, *It.*, *Sp.*

It is uncertain from what plant galbanum is derived. At one time it was supposed to be the product of *Bubon Galbanum*, an umbelliferous plant of the eastern coast of Africa. It has also been referred to the *Ferula Ferulago* of Linnæus, the *Ferula galbanifera* of Lobel, which inhabits the coast of the Mediterranean, and is found also in Transylvania and the Caucasus. But no part of either of these plants has the odor of galbanum; and it is, therefore, scarcely probable that they yield the drug. Mr. Don, having found the seeds taken from a parcel of galbanum to belong to an undescribed genus of umbelliferous plants, and concluding that they came from the same source as the gum-resin itself, gave the title of Galbanum to the new genus, and named the species *Galbanum officinale.* This was rather hastily adopted by the London College; as it is by no means certain that the same plant produced the seeds and the gum-resin. Specimens of a plant were received in England from Persia having a concrete juice adhering to them, which was taken by Dr. Lindley for galbanum: and that botanist, finding that the plant belonged to an undescribed genus, named it *Opoïdia*, with the specific name *galbanifera.* Dr. Pereira, however, found the substance not to be galbanum; and this supposed origin of the drug, therefore, must be considered as more than doubtful. A German traveller, F. A. Buhse, who has resided in Persia, states that, in 1848, he met with the *galbanum* plant on the declivities of the Demavend, near the southern coast of the Caspian. He saw the gum-resin exuding spontaneously from the plant, and was informed by the natives that the drug was collected from it. The plant is a Ferula, and has received the name of *F. galbaniflua*, Boissier and Buhse. Buhse also states that the Persian galbanum is yielded by a second plant, which is doubtfully distinct from *F. galbaniflua;* this is the *F. rubricaulis*, Boissier (*F. erubescens*, Berg). Galbanum is said to be obtained by making incisions into the stem, or cutting it off a short distance above the root. A cream-colored juice exudes, which concretes upon exposure to the air. A portion of juice also exudes spontaneously from the joints, and hardens in the shape of tears. The drug is brought from India and the Levant.

Properties. Galbanum usually appears in the form of masses composed of whitish, reddish, or yellowish tears, from the size of a pin's head to that of a pea, and larger, irregularly agglutinated by a darker colored yellowish brown or greenish substance, more or less translucent, and generally mixed with pieces of stalk, seeds, or other foreign matters. It is also found, though rarely in our markets, in the state of distinct roundish tears, about as large as a pea, of a yellowish white or pale brownish yellow color, shining externally as if varnished, translucent, and often adhering together. Galbanum has in cool weather the consistence of firm wax, but softens in summer, and by the heat of the hand is rendered ductile and adhesive. At 100° C. (212° F.) it is sufficiently liquid to admit of straining; and it generally requires to be strained before it can be used. A dark brown or blackish color, a consistence always soft, the absence of whitish grains, a deficiency in the characteristic odor and taste, and the intermixture of earthy impurities, are signs of inferiority.

The odor of galbanum is peculiar and disagreeable; its taste bitterish, warm, and acrid; its sp. gr. 1·212. Triturated with water, it forms an imperfect milky solution, which on standing deposits the greater portion of what was taken up. Wine and vinegar act upon it in a similar manner. Alcohol dissolves a considerable proportion, forming a yellow tincture, which has the smell and taste of galbanum, and becomes milky with water, but affords no precipitate. In dilute alcohol it is wholly soluble, with the exception of impurities. Ether dissolves the greater portion. "When moistened with alcohol, galbanum acquires a purple color on the addition of a little hydrochloric acid." *U. S.* It contains volatile oil, resin, and mucilage. The oil, amounting to 7 per cent., is a slightly yellowish liquid, partly consisting of a hydrocarbon, $C_{10}H_{16}$, boiling at from 170° to 180° C. The greater part of oil of galbanum, however, consists of hydrocarbons of a much higher boiling point. The crude oil is dextrogyrate. The resin, constituting about 60 per cent., is very soft, and dissolves in ether or in alkaline liquids, even in milk of lime, but only partially in bisulphide of carbon. When heated with hydrochloric acid for some time, it yields *umbelliferone*, $C_9H_6O_3$, which may be dissolved from the acid liquid by means of ether or chloroform, and obtained on evaporation in colorless acicular crystals. The aqueous solution of umbelliferone exhibits, especially on addition of an alkali, a brilliant blue fluorescence, which is destroyed by an acid. If a small fragment of galbanum is immersed in water, a fluorescence is produced by a drop of ammonia. Asafœtida shows the same, but ammoniacum does not.

Galbanum submitted to dry distillation yields a thick oil of brilliant blue color. This oil on rectification yields a greenish portion, and then a superb blue oil. Kachler (*Ber. Ch. Ges.*, 1871, p. 36) found a colorless oil, $C_{10}H_{16}$, and a blue oil, $C_{10}H_{16}O$, boiling at 289° C. The blue oil, according to Kachler, after purification, agrees with the blue oil of the flowers of *Matricaria Chamomilla.*

By fusing galbanum resin with potash, Hlasiwetz and Barth (*Ann. Ch. Pharm.*, 130, p. 354) obtained *resorcin*, together with acetic and volatile fatty acids.

According to Ludewig, a gum-resin, designated as *Persian galbanum*, is received in Russia by the way of Astracan or Orenburg, and is the kind used in that country. It comes enclosed in skins, and is in masses of a reddish brown color with whitish streaks, of a disagreeable odor, somewhat like that of asafœtida, and of an unpleasant, bitter, resinous taste. It is so soft as to melt with a slight elevation of temperature. It differs from common galbanum in its odor, in its color, which is never greenish, and in the absence of tears, and is probably derived from a different plant. It abounds in impurities.

Medical Properties and Uses. Galbanum was known to the ancients. It is stimulant, expectorant, and antispasmodic, and is considered as intermediate in power between ammoniac and asafœtida. It has chiefly been used in chronic affections of the bronchial mucous membrane, amenorrhœa, and chronic rheumatism. It is occasionally applied externally as a plaster to indolent swellings, with the view of promoting resolution or suppuration. The dose is from ten to twenty grains (0·65–1·3 Gm.), and may be given in pill, or triturated with gum arabic, sugar, and water, so as to form an emulsion.

Off. Prep. Emplastrum Asafœtidæ, *U. S.;* Emplastrum Galbani; Pilula Assafœtidæ Composita, *Br.;* Pilulæ Galbani Compositæ, *U. S.*

GALLA. *U. S.* *Nutgall.* [*Galls.*]

(GĂL'LẠ.)

"Excrescences on Quercus lusitanica, Webb, *var.* infectoria, De Candolle (*Nat. Ord.* Cupuliferæ), caused by the punctures and deposited ova of Cynips Gallæ tinctoriæ. Olivier. (*Class*, Insecta. *Order*, Hymenoptera.)" *U. S.* "Excrescences on Quercus infectoria, caused by the punctures and deposited ova of Diplolepis Gallæ tinctoriæ." *Br.*

Gallæ, *P.G.;* Gale Halepense, vel Hercica, vel Levantica, vel Tinctoria, vel Quercina; Galle de Chêne, Noix de Galle, *Fr.;* Galläpfel, *G.;* Galla, *It.;* Agallas de Levante, *Sp.*

Many plants, when pierced by certain insects, particularly those of the genus *Cynips*, are affected at the points of puncture with a morbid action, resulting in excrescences, which, as they are derived from the juices of the plant, partake more or less of its chemical character. Most of the oaks are occasionally thus affected; and the resulting excrescences, having in a high degree the astringency of the plant, have been employed for various practical purposes. They are known by the name of *galls*, a term which, as well as their use in medicine, has been handed down from the ancients. *Quercus infectoria*, *Q. Ægilops*, *Q. excelsa*, *Q. Ilex*, *Q. Cerris*, and *Q. Robur* have been particularized as affording this product; but it is now generally admitted, on the authority of Olivier, that the officinal galls are derived chiefly, if not exclusively, from *Q. infectoria.**

QUERCUS. See *Quercus Alba.*

Quercus infectoria. Willd. *Sp. Plant.* iv. 436; Olivier, *Voy. Orient.* t. 14 *et* 15; Carson, *Illust. of Med. Bot.* ii. 40, pl. 85. The *dyer's oak* is a small tree or shrub, with a crooked stem, seldom exceeding six feet in height. The leaves are obtusely toothed, smooth, of a bright green color on both sides, and stand on short footstalks. The acorn is elongated, smooth, two or three times longer than the cup, which is sessile, somewhat downy, and scaly. This species of Quercus grows, according to Olivier, throughout Asia Minor, from the Archipelago to the confines of Persia. Captain M. Kinnier found it also in Armenia and Kurdistan; General Hardwicke observed it growing in the neighborhood of Adwanie; and it probably pervades the middle latitudes of Asia.

The gall originates from the puncture of the *Cynips quercûsfolii* of Linnæus, the *Diplolepis gallæ tinctoriæ* of Geoffroy, a hymenopterous insect or fly, with a fawn-colored body, dark antennæ, and the upper part of its abdomen shining brown. The insect pierces the shoots and young boughs, and deposits its egg in the wound. This irritates the part, and a small tumor quickly rises, which is the result of a morbid growth, exhibiting various cells under the microscope, but no proper vegetable fibre. The egg grows with the gall, and is soon converted into a larva, which feeds upon the vegetable matter around it, and thus forms a cavity in the centre of the excrescence. The insect at length becomes a fly, and escapes by eating its way out. The galls are in perfection when fully developed, before the egg has been hatched, or the fly has escaped. Collected at this period, they are called, from their dark color, *blue*, *green*, or *black galls*, and are most highly esteemed. Those which are gathered later and have been injured by the insect are *white galls*. They are usually larger, less heavy and compact, and of a lighter color than the former.

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* Under the name of *Chinese galls*, a product has been brought from China, supposed to be caused by an insect allied to the Aphis, as such an insect has been found in the interior of them. They are irregularly spindle-shaped, often more or less bent, with obtusely pointed protuberances, about two inches long by an inch in diameter at the central thickest part, of an ash color and a soft velvety feel, very light, hollow, with translucent walls about a line in thickness, of a slight odor recalling that of ipecacuanha, and a bitter astringent taste. From an examination of fragments of leaves and petioles found among these galls, Dr. Schenck concluded that the tree on which they are found is a species of Rhus; but, according to M. Decaisne, professor at the Museum of Natural History in Paris, their true source is probably the *Distylium racemosum* of Zuccarini (*Flor. Japon.*, i. p. 178, t. 94), a large tree of Japan, the leaves of which produce a velvety gall, resembling the one in question. (Guibourt, *Hist. Nat. des Drogues*, 1850, iii. 703.) More recently, however, it has been asserted by Mr. Daniel Hanbury that this opinion of Decaisne is erroneous (*P. J. Tr.*, Feb. 1862, p. 421); as, in his examination of the packages imported from China and Japan, he has found remains of different parts of a species of Rhus, but never any of a Distylium. Besides, the form of the galls of the Distylium, as figured by Siebold and Zuccarini, is entirely different. The species of Rhus which yields the commercial Chinese galls is the *R. semi-alata.* (Murray.) The Chinese make great use of this product both in dyeing and as a medicine. L. A. Buchner, Jr., has found it to contain 65 per cent. of tannic acid identical with that of the officinal galls. (*Pharm. Centralblatt*, July, 1851, p. 526.) It is recommended by Stenhouse for the manufacture of gallic acid, being preferable for this purpose to the officinal galls, in consequence of its less amount of coloring matter. (*P. J. Tr.*, Dec. 1862.) An inferior kind of galls is produced in great quantities in England, by the attack of the *Cynips Kollari* of Hartig, upon the common English oak; but they have been ascertained to contain little tannic acid, and are of little value.

The galls collected in Syria and Asia Minor are brought to this country chiefly from the ports of Smyrna and Trieste, or from London. As they are produced abundantly near Aleppo, it has been customary to designate them by the name of that town; though the designation, however correct it may formerly have been, is now wholly inapplicable, as they are obtained from many other places, and the produce of different parts of Asiatic Turkey is not capable of being discriminated. at least in our markets. Great quantities of galls, very closely resembling those from the Mediterranean, have been brought to the United States from Calcutta. Dr. Royle states that they are taken to Bombay from Bussorah through the Persian Gulf. We are, nevertheless, informed that galls are among the products of Moultan. Those of France and other southern countries of Europe have a smooth, shining reddish surface, are little esteemed, and are seldom brought to the United States.

Properties. Galls are nearly round, from the size of a pea to that of a very large cherry, with a surface usually studded with small tuberosities, in the intervals of which it is smooth. The best are externally of a dark bluish or lead color, sometimes with a greenish tinge, internally whitish or brownish, hard, solid, brittle, with a flinty fracture, a striated texture, and a small spot or cavity in the centre, indicating the presence of the undeveloped or decayed insect. Their powder is of a light yellowish gray. Those of inferior quality are of a lighter color, sometimes reddish or nearly white, of a loose texture, with a large cavity in the centre, communicating externally by a small hole through which the fly has escaped. The U. S. P. directs that " light, spongy and whitish-colored Nutgalls should be rejected," but allows " in the centre a cavity containing either the partly developed insect, or pulverulent remains left by it," and therefore permits white galls of good quality. Galls have a bitter, very astringent taste, and when whole are inodorous or nearly so, but bruised or in powder they have a decided and peculiar though not very strong smell. The tannin of galls, which is a distinct variety usually known as *gallo-tannic acid*, appears to exist in the galls as a glucoside, but one very easily broken up by ferments like pectase into glucose and *di-gallic acid*, $C_{14}H_{10}O_9$, which is the material, therefore, extracted from the galls. This di-gallic acid may be considered as the anhydride of *gallic acid*, $C_7H_6O_5$, formed from two molecules of this latter by the elimination of one molecule of water. Commercial tannin yields from 0 to 22 per cent. of glucose, showing the presence of varying amounts of the unaltered glucoside. Galls yield on an average from 65 to 77 per cent. of tannin. (See *Acidum Tannicum* and *Acidum Gallicum*, pages 114 and 60.) All the soluble matter of galls is taken up by forty times their weight of boiling water, and the residue is tasteless. Alcohol dissolves seven parts in ten, ether five parts. (*Thompson's Dispensatory.*) A saturated decoction deposits upon cooling a copious pale yellow precipitate. The infusion or tincture affords precipitates with sulphuric and hydrochloric acids, lime-water, and the carbonates of ammonium and potassium; with solutions of acetate and subacetate of lead, the sulphates of copper and iron, the nitrates of silver and mercury, and tartrate of antimony and potassium; with solution of gelatin; and with the infusions of Peruvian bark, columbo, opium, and many other vegetables, especially those containing alkaloids, with most of which tannic acid forms insoluble compounds. The infusion of galls reddens litmus paper, is rendered orange by nitric acid, milky by the corrosive chloride of mercury, and has its color deepened by ammonia; but yields no precipitate with either of these reagents. Sulphate of zinc was said by Dr. A. T. Thomson to occasion a slow precipitate, but this result was not obtained by Dr. Duncan.

A variety of galls was imported into Germany, which was said to be derived from Central Asia, especially from the provinces of Khokan, Khiva, and Bucharia, where they are used in dyeing. They are of various forms, some being long, others round, cylindrical, or angular; and sometimes they are grouped upon a single stalk, and covered with little elevations. They differ from all other galls by their color, being on one side yellow, and on the other of a fine red. Most of them present a little opening; and in the interior are eggs and larvæ of a peculiar species of Aphis. They have yielded, on analysis, 43·10 per cent. of tannin, 3·03 of a green wax, 16 of cellulose, and an undetermined quantity of fecula and volatile oil. (R. Palne, *Journ. de Pharm.*, Avril, 1873, p. 336.)

Medical Properties and Uses. Galls are powerfully astringent, but are no longer used internally.*

Off. Prep. Tinctura Gallæ; Unguentum Gallæ; Unguentum Gallæ cum Opio. *Br.*

GAULTHERIA. *U.S.* *Gaultheria.* [*Wintergreen.*]

(GÂUL-THĒ′RỊ-Ạ—gâwl-thē′rị-ạ.)

Boxberry, Chickerberry; Feuilles de Gaulthérie (de Paloninier), Thé du Canada, Thé de Terre-neuve, *Fr.;* Canadischer Thee, Bergthee, *G.*

"The leaves of Gaultheria procumbens. Linné. (*Nat. Ord.* Ericaceæ.)" *U. S.*

Gen. Ch. *Calyx* five-cleft, bibracteate at the base. *Corolla* ovate. *Capsule* five-celled, invested with the berried calyx. *Pursh.*

Gaultheria procumbens. Willd. *Sp. Plant.* ii. 616; Bigelow, *Am. Med. Bot.* iii. 27; Barton, *Med. Bot.* i. 171. This is a small, indigenous, shrubby, evergreen plant, with a long, creeping, horizontal root, which sends up at intervals one or two erect, slender, round, reddish stems. These are naked below, leafy at top, and usually less than a span in height. The *leaves* are short-petiolate, obovate or roundish-oval, about an inch and a half (4 centimeters) long, and three-quarters of an inch (2 centimeters) or more broad, acute, revolute at the edges with a few mucronate serratures, coriaceous, shining, bright green above, paler beneath, of unequal size, and supported irregularly on short red petioles. The flowers, of which not more than from three to five are usually on each stem, stand upon curved, drooping, axillary peduncles. The calyx is white, five-toothed, and furnished at its base with two concave cordate bracts, described by some as an outer calyx. The corolla is white, ovate, or urceolate, contracted at the mouth, and divided at the border into five small acute segments. The stamens have curved, plumose filaments, and oblong orange-colored anthers opening on the outside. The germ, which rests upon a ring having ten teeth alternating with the ten stamens, is roundish, depressed, and surmounted by an erect filiform style, ending in an obtuse stigma. The fruit is a small, five-celled, many-seeded capsule, with a fleshy covering, formed by the enlarged calyx, and presenting the appearance of a bright scarlet berry.

The plant extends from Canada to Georgia, growing in large beds in mountainous tracts, or in dry barrens and sandy plains, beneath the shade of shrubs and trees, particularly of other evergreens, as the Kalmiæ and Rhododendra. It is abundant in the pine-barrens of New Jersey. In different parts of the country, it is variously called *partridge-berry*, *deer-berry*, *tea-berry*, *wintergreen*, and *mountain-tea.* The flowers appear from May to September, and the fruit ripens at corresponding periods. Though the leaves only are officinal, all parts of the plant are endowed with the peculiar flavor for which these are employed, and which is found in several other plants, particularly in the bark of *Betula lenta*, or sweet birch. The fruit possesses it in a high degree, and, being at the same time sweetish, is much relished by some persons, and forms a favorite article of food with partridges, and other wild animals. To the very peculiar aromatic odor and taste which belong to the whole plant, the leaves add a marked astringency. The aromatic properties reside in a volatile oil, which may be separated by distillation. (See *Oleum Gaultheriæ.*)

Medical Properties and Uses. Gaultheria has the usual stimulant operation of the aromatics, united with astringency, and may, therefore, be used with advantage in some forms of chronic diarrhœa. Like other substances of the same class, it has been employed as an emmenagogue, and with the view of increasing the secretion of milk; but its chief use is in the form of oil to impart an agreeable flavor. Death, from gastric inflammation, has been produced by about a fluidounce of the oil.

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* *Aromatic Syrup of Galls.* The following old formula based upon one of Dr. Physick's is still sometimes employed. Macerate for twenty-four hours half an ounce of powdered galls, two drachms of bruised cinnamon, and two drachms of bruised nutmeg, in half a pint of brandy; then percolate, and, when the liquor has ceased to pass, add enough diluted alcohol to yield half a pint of filtered liquor. Put this into a shallow capsule, suspend over it two ounces of sugar on a slip of wire-gauze, and set the tincture on fire. The sugar melts with the flame, and falls into the liquid beneath. When the combustion ceases, agitate and filter. A highly astringent aromatic syrup is obtained, a fluidrachm of which may be given in diarrhœa. (*A. J. P.*, xxvii. 416.)

Off. Prep. Oleum Gaultheriæ, *U. S.;* Spiritus Gaultheriæ, *U. S.*

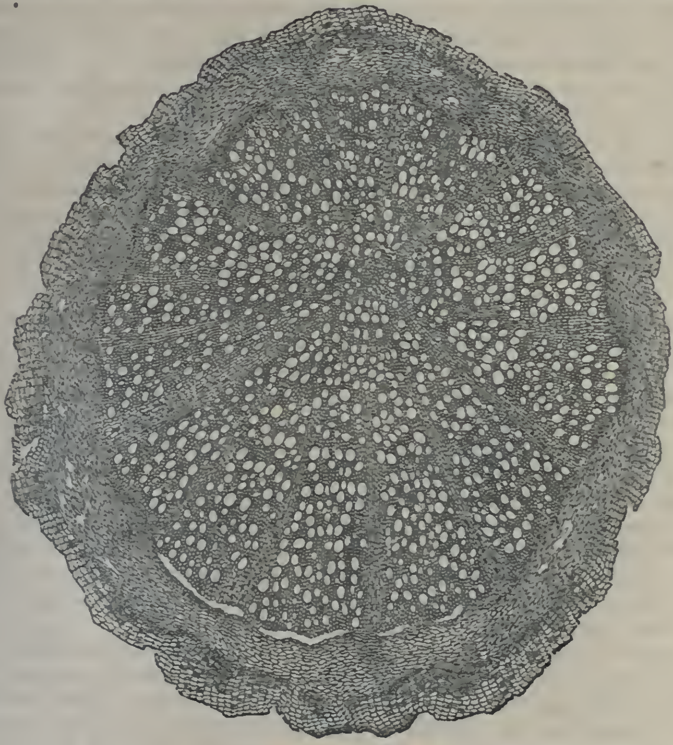
GELSEMIUM. *U. S.* *Gelsemium.* [*Yellow Jasmine.*]

(ÇẸL-SĔM'Ị-ŬM.)

"The rhizome and rootlets of Gelsemium sempervirens. Aiton. (*Nat. Ord.* Loganiaceæ.)" *U. S.* "The root of Gelsemium sempervirens (Gray, *Manual of Botany*)." *U. S.*

Gen. Ch. *Calyx* five-parted. *Corolla* funnel-form, with a spreading border, five-lobed, nearly equal. *Anthers* oblong, sagittate. *Style* long and slender. *Stigmas* two, two-parted. *Capsule* elliptical, flat, two-valved, two-celled. *Seeds* flat, attached to the margin of the valves.

Gelsemium sempervirens. Gray, *Man. of Bot.*—*Gelseminum nitidum.* Michaux.—*Bignonia sempervirens.* Willd. *Sp. Plant.* iii. 291. Figured in *A. J. P.*, xxvii. 197. The *yellow* or *Carolina jasmine* is one of the most beautiful climbing plants of our Southern States, ascending lofty trees, and forming festoons from one tree to another, and in its flowering season, in the early spring, scenting the atmosphere with its delicious odor. The stem is twining, smooth, and shining; the leaves perennial, opposite, shortly petiolate, lanceolate, entire, dark green above, and paler beneath; the flowers in axillary clusters, large, of a deep yellow color, and fragrant, with a very small, five-leaved calyx, and a funnel-shaped corolla, having a spreading, five-lobed, nearly equal border. The fruit is a flat, compressed capsule, divisible into



Gelsemium, transverse section.

two parts, two-celled, and furnished with flat seeds, which adhere to the margins of the valves. The plant grows in rich, moist soils along the sea-coast from Virginia to the south of Florida. The flowers are said to be poisonous.

Properties. As we have seen it in commerce, the rhizome is sliced into pieces, about an inch in length, cylindrical or split, very light and fibrous, of a dirty yellowish white color, but darker where the epidermis remains, of a slight feebly narcotic odor, and a bitterish, not unpleasant taste. It is officinally described as "cylindrical, long, or cut in sections, occasionally an inch and a quarter (3 cm.) thick, the roots much thinner; externally light brown-yellow with purplish brown, longitudinal lines; tough; fracture splintery; bark thin, with silky bast-fibres, closely adhering to the pale yellowish, porous wood, having fine, medullary rays, and in the rhizome a thin pith." The figure (page 703), shows in transverse section its well-marked characteristics. It yields its virtues to water, and readily to diluted alcohol. Analyzed by Mr. Henry Kollock, it was found to contain gum, starch, pectic acid, albumen, gallic acid, fixed oil, a fatty resin, a dry acrid resin, yellow coloring matter, volatile oil, extractive, lignin, a peculiar alkaloid called *gelsemine*, salts of potassa, lime, and magnesia, iron and silica. The alkaloid, however, was not obtained sufficiently pure to admit of a full investigation of its properties. (*A. J. P.*, xxvii. 203.) After Mr. Kollock's experiments, the alkaloid was obtained in a crystalline form, but still impure, by Prof. Maisch, from a tincture of the root, by a process of which a very brief abstract is given in *A. J. P.*, 1869, p. 36, by Mr. C. L. Eberle, who, in the same paper, publishes the results of his own investigation. Mr. Eberle not only extracted gelsemine, but satisfactorily established its alkaline properties, and proved that it was not contained in the wood of the root. Soon afterwards, the chemistry of Yellow Jasmine was more thoroughly investigated by Prof. Theo. G. Wormley. (*A. J. P.*, 1870, p. 1.) He obtained pure gelsemine from the root, and a peculiar acid, which he called *gelseminic* (gelsemic) acid.

Gelsemic or *Gelseminic Acid.* Prof. Wormley obtains the acid from a fluid extract of the root, which is actually a concentrated tincture, by evaporating it on a water-bath to about one-eighth of its volume, adding to the residue several times its bulk of pure water, allowing the mixture to stand until the supernatant liquid is nearly or quite clear, then transferring to a filter, washing the solids well with water, and reducing the filtrate thus obtained, together with the washings, on a water-bath, to about the volume of the concentrated fluid extract. To this, filtered if necessary, hydrochloric acid is added in the proportion of a drop of the pure acid to each fluidounce of the original fluid extract; the acidulated liquid is then agitated with twice its volume of ether; and, after the liquids have separated, the ethereal portion is decanted, the aqueous liquid again agitated with a similar quantity of ether, which is in its turn decanted, and the watery part finally washed with about its volume of ether. On mixing the ethereal liquids thus obtained, and allowing them to evaporate spontaneously, the gelsemic acid is left, chiefly in the form of nearly colorless groups of crystals, together with more or less yellowish or brownish resinous matter. From this the crystals are separated by washing with a little cold absolute alcohol, which dissolves the resin, with but a little of the crystals. To purify the crystals further, they are mixed with a little hot water, and extracted from the mixture when cool by chloroform, which, on spontaneous evaporation, yields them nearly if not quite colorless.

The acid, when pure, is colorless, inodorous, almost tasteless, and readily crystallizable, usually in groups or tufts of fine needles. It has strong neutralizing powers; combining with bases to form completely neutral salts, of which those formed with alkalies are freely soluble, while the others are at best but sparingly soluble in water. The acid itself is freely soluble in chloroform and ether, but slightly so in cold water, which takes up only about one-thousandth of its weight of the acid. Hot water dissolves it more freely, but on cooling deposits it in long, slender needles. The action of concentrated nitric acid may be considered as a test. If a drop of this acid be added to gelsemic acid or any of its salts, it forms a yellow, reddish, or red solution, which, if treated with ammonia in excess, becomes of a deep blood-red color, lasting for hours. The $\frac{1}{1000}$ of a grain will exhibit these changes. Caustic potassa, soda, or ammonia, added to the acid, causes it to become intensely yellow, and forms with it highly fluorescent solutions. The acid is fusible, and, at a high heat, volatilizable without change.

Robbins (*Deut. Chem. Ges.*, 1876, p. 1182), who has also investigated gelsemic acid, states that it is identical with *æsculin* (the glucoside of the horse-chestnut), and gives it the formula $C_{30}H_{34}O_{19} + 2H_2O$. Dragendorff (*Jahresb. für Pharmacog., Pharm. und Toxicol.*, 1878, p. 640) reinvestigated the constituents of Gelsemium sempervirens, and found æsculin and gelsemine, extracting the former out of an acid solution by chloroform and the latter from an alkaline solution by benzin and chloroform. Schwartz (*Inaugural Dissertation*, Dorpat, 1882) also found æsculin, the identity of which he established by a series of reactions, and some *æsculetin*, presumably from the decomposition of portions of the æsculin. The subject has very recently (*A. J. P.*. July, 1882) been re-examined by Prof. Wormley, who finds that gelsemic acid differs from æsculin in the following well-marked particulars: 1, in crystallization, the gelsemic acid crystallizes much more readily; 2, its insolubility in water and ether, the gelsemic acid is more soluble in ether and less soluble in water than æsculin; 3, gelsemic acid is not soluble in hydrochloric acid, while æsculin is; 4, corrosive sublimate gives a copious yellow precipitate with gelsemic acid, while it gives no result with æsculin; 5, sulphate of copper and acetate of lead yield precipitates with gelsemic acid differing from those of the same reagents with æsculin. Wormley, therefore, concludes that they are "very different substances."

Gelsemine, Gelsemia. This may be obtained, according to Wormley, from the concentrated extract from which gelsemic acid has been separated by ether, by rendering it slightly alkaline with potassa (Schwartz (*loc. cit.*) prefers soda solution on account of the too great energy of the caustic potassa), then agitating repeatedly with chloroform, which dissolves the alkaloid with some impurities, and yields it, when evaporated at a very moderate heat, in the form of a hard, gum-like, yellowish, or brownish yellow solid. If this be treated with a little water, and acidulated with hydrochloric acid, it yields the alkaloid with some impurities to the liquid, which, if now filtered, evaporated to about one-sixteenth by volume of the original fluid extract employed, and then treated with a slight excess of caustic potassa, will give up the alkaloid in the form of a more or less white precipitate. This, upon being separated, and allowed to dry, shrinks greatly, and becomes dark. To purify it, the dry mass is powdered, and dissolved, with the aid of a few drops of hydrochloric acid, in a little water, from which the alkaloid is precipitated by a slight excess of caustic potassa, and then taken up by ether, which leaves it, on spontaneous evaporation, in the state of a very hard, brittle, and transparent mass, strongly adhering to the surface of the vessel employed. If now detached and pulverized, it forms a powder nearly or quite colorless. If still colored, it may be again treated with ether.

Gelsemine, when pure, is a colorless inodorous solid, not yet obtained in well-defined crystals, of an intensely bitter and persistent taste, having strongly basic properties, and completely neutralizing the strongest acids. Of its salts, the sulphate, nitrate, chloride, and acetate are freely soluble in water. It is itself sparingly soluble in water, requiring several hundred times its weight for solution; but it is very freely soluble in chloroform and ether. A drop of strong sulphuric acid added to a little gelsemine, or any one of its colorless salts, produces with it a reddish solution, which, if moderately heated, acquires a beautiful purple color; but if without heating, after addition of sulphuric acid, potassium dichromate be added, a cherry-red color is immediately produced. (Schwartz, *Inaugural Dissertation*, Dorpat, 1882.) If instead of potassium dichromate ceroso-ceric oxide be added, a beautiful rose-red color is obtained. (*Robbins.*) Robbins (*loc. cit.*) gives it the formula $C_{11}H_{19}NO_2$, or more probably $C_{22}H_{38}N_2O_4$.

Medical Properties.* Gelsemium produces in the healthy adult agreeable sensations of languor, with muscular relaxation, so that the subject finds some difficulty in moving the eyelids, and keeping the jaws closed. More largely taken, it occasions dizziness, dimness of vision, dilated pupil, general muscular debility, and universal prostration; reducing the frequency and force of the pulse, and the frequency of respiration, and producing insensibility to pain; but without stupor or delirium. After a short time these symptoms usually pass off, leaving no unpleasant effects, except that in some instances there has been severe diarrhœa. In at least six recorded cases, however, they have progressively increased until death has occurred. Consciousness is usually preserved until near the close: dropping of the jaw, dilatation of the pupil, and a tendency to internal squint and ptosis are somewhat characteristic symptoms. The effects usually begin in half an hour, and pass off in two or three hours, if at all.

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* Gelsemium is said to have been long popularly employed as a vermifuge in the Southern and Southwestern States; but its more valuable properties have been known but for a few years. Their discovery was accidental. A planter of Mississippi, laboring under an obstinate bilious fever, directed his servant to get a particular root from the garden, and prepare a tea from it. The tea was

The treatment of poisoning by gelsemium should consist in evacuating the stomach, maintaining absolute rest in the horizontal position, keeping up the bodily temperature, if required, by external warmth, and administering spinal and arterial stimulants. It is probable that hypodermic injections of atropine, strychnine, and digitaline would be effective.

Recent physiological studies, whilst by no means complete, have thrown much light upon the action of gelsemium. The muscular weakness which it causes is always associated with a depression of reflex activity, and is the result of a direct paralyzing influence upon the spinal cord, as probably is also the diminution of sensibility; the nerves and muscles not being sensibly affected by the poison. The action upon the circulation is less marked than upon the nervous system, the heart and arterial pressure not being much affected by therapeutic doses. After toxic amounts there is great depression of the circulation, which has been shown by Dr. I. Ott to be at least in part due to a direct action upon the heart. The dilatation of the pupil which is present in poisoning with the drug, and which is also produced by its local application to the eye, is probably due to a paralysis of the oculo-motor nerve; to which also may be ascribed the palsy of accommodation and of the external rectus muscle. The diseases in which the medicine has been prescribed are intermittent, remittent, typhoid, and yellow fevers, the irritative fevers of childhood, inflammation of the lungs and pleura, dysentery, rheumatism and other inflammatory affections, neuralgia, dysmenorrhœa, morbid wakefulness, delirium tremens, trismus nascentium, chorea, hysteria, and epilepsy. The drug is, however, not applicable to the treatment of low fevers, and is not sufficiently powerful as a cardiac depressant to be relied upon in very sthenic inflammations; its use should be chiefly restricted to spasmodic and neuralgic affections. In supraorbital neuralgia and in odontalgia it has been especially commended.

There is much testimony as to its antiperiodic properties; and it may be used as an adjuvant to quinine in the treatment of remittent fever. Dr. James D. McGarghey praises it especially in cases of intermittent, when the attacks are disposed to return obstinately and irregularly. (*Phila. Med. Times*, March 7, 1874.) It has also been employed with a measure of success in controlling cardiac palpitations.

Gelsemium should be administered in the form either of the tincture or of the fluid extract; the dose of the tincture being five minims (0·3 C.c.), that of the fluid extract one minim (0·06 C.c.); to be repeated, if necessary, every 2, 4, or 6 hours, and be gradually increased till the object is obtained, or some obvious effect is produced on the system. How much exactly would produce fatal effects has not been determined. In one fatal case recorded, 40 drops of the fluid extract were said to have been taken; but very much less than this would be a dangerous dose.

The alkaloid gelsemine is exceedingly powerful. Prof. Wormley injected one-

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prepared accordingly, and drunk by the invalid, who was soon afterwards affected with great prostration, and especially muscular debility, so that he could not raise a limb, but without stupor. These effects gradually passed off, and with them the fever. The servant had made a mistake in the root, and dug that of the Gelsemium instead of the one intended. The planter, having made this discovery, employed the root afterwards with success upon his own plantation and in the neighborhood. The remedy passed into the hands of irregular practitioners, and was used by the "eclectic physicians" before its virtues came to the knowledge of the profession.

eighth of a grain into a strong cat, with the result of death in one and a half hours. He also found, as the average result of several experiments, that eight fluidounces of the fluid extract yield 3·20 grains of the pure alkaloid. On the basis of this result, the dose of gelsemia may be estimated at the 200th or 300th of a grain, supposing all the virtue of the root to reside in the alkaloid. But this estimate probably exceeds its strength; and the proper dose can be determined only by a series of carefully conducted trials.

Off. Prep. Extractum Gelsemii Fluidum, *U. S.;* Tinctura Gelsemii, *U. S.*

GENTIANA. *U. S.* *Gentian.*

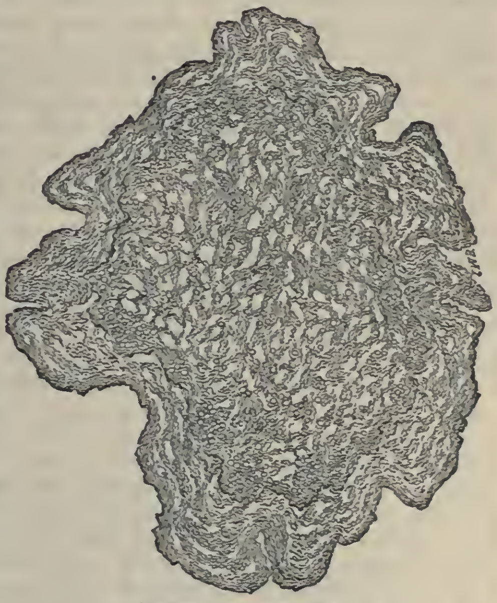
(ĢĔN-TI̦-Ā′NA̦—jĕn-sher̦-ā′na̦.)

"The root of Gentiana lutea. Linné. (*Nat. Ord.* Gentianaceæ.)" *U. S.* "The dried root of Gentiana lutea." *Br.*

Gentianæ Radix, *Br.;* Gentian Root; Radix Gentianæ, *P. G.;* Radix Gentianæ Rubræ (vel Luteæ vel Majoris); Racine de Gentiane (de Gentiane jaune), Gentiane jaune, *Fr.;* Enzian, Enzianwurzel, Bitterwurzel, Rother Enzian, *G.;* Genziana, *It.;* Genciana, *Sp.*

Gen. Ch. Corolla one-petalled. *Capsule* two-valved, one-celled, with two longitudinal receptacles. *Willd.*

Gentiana lutea. Willd. *Sp. Plant.* i. 1331; Woodv. *Med. Bot.* p. 273, t. 95; Carson, *Illust. of Med. Bot.* ii. 12, pl. 60. *Yellow Gentian* is among the most remarkable of the species which compose this genus, both for its beauty and great comparative size. From its thick, long, branching, perennial root, an erect, round stem rises to the height of three or four feet, bearing opposite, sessile, ovate, acute, five-nerved leaves of a bright green color, and somewhat glaucous. The lower leaves, which spring from the root, are narrowed at their base into the form of a petiole. The flowers are large and beautiful, of a yellow color, peduncled, and placed in whorls at the axils of the upper leaves. The calyx is monophyllous, membranous, yellowish, and semi-transparent, splitting when the flower opens, and reflected when it is fully expanded; the corolla is rotate, and deeply divided into five or six lanceolate, acute segments; the stamens are five or six, and shorter than the corolla. This plant grows among the Apennines, the Alps, the Pyrenees, and in other mountainous or elevated regions of Europe. The root is the only part used.



Gentian, transverse section.

Several other species possess analogous virtues, and are used for similar purposes. The roots of *G. purpurea* and *G. punctata*, inhabiting the same regions as *G. lutea*, and of *G. Pannonica*, growing in Austria, are said to be often mingled with the officinal, from which they are scarcely distinguishable. The *G. macrophylla* of Pallas is used in Siberia; one indigenous species, *G. Catesbæi*,* growing in the

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* *Gentiana Catesbæi.* The blue gentian has a perennial, branching, somewhat fleshy root, and a simple, erect, rough stem, rising eight or ten inches in height, and bearing opposite leaves, which are ovate-lanceolate, acute, and rough on their margin. The flowers are of a palish blue color, crowded, nearly sessile, and axillary or terminal. The divisions of the calyx are linear-lanceolate, and longer than the tube. The corolla is large, ventricose, plaited, and divided at its border into ten segments, of which the five outer are more or less acute, the five inner bifid and fringed. The

Southern States, formerly had a place in the secondary catalogue of the U. S. Pharmacopœia, and is reputed to be but little inferior to the officinal species. *G. quinqueflora*, growing throughout the Northern and Northwestern States, is said to be much used in domestic practice.

Properties. As found in the shops, gentian is in pieces of various dimensions and shape, usually of considerable length, consisting sometimes of longitudinal slices, sometimes of the root cut transversely, twisted, wrinkled externally, sometimes marked with close transverse rings of a grayish brown color on the outside, yellowish or reddish within, and of a soft, spongy texture. It is officinally described as occurring "in nearly cylindrical pieces or longitudinal slices, about one inch (25 mm.) thick, the upper portion closely annulate, the lower portion longitudinally wrinkled; externally deep yellowish brown; internally lighter; somewhat flexible and tough when damp; rather brittle when dry; fracture uneven; the bark rather thick, separated from the somewhat spongy meditullium by a black cambium line; odor peculiar, faint, more prominent when moistened; taste sweetish and persistently bitter." *U. S.*

There is no distinct pith, no distinct liber-cells, starch granules, or raphides. (For further details, see *P. J. Tr.*, July, 1872, p. 42.) The odor is feeble, but decided and peculiar. The taste is slightly sweetish and intensely bitter, without being nauseous. The powder is yellowish. Water and alcohol extract the taste and virtues of the root.

Several chemists, as Henry, Caventou, Trommsdorff, Leconte, and Dulk, have described the bitter principle of gentian in an impure state under the name of *gentianin*, but Kromayer, in 1862, first obtained it in a state of purity, and gave it the name of *gentio-picrin*, and the formula $C_{20}H_{30}O_{12}$. It is a neutral body, crystallizing in colorless needles, which readily dissolve in water. It is soluble in spirit of wine, but in absolute alcohol only when aided by heat; it does not dissolve in ether. A solution of caustic soda forms with it a yellow solution. Under the influence of dilute acids, gentio-picrin is resolved into glucose and an amorphous yellowish brown neutral substance named *gentiogenin*. Fresh gentian roots yield about $\frac{1}{10}$ per cent. of gentio-picrin. Another constituent is *gentianin*, or *gentisin*, $C_{14}H_{10}O_5$. It forms tasteless, yellowish prisms, sparingly soluble in alcohol, and, with alkalies, yields intensely yellow, crystallizable compounds, easily decomposed by carbonic acid. Hlasiwetz and Habermann showed, in 1875, that when *gentianin* was melted with caustic potash, it yielded *phloroglucin*, $C_6H_3(OH)_3$, and *oxysalicylic acid* $C_6H_3.(OH)_2COOH$. The latter was at first called *gentianic* or *gentisinic acid.*

Prof. Maisch believes that tannin is absent from gentian root, and states that the dark, olive-green coloration observed when ferric chloride is added to its preparations is due to gentisic acid. (*A. J. P.*, 1876, p. 117); Ville (*A. J. P.*, 1877, p. 429) and Davies (*P. J. Tr.*, 1879, p. 220) maintain that there is a small quantity of tannin in gentian root, but the weight of evidence at present is against the assertion. Prof. Patch (*A. J. P.*, 1876, p. 188) found that an alcoholic solution of an ethereal extract of gentian yielded a dark green coloration with ferric salts, but if the alcoholic solution be diluted with water it yields no precipitate with gelatin.

M. Louis Magnes found in the root, when perfectly dried at 100° C. (212° F.), 15 per cent. of glucose, and 12 per cent. in the root in its ordinary state. (*A. J. P.*, pp. 333–4.) When gentian is macerated in cold water, it undergoes the vinous fermentation, in consequence of the presence of this saccharine principle. From the fermented infusion a spirituous liquor is obtained by distillation, which, though bitter and unpleasant to the smell, is said to be relished by the Swiss and Tyrolese.

number of stamens is five, and the two stigmas are seated on the germ. The capsule is oblong, acuminate, with two valves, and a single cell. *G. Catesbæi* grows in the grassy swamps of North and South Carolina, where it flowers from September to December. It was named by Walter and Elliot in honor of Catesby, by whom it was delineated nearly a century ago. The dried root is said to have at first a mucilaginous and sweetish taste, which is soon succeeded by an intense bitterness, approaching nearly to that of the officinal gentian. Alcohol and boiling water extract its virtues, and the tincture and decoction are even more bitter than the root in substance. It may be given in powder in the dose of from fifteen to thirty grains, or in the form of extract, infusion, wine or tincture, which may be prepared in the manner directed for the similar preparations of foreign gentian.

Infusion of gentian is precipitated by tannic acid and the soluble salts of lead, but is compatible with the salts of iron.

Medical Properties and Uses. Gentian possesses, in a high degree, the tonic powers which characterize the simple bitters. It excites the appetite, invigorates digestion, moderately increases the temperature of the body and the force of the circulation, and operates in fact as a general corroborant. In very large doses, however, it is apt to load and oppress the stomach, to irritate the bowels, and even to occasion nausea and vomiting. It has been known as a medicine from the highest antiquity, and is said to have derived its name from Gentius, a king of Illyria. Many of the complex preparations handed down from the Greeks and Arabians contain it among their ingredients; and it enters into most of the stomachic combinations employed in modern practice. It may be used in all cases of pure debility of the digestive organs, or where a general tonic impression is required. Dyspepsia, atonic gout, amenorrhœa, hysteria, scrofula, intermittent fever, diarrhœa, and worms are among the many affections in which it has proved useful; but it is the condition of the stomach and of the system generally, not the name of the disease, which must be taken into consideration in prescribing it; and there is scarcely a complaint in which it can be advantageously given under all circumstances. Its powder has been applied externally to malignant and sloughing ulcers. It should be administered only in the form of preparation. A syrup may be prepared by forming a saccharated infusion by means of percolation, and incorporating this at a boiling heat with simple syrup; or, perhaps more eligibly, by dissolving two drachms of the extract of gentian, and afterwards fifteen ounces of sugar, in half a pint of water. The porous property of the root causes it to expand with moisture, and it has been employed, as a substitute for sponge tent, in the enlargement of strictured passages.

Off. Prep. Extractum Gentianæ; Extractum Gentianæ Fluidum, *U. S.;* Infusum Gentianæ Compositum, *Br.;* Mistura Gentianæ, *Br.;* Tinctura Gentianæ Composita.

GERANIUM. *U. S.* *Geranium.* [*Cranesbill.*]

(ÇẸ-RĀ'NỊ-ŬM.)

"The rhizome of Geranium maculatum. Linné. (*Nat. Ord.* Geraniaceæ)." *U. S.*

Cranesbill Root; Racine de Bec-de-Grue tacheté, Racine de Pied-de-Corneille, *Fr.;* Fleckstorchschnabel-Wurzel, *G.*

Gen. Ch. *Calyx* five-leaved. *Corolla* five-petalled, regular. *Nectary* five melliferous glands, united to the base of the longer filaments. *Arilli* five, one-seeded, awned, at the base of a beaked receptacle; awns simple, naked, neither spiral nor bearded. *Willd.*

Geranium maculatum. Willd. *Sp. Plant.* iii. 705; Bigelow, *Am. Med. Bot.* i. 84; Barton, *Med. Bot.* i. 149. This plant has a perennial, horizontal, fleshy root, which is furnished with short fibres, and sends up annually an herbaceous stem, with several radical leaves. The stem is erect, round, dichotomously branched, from one to two feet high, of a grayish green color, and thickly covered, in common with the petioles and peduncles, with reflexed hairs. The leaves are deeply divided into three, five, or seven lobes, which are variously incised at their extremities, hairy, and of a pale green color, mottled with still paler spots. Those which rise from the root are supported on footstalks eight or ten inches long; those of the stem are opposite, the lower petiolate, the upper nearly sessile, with lanceolate or linear stipules. The flowers are large, and usually of a purple color. The peduncles spring from the forks of the stem, and severally support two flowers upon short pedicels. The calyx is composed of five oblong, ribbed, cuspidate leaves; the petals are five, obovate, and entire; the stamens ten, with oblong, deciduous anthers, the five alternate filaments being longer than the others, and having glands at their base; the germ is ovate, supporting a straight style as long as the stamens, and surmounted by five stigmas. The fruit consists of five aggregate, one-seeded capsules, attached by a beak to the persistent style, curling up and scattering the seeds when ripe.

The cranesbill is indigenous, growing throughout the United States, in moist woods, thickets, and hedges, and generally in low grounds. It flowers from May to July. The root should be collected in autumn.

Properties. Geranium occurs in pieces from one to three inches long, from a quarter to half an inch in thickness, somewhat flattened, contorted, wrinkled, tuberculated, and beset with slender fibres. It is externally of an umber-brown color, internally reddish gray, compact, inodorous, and of an astringent taste, without bitterness or other unpleasant flavor. "The bark is thin; the wood-wedges yellowish, small, forming a circle near the cambium line; the medullary rays broad; the central pith large, and the rootlets thin and fragile." Water and alcohol extract the virtues of geranium. According to Dr. Edward Staples, it contains tannic and gallic acids, mucilage, red coloring matter, resin, and a crystallizable vegetable principle. (*A. J. P.*, 1829, p. 171.) The Messrs. Tilden found, besides tannic and gallic acids, gum, pectin, sugar, starch, albumen, resin soluble in alcohol, oleoresin soluble in ether only, coloring matter, chlorophyll, lignin, and various salts. (*P. J. Tr.*, 1863, p. 22.) Tannic and gallic acids are probably the sole active ingredients.

Medical Properties and Uses. Geranium is one of our best indigenous astringents, and may be employed for all the purposes to which these medicines are applicable. The absence of unpleasant taste, and of other offensive qualities, renders it peculiarly serviceable in the case of infants, and persons of very delicate stomach. Diarrhœa, chronic dysentery, cholera infantum in the latter stages, and the various hemorrhages are the forms of disease in which it is most commonly used, and with greatest advantage; but care should be taken, before it is administered, that the condition of the system and of the part affected is such as not to contraindicate the use of astringents. As an application to indolent ulcers, an injection in gleet and leucorrhœa, and a gargle in relaxation of the uvula and aphthous ulcerations of the throat, it answers the same purpose as kino, catechu, and other medicines of the same class. It is a popular domestic remedy in various parts of the United States, and is said to be employed by the Indians. It may be given in substance, decoction, tincture, or extract. The dose of the powder is twenty or thirty grains (1·3–1·95 Gm.); that of a decoction, made by boiling an ounce of the root in a pint and a half of water to a pint, from one to two fluidounces (30–60 C.c.); that of the fluid extract, twenty to thirty minims (1·25 to 1·9 C.c.). The medicine is sometimes given to children, boiled in milk.

Off. Prep. Extractum Geranii Fluidum, *U. S.*

GLYCERINUM. *U. S., Br.* *Glycerin.*

(GLY̆Ç-Ẹ-RĪ′NŬM.)

Glycerina, *U. S.* 1870; Glycerine; Glycerinum, *P.G.;* Glycérine, *Fr.;* Oelsüss, *G.*

"A liquid obtained by the decomposition of fats and fixed oils, and containing not less than 95 per cent. of absolute Glycerin [$\mathbf{C_3H_5(HO)_3}$; **92.** — $C_6H_5O_3.3HO$; 92.]" *U. S.* "A sweet principle, $C_6H_8O_6$, obtained from fats and fixed oils, and containing a small percentage of water." *Br.*

In the process for making lead plaster, litharge, olive oil, and water are boiled together, when the olein of the oil is decomposed by the lead oxide, according to the following reaction: $2(C_3H_5(OC_{18}H_{33}O)_3) + (PbO)_3 + (H_2O)_3 = 2(C_3H_5(OH)_3) + 3(Pb(OC_{18}H_{33}O)_2)$, when we obtain lead oleate or plaster and free glycerin. (See *Emplastrum Plumbi.*) It follows, therefore, that the plaster, while still hot and in the liquid state, contained glycerin diffused through it. It was this process that was used for preparing glycerin in the formula of U. S. P. 1850. In accordance with this, when the liquid plaster is mixed with an equal measure of boiling water, and the mixture stirred briskly, a solution of glycerin is obtained; which, after having been decanted, and evaporated to a limited extent, is freed from lead by sulphuretted hydrogen. The liquid is then filtered to separate sulphide of lead, heated to free it from sulphuretted hydrogen, and finally evaporated to expel the water, which is known to be all removed when the mass ceases to lose weight.

Glycerin was discovered in 1789 by Scheele, by whom it was called the *sweet principle of oils.* It is produced not only during the saponification of the fats and oils by oxide of lead in forming lead plaster, but also during the same process when effected by potassa and soda in the manufacture of soap; the alkalies uniting with the oily acids, and setting the glycerin free. Soap-makers' waste is an abundant source of glycerin; but, when thus obtained, it is apt to have more or less odor, which even percolation through animal charcoal does not always remove. A method of purifying glycerin from soap-makers' waste is given by M. Bruère-Perrin. (*A. J. P.*, xx. 549.) The process of Mr. Richard A. Tilghman, of this city, patented Jan. 9, 1854, consists in subjecting fatty bodies to the action of water at a high temperature under pressure, whereby the fats, which are *glycerides* or ethers of the fatty acids, are broken up into free glycerin and free fatty acids, the water supplying the elements of hydrogen and oxygen necessary for that change. The reaction is as follows for the case of a fat like stearin: $C_3H_5(OC_{18}H_{35}O)_3 + (H.OH)_3 = C_3H_5(OH)_3 + 3(C_{18}H_{35}O.OH)$. (*A. J. P.*, March, 1855, p. 121.) Thus obtained it is called *distilled glycerin*, and is produced at once in the purest form. This process is used at the great candle manufactory of Price & Co., London, as well as by our home manufacturers. Through a distillatory apparatus containing palm oil, heated steam between 550° and 600° is passed. The oil is decomposed into free acids and glycerin, which, together with water, distil over, and, condensing in the receiver, separate into two layers, the lower of which is glycerin. If this, as first procured, contain too much water, it must be concentrated; if discolored, it must be redistilled with vapor. (*P. J. Tr.*, 1861, p. 350.) Ordinary impure glycerin may be purified by distillation with steam under pressure. Though, when distilled alone, it is partially decomposed, giving off pungent vapors of *acrolein*, yet in a current of superheated steam it passes over unchanged at temperatures between 204·4° C. and 260° C. (400° F. and 500° F.). (*Brande & Taylor.*) Very pure glycerin is now produced in the United States in immense quantities; the great advance in price which took place in 1880, due to its extended employment in the manufacture of nitroglycerin, has somewhat curtailed its use. (See *Nitroglycerin*, Part II.)

Properties. Glycerin is "a clear, colorless liquid, of syrupy consistence, oily to the touch, hygroscopic, without odor, very sweet and slightly warm to the taste, and neutral in reaction. It is soluble, in all proportions, in water and in alcohol, also in a mixture of 3 parts of alcohol and 1 part of ether, but insoluble in ether, chloroform, benzol, or fixed oils. Its sp. gr. should not be less than 1·250, corresponding to the presence of at least 95 per cent. of absolute Glycerin. In solution with water it is slowly vaporized, with steam, at 100° C. (212° F.); exposed alone to higher temperature, it yields acrid decomposition vapors of a characteristic odor, with a little Glycerin vapor, and at 290° C. (554° F.) it boils, and is decomposed. If a fused bead of borax, on a loop of platinum wire, be moistened with Glycerin previously made slightly alkaline with diluted solution of soda, and after a few minutes held in a colorless flame, the latter will be tinted deep green." *U. S.* This last officinal test is that of Senier and Lowe. (*Jour. Chem. Society*, Sept. 1878.) In properties, glycerin is intermediate between water and the oils. When exposed to the air it gradually absorbs moisture. As already stated, though decomposed by a high heat in its unmixed state, yet with water under pressure it is volatilizable unchanged at a temperature between 204·4° C. and 260° C. (400° F. and 500° F.). Cooled down rapidly, it only becomes more viscid, without congealing, even when a temperature of —40° C. is attained; but, if kept for some time at a temperature of about 0° C. (32° F.), it gradually forms hard but deliquescent crystals, which melt only at about 22° C. (71·6° F.).* This fact is now utilized as a means of concentrating and purifying glycerin. According to Mr. G. F. Wilson, glycerin, when of the density 1·24, contains 94 per cent. of anhydrous glycerin; when of the density 1·26, 98 per cent. The following table by Dr. Wilhelm Lenz (*Zeitsch. f. Anal. Chem.*, 1880, p. 297), showing the percentage of absolute glycerin in mixtures of glycerin and water, was obtained by a quantitative determination of the carbon in the various dilutions by ultimate analysis.

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* Mr. Wm. Crookes gives an account, in the *Chem. News* of Jan. 18, 1867, of 5 tons of glycerin imported into London from Germany in casks of 8 cwt. each, which, though when it left the continent it was in its ordinary state of a viscid liquid, was found, on reaching London, to have become solidified into a mass of very hard, brilliant crystals. The same result has been noticed in Vienna, in a mass of glycerin which had been in an iron tank more than a year. (*Chem. News*, April 5, 1867, p. 174.) The crystalline mass noticed by Mr. Crookes yielded pure glycerin when melted.

Anhydrous Glycerin %	Spec. Grav.	Anhydrous Glycerin %	Spec. Grav.	Anhydrous Glycerin %	Spec. Grav.	Anhydrous Glycerin %	Spec. Grav.
100	1·2691	75	1·2016	50	1·1320	25	1·0635
95	1·2581	70	1·1889	45	1·1183	20	1·0498
90	1·2425	65	1·1733	40	1·1045	15	1·0374
85	1·2292	60	1·1582	35	1·0907	10	1·0245
80	1·2152	55	1·1455	30	1·0798	5	1·0123

Glycerin possesses extensive powers as a solvent, and is an excellent excipient for many medicinal substances. It dissolves bromine and iodine, the iodide of sulphur, the chlorides of potassium and sodium, the fixed alkalies, some of the alkaline earths, lime, for example, for which it increases the solvent powers of water (*Journ. de Pharm.*, Juin, 1874), and a large number of neutral salts. It also dissolves the vegetable acids, particularly tannic acid. It is a good solvent of pepsin, and is used for the extraction of this principle from the mucus of the stomach. Two parts and a half of glycerin dissolve one of sugar, and three and a half parts, one of gum. When starch-paste and glycerin are heated together, a turbid liquid is formed, which deposits on cooling; the supernatant liquid holding starch in solution. (*Journ. de Pharm.*; Nov. 1868, pp. 361–2.) Prof. J. S. Blockley, of London, has ascertained that certain neutral vegetable substances are far more soluble in glycerin than in water. Thus salicin dissolves in eight parts of cold glycerin, and santonin in eighteen parts when boiling. The latter solution, when of half this strength, forms on cooling an almost solid mass. It is not always a good solvent for alkaloids or their salts, and will *sometimes precipitate the latter from their watery solutions.* Glycerin, next to alcohol, is the best solvent of iodine. Iodine and iodide of potassium, when dissolved in it, form *iodized glycerin*, the medical applications of which are given under iodine. (See *Iodinium.*)* It combines with potassa and baryta, and also with sulphuric acid. Glycerin is not susceptible of becoming rancid, or of fermenting spontaneously; but will generate a portion of alcohol under the combined influence of chalk, and of a ferment formed of cheese or animal tissue. During this change there is no intermediate formation of glucose, provided carbonate of calcium is present. (*Berthelot.*) Glycerin does not evaporate when exposed to the air; nor can it be distilled without decomposition, unless in the presence of water or steam. When decomposed by heat, it emits extremely irritating vapors. At a full red heat it takes fire, and burns with a blue flame. In consequence of the high temperature required for its volatilization, it has been proposed to use it for an evaporating bath, in which a heat beyond that of boiling water is required. Glycerin is antiseptic, and has been recommended by Mr. Warington and M. Demarquay to preserve alimentary substances and objects of natural history, and to inject bodies for dissection. According to Dr. W. Frazer, it does not answer to keep pathological preparations; as they are completely softened by its action. M. Berthelot, of Paris, has succeeded in combining glycerin with a number of acids, both mineral and organic, forming three distinct series of neutral compounds. Among others he has united it with the fatty acids, producing, by synthesis, the organic fatty substances, stearin, palmitin, olein, etc. Glycerin has been formed artificially from

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* The following table, by Klever, gives a general view of the solvent powers of glycerin, 100 parts of glycerin dissolving the annexed quantities of substances:

	PARTS.		PARTS.		PARTS.		PARTS.
Acidum arseniosum	20	Brucine	2·25	Morphine	0·45	Sodii bicarbonas	8
“ arsenicum	20	Calcii sulphid	5	Morphinæ acetas	20	“ boras	60
“ benzoicum	10	Cinchonine	0·30	“ murias	20	“ carbonas	98
“ boracicum	10	Cinch. sulphas	6·70	Phosphorus	0·20	“ chloras	20
“ oxalicum	15	Cupri acetas	10	Plumbi acetas	20	Sulphur	0·10
“ tannicum	50	“ sulphas	30	Potassii arsenias	50	Strychnine	0·25
Alumen	40	Ferr. et potas. tart.	8	“ chloras	3·50	Strychninæ nitras	4
Ammonii carbonas	20	“ lactas	16	“ bromidum	25	“ sulphas	22·50
“ murias	20	“ sulphas	25	“ cyanidum	32	Urea	50
Antimon. et pot. tart.	5·50	Hydrarg. chlorid. corrosiv.	7·50	“ iodidum	40	Veratrine	1
Atropine	3	“ cyanidum.	27	Quinine	0·50	Zinci chloridum	50
Atropinæ sulphas	33	Iodinium	1·90	Quininæ tannas	0·25	“ iodidum	40
Barii chloridum	10			Sodii arsenias	50	“ sulphas	35

(*Neues Jahrb. für Pharm.*, 1869, Mai u. Juni, 315.)

tribromallyl, by Wurtz, and from trichlorhydrin, by Friedel and Silva. Neither synthesis is practical on a large scale, nor could they compete with its preparation from natural fats. By Pasteur it has been ascertained to be one of the products of the vinous fermentation. Glycerin is a triatomic alcohol, being a compound of the triad radical (C_3H_5) with 3(OH) groups. In the natural fats, the three H atoms of these OH groups are replaced by fatty acid radicals like stearyl, $C_{18}H_{35}O$, palmityl, $C_{16}H_{33}O$, and oleyl, $C_{18}H_{33}O$. The natural fats are, therefore, compounds of an alcohol radical with an organic acid, and are true ethers, to which the special names of *glycerides* have been given.

The solvent and preservative properties as well as agreeable taste and permanent consistence of glycerin render it very useful as a menstruum in pharmacy; and a class of preparations consisting of medicinal substances dissolved in it has come into extensive use. The British Pharmacopœia has adopted such a class, under the name of *Glycerina* or *glycerines.* This title is not now available because these terminations are reserved for alkaloids, whilst the term *glyceroles,* adopted from the French, is objectionable, as the termination has been used as designative of certain proximate principles. But the U. S. title, *Glycerita* or *glycerites,* is satisfactory.

Impurities and Tests. Glycerin is occasionally deficient in density and consistency. According to M. Dalpiaz, it is sometimes perfectly colorless from being bleached by chlorine, when it is apt to contain chloride of calcium, as well as free chlorine. The latter may be detected by rendering the suspected sample slightly blue by a few drops of sulphate of indigo, and then adding a little sulphuric acid, when, if free chlorine be present, the blue color will disappear. The Pharmacopœia furnishes the following tests. "Glycerin should be neutral to litmus paper. Upon warming a portion of 5 or 6 Gm. with half its weight of diluted sulphuric acid, no butyric or other acidulous odor should be developed. A portion of 2 or 3 Gm., gently warmed with an equal volume of sulphuric acid in a test-tube, should not become dark colored (abs. of cane sugar). A portion of about 2 Gm., heated in a small, open porcelain or platinum capsule, upon a sand-bath, until it boils, and then ignited, should burn and vaporize so as to leave not more than a dark stain (abs. of sugars and dextrin, which leave a porous coal). A portion heated to about 85° C. (185° F.), with test-solution of potassio-cupric tartrate, should not give a decided yellowish brown precipitate, and the same result should be obtained, if, before applying this test, another portion be boiled with a little diluted hydrochloric acid for half an hour (abs. of sugars). After full combustion no residue should be left (metallic salts). Diluted with 10 times its volume of distilled water, portions should give no precipitates or colors, when treated with test-solution of nitrate of silver, chloride of barium, chloride of calcium, sulphide of ammonium, or oxalate of ammonium (acrylic, hydrochloric, sulphuric, or oxalic acids, iron or calcium salts)." *U. S.* Lime may be detected by oxalate of ammonium; lead, by hydrosulphate of ammonium; and sulphuric acid, by a soluble salt of baryta. Diluted, and boiled with a solution of potassa, it is not altered in color, showing the absence of glucose. Trommer's test is probably still more effectual. Chloroform was proposed as a test of sugar, in consequence of the complete insolubility of sugar in it, while glycerin was said to be very soluble; but subsequently chloroform has been shown to be incapable of dissolving glycerin, though readily forming an even mixture, which separates into its two constituents, on standing. (*Chem. News*, Feb. 25, 1870, p. 87.) The absence of sugar is shown, if, upon the addition of two drops of concentrated sulphuric acid, and the application of heat, no brown discoloration is observed. (*Journ. de Pharm.*, Nov. 1863, p. 405.) The late Prof. Procter believed that the most satisfactory method of detecting cane sugar is to dilute a little glycerin with three parts of water, then add a few grains of tartaric acid, and boil for a short time. Cane sugar, if present, is thus converted into glucose, which may be detected by adding first a solution of sulphate of copper, and then the solution of potassa to the heated liquid, when the formation of the reddish suboxide of copper will afford the requisite proof. (*A. J. P.*, 1867, p. 110.) According to M. Hager, sugar or dextrine may be detected in the following manner. Dilute the glycerin with water, add molybdate of ammonium and some drops of nitric acid, and boil.

If these impurities are present, a blue color is produced; if not, it remains colorless. (*Ibid.*, May, 1869, p. 206.)*

Among the most injurious impurities of glycerin are thought to be oxalic and formic acids, the latter of which is especially irritating to the skin, so as to unfit glycerin for some of the purposes for which it is most employed. The oxalic acid is said to result from the action of sulphuric acid employed in purifying glycerin; the formic, from the reaction between glycerin and oxalic acid. They may be detected by the U. S. P. tests. Mr. Henry Bower, of Philadelphia, who manufactures very pure glycerin, says that nitrate of silver is the most reliable test. Glycerin which shows no reaction with this salt, he considers suitable for all uses. (*A. J. P.*, 1868, p. 265.) For a method of extracting glycerin from mixtures containing sugar and glucose, see a paper by Prof. Prescott. (*N. R.*, 1878, p. 354.)

Medical Properties. The uses of glycerin as a vehicle of other medicines have been already given. When given internally, it is laxative, and it has also been suggested as a substitute for cod-liver oil in phthisis, etc. Dr. R. P. Cotton, however, has tried it in the Consumption Hospital at Brompton, and concluded that it has generally but little influence, and that as a remedial agent it will bear no comparison with cod-liver oil. Dr. W. Lauder Lindsay made experiments with it, to determine its alterative and nutrient properties, and found it to increase the weight of the body; but his experiments were not on a sufficient scale to be conclusive. The general verdict of the profession is certainly not in favor of its use in tuberculous affections, and it is now very rarely employed. The same may be said of its administration in diabetes.

Glycerin has come into extensive use as an *external* remedy. Its emollient virtues and undrying property adapt it to the treatment of skin diseases in which a softening and soothing application is required. It appears to have been first employed externally, in 1846, by Mr. Thomas De la Rue, of London, whose observation of its utility led Mr. Startin to try it in the Hospital for Skin Diseases, where it came into extensive use. The principal cutaneous diseases in which it has been found beneficial are pityriasis, lepra, herpes, eczema, psoriasis, prurigo, and lichen. It is a useful addition to lotions in the incrusted form of lupus, and in various syphilitic and strumous eruptions. It is also useful in chapped skin and excoriated surfaces. Added to poultices, in a proportion varying from one-fourth to one-sixteenth, it has the effect of keeping them soft for a long time. To collodion it gives a plasticity which renders it often better suited to skin affections. Incorporated in very small proportion with extracts and pills, it keeps them soft and free from mouldiness. M. Devergie, in giving the results of his trials of glycerin in skin diseases, thinks its virtues have been exaggerated, and that it is not superior to pure lard and similar fatty substances; though it has the advantages of liquidity and freedom from odor. In cases of deafness, from deficiency, accumulation, or hardness of the cerumen, and attended with dryness of the meatus, glycerin is an excellent remedy, introduced into the canal by means of raw cotton saturated with it. Glycerin may be used in the form of an ointment.†

Glycerin has been recommended by M. Vogel as a substitute for the common water-bath. A temperature of 100° C. (212° F.) can be applied by means of it, without the diffusion of unpleasant odors, as from fixed oils or paraffine used in the same way. (*Journ. de Pharm.*, Oct. 1868, p. 315.)

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* As impure glycerin is often irritant to the skin, and thus unfitted for some of the most important uses of this principle, it is very important to have a test by which this kind of impurity may be detected. According to M. Hager, if equal volumes of the irritating glycerin and pure sulphuric acid be mixed in a glass tube, there will be an immediate disengagement of gas; and, after the escape of gas has ceased, and the mixture allowed to rest, a renewed agitation will cause a new development of gas; and this phenomenon may be repeated several times; whereas, if the glycerin be pure and unirritant, there is a rise of temperature, and there may be a slight discoloration, but no effervescence, and only the production of a few bubbles of air on agitation. (*Journ. de Pharm. et de Chim.*, Nov. 1867, p. 360.)

† Mr. Ecky's *glycerin ointment* is made as follows. Take of spermaceti *half an ounce;* white wax *a drachm;* oil of almonds *two fluidounces;* glycerin *a fluidounce.* Melt the spermaceti and wax with the oil of almonds by a moderate heat. Then, having poured the melted liquid into a Wedgwood mortar, add the glycerin, and rub until the ingredients are thoroughly mixed and cool. This ointment may be used with advantage in chaps and excoriations.

Off. Prep. Extracta Fluida, *U. S.;* Glycerinum, Acidi Carbolici, *Br.;* Glycerinum Acidi Gallici, *Br.;* Glycerinum Acidi Tannici, *Br.;* Glycerinum Amyli, *Br.;* Glycerinum Boracis, *Br.;* Glyceritum Amyli, *U. S.;* Glyceritum Vitelli, *U. S.;* Linimentum Potassii Iodidi cum Sapone, *Br.;* Mucilago Tragacanthæ, *U. S.*

GLYCERITA. *Glycerites.*

(GLȲÇ-Ẹ-RĪ'TẠ.)

Glycerina, *Br.;* Glycerines.

These are solutions of medicinal substances in glycerin. In the thirteenth edition of the Dispensatory various reasons were adduced for preferring the name glycerates for these preparations, but, as the revisers of the U. S. Pharmacopœia have since adopted that of glycerites, these reasons are omitted. The U. S. name is certainly much better than the English. (See p. 713.)

Glycerin has valuable properties as a solvent and vehicle of medicinal substances. Such are its not unpleasant taste and bland character; its wide range of solvent power, which adapts it sometimes as a menstruum where neither water nor alcohol could be advantageously used, and enables it to retain in solution insoluble substances so frequently deposited from infusions and decoctions; and its preservative influence, which often protects against oxidation, and, by a destructive agency upon all of the lowest forms of vegetable and animal life, prevents the various fermentative processes so destructive of organic bodies. Another important property, as a vehicle for external remedies, is the permanence of its liquid character, so that it does not, like water and alcohol, dry up when applied to the skin; resembling in this respect, as well as in its demulcent quality, the fixed oils, without their tendency to rancidity. Hence it has of late come into extensive use in the preparation of medicinal solutions, which under the name of *Glycérés* found admission into the French Codex of 1866, and are now recognized by both the United States and British Pharmacopœias.* In the last revision of the U. S. Pharmacopœia *all* of the formerly officinal glycerites were dropped, including two of the most valuable and frequently used, glycerite of tannic and carbolic acids. Two new glycerites were introduced, Glyceritum Amyli and Glyceritum Vitelli.

GLYCERINUM ACIDI CARBOLICI. *Br.* *Glycerine of Carbolic Acid.*

(GLȲÇ-Ẹ-RĪ'NŬM ĂÇ'Ị-DĪ CĂR-BŎL'Ị-CĪ.)

Glycérole d'Acide phénique, Glycérine phénique, *Fr.;* Phenol-Glycerit, *G.*

"Take of Carbolic Acid *one ounce* [avoirdupois]; Glycerine *four fluidounces* [Imperial measure]. Rub them together in a mortar until the Acid is dissolved." *Br.*

For the uses of this preparation, see *Acidum Carbolicum* (p. 54). It is nearly identical in strength with the *Glyceritum Acidi Carbolici* of U. S. P. 1870, which was made by mixing *one troyounce* of carbolic acid with *four fluidounces* of glycerin. It may be used internally or locally, and for both purposes should in general be diluted with water at the time of application. Four and a half minims represent about a grain of the acid. The dose is from five to ten minims (0·3–0·6 C.c.).

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* *Glyceritum Picis Liquidæ.* U. S. 1870. *Glycerite of Tar.* "Take of Tar *a troyounce;* Carbonate of Magnesium, in powder, *two troyounces;* Glycerin *four fluidounces;* Alcohol *two fluidounces;* Water *ten fluidounces.* Having mixed the Glycerin, Alcohol, and Water, rub the Tar in a mortar, first with the Carbonate of Magnesium, and then with six fluidounces of the mixed liquids gradually added, and strain with expression. Rub the residue in like manner with half the remaining liquid, and strain as before. Repeat the process again with the remaining liquid. Put the residue into a percolator, add gradually the expressed liquids previously mixed, and afterwards a sufficient quantity of water to make the liquid which passes measure a pint." *U. S.*

This is a very excellent preparation of tar, which may be used either externally or internally. The formula is essentially the same as that proposed by Mr. J. B. Moore, although employing one-third less of the magnesium salt (*A. J. P.*, 1869, p. 115). As first made it is of a reddish brown color; after a time it is apt to deposit pitchy matter, which should be separated by filtration. An ounce of it represents half a fluidrachm of tar. The dose is a drachm to a half ounce (3·75–15 C. c.).

GLYCERINUM ACIDI GALLICI. *Br.* *Glycerine of Gallic Acid.*

(GLȲÇ-Ẹ-RĪ'NŬM ĂÇ'Ị-DĪ GĂL'LỊ-CĪ.)

Glycérole d'Acide gallique, *Fr.;* Gallussaüre-Glycerit, *G.*

"Take of Gallic Acid *one ounce* [avoirdupois]; Glycerine *four fluidounces* [Imperial measure]. Rub them together in a mortar, then transfer the mixture to a porcelain dish, and apply a gentle heat until complete solution is effected." *Br.*

This preparation was dropped at the last revision of the U. S. Pharmacopœia. The strength of the *Glyceritum Acidi Gallici* of U. S. P. 1870 was *one troyounce* of gallic acid to *four fluidounces* of glycerin, the manipulation being the same as in the British.

Glycerin is peculiarly fitted for a vehicle of gallic acid, which it readily dissolves, while the acid is but sparingly soluble in water. For the uses of this glycerite, see *Acidum Gallicum* (p. 62). The solution contains one grain of gallic acid in about four and a half minims of glycerin, and the dose is from twenty to sixty minims (1·25–3·75 C.c.).

GLYCERINUM ACIDI TANNICI. *Br.* *Glycerine of Tannic Acid.*

(GLȲÇ-Ẹ-RĪ'NŬM ĂÇ'Ị-DĪ TĂN'NỊ-CĪ.)

Glycérole de Tannin, Glycérine tannique, *Fr.;* Tannin-Glycerol, *G.*

"Take of Tannic Acid *one ounce* [avoirdupois]; Glycerine *four fluidounces* [Imperial measure]. Rub them together in a mortar, then transfer the mixture to a porcelain dish and apply a gentle heat until a complete solution is effected." *Br.*

This, the most valuable of all glycerites, was unfortunately dropped at the last revision of the U. S. Pharmacopœia: the strength of the British preparation very closely corresponds with that of the *Glyceritum Acidi Tannici*, U. S. P. 1870, which was *one troyounce* of tannic acid to *four fluidounces* of glycerin.

This preparation may be used, both internally and externally, for most of the purposes to which tannic acid is applied. (See *Acidum Tannicum*, p. 117.) Dr. S. Ringer esteems it highly as a remedy in ozæna and other sanious or purulent discharges from the nostrils and ears, being omitted if the symptoms present an acute form. He has found it also very serviceable in the early stages of eczema, and in impetigo; the scabs being removed before it is applied; and considers it extremely useful in chronic inflammation and superficial ulceration of the fauces, with a relaxed, moist, and granular appearance of the pharyngeal mucous membrane. (*Am. Journ. of Med. Sci*, Jan. 1869, p. 241.) The solution contains one grain of tannic acid in between four and five minims; and the dose is from ten to forty minims (0·6–2·5 C.c.).

On the whole, it is a most useful preparation of tannic acid for external use; as circumstances require it the officinal strength may be altered by directions of the physician; a very concentrated solution, two parts of glycerin to one of tannin, may be made by the aid of a moderate heat. This applied daily to nipples, during the later months of pregnancy, will usually prevent the occurrence of "sore nipples" during suckling.

GLYCERITUM AMYLI. *U.S., Br.* *Glycerite of Starch.*

(GLȲÇ-Ẹ-RĪ'TŬM Ạ-MȲ'LĪ.)

Glycerinum Amyli, *Br.;* Glycerine of Starch; Unguentum Glycerini, *P. G.;* Glycamyl, Plasma Glycéré d'Amidon, Glycérat simple (d'Amidon), *Fr.;* Stärke-Glycerit, *G.*

"Starch, *ten parts* [or one ounce av.]; Glycerin, *ninety parts* [or seven fluidounces], To make *one hundred parts*. Rub them together in a mortar until they are intimately mixed. Then transfer the mixture to a porcelain capsule, and apply a heat gradually raised to 140° C. (284° F.), and not exceeding 144° C. (291° F.), stirring constantly, until the starch-granules are completely dissolved and a translucent jelly is formed." *U. S.*

"Take of Starch *one ounce* [avoirdupois]; Glycerine *eight fluidounces* [Imperial measure]. Rub them together until they are intimately mixed, then transfer the mixture to a porcelain dish, and apply a heat gradually raised to 240°, stirring it constantly until the starch particles are completely broken and a translucent jelly is formed." *Br.*

Of these preparations it is only necessary to say that, with the exception of an inconsiderable difference in the proportions, they are the same as that brought into notice in 1858 by Mr. G. F. Schacht under the name of *plasma*, as a substitute for ointments, the emollient and demulcent properties of which they possess, without their inconvenience, whether used simply, or as a vehicle for other substances to be employed locally. Mr. Schacht prepares plasma by mixing 70 grains of starch in powder, and a fluidounce of glycerin, heating to 240° F. until the union is effected, and stirring constantly. The stirring should be continued moderately, during the cooling, to secure a proper consistence. As the plasma is liable to absorb moisture, it should be kept in well-closed vessels. (*P. J. Tr.*, Oct. 1866, p. 210.)

GLYCERINUM BORACIS. *Br.* *Glycerine of Borax.*

(GLY̆Ç-Ẹ-RĪ'NŬM BỌ-RĀ'CĬS.)

Glycérole de Borax, *Fr.;* Borax-Glycerol, *G.*

"Take of Borax, in powder, *one ounce* [avoirdupois]; Glycerine *four fluidounces.* Rub them together in a mortar until the Borax is dissolved." *Br.*

The *Glyceritum Sodii Boratis* of U. S. 1870 was of the strength of *one troy-ounce* to *four fluidounces.* Otherwise it did not differ from the British preparation.

The demulcent properties and sweet taste of this preparation render it a useful and convenient method of applying borax to the infantile thrush, and other forms of sore mouth in children. It has been very highly commended in facial erysipelas by Prof. D. M. Salazar, of Madrid. The part should be freely painted with it and then covered with raw cotton. (*N. Y. Med. Record*, viii. 311.)

GLYCERITUM VITELLI. *U.S.* *Glycerite of Yolk of Egg.* [*Glyconin.*]

(GLY̆Ç-Ẹ-RĪ'TŬM VỊ-TĔL'LĪ.)

"Fresh Yolk of Egg, *forty-five parts* [or thirteen ounces av.]; Glycerin, *fifty-five parts* [or sixteen ounces av.], To make *one hundred parts.* Rub the Yolk of Egg with the Glycerin gradually added, until they are thoroughly mixed." *U. S.*

Under the name of *Glyconin* there has been employed in France for many years, both for medical purposes and for those of the toilet, an emulsion made of glycerin and the yolk of eggs. When these two substances are rubbed together, they unite to form a very intimate mixture, which does not separate. It has the consistence of honey, and forms an opaque emulsion with water. It may be preserved almost indefinitely. The usual proportions of the ingredients are four parts of the yolk of eggs and five parts of pure glycerin. Attention was called to its usefulness as a vehicle for the administration of cod-liver oil by Mr. Geo. C. Close, of Brooklyn, N. Y., in 1874,* and it has since been repeatedly recommended for this purpose, and as a basis emulsion for general purposes. It is itself not medicinal. It is also used in the hospitals as a protective local application in burns, erysipelas, fissure of the nipples, and various cutaneous affections.

GLYCYRRHIZA. *U. S.* *Glycyrrhiza.* [*Liquorice Root.*]

(GLY̆Ç-Y̆R-RHĪ'ZẠ—glĭs-ịr-rī'zạ.)

Glycyrrhizæ Radix, *Br.;* Radix Liquiritiæ Glabræ, *P.G.;* Radix Glycyrrhizæ Hispanicæ; Spanish Licorice Root; Réglisse, Bois doux, Racine douce; Bois de Réglisse, *Fr.;* Spanisches Süssholz, Spanische Süssholzwurzel, Süssholzwurzel, *G.;* Liquirizia, *It.;* Regaliza, *Sp.*

"The root of Glycyrrhiza glabra. Linné. (*Nat. Ord.* Leguminosæ, Papilionaceæ.)" *U. S.* "The root or underground stem, fresh and dried, of Glycyrrhiza glabra." *Br.*

Gen. Ch. Calyx bilabiate; upper lip three-cleft, lower undivided. *Legume* ovate compressed. *Willd.*

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* *Glyconin Emulsion of Cod-Liver Oil.* The formula proposed by Mr. Close, and at one time largely used by Drs. Andrews, Beard, and others, is as follows. Cod-Liver Oil 4 fluidounces, Glyconin 9 fluidrachms, Aromatic Spirit of Ammonia 1 fluidrachm, Sherry Wine 2 fluidounces, Diluted Phosphoric Acid 4 fluidrachms, Essence of Bitter Almond (made by dissolving 1 fluidrachm of the volatile oil in half a pint of alcohol) 2 fluidrachms. The cod-liver oil is to be added *very slowly* to the glyconin with brisk stirring, and the other ingredients added in the order named.

Glycyrrhiza glabra. Willd. *Sp. Plant.* iii. 1144; Woodv. *Med. Bot.* p. 420, t. 152; Carson, *Illust. of Med. Bot.* i. 38, pl. 32. The liquorice plant has a perennial root, which is round, succulent, tough, and pliable, furnished with sparse fibres, rapid in its growth, and in a sandy soil penetrates deeply into the ground. The stems are herbaceous, erect, and usually four or five feet in height, have few branches, and are garnished with alternate, pinnate leaves, consisting of several pairs of ovate, blunt, petiolate leaflets, with a single leaflet at the end, of a pale green color, and clammy on their under surface. The flowers are violet or purple, formed like those of the pea, and arranged in axillary spikes supported on long peduncles. The calyx is tubular and persistent. The fruit is a compressed, smooth, acute, one-celled legume, containing from one to six small kidney-shaped seeds. There are two very distinct varieties of the plant, yielding the root; the typical form, which is smooth throughout, and the variety, *G. glandulifera,* W. K., in which the stem, leaves, and pods are more or less roughly glandular or pubescent.

The plant is a native of the south of Europe, Barbary, Syria, and Persia; and is cultivated in England,* the north of France, and Germany. Much of the root imported into this country comes from Messina and Palermo in Sicily. It is also largely produced in the north of Spain, where it is an important article of commerce. It is probable that a portion of the root from Italy and Sicily is the product of *G. echinata*, which grows wild in Apulia. This species is also abundant in the south of Russia, where, according to Hayne, sufficient extract is prepared from it to supply the whole Russian empire. Large quantities of liquorice root are now imported for the purpose of making the Extract, the imports for 1881 being 12,000 tons.

A species of Glycyrrhiza, *G. lepidota*, grows abundantly about St. Louis, in the State of Missouri, and flourishes along the banks of the Missouri River to its source. It is probably the same as the liquorice plant mentioned by Mackenzie as growing on the northern coast of this continent. Mr. Nuttall states that its root possesses in no inconsiderable degree the taste of liquorice.

Properties. The liquorice root of the shops is in long pieces, varying in thickness from a few lines to two inches, fibrous when not peeled, externally grayish brown and longitudinally wrinkled by desiccation, internally yellowish, pliable, tough, without smell, and of a sweet mucilaginous taste, mingled with a slight degree of acrimony. "Fracture coarsely fibrous; bark rather thick; wood porous, but dense, in narrow wedges; medullary rays linear; taste sweet, somewhat acrid. The underground stem, which is often present, has the same appearance, but contains a thin pith." *U. S.* There are two chief varieties of it, the Spanish and the Russian. The roots of the latter form are much larger than the Spanish, and their taste has more or less bitterness mixed with its sweetness. Mr. Henry N. Rittenhouse informs us that commercially the roots are preferred in the following order: 1, Italian; 2, Spanish; 3, Syrian; 4, Turkish; 5, Russian,—the Italian being the sweetest and the Russian the most bitter. Liquorice root is often worm-eaten and more or less decayed. The best pieces are those which have the brightest yellow color internally, and of which the layers are distinct. The bark is chiefly liber, consisting of parenchymatous tissue with bast-cells, which are stained yellow by iodine, and are arranged so as to make ordinary liber bundles, and also a sort of net-work. In the Russian root the prosenchymatous wood-cells are larger than in the Spanish. The powder is of a grayish yellow color, when the root is pulverized without being deprived of its epidermis; of a pale sulphur-yellow, when the epidermis has been removed. Robiquet found the following ingredients in liquorice root: 1, a peculiar transparent yellow substance, called *glycyrrhizin*, of a sweet taste, scarcely soluble in cold water, very soluble in boiling water, with which it gelatinizes on cooling, thrown down from its aqueous solution by acids, readily soluble in cold alcohol, insusceptible of the vinous fermentation, yielding no oxalic acid by the action of the nitric, and therefore wholly distinct from sugar; 2, a crystallizable principle named *agedoïte* by Robiquet, but subsequently proved to be identical with *asparagin;* 3, starch; 4, albumen; 5, a brown acrid resin; 6, a brown nitrogenous extractive matter; 7, lignin; 8, salts of lime and magnesia, with phosphoric, sulphuric, and malic acids. The chief constituent, *glycyrrhizin*, Gorup-Besanez (*Ann. Ch. und Pharm.*, 118, p. 236) found to be a glucoside, having the composition $C_{24}H_{36}O_9$. On boiling with dilute acids it breaks up into glycyrretin and an uncrystallizable sugar capable of fermentation. Roussin (*Journ. de Pharm. et de Chim.*, July, 1875, p. 6) found that the sweet taste of the root was not owing to the free glucoside, but to its compound with ammonia. Habermann (*Ann. Ch. und Pharm.*, 197, p. 105) found that glycyrrhizin-ammonia was the acid ammonium salt of glycyrrhizic acid, a nitrogenous acid, and gave the formula $C_{44}H_{62}NO_{18}.NH_4$ for it. (See *Glycyrrhizinum Ammoniatum.*) He succeeded in extracting from the commercial "ammoniacal glycyrrhizin" *glycyrrhizic acid*, which may be considered to be the active constituent of liquorice. It was obtained by dissolving the crude glycyrrhizin in glacial acetic acid at a boiling temperature, rapidly filtering, again treating the crystalline parts of the filtrate in the same manner, and finally purifying by repeated crystallizations from 90 per cent. alcohol. Its properties are peculiar, and account to a great extent for the singular behavior of liquid liquorice preparations. With water, in which the substance is but little soluble at ordinary temperature, it forms a transparent, faintly yellow jelly. On mixing 1 Gm. of the body with 100 C.c. of water, the mixture after a few hours becomes so jelly-like that the open vessel may be inverted without losing any substance. It is insoluble in ether, but slightly soluble in absolute alcohol (even boiling), more so in alcohol of 90 per cent., and especially so when hot. Its solubility increases with the decrease of the percentage of alcohol. (*Lieb. Ann. de Chem.*, 197, 105; *N. R.*, Sept. 1879.) By fusing glycyrrhizin with caustic potash, Weselsky and Benedikt (*Deutsch. Chem. Ges.*, 1876, p. 1158) obtained *paraoxybenzoic acid.*

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* It is cultivated in England at Pontefract in Yorkshire, and somewhat largely at Mitcham in Surrey, whence considerable quantities are sent into market. For an account of its growth at Mitcham the reader is referred to an article in *A. J. P.*, 1874, p. 473–4. Attempts have been made to introduce its cultivation into this country, but hitherto with no great success commercially.

Medical Properties and Uses. Liquorice root is an excellent demulcent, well adapted to catarrhal affections, and to irritations of the mucous membrane of the bowels and urinary passages. It is best given in the form of decoction, either alone, or combined with other demulcents. It is frequently employed as an addition to the decoctions of acrid or irritating vegetable substances, such, for example, as seneka and mezereon, the acrimony of which it covers, while it renders them more acceptable to the stomach. Before being used, it should be deprived of its cortical part, which is somewhat acrid, without possessing the peculiar virtues of the root. The decoction may be prepared by boiling an ounce of the bruised root, for a few minutes, in a pint of water. By long boiling, the acrid resinous principle is extracted. Perhaps, however, to this principle may in part be ascribed the therapeutical virtues of liquorice root in chronic bronchial diseases. The powder is used in the preparation of pills, either to give due consistence, or to cover their surface and prevent them from cohering.

Off. Prep. Confectio Terebinthinæ, *Br.;* Decoctum Sarsæ Compositum, *Br.;* Decoctum Sarsaparillæ Compositum, *U. S.;* Extractum Glycyrrhizæ, *Br.;* Extractum Glycyrrhizæ Fluidum, *U. S.;* Extractum Glycyrrhizæ Purum; Glycyrrhizinum Ammoniatum; Pulvis Glycyrrhizæ Compositus; Extractum Sarsaparillæ Fluidum Compositum, *U. S.;* Infusum Lini, *Br.;* Pilula Ferri Iodidi, *Br.;* Pil. Hydrargyri; Syrupus Sarsaparillæ Compositus, *U. S.*

GLYCYRRHIZINUM AMMONIATUM. *U. S.* *Ammoniated Glycyrrhizin.*

(GLȲÇ-Y̤R-RHI̤-ZĪ'NŬM A̤M-MŌ-NI̤-Ā'TŬM—glĭs-i̤r-ri̤-zī'nŭm.)

"Glycyrrhiza, in No. 20 powder. *one hundred parts* [or sixteen ounces av.]; Water, Water of Ammonia, Sulphuric Acid, each, *a sufficient quantity.* Mix *ninety-five parts* [or six pints] of Water with *five parts* [or five fluidounces] of Water of Ammonia, and, having moistened the powder with the mixture, macerate for twenty-four hours. Then pack it moderately in a cylindrical percolator and gradually pour water upon it until *five hundred parts* [or five pints] of percolate are obtained.

Add to the percolate, slowly and while stirring, a sufficient quantity of Sulphuric Acid, so long as a precipitate is produced. Collect this on a strainer, wash it with cold Water, redissolve it in Water with the aid of Water of Ammonia, filter, if necessary, and again add Sulphuric Acid so long as a precipitate is produced. Collect this, wash it, dissolve it in a sufficient quantity of Water of Ammonia previously diluted with an equal volume of Water, and spread the clear solution upon plates of glass, so that, on drying, the product may be obtained in scales." *U. S.*

This is a new officinal preparation; its introduction is a result of the very important researches of Z. Roussin, communicated to the Société de Pharmacie of Paris, June 2, 1875. This investigator noticed that *glycyrrhizin*, the sweet principle of liquorice root, was insipid when compared with the root itself, and suspected that it existed in a modified form in the root. Experiment showed that alkalies developed the sweet taste, and he ultimately proved that the alkali with which it was combined in the root was ammonia, and that glycyrrhizin played the part of an acid. He named the compound *glycyrrhizate of ammonium*, and called attention to the fact that liquorice root which had lost a portion of its sweetness through fermentation and the development of acetic acid and precipitation of insoluble glycyrrhizin could be restored to its former sweetness if allowed to remain a sufficient length of time in an ammoniacal atmosphere. The officinal process for ammoniated glycyrrhizin is closely modelled after Roussin's, with the exception of the substitution of percolation by a slightly ammoniated menstruum for maceration and expression with cold water. Roussin purified his product by redissolving it in alcohol and precipitating with ether; this is deemed unnecessary for a preparation which is intended to be useful without being expensive. (See *Proc. A. P. A.*, 1876, p. 544.) Connerade has proposed some modification of Roussin's method; his process is as follows. "Macerate ground liquorice root with one and a half parts by weight of water, strain, wash the residue with a very small quantity of water, heat the mixed liquids to boiling to coagulate albumen, strain again, and then add diluted sulphuric acid (1 in 10), as long as a precipitate is produced. Let this settle, decant the liquid, and dissolve the precipitate in solution of ammonia, diluted with nine parts of water. Filter the latter and evaporate it to dryness. The compound then remains as a brown, friable varnish, unaltered by air, of a pure, sweet taste, easily soluble in cold water, and imparting to the latter, even when diluted to 1 in 1000 parts, an amber color. The yield is about 10 per cent. of the weight of the root." (*N. R.*, March, 1881.)

Properties. The following is the description given in the U. S. Pharmacopœia. "Dark brown or brownish red scales, inodorous, of a very sweet taste, and soluble in water and in alcohol. The aqueous solution, when heated with potassa or soda, evolves vapor of ammonia. On supersaturating the aqueous solution with an acid, a substance (Glycyrrhizin) is precipitated, which, when dissolved in hot water, forms a jelly on cooling. This substance, when washed with diluted alcohol and dried, appears as an amorphous, yellow powder, of a strong, bitter-sweet taste, and an acid reaction." *U. S.*

Medical Properties and Uses. This substance appears to possess the medical properties of liquorice, and may be used as an elegant substitute for it in mixtures which are neither acid nor alkaline. The dose of it is from five to fifteen grains.

GOSSYPII RADICIS CORTEX. *U. S.* *Cotton Root Bark.*

(GOS-SŸP'Ī-Ī RA-DĪ'CĬS CŎR'TĔX.)

"The bark of the root of Gossypium herbaceum, Linné, and of other species of Gossypium. (*Nat. Ord.* Malvaceæ.)" *U. S.*

Cottonroot Bark; Écorce de la Racine de Cotonnier, *Fr.;* Baumwollen-Wurzelrinde, *G.*

Gen. Ch. Calyx cup-shaped, obtusely five-toothed, surrounded by a three-parted involucel, with dentate-incised, cordate leaflets, cohering at the base. *Stigmas* three to five. *Capsule* three to five-celled, many-seeded. *Seeds* surrounded by a tomentose wool. *De Cand.*

In consequence of changes produced in the plants of this genus by cultivation, botanists have found great difficulty in determining which are distinct species, and which are merely varieties. De Candolle describes thirteen species in his Prodromus, and mentions six others, but considers them all uncertain. Royle describes eight and admits others. Schwartz thinks they may all be referred to one original species. The plants inhabit different parts of tropical Asia and Africa, and many of them are cultivated for their cotton in climates adapted to their growth. The species from which most of the cotton of commerce has been thought to be obtained, is the one specially indicated by the U. S. Pharmacopœia. According to Dr. Royle, it is the India cotton which is produced by *G. herbaceum*, while *G. Barbadense* furnishes all the cotton of North America, and *G. Peruvianum* that produced in Brazil, Peru, and other parts of South America. (See *A. J. P.*, 1858, p. 339.) Dr. A. W. Chapman, however, in his *Flora of the Southern United States* (N. Y., 1860, p. 58), states that the numerous varieties of the cotton-plant are now referred to two species, the *long-staple*, or *sea-island*, to *G. album* (Haw.), and the *short-staple*, or *upland*, to *G. nigrum* (Haw.).

Gossypium herbaceum. Linn. *Sp. Plant.* 975; De Cand. *Prodrom.* i. 456. This is a biennial or triennial plant, with a branching stem from two to six feet high, and palmate hoary leaves, the lobes of which are somewhat lanceolate and acute. The flowers are pretty, with yellow petals, having a purple spot near the claw. The leaves of the involucel or outer calyx are serrate. The capsule opens when ripe, and displays a loose white tuft of long slender filaments, which surround the seeds and adhere firmly to the outer coating. The plant is a native of Asia, but is cultivated in most tropical countries. It requires a certain duration of warm weather to perfect its seeds, and, in the United States, does not mature north of Virginia.

The herbaceous part of the plant contains much mucilage, and has been used as a demulcent. The seeds yield by expression a fixed oil of the drying kind, which is employed for making soap and other purposes. (See *Oleum Gossypii.*) The bark of the root has been supposed to possess medical virtues, and is now recognized by the U. S. Pharmacopœia. Another officinal portion, and that for which the plant is cultivated, is the filamentous substance surrounding the seeds. This when separated constitutes the cotton of commerce.

Cotton seeds have been employed in our Southern States with great asserted success in the treatment of intermittents. In a communication from Prof. H. R. Frost to the *Charleston Medical Journal* for May, 1850, it is stated, on the authority of Dr. W. K. Davis, of Monticello, that this application of the cotton seed originated with a planter in Newberry District, South Carolina, who had often used the remedy in intermittents, and never failed to effect a cure. A pint of the seeds is boiled in a quart of water to a pint, and a teacupful of the decoction is given to the patient in bed, an hour or two before the expected return of the chill.

Properties. Cotton Root Bark is officinally described as "in thin, flexible bands or quilled pieces; outer surface brownish-yellow, with slight, longitudinal ridges or meshes, small, black circular dots, or short, transverse lines, and dull, brownish orange patches, from the abrasion of the thin cork; inner surface whitish, of a silky lustre, finely striate; bast fibres long, tough, and separable into papery layers; inodorous; taste very slightly acrid and faintly astringent." *U. S.* Prof. E. S. Wayne, of Cincinnati, found in it a peculiar acid resin, colorless and soluble in water, when pure, but absorbing oxygen on exposure, and then becoming red and insoluble in water. It is deposited by the fluid extract on standing. He suggests that this may be the active principle of the root; but the fact has not been determined. (*A. J. P.*, 1872, p. 289.)

William C. Staehle (*A. J. P.*, 1875, p. 457) made an examination of this resin, and obtained results somewhat different from those of Prof. Wayne. Staehle's percolate was of a dark, reddish brown color, whilst Wayne's was pale amber. This is accounted for, however, by the presence of a principle which is colorless in the fresh bark, but of a dark red in bark which has been exposed to air and light. W. A. Taylor noticed that the change in color from pale amber to dark red took place in an alcoholic tincture. (*A. J. P.*, 1876, p. 403.) Staehle found the resin soluble in 14 parts of alcohol, 15 parts of chloroform, 23 parts of ether, and 122 parts of benzol.

Medical Properties. It has been employed by Dr. Bouchelle, of Mississippi, who believes it to be an excellent emmenagogue, and not inferior to ergot in promoting uterine contraction. He states that it is habitually and effectually resorted to by the slaves of the South for producing abortion, and thinks that it acts in this way without injury to the general health. To assist labor, he employs a decoction made by boiling four ounces of the inner bark of the root in a quart of water to a pint, and gives a wineglassful (60 C.c.) every twenty or thirty minutes. (*West. Journ. of Med. and Surg.*, Aug. 1840.) These opinions of Dr. Bouchelle have been confirmed by various Southern practitioners of medicine, but for some reason the drug has not come into general use. Dr. Bellany, of Columbus, Georgia, says that the root should be gathered as late as possible in the fall before frost. The officinal fluid extract may be used in doses of half a fluidrachm to one fluidrachm (1·9 to 3·75 C.c.), repeated at short intervals if necessary.

Off. Prep. Extractum Gossypii Radicis Fluidum, *U. S.*

GOSSYPIUM. *U.S., Br.* *Cotton.* [*Purified Cotton. Absorbent Cotton.*]

(GỌS-SY̆P′Ị-ŬM.)

"The hairs of the seed of Gossypium herbaceum, Linné, and of other species of Gossypium (*Nat. Ord.* Malvaceæ), freed from adhering impurities and deprived of fatty matter." *U. S.* "The hairs of the seed of various species of Gossypium, carded." *Br.*

Bonelyax, Lana (Lanugo, s. Pili) Gossypii; Coton, *Fr.;* Baumwolle, *G.;* Cotone, *It.;* Algodon, *Sp.*

Cotton consists of "white, soft, fine filaments, under the microscope appearing as flattened, hollow and twisted bands, spirally striate and slightly thickened at the edges; inodorous, tasteless, insoluble in water, alcohol, or ether; soluble in an ammoniacal solution of sulphate of copper." It is without smell or taste, soluble in strong alkaline solutions, and decomposed by the concentrated mineral acids. In chemical character it is identical with lignin. By nitric acid it is converted into that remarkable explosive substance denominated gun cotton, for an account of which, see *Pyroxylinum* and *Collodium.* Officinal cotton is made by boiling the raw cotton in a diluted alkaline solution. A soap is formed through the union of the fatty matter with the alkali, and this is subsequently dissolved out by repeated washings. Mr. F. L. Slocum has published recently (1881) a process for preparing it. For details see the foot-note.* The U. S. P. tests are as follows. "Cotton should be perfectly free from all perceptible impurities, and, on combustion, should not leave more than 0·8 per cent. of ash. When thrown upon water, it should immediately absorb the latter and sink, and the water should not acquire either an acid or an alkaline reaction." *U. S.* The latter test proves the absence of fatty matter, for if even a small quantity be present the cotton will float in water. Repeated experiments have proven that cotton will take fire and burn spontaneously, if impregnated with olive oil, linseed oil, or almost any other fixed oil, and allowed to stand. (*P. J. Tr.*, 1872, p. 225.) Cotton, analyzed by M. Schunck, was found, independently of cellulose, ($C_6H_{10}O_5$), of which it chiefly consists, to contain vegetable wax, a fatty acid, coloring matter, pectic acid, and a little of an albuminoid substance. (*Journ. de Pharm.*, Sept. 1868, p. 233.) For medical use it should be carded into thin sheets. It is said that air passed through cotton loses the property of inducing the putrefactive fermentation in animal substances, on account of the microscopic organisms being strained out of it.

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* Take of the best quality of carded cotton batting, any desired quantity, and boil it with a 5 per cent. solution of caustic potassa or soda for one-half hour, or until the cotton is entirely saturated with the solution, and the alkali has saponified all oily matter. Then wash thoroughly, to remove all soap, and nearly all alkali; press out the excess of water, and immerse in a 5 per cent. solution of chlorinated lime for 15 or 20 minutes; again wash, first with a little water, then dip in water acidulated with hydrochloric acid, and thoroughly wash with water; press out the excess of water, and again boil for 15 or 20 minutes in a 5 per cent. solution of caustic potassa or soda; now wash well, dipping in the acidulated water and washing thoroughly with pure water. Afterwards press out and dry quickly.

The amount of loss by this process is practically 10 per cent. A sample of 360 grs. lost, on boiling with alkali and bleaching, 15 grs., or 4·17 per cent., and 270 grs. of this bleached sample lost, on again boiling with an alkali, 14 grs., or 5·18 per cent., a total loss of 9·35 per cent. (*A. J. P.*, 1881, p. 53.)

Medical Properties. Cotton has been used from time immemorial for the fabrication of cloth; but it is only of late that it has entered the catalogue of medicines. The use of cotton as a filtering medium and in the preparation of medicated waters has already been alluded to. It is chiefly employed in recent burns and scalds; an application of it adopted from popular practice. It is said to relieve the pain, diminish the inflammation, prevent vesication, and very much to hasten the cure. Whatever advantages result from it are probably ascribable to the absorption of effused liquids, and the protection of the part affected from the air. It is applied in thin and successive layers; and benefit is said to result from the application of a bandage when the skin is not too much inflamed. We have, however, seen cotton do much harm in burns, by becoming consolidated over a vesicated surface and acting as a mechanical irritant. Such a result may be prevented by first dressing the burn with a piece of fine linen spread with simple ointment. Cotton is also recommended in erysipelas, and as a dressing for blisters; and we have found it useful, applied in a large bunch over parts affected with rheumatism, especially in lumbago.* It has also been used as a dressing for wounds, including amputation and other operations by the surgeons; being largely applied to injured surfaces, and confined in its place by bandages, which are allowed to remain undisturbed, in order to prevent the injurious influence of the impure hospital air, and the access to the wounds of organic germs, which dispose to suppuration and septic disease. (See *Bost. Med. & Surg. Journ.*, May, 1872, p. 325; Aug. 1874, p. 197; *Arch. Gén.*, Dec. 1871; *Journ. de Pharm.*, Jan. 1872.)

Off. Prep. Pyroxylinum.

GRANATUM. *U. S.* *Pomegranate.*

(GRẠ-NĀ'TŬM.)

"The bark of the root of Punica Granatum. Linné. (*Nat. Ord.* Granataceæ.)" *U. S.* "The dried bark of the root." *Br.*

Granati Radicis Cortex, *Br.;* Cortex Radicis Granati, *P.G.;* Écorce de la Racine de Grenadier (de Balaustier), Écorce de Granade, *Fr.;* Granatwurzelrinde, Granatäpfelschale, *G.;* Malicorio, Scorza del Melogranati, *It.;* Corteza de Granada. *Sp.*

Gen. Ch. *Calyx* five-cleft, superior. *Petals* five. *Pome* many-celled, many-seeded. *Willd.*

Punica Granatum. Willd. *Sp. Plant.* ii. 981; Woodv. *Med. Bot.* p. 531, t. 190; Carson, *Illust. of Med. Bot.* i. 45, pl. 38. The pomegranate is a small shrubby tree, attaining in favorable situations the height of twenty feet, with a very unequal trunk, and numerous branches which sometimes bear thorns. The leaves are opposite, entire, oblong or lance-shaped, pointed at each end, smooth, shining, of a bright green color, and placed on short footstalks. The flowers are large, of a rich scarlet color, and stand at the end of the young branches. The petals are roundish and wrinkled, and are inserted into the upper part of the tube of the calyx, which is red, thick, and fleshy. The fruit is a globular berry, about the size of an orange, crowned with the calyx, covered with a reddish yellow, thick, coriaceous rind, and divided internally into many cells, which contain an acidulous pulp, and numerous oblong, angular seeds.

This tree grows wild upon both shores of the Mediterranean, in Arabia, Persia, Bengal, China, and Japan, has been introduced into the East and West Indies, and is cultivated in all civilized countries where the climate is sufficiently warm to allow the fruit to ripen. In higher latitudes, where it does not bear fruit, it is raised in gardens and hot-houses for the beauty of its flowers, which become double and acquire increased splendor of coloring by cultivation. Doubts have been entertained as to its original country. The name of *Punicum malum*, applied by the ancients to its fruit, implies that it was abundant at an early age in the vicinity of Carthage. The fruit, for which the plant is cultivated, varies much in size and flavor. It is said to attain greater perfection in the West Indies than in its native country. The edible pulp is red, succulent, pleasantly acid, and sweetish. The flowers were recognized by the Dublin College, and the seeds are officinal in France.

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* Absorbent cotton has been medicated in various ways and come largely into use. (See *Iodinized Cotton*, under *Iodinum.*) *Picric Cotton* is prepared by dissolving 0·25 Gm. of picric acid in 25 Gm. of ether, or of 94 per cent. alcohol, and immersing in the solution 10 Gm. of clean cotton, and drying. *Salicylic Cotton* (5 per cent.) may be prepared by Prof. Brun's process, by saturating 1 kilogramme of cotton with 4 litres of a solution of 50 Gm. of salicylic acid, 20 Gm. of castor oil in 3·930 litres of alcohol. *Benzoic Cotton* is made in the same way, substituting benzoic for salicylic acid. (*A. J. P.*, Dec. 1878.) *Chlorinated Cotton.* Prof. Pavesi subjects cotton moistened with glycerin, and suspended at the top of a large wide-mouthed bottle, to the action of chlorine vapor, generated by adding sulphuric acid to chlorinated lime. (*N. R.*, July, 1880.)

Rind of the Fruit. This is presented in commerce under the form of irregular fragments, hard, dry, brittle, of a yellowish or reddish brown color externally, paler within, without smell, and of an astringent, slightly bitter taste. It contains a large proportion of tannin, and, in countries where the tree abounds, has been employed for tanning leather.

Flowers. The flowers, sometimes called *bàlaustines*, are inodorous, have a bitterish, astringent taste, and impart a violet-red color to the saliva. They contain tannic and gallic acids, and were used by the ancients in dyeing.

Bark of the Root. The roots of the pomegranate are hard, heavy, knotty, ligneous, and covered with a bark which is yellowish gray or ash-gray on the outer surface, and yellow on the inner. As officinally described, the bark is "in thin quills or fragments, from two to four inches (5 to 10 cm.) long, little over one twenty-fifth of an inch (1 mm.) thick; outer surface yellowish gray, free from lichens; somewhat warty, or longitudinally and reticulately ridged; inner surface smooth, finely striate, grayish yellow; fracture short, granular, greenish yellow, indistinctly radiate." *U. S.* It has little or no smell, colors the saliva yellow when chewed, and leaves in the mouth an astringent taste without disagreeable bitterness. The infusion of the bark yields a deep blue precipitate with salts of iron, and a yellowish white precipitate with solution of gelatin. The inner surface of the bark, steeped in water and then rubbed on paper, produces a yellow stain, which, by the contact of sulphate of iron, is rendered blue, and by that of nitric acid acquires a slight rose tint, which soon vanishes. (*Ibid.*, xvii. 438.) These properties serve to distinguish this bark from those of the box root and barberry, with which it is said to be sometimes adulterated. When used, it should be separated from the ligneous portion of the root, as the latter is inert.*

The bark contains more than 22 per cent. of tannic acid, which Rembold (*Ann. der Ch. und Pharm.*, 143, p. 285) found to consist for the most part of a peculiar variety called *punico-tannic acid*, $C_{20}H_{16}O_{13}$; when boiled with dilute sulphuric acid, it is resolved into *ellagic acid*, $C_{14}H_8O_9$, and sugar. Punico-tannic acid is accompanied by common tannic acid, yielding by means of sulphuric acid gallic acid, which appears sometimes to pre-exist in the bark.

Pomegranate bark also yields a considerable quantity of *mannite*, which was formerly described under the names of *punicin* or *granatin*. The active power of the root, however, is due, according to Tanret (*Comp.-Rend.*, 86, p. 1270, and 87, p. 358), to an alkaloid *pelletierine*, $C_8H_{13}NO$, a dextrogyrate liquid boiling at 180° to 185° C. The alkaloid is easily soluble in water, alcohol, and ether, and specially so in chloroform. It has strong basic properties, and precipitates many metallic salts. 1000 parts of dry bark yielded 4 parts of the alkaloid.

In a later communication (*Comp.-Rend.*, 88, p. 716), Tanret announces that he has found three additional volatile bases in the bark, a liquid left-rotating one, a liquid optically inactive one, and a crystallizable inactive one, which latter has the formula $C_9H_{15}NO + 2H_2O$, fuses at 46° C., and boils at 246° C. His process for obtaining these alkaloids is as follows. "A mixture of the salts of the alkaloids is prepared by mixing the powdered bark with a milk of lime, exhausting with water, shaking the resulting liquor with chloroform and neutralizing the latter with dilute acid. A solution of the mixed alkaloids is thus obtained in which one or other of them predominates, according to the source of the bark. Two of the four alkaloids are displaced from their salts by bicarbonate of sodium, and two are not. This solution is therefore treated with an excess of bicarbonate of sodium and shaken with chloroform, and this in its turn is agitated with dilute sulphuric acid. The resulting solution contains the sulphates of two alkaloids, to which the names of "*methylpelletierine*" and "*pseudopelletierine*" have been given. Caustic potash is then added to the first liquor, and upon repeating the treatment with chloroform and acid there is obtained a solution of the sulphates of "pelletierine" and "*isopelletierine.*" (*P. J. Tr.*, 1880, p. 829.)

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* Dr. C. Harz stated in 1870 that the commercial bark, sold as the bark of the root of the pomegranate, consisted really, in great measure, of that of the stem; a little of the proper root-bark being occasionally intermingled with it. The root-bark, the author observes, "has large cells; and at a distance from the cambium, the cells of the medullary rays are not elongated but quadratic. The trunk-bark, as well as that of the root, has anthelmintic properties." (*A. J. P.*, 1870, p. 220.) A minute description of the microscopic character of the root-bark, by which it may be distinguished, is contained in *P. J. Tr.* (1873, p. 703).

Medical Properties and Uses. The rind of the pomegranate fruit was formerly recognized by the U. S. Pharmacopœia. It is astringent, and in the form of decoction is sometimes employed in diarrhœa and colliquative sweats, and, more frequently, as an injection in leucorrhœa, and as a gargle in sore throat in the earlier stages, or after the inflammatory action has in some measure subsided. The powdered rind has also been recommended in intermittent fever. The flowers have the same medical properties, and are used for the same purposes. The bark of the root was used by the ancients as a vermifuge, and is recommended in the writings of Avicenna, but was unknown in modern practice till brought into notice by Dr. F. Buchanan, who learned its powers in India. The Mahometan physicians of Hindostan consider it a specific against tænia. One of these practitioners, having relieved an English gentleman in 1804, was induced to disclose his secret, which was then made public. The French writers prefer the product of the wild pomegranate, growing on the borders of the Mediterranean, to that of the plant cultivated in gardens for ornamental purposes. The bark may be administered in powder or decoction; but the latter form is usually preferred. The decoction is prepared by macerating two ounces of the bruised bark in two pints of water for twenty-four hours, and then boiling to a pint. Of this a wineglassful may be given every half-hour, hour, or two hours, until the whole is taken. It often nauseates and vomits, and usually purges. Portions of the worm often come away soon after the last dose. It is recommended to give a dose of castor oil and to diet the patient strictly on the day preceding the administration of the remedy; and, if it should not operate on the bowels, to follow it by castor oil, or an enema. If not successful on the first trial, it should be repeated daily for three or four days, until the worm is discharged. It appears to have been used by the negroes of St. Domingo before its introduction into Europe.

Various trials have been made to determine the tænifugal properties of pelletierine. They seem to show that the alkaloid is a valuable drug, and that the tannate has not only freedom from taste to recommend it, but is decidedly more effective and less apt to derange the stomach than the sulphate, probably because its insolubility prevents its absorption before it reaches the worm. M. Bérenger-Férand also studied the comparative value of the four alkaloids which M. Tanret has found in the bark, and showed that those alkaloids whose sulphates are not decomposable by the bicarbonate of sodium are nearly devoid of power. The dose of the tannate of pelletierine is half to three-quarters of a grain (0·03–0·05 Gm.), taken after fasting, and followed in 15 minutes by a sharp purgative. (*Bull. de Thérap.*, xcvi. xcvii.) Much larger doses are asserted, with very doubtful correctness, to be proper; thus, according to *N. R.*, 1879, 8 grains (0·52 Gm.) is the dose. The dose of the rind and flowers in powder is from twenty to thirty grains (1·3–1·95 Gm.). A decoction may be prepared in the proportion of an ounce of the medicine to a pint of water, and given in the dose of a fluidounce (30 C.c.). The seeds are demulcent.

Off. Prep. of the Bark of the Root. Decoctum Granati Radicis, *Br.*

GRINDELIA. *U.S.* *Grindelia.*

(GRĬN-DĒ′LỊ-Ạ.)

"The leaves and flowering tops of Grindelia robusta. Nuttall. (*Nat. Ord.* Compositæ.)" *U.S.*

Gen. Ch. Heads solitary, terminating leafy branches, or occasionally more or less corymbose, heterogamous with the rays fertile, or in one species homogamous (rayless), many-flowered. *Involucre* hemispherical or globular, commonly coated with resin or balsam; its scales very numerous, imbricated, narrow, with coriaceous, appressed, bare, and slender, more or less spreading or squarrose, green tips. *Receptacle* flat or convex, foveolate. *Rays* numerous, narrow. *Branches* of the style tipped with a lanceolate or linear appendage. *Akenes* compressed or turgid, or the outermost somewhat triangular, glabrous, truncate. *Pappus* of two to eight caducous awns or stout corneous bristles. Biennial or perennial, and mostly coarse herbs, with sessile or partly clasping leaves, often viscid or resinous, and middle-sized or rather large heads of yellow flowers. *Torrey & Gray.*

This genus inhabits the western side of both North and South America. Most if not all of the species produce a resinous exudation, especially from the flower-heads, and it is probable that medical properties are common to the genus.

G. robusta, Nuttall, is an herbaceous plant, from one to three feet high, very glabrous, with leaves varying from broadly spatulate or oblong to lanceolate, or the upper cordate and clasping, commonly obtuse, sharply more or less serrate; the scales of the involucre are produced into long circinate, squarrose, awn-like tips; the pappus of two to three, rarely five, nearly smooth, flattish awns; akenes mostly one- to three-toothed at the apex.

Grindelia squarrosa, Dunal, is in general a less leafy and bushy plant than *G. robusta*, but so closely resembles some varieties of the latter, that after a careful study of various published descriptions and of the specimens in the herbarium of the Academy of Natural Sciences, we are not satisfied of this specific distinctness. The character pointed out by Torrey and Gray, that in *robusta* the leaves are broader at the base than above, does not hold; for in a specimen in the herbarium of the Philadelphia Academy of Natural Sciences labelled in Nuttall's handwriting, and, therefore, probably the type of *G. robusta*, the leaves are not broader at the base; whilst in various specimens of *G. squarrosa* they are not narrowed at the base. The most constant distinctive characters in the specimens at hand are that *G. robusta* has a more leafy involucre and its leaves usually are more coarsely serrate; but Watson describes a variety of *G. robusta* in which the upper leaves are entire. There is no constant difference in the scales of the involucre.

Properties. The officinal description of grindelia is as follows. "Leaves about two inches (5 cm.) or less long, varying from broadly spatulate or oblong to lanceolate, sessile or clasping, obtuse, more or less sharply serrate, pale green, smooth, finely dotted, brittle; heads many-flowered; the involucre hemispherical, about half an inch (12 mm.) broad, composed of numerous, imbricated, squarrosely tipped scales; ray-florets yellow, ligulate, pistillate; disk-florets yellow, tubular, perfect; pappus consisting of about three awns of the length of the disk-florets." *U. S.*

As it occurs in commerce, grindelia is in the form of the whole dried herb; the stems are about eighteen inches in length, light brownish, very frequently stripped of their leaves, but with some of the floral heads adherent. The brittle leaves are much broken, and with separated floral heads are mixed with the stem. The taste is warmish, peculiar, and very persistent. The specimens we have examined seemed to contain numerous floral heads, some according with those of the typical *G. robusta*, others without trace of involucral leaves. Some of the latter may have been removed, it is true, by accidents of carriage; but if *G. squarrosa* and *robusta* be distinct species, it would appear that they are indiscriminately collected. The activity of the drug probably resides in the resinous exudation. Dr. C. J. Rademaker obtained from it an oil, the odor of which closely resembled that of oil of turpentine, resin, and a crystalline body, having an alkaline reaction: the constituents deserve further chemical investigation. (*N. R.*, 1876, p. 205.)

Medical Properties and Uses. Attention was first called to the therapeutic value of grindelia by Dr. H. Gibbons, of San Francisco, and the medicine has since gradually worked its way into favor. Its chief use has been in asthma and in bronchitis; it is especially valuable in the latter complaint when there is much dyspnœa and a distinct tendency to bronchial spasm. The drug, however, probably not only exerts an antispasmodic influence, but also stimulates the bronchial mucous membrane, and it may be confidently exhibited in chronic bronchitis, especially of the aged. It has been employed with asserted success in hooping-cough. Its active principles appear to be excreted from the kidneys; hence after large doses there are sometimes evidences of renal irritation; and in chronic catarrh of the bladder good has been effected by its stimulant influence upon the mucous membrane of the viscus. As a local application, grindelia has been employed with asserted advantage in burns, vaginitis, genito-urinary catarrh, etc., applied either in the form of a poultice or in solution.

Off. Prep. Extractum Grindeliæ Fluidum, *U. S.*

GUAIACI LIGNUM. *U. S., Br.* *Guaiacum Wood.*

(GUĀ′IẠ-CĪ LĬG′NŬM—gwā′yạ-sī.)

"The heart-wood of Guaiacum officinale, Linné, and of Guaiacum sanctum, Linné. (*Nat. Ord.* Zygophyllaceæ.)" *U. S.* "The wood reduced by the turning lathe to the form of a coarse powder or small chips." *Br.*

Lignum Guajaci, *P.G.;* Lignum Sanctum (vel Benedictum, vel Vitæ); Lignum Vitæ: Bois de Gayac, *Fr.;* Guajakholz, Franzosenholz, Pockenholz, *G.;* Legno Guaiaco, *It.;* Guayaco, *Sp.*

Gen. Ch. Calyx five-cleft. unequal. *Petals* five, inserted into the calyx. *Capsule* angular, three- or five-celled. *Willd.*

Guaiacum officinale Willd. *Sp. Plant.* ii. 538; Woodv. *Med. Bot.* p. 557, t. 200; Carson, *Illust. of Med. Bot.* i. 25, pl. 17. This is a large tree, of very slow growth. When of full size it is from forty to sixty feet high, with a trunk four or five feet in circumference. The branches are knotted, and covered with an ash-colored striated bark. That of the stem is of a dark gray color, variegated with greenish or purplish spots. The leaves are opposite, and abruptly pinnate, consisting of two, three, and sometimes four pairs of leaflets, which are obovate, veined, smooth, shining, dark green, from an inch to an inch and a half long, and almost sessile. The flowers are of a rich blue color, stand on long peduncles, and grow to the number of eight or ten at the axils of the upper leaves. The seeds are solitary, hard, and of an oblong shape.

G. sanctum, L., is distinguished from *G. officinale* by its five-celled fruit and its oblong or obliquely obovate, or sometimes rhomboid-ovate leaflets, six to eight to each leaf. It grows in Cuba and some other of the West India Islands, and in the Bahama Islands. Its wood is smaller than that of *G. officinale*, and is said by Fée to be paler and less dense.

G. officinale grows in the West Indies, particularly in Hayti and Jamaica, and is found also in the warmer parts of the neighboring continent. All parts of the tree are possessed of medicinal properties; but the wood and the concrete juice only are officinal. The bark, though much more efficacious than the wood, is not kept in the shops. It is said that other species of Guaiacum contribute to the supplies brought into the market. *G. sanctum* of Linnæus, and *G. arboreum* of De Candolle, are particularly specified.

Guaiacum wood is imported from Hayti and other West India islands, in the shape of logs or billets, covered with a thick gray bark, which presents on its inner surface, and upon its edges when broken, numerous shining crystalline points. These were supposed by Guibourt to be benzoic acid, by others a resinous exudation from the vessels of the plant; but Dr. Otto Berg has determined that they are crystals of sulphate of calcium. The billets are used by the turners for the fabrication of various instruments and utensils, for which the wood is well adapted by its extreme hardness and density. It is kept by the druggists and apothecaries in the state of shavings or raspings, which they obtain from the turners. It is commonly called *lignum vitæ*, a name which obviously originated from the supposition that the wood was possessed of extraordinary remedial powers.

Properties. Guaiac wood is very hard and heavy. The color of the sap-wood is yellow, that of the older and central layers greenish brown, that of the shavings a mixture of the two. It is said that, when the wood is brought into a state of minute division, its color is rendered green by exposure to the air, and bluish green by the action of nitric acid fumes; and the latter change may be considered as a test of its genuineness. (*Duncan.*) An easier test is a solution of corrosive sublimate, which, added to the shavings and slightly heated, causes a bluish green color in the genuine wood. (*Chem. Gaz*, No. 80, Feb. 1846.) Guaiacum wood is almost without smell unless rubbed or heated, when it becomes odorous. When burnt it emits an agreeable odor. It is bitterish and slightly pungent, but requires to be chewed for some time before the taste is developed. It contains, according to Trommsdorf, 26 per cent. of resin, and 0·8 of a bitter pungent extractive, upon both of which, probably, though chiefly on the former, its medicinal virtues depend. (See *Guaiaci Resina.*) It yields its virtues but partially to water. One pound of the wood afforded to Geiger two ounces of extract.

Medical Properties and Uses. Guaiacum wood ranks among the stimulant diaphoretics. It is said to have been introduced to the notice of European practitioners by the natives of Hispaniola, soon after the discovery of America. It was used in Europe so early as 1508, and attained great celebrity as a remedy for lues venerea; but more extended experience has proved it to be wholly inadequate to the cure of that disease; and it is now employed simply to palliate the secondary symptoms, or to assist the operation of other and more efficient remedies. It is thought to be useful also in chronic rheumatism and gout, scrofula, certain cutaneous eruptions, ozæna, and other protracted diseases dependent on a depraved or vitiated condition of the system. It is usually exhibited in decoction, and in combination with other medicines, as in the compound decoction of sarsaparilla. As but a small portion of the guaiac contained in it is soluble in water, the probability is that its virtues have been greatly overrated, and that the good which has followed its employment resulted rather from the more active medicines with which it is associated, or from the attendant regimen, than from the wood itself. The simple decoction may be prepared by boiling an ounce in a pint and a half of water down to a pint, the whole of which may be administered in divided doses during the twenty-four hours. An aqueous extract is directed by the French Codex.

Off. Prep. Decoctum Sarsæ Compositum, *Br.;* Decoctum Sarsaparillæ Comp., *U. S.;* Syrupus Sarsaparillæ Comp., *U. S.*

GUAIACI RESINA. *U. S., Br.* *Guaiac.*

(GUĀ'IA-CĪ RE-ṢĪ'NA—gwā'ya-sī.)

"The resin of the wood of Guaiacum officinale. Linné. (*Nat. Ord.* Zygophyllaceæ.)" *U. S.* "The resin obtained from the stem by natural exudation, by incisions, or by heat." *Br.*

Resina Guajaci, *P.G.;* Guaiacum; Guaiacum Resin: Résine de Gayac, *Fr.;* Guajak, Guajakharz. *G.;* Resina de Guajaco, *It.;* Resina de Guayaco, *Sp.*

For a description of *Guaiacum officinale*, see *Guaiaci Lignum*, p. 727.

Guaiac is the concrete juice of this tree. It is obtained in several different modes. The most simple is by spontaneous exudation, or by incisions made into the trunk. Another method is by sawing the wood into billets about three feet long, boring them longitudinally with an auger, then placing one end of the billet on the fire, and receiving in a calabash the melted guaiac, which flows out through the hole at the opposite extremity. But the plan most frequently pursued is probably to boil the wood, in the state of chips or sawdust, in a solution of common salt, and skim off the matter which rises to the surface. Guaiac is brought to this market from the West Indies. It is usually in large irregular pieces of various size, in which small fragments of bark, sand, and other impurities are mixed with the genuine guaiac, so as to give to the mass a diversified appearance. Sometimes we find it in small roundish homogeneous portions, separate or agglutinated; sometimes in homogeneous masses, prepared by melting and straining the drug in its impure state. It is probable that the guaiac, obtained from the billets in the manner above described, is of uniform consistence.*

Properties. The masses are irregular or somewhat globular, of a glassy lustre and resinous fracture. They are of a deep greenish brown or dark olive color on their external surface, and internally wherever the air can penetrate. The predominant hue of those parts not exposed to the air is reddish brown or hyacinthine, diversified, however, with shades of various colors. The odor is feeble but fragrant, and is rendered stronger by heat. The taste, which is at first scarcely perceptible, becomes acrid after a short period; and a permanent sense of heat and pungency is left in the mouth and fauces. Guaiac is brittle, and when broken presents a shining glass-like surface, conchoidal or splintery, with the smaller fragments more or less translucent. It is readily pulverized; and the powder, at first of a light gray color, becomes green on exposure to the light. Its sp. gr. varies from 1·2 to 1·23. It softens in the mouth, and melts with a moderate heat. Water dissolves a small proportion of guaiac, not exceeding nine parts in 100, forming an infusion of a greenish brown color and sweetish taste, which, upon evaporation, yields a brown substance soluble in hot water and alcohol, but scarcely so in ether. Alcohol takes up the whole, with the exception of impurities. The tincture is of a deep brown color, is decomposed by water, and affords blue, green, and brown precipitates, with the mineral acids. It is colored blue by nitric acid, by chlorine, and by tincture of the chloride of iron, and usually by spirit of nitrous ether; and is similarly changed when treated successively by dilute hydrocyanic acid, and solution of sulphate of copper. Either in substance or tincture, guaiac gives a blue color to gluten and substances containing it, to mucilage of gum arabic, to milk, and to various freshly cut roots, as the potato, carrot, and horseradish. It is soluble also in ether, alkaline solutions, and sulphuric acid. The solution in sulphuric acid is of a rich claret color, deposits, when diluted with water, a lilac precipitate, and, when heated, evolves charcoal. Exposed to air and light, guaiac absorbs oxygen and becomes green, and the change takes place rapidly in the sunshine. Tincture of guaiac has been used for the detection of blood-stains, which it does by the blue color produced by it, when in contact with the red coloring matter of blood, in connection with some ozonized substance, especially peroxide of hydrogen. (*Guy's Hosp. Reports*, 3d ser., xiii. 432.)

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* Under the name of *Resina Guaiaci Peruviana Aromatica* there is a substance circulating in European commerce, which probably has no relation to guaiac. For a summary of our knowledge concerning it, see *A. J. P.*, 1877, p. 18.

It may be used also to distinguish the blood of man and other mammals, in which the corpuscles are non-nucleated, from that of other classes, as birds, fishes, and reptiles, which have nucleated corpuscles. The following method of applying the test, made known by Dr. R. M. Bertolet, microscopist of the Philadelphia Hospital, has the advantage that it will present the evidence to the spectator, and thus be made to give conviction in jury trials. A microscopic preparation, duly mounted, is carefully irrigated with a simple tincture of guaiac resin, and then, under glass, exposed to the action of a very small quantity of an ethereal solution of peroxide of hydrogen. The mammalian corpuscles will exhibit a uniform blue coloration throughout, of different shades in the different corpuscles, while, if the blood corpuscle is nucleated, the nucleus is seen as a well-defined and deep blue body, with a delicate violet-colored medium around it. (*Am. Journ. of Med. Sci.*, Jan. 1874, p. 129.)

The composition of guaiacum resin was ascertained by Hadelich (*Journ. für pr. Chem.*, 87, p. 335) to be as follows. Guaiaconic acid 70·3 per cent., guaiaretic acid 10·5 per cent., guaiac beta-resin 9·8 per cent., gum 3·7 per cent., ash constituents 0·8 per cent., guaiacic acid, coloring matter (guaiac yellow), and impurities 4·9 per cent. Of these constituents, *guaiaretic acid*, $C_{20}H_{26}O_4$, was discovered by Hlasiwetz in 1859. It may be extracted from the crude resin by alcoholic potash or by quicklime, forming a crystalline salt with the former and an amorphous compound with the latter. The free acid is obtained by decomposing one of these salts with hydrochloric acid and crystallizing from alcohol. The crystals, which are soluble in ether, alcohol, benzol, chloroform, carbon disulphide, or acetic acid, but not in ammonia or in water, melt below 80° C., and may be volatilized without decomposition. They are not colored blue by oxidizing agents. If the mother-liquor from the potassium salt of the guaiaretic acid be decomposed with hydrochloric acid and the precipitate washed with water, ether will extract *guaiaconic acid*, $C_{38}H_{40}O_{10}$. This compound, discovered by Hadelich in 1862, is a light brown amorphous substance, fusing at 100° C. It is without acid reaction, but decomposes alkaline carbonates, forming salts easily soluble in water and alcohol. It is insoluble in water, benzol, or bisulphide of carbon, but dissolves in ether, chloroform, acetic acid, or alcohol. With oxidizing agents it assumes a transient blue tint. After the extraction of the guaiaconic acid, there remains a substance insoluble in ether, to which the name of *Guaiac Beta-resin* has been applied. Its composition does not appear to differ greatly from that of guaiaconic acid.

Guaiacic acid, $C_{12}H_{16}O_6$, obtained in 1841 by Thierry, from guaiacum wood, or from the resin, crystallizes in colorless needles. Hadelich states that not more than one part in 20,000 can be obtained from the resin.

Guaiac yellow, the coloring matter of guaiacum resin, was first observed by Pelletier. It crystallizes in pale yellow quadratic octahedra, having a bitter taste, but is not a glucoside.

Guaiac resin also yields interesting products on dry distillation. First, *guaiacene*, C_5H_8O, at 118° C., next, *guaiacol*, $C_6H_4\left\{\begin{matrix}OCH_3\\OH\end{matrix}\right.$, being the methyl ether of pyrocatechin, at 205°–210° C., and with it *kreosol*, $C_6H_3(CH_3)_2OH$, and finally, *pyroguaiacin*, $C_{38}H_{44}O_6$, in pearly scales, melting at 180° C. (*Pharmacographia*, 2d ed., p. 104.)

It will be inferred, from what has been said, that the mineral acids are incompatible with the solutions of guaiac.

Adulterations. This drug is sometimes adulterated with the resin of the pine. The fraud may be detected by the terebinthinate odor exhaled when the sophisticated guaiac is thrown upon burning coals, as well as by its partial solubility in hot oil of turpentine. This liquid dissolves resin, but leaves pure guaiac untouched. Amber is said to be another adulteration. Nitric acid affords an excellent test of guaiac. If paper moistened with the tincture be exposed to the fumes of this acid, it speedily becomes blue. Purgotti proposed guaiac resin as a test for copper. (See *A. J. P.*, June, 1880.)

Medical Properties and Uses. Guaiac is stimulant and alterative, producing, when swallowed, a sense of warmth in the stomach, with dryness of the mouth and thirst, and promoting various secretions. If given to a patient when covered warm in bed, especially if accompanied with opium and ipecacuanha, or the antimonials, and assisted by warm drinks, it often excites profuse perspiration; and hence it has been usually ranked among the diaphoretics. If the patient be kept cool during its administration, it is sometimes directed to the kidneys, the action of which it promotes. In large doses it purges; and it is thought by some practitioners to be possessed of emmenagogue powers. It has been given with asserted advantage in chronic rheumatism, gouty affections, secondary syphilis, scrofulous diseases, and cutaneous eruptions. It was much relied upon by the late Dr. Dewees in the cure of amenorrhœa and dysmenorrhœa. Dr. James Jackson, of Boston, recommends it occasionally as a laxative, in the dose of a drachm.

The medicine is given in substance or tincture. The dose of the powder is from ten to thirty grains (0·65–1·95 Gm.), which may be exhibited in pill or bolus, in the shape of an emulsion formed with gum arabic, sugar, and water, or as a syrup.[*] An objection to the form of powder is that it quickly aggregates. Guaiac is sometimes administered in combination with alkalies, with which it readily unites. Several European Pharmacopœias direct a *soap of guaiac*, under the name of *sapo guaiacinus*, to be prepared by diluting the liquor potassæ with twice its weight of water, boiling lightly, then adding guaiac gradually, with continued agitation, so long as it continues to be dissolved, and finally filtering, and evaporating to the pilular consistence. One scruple (1·3 Gm.) may be taken daily in divided doses.

Off. Prep. Mistura Guaiaci, *Br.;* Pilulæ Antimonii Compositæ, *U. S.;* Pilula Hydrargyri Subchloridi Composita, *Br.;* Tinctura Guaiaci, *U. S.;* Tinctura Guaiaci Ammoniata.

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[*] *Syrup of Guaiac.* Dr. T. C. Craig. (*A. J. P.*, July, 1880.) Powd. Guaiac Resin, 640 grains; Caustic-Potassa, 58 grains; White Sugar, ℔j (avoird.); Water. q. s. Dissolve the Potassa in 8 fluidounces of water; moisten the Guaiac with this solution; pack it in a percolator and gradually pour on the remainder of the solution; when this ceases dropping, add sufficient water to make the percolate measure eight fluidounces; add the sugar and dissolve.

GUARANA. *U.S.* *Guarana.**

(GUẠ-RĀ'NẠ.)

"A dried paste prepared from the crushed or ground seeds of Paullinia Sorbilis. Martius. (*Nat. Ord.* Sapindaceæ.)" *U.S.*

Paullinia, Brazilian Cocoa, Guarana Bread; Pao de Guarana, *Indian;* Pasta Guarana, *P.G.;* Guarana, *Fr.*, *G.*

Gen. Ch. *Capsule* pyriform, septicidal. *Stem* climbing. *Leaves* compound. *Bentham and Hooker.*

There are described of the genus Paullinia 80 species, all of them confined in their geographical range to Eastern South America, except one, which has strayed to Western Africa. The name of the genus was given in honor of Christ. Fred. Paullini, a German medico-botanical writer, who died in 1712.

P. Sorbilis. Martius, *Reise in Brasil*, vol. iii. p. 1098; *B. & T.* 67.—*Guarana üva.* This woody climber grows in the northern and western provinces of Brazil, ripening its seeds in October and November. The leaves are alternate, on long stalks, impari-pinnate, with five oblong oval, coarsely irregularly sinuate-dentate leaflets, five to six inches long by two to three broad, contracted into a shortly attenuated blunt point. The flowers are arranged in axillary, spicate panicles, four inches or more in length. The fruit is about the size of a grape, ovoid or pyriform, on a short peduncle, with a short strong beak, glabrous, with six longitudinal ribs. The three-valved pericarp is thin, tough, and strongly hairy within. Another species, the *P. Cupana*, growing on the banks of the Orinoco River, is said also to be used in making guarana. (*Ann. de Thérap.*, 1858, p. 70.)

Preparation and Properties. The seeds, which look like small horse-chestnuts, are contained in a three-celled, three-valved, coriaceous capsule, are lenticular and almost thorny, and invested with a flesh-colored arillus, which is easily separable when dry. From them the drug is prepared by powdering them in a mortar, or upon a chocolate-stone previously heated, mixing the powder with a little water, exposing it for some time to the dew, then kneading it into a paste, mixing with this some of the seeds either whole or merely bruised, and finally forming the mixture into cylindrical or globular masses, which are dried and hardened in the sun, or by the smoke of a fire. These masses are of a reddish brown color, rugose on the surface, very hard, with an irregular fracture, and of a marbled appearance when broken, due to the fragments of the seeds and their black testa imbedded in the mass. Paullinia is of a somewhat astringent and bitterish taste, and, in this as well as in its odor, bears some resemblance to chocolate, though not oleaginous. It swells up and softens in water, which partially dissolves it. Martius found in it a crystallizable principle, which he named *guaranine*, but which has been proved by MM. Berthemot and Dechastelus to be identical with *caffeine.* Alexander Bennett, in an elaborate series of physiological experiments, has confirmed this identity. The discovery of caffeine in plants belonging to distinct natural families, namely, the coffee and tea plants, the Paraguay tea, and the Paullinia, is a highly interesting result of recent chemical investigations. It is said to be more abundant in the Paullinia than in either of the other vegetables; 5·07 per cent. having been found by Dr. Stenhouse in Paullinia, while he got only 2·13 from good black tea, 1·00 per cent. from coffee, and 1·2 from Paraguay tea. (*P. J. Tr.*, xvi. 213.) According to Berthemot and Dechastelus, it exists in the seeds united with tannic acid, with which it appears to form two compounds, one crystallizable and soluble in water, the other of a resinoid appearance and insoluble. Besides these ingredients, the seeds contain free tannic acid, gum, albumen, starch, and a greenish fixed oil. (*Journ. de Pharm.*, xxvi. 514.) For a method of preparing guaranine, see *Journ. de Pharm.*, 4e sér., xviii. 224. Dr. F. V. Greene, U. S. N., prefers a process for obtaining caffeine from guarana similar to one proposed by Prof. Wayne for its extraction from tea and coffee. The details of the method are as follows. The powdered guarana is intimately mixed with three times its weight of finely divided litharge, and the mixture boiled in distilled water, until, on allowing the temperature to fall below the boiling point, the insoluble portion is found to subside rapidly, leaving the supernatant liquid clear, and without color. When cool, the clear liquid is filtered, and the precipitate is transferred to the filter and washed with boiling water, the washing to be continued as long as yellowish precipitates are produced with either phosphomolybdic acid solution, auric or platinic chloride. A stream of sulphuretted hydrogen gas is now passed through the filtrate, and the sulphide of lead thus formed separated by filtration. The solution is evaporated on a water-bath to expel the excess of sulphuretted hydrogen, filtered to remove a trace of sulphur, finally evaporated to the crystallizing point, and the caffeine, which crystallizes out on cooling, removed from the mother-liquor and pressed between folds of bibulous paper. After being thus treated, the crystals will be found to be perfectly white. Dr. F. V. Greene has shown that the tannic acid from guarana has different properties from that found in other plants, and proposes to call it *paullinitannic acid.* (*A. J. P.*, 1877, p. 390.) M. Fournier has found in paullinia, besides tannate of caffeine, the following principles: gum, starch, an acrid green fixed oil, a concrete volatile oil, an aromatic liquid volatile oil soluble in water with a little alcohol, another liquid volatile oil scarcely soluble in water, a peculiar principle not precisely determined, and tannic acid. (*Ibid.*, Avril, 1861, p. 291.)

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* It is said to have been by mistake that *Paullinia* and *guarana* have been considered identical; the former term being applicable exclusively to the product of the two species of Paullinia above referred to, while the latter belongs properly to a preparation made by the aborigines, belonging to the tribe Guaranas, whence its name. This second substance contains the seeds of the Paullinia, but is a mixture of various substances, among them chocolate and farina, the precise composition of which is most carefully kept secret by the natives. (*Ann. de Thérap.*, 1858, p. 70.)

Medical Properties and Uses. The effects of guarana upon the system are chiefly those of its alkaloid, although it contains enough tannin to have an appreciable influence. It is habitually employed by the Indians, either mixed with articles of diet, as with cassava or chocolate, or in the form of drink, prepared by scraping it, and suspending the powder in sweetened water, precisely as other nations use teas, coffees, etc. It is also considered by the Indians useful in the prevention and cure of bowel complaints. Dr. Gavrelle, who was formerly physician to Dom Pedro, in Brazil, and there became acquainted with the virtues of this medicine, called the attention of the profession to it some years since in France. He had found it advantageous in the diarrhœa of phthisis, sick headache, paralysis, tedious convalescence, and generally as a tonic. It has since been employed in various affections, but is now chiefly used in migraine or nervous sick headaches, administered when the attack is developing. It may be given in substance, in the quantity of one or two drachms (3·9–7·8 Gm.), rubbed into powder and mixed with sweetened water; but the fluid extract may be substituted in equivalent doses.

Off. Prep. Extractum Guaranæ Fluidum, *U. S.*

GUTTA-PERCHA. *U. S.* *Gutta-Percha.*

(GŬT′TA̤ PĔR′CHA̤.)

"The concrete exudation of Isonandra Gutta. Hooker. (*Nat. Ord.* Sapotaceæ.)" *U. S.*

Gutta-Percha Depurata, *P.G.;* Gutta-Taban; Gutta-Percha, *Fr.*, *G.*

This valuable product of the East Indies was first brought into notice by Dr. Wm. Montgomerie, a British army surgeon, who became acquainted with its singular properties in the year 1842, at Singapore, and in the following year sent specimens of it to Europe. It is the product of a large tree growing in the southern extremity of the Malayan Peninsula, the islands of Singapore and Borneo, and probably many other islands in the neighborhood. *Isonandra gutta* is of considerable magnitude, with a trunk commonly three feet and sometimes as much as six feet in diameter, having numerous ascending branches, which are crowded with leaves at their extremities. The flowers are small and white; the leaves petiolate, oblong, four or five inches long by two in breadth, bright green above and brownish beneath.*

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* *Bulata.* Under the name of *bulata*, the product of *Sapota Mulleri*, a tree growing in great abundance in Dutch Guiana in South America, has recently attracted considerable attention, having been imported into England from Demerara. It is said to have properties which will render it, in some instances, a useful substitute for gutta-percha, which it resembles in elasticity and exceeds in ductility, while requiring a much higher heat to soften. Its solubilities in various menstrua do not seem to have been determined; but they are probably analogous to those of gutta-percha and

Dr. Montgomerie states that the natives procure the gutta-percha by the very wasteful mode of cutting down the tree, stripping off the bark, and then collecting the milky juice, which is put into convenient recipients, and coagulates on exposure to the air. Twenty or thirty pounds are thus collected from each tree; but the probability is that the product would be much greater if obtained by tapping the tree, and thus preserving it for future use. In consequence of the abundance in which it is collected, and the wasteful methods pursued, fears are entertained that the tree will before long be extirpated. Large quantities of gutta-percha are now imported into Europe and this country. As found in commerce it is generally impure, containing fragments of vegetable matter and earth. From these it may be freed by kneading it in hot water, or by melting it with oil of turpentine, straining, and evaporating. It may also be purified by means of chloroform. One part of gutta-percha cut into small pieces, put into a flask with 20 parts of chloroform, and frequently shaken, will be fully dissolved in two or three days. To this solution, which cannot be readily filtered, add one-fourth of a part of water, shaking the mixture, and then allowing it to rest for two weeks. The impurities rise or sink, and the clear intervening liquid yields pure gutta-percha by the distillation of the chloroform. (*Chem. Centralbl.*, Feb. 1857, p. 108.) A more satisfactory method is probably by dissolving one part of gutta-percha in twenty of boiling benzol, shaking the solution frequently with sulphate of calcium, which upon standing two or three days carries down with it the coloring matter, then decanting the clear liquid, and adding it, in small portions at a time, to alcohol, agitating continually. During this process the gutta-percha is deposited perfectly white. Thorough desiccation requires an exposure of several weeks, but it may be hastened by rubbing in a mortar. (*Journ. de Pharm.*, Août, 1863, p. 138.)*

Properties. Gutta-percha is of a dull white or whitish color, often with reddish brown streaks, of a feeble odor, tasteless, at ordinary temperatures hard and almost horny, somewhat flexible in thin pieces, having an unctuous feel under the fingers, and very tenacious. Its sp. gr. is 0·9791. (*Soubeiran.*) At about 49° C. (120° F.), it becomes softer and more flexible, but is still elastic, resisting, and tenacious. At 66° C. to 71° C. (150° F. to 160° F.), it is soft, very plastic, and capable of being welded and moulded into any form. It can be softened, either by means of hot water or by dry heat. On cooling it reassumes its former state, and retains any form which may have been given to it. In the softened state it is readily cut with a knife, though with some difficulty when cold. Exposed to a heat of 166° C. (330° F.), it loses a portion of water, and on hardening becomes translucent and gray; but it recovers its original characters if immersed in water. Subjected to igneous distillation, it yields volatile products, resembling closely the volatile oil obtained from caoutchouc by the same process. Heated in an open vessel, it melts, foams up, and takes fire, burning with a brilliant flame and smoke. A portion thus melted retains the state of a viscid fluid on cooling. Gutta-percha is a non-conductor of electricity. It is insoluble in water, alcohol, alkaline solutions, and the weak acids. Ether and the volatile oils soften it in the cold, and imperfectly dissolve it with the

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caoutchouc. It is the concrete juice of the *Sapota Mulleri*, or *bullet tree.* The idea is entertained that it may serve as a good insulating material for submarine telegraphic wires. Another possible substitute for gutta-percha has been found in the concrete juice of an *Apocynea* growing in Ceylon, named *Alstonia scholaris.* (*P. J. Tr.*, 2d ser., vi. 490. See also *Caoutchouc*, Part II.)

* *Pure white gutta-percha.* For dental purposes, as for filling carious hollows, it is desirable that gutta-percha should be purified, and rendered perfectly white. But what is sold as such in the market is said to consist largely of the white oxide of zinc, and is on this account badly adapted to the purpose intended. Mr. F. Baden Benger recommends the following method of purification for dentists' use. He states that good crude gutta-percha will yield at least 75 per cent. of the purified. Four ounces of the gutta-percha, in small pieces, are to be digested for a few days with five pounds of methylated chloroform; and the solution thus formed should be filtered in such a way as to permit little or no loss of chloroform. To the liquid thus filtered, which should be nearly colorless, an equal bulk of alcohol should be added, or a sufficiency to precipitate the gutta-percha, which will separate as a white mass. This is to be washed with alcohol, pressed in a cloth, and dried by exposure to the air. In this state, the gutta-percha is perfectly white, but too porous for use. To give it the proper consistence, it should be boiled for half an hour in a porcelain capsule, and rolled into cylinders while hot. The dentist can prepare this himself with sufficient economy, if he guard against the loss of chloroform. This may be separated from alcohol by washing with water, and the alcohol from the water by distillation. (*P. J. Tr.*, Sept. 1868, p. 160.)

aid of heat. Oil of turpentine dissolves it perfectly, forming a clear colorless solution, which yields it unchanged by evaporation. It is also dissolved by bisulphide of carbon, chloroform, and benzol and benzin. According to Soubeiran, it contains, besides pure gutta-percha, small portions of a vegetable acid, casein, and two resins, one soluble in ether and oil of turpentine, the other in alcohol. (*Journ. de Pharm.*, 3e sér., xi. 22.) Freed from these impurities, it has an ultimate composition closely analogous to if not identical with that of caoutchouc. For a particular account of the distinctive properties of pure gutta-percha, and the two resins mixed with it, the reader is referred to an article by M. Payen, in the *Journ. de Pharm.* (3e sér., xxii. 183), also in the *Chem. Gaz.* (x. 353). According to Baumhauer, pure gutta-percha, as it issues from the tree, is a hydrocarbon, with the formula $C_{10}H_{16}$, which he calls *gutta*, and by the oxidation of which, in various degrees, the different bodies constituting gutta-percha are produced. This hydrocarbon can be separated by treating gutta-percha with dilute hydrochloric acid, and boiling the residue with ether, which deposits the gutta on cooling; but the ethereal treatment must be frequently repeated to obtain it quite pure. (*Journ. für prakt. Chem.*, lxxviii. 279.) M. Arppe considers gutta-percha as a mixture of six different resins, which may have been formed from a hydrocarbon, $C_{10}H_{16}$. (See *Chem. Gaz.*, ix. 471.) Oudemans (*Jahresber.*, 1859, p. 517) finds two resinous products in gutta-percha: *fluavil*, fusing at 42° C., with the formula $C_{20}H_{32}O$, and soluble in cold alcohol, and *alban*, fusing at 140° C., with the formula $C_{10}H_{16}O$, and soluble in chloroform, bisulphide of carbon, and ether, from which last it crystallizes out on cooling. Gutta-percha resists putrefaction strongly; but in certain situations, as when employed to protect underground telegraph wires passing near the roots of the oak, it has been observed to undergo speedy decomposition, in consequence, as is supposed, of the action of fungi. (*P. J. Tr.*, xvii. 193.)

Gutta-percha has been applied to many useful and ornamental purposes. Its plasticity when moderately heated, great firmness and tenacity at ordinary temperatures, and insolubility in water and alcohol are the properties to which it chiefly owes its value. By immersing it in hot water, it is made susceptible of being formed into any desirable shape; so that utensils of various kinds, ornamental impressions, casts, sheets, bands, cords, sticks, tubes, etc., applicable to numerous purposes in the arts, may be made from it with great facility. To give it greater pliability, it is sometimes mixed with the tar resulting from the igneous decomposition of caoutchouc, or with its own tar and lampblack. It may be vulcanized in the same manner as caoutchouc, and undergoes a similar change of properties. (See *Caoutchouc.*) In the dissolved state it may be employed as a varnish, impervious to moisture.

Medical Uses. Gutta-percha has been introduced into surgery, in order to preserve limbs and joints in fixed positions, and has been used beneficially in club-foot, fractures, and diseases of the joints. It is employed for these purposes in the shape of bands, two or three inches broad and about a line thick, which, being softened in water, are applied in this state, and, when they harden, form a firm case for the limb. Holes should be made through the bands, for the escape of the vapor from the surface. It may in some cases be applied by moulding it, in its soft state, upon the part to be kept at rest, as to the hip and adjacent parts of the body and thigh, in cases of hip-joint disease, for which, when dried, it will form a support equal to the most accurately carved wooden splint. It is also used for the formation of catheters and other tubes, splints, stethoscopes, bougies, specula, pessaries, and various other instruments useful in surgery. In fractures it is much used as a splint; sometimes, after softening by immersion in warm water at the time, it is applied as a bandage without difficulty, and, hardening afterwards, acts as a splint to the injured limb. The officinal Liquor Gutta-Perchæ affords a liquid which, when applied by means of a camel's-hair pencil, forms, on the evaporation of the solvent, a thin, elastic covering, which completely excludes the air, and acts like an artificial cuticle to the part. Another application of gutta-percha is to serve as a vehicle of certain caustic substances, particularly chloride of zinc, and caustic potassa. The preparation is made by reducing the caustic substance to fine powder, and then thoroughly mixing it with its weight of gutta-percha, melted at the lowest possible temperature. (See

Potassa, and *Zinci Chloridum.*) A great advantage of the preparation is that it may be made into any desirable form, and will retain that form when applied.

Off. Prep. Liquor Gutta-Perchæ, *U. S.*

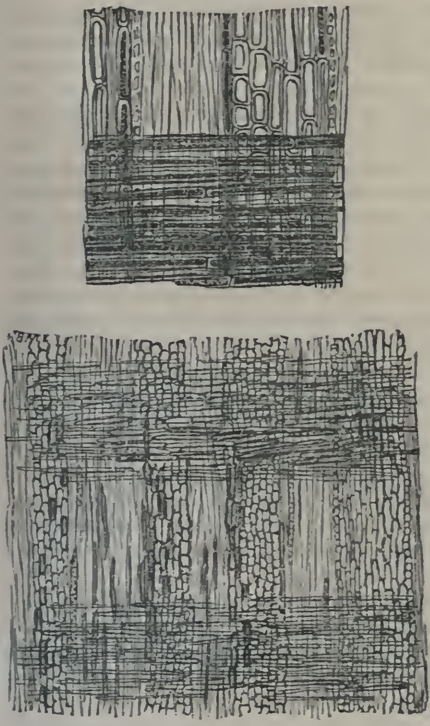
HÆMATOXYLON. *U. S.* *Hæmatoxylon.* [*Logwood.*]

(HÆ-MA-TŎX′Y-LŎN.)

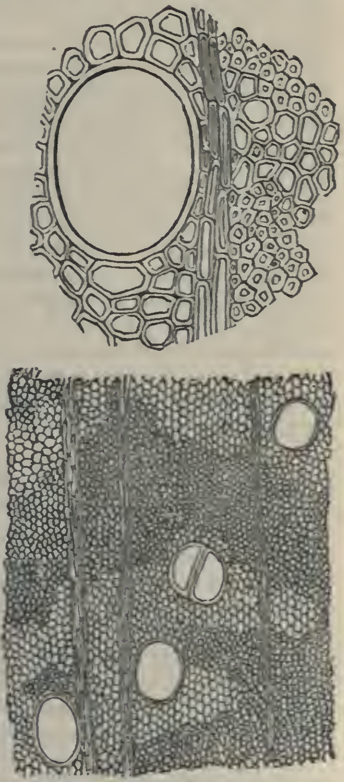
"The heart-wood of Hæmatoxylon Campechianum. Linné. (*Nat. Ord.* Leguminosæ, Papilionaceæ.)" *U. S.* "The sliced heart-wood of Hæmatoxylum Campechianum." *Br.*

Hæmatoxyli Lignum, *Br.;* Lignum Campechianum, *P.G.;* Lignum Cœruleum; Bois d'Inde, Bois de Sang, Bois de Campêche, *Fr.;* Blauholz, Campecheholz, Blutholz, Kampeschenholz, *G.;* Legno di Campeggio, *It.;* Palo de Campeche, *Sp.*

Gen. Ch. *Calyx* five-parted. *Petals* five. *Capsule* lanceolate, one-celled, two-valved, with the valves boat-form. *Willd.*



Hæmatoxylon, longitudinal section, as seen under high and low powers.



Hæmatoxylon, transverse section, as seen under high and low powers.

Hæmatoxylon Campechianum. Willd. *Sp. Plant.* ii. 547; Woodv. *Med. Bot.* p. 455, t. 163; Carson, *Illust. of Med. Bot.* i. 33, pl. 25. This is a tree of middle size, usually not more than twenty-four feet high, though, under favorable circumstances, it sometimes rises forty or fifty feet. The trunk, seldom exceeding twenty inches in diameter, is often very crooked, and is covered with a dark rough bark. The branches are also crooked, with numerous smaller ramifications, which are beset with sharp spines. The sap-wood is yellowish, but the interior layers are of a deep red color. The leaves are alternate, abruptly pinnate, and composed of three or four pairs of sessile, nearly obcordate, obliquely nerved leaflets. The flowers, which are in axillary spikes or racemes near the ends of the branches, have a brownish purple calyx and lemon-yellow petals. They exhale an agreeable odor, said to resemble that of the jonquil.

The tree is a native of Campeachy, the shores of Honduras Bay, and other parts of tropical America, and has become naturalized in Jamaica. The wood, which is the part used in medicine, is a valuable article of commerce, and largely employed in dyeing. It comes to us in logs deprived of the sap-wood, and having a blackish brown color externally. For medical use it is cut into chips, or rasped into coarse powder, and in these states it is kept in the shops.

Properties. Logwood is hard, compact, heavy, of a deep red color, becoming purplish black by exposure, internally brown-red, and marked with irregular, concentric circles, splitting irregularly, of a slight peculiar odor, and a sweet, somewhat astringent taste. Logwood is generally kept in the shops in small chips or coarse powder of a dark brown-red color, often with a greenish lustre. When chewed it colors the saliva dark pink. It imparts its color to water and to alcohol. The infusion made with cold water, though red, is less so than that with boiling water. It affords precipitates with sulphuric, nitric, hydrochloric, and acetic acids, alum, sulphate of copper, acetate of lead, and sulphate of iron, striking a bluish black color with the last-mentioned salt. (*Thompson's Dispensatory.*) Precipitates are also produced with it by lime-water and gelatin. Chevreul found in logwood a volatile oil, an oleaginous or resinous matter, a brown substance the solution of which is precipitated by gelatin (*tannin*), another brown substance soluble in alcohol but insoluble in water or ether, a nitrogenous substance resembling gluten, free acetic acid, various salts, and a peculiar principle, called *hæmatoxylin* or *hématin*, on which the coloring properties of the wood depend. This is obtained by digesting the aqueous extract in alcohol, evaporating the tincture till it thickens, then adding a little water, and submitting the liquid to a new but gentle evaporation. Upon allowing it to rest, hæmatoxylin is deposited in crystals, which may be purified by washing with alcohol and drying. Thus procured, the crystals are shining, of a yellowish rose color, bitterish, acrid, and slightly astringent to the taste, readily soluble in boiling water, forming an orange-red solution which becomes yellow on cooling, and soluble also in alcohol and ether. According to Erdmann, who obtained hæmatoxylin by the process of Chevreul, substituting ether for alcohol, its crystals, when quite pure, are colorless, without a tinge of redness; its taste is sweet, like that of liquorice, without bitterness or astringency; and it is not of itself a coloring substance, but affords beautiful red, blue, and purple colors, by the joint action of an alkaline base and the oxygen of the air. He obtained from logwood 9 to 12 per cent. of crystallized hæmatoxylin, to which he gave the formula $C_{16}H_{14}O_6$. It crystallizes with 1 or with 3 molecules of water, and is readily soluble in hot water or alcohol, but sparingly in cold water or in ether. (*Journ. für pr. Chem.*, 36, p. 205.)

By the combined action of ammonia and oxygen dark violet crystalline scales of *hæmatëin*, $C_{16}H_{12}O_6 + 3H_2O$, are produced. They show a fine green hue, which is also very commonly observable on the surface of the logwood chips of commerce. Hæmatein may again be transformed into hæmatoxylin by means of hydrogen or of sulphurous acid. Commercial extract of logwood extracted from the wood by boiling water contains both hæmatoxylin and hæmatein.

Medical Properties and Uses. Logwood is a mild astringent, devoid of irritating properties, and well adapted to the treatment of that relaxed condition of bowels which is apt to succeed cholera infantum. It is also occasionally used with advantage in ordinary chronic diarrhœa and chronic dysentery. It may be given in decoction or extract.

Off. Prep. Extractum Hæmatoxyli.

HAMAMELIS. *U. S.* *Hamamelis.* [*Witchhazel.*]

(HĂM-Ạ-MĒ'LĬS.)

"The fresh leaves of Hamamelis virginica, Linné (*Nat. Ord.* Hamamelaceæ), collected in autumn." *U. S.*

Gen. Ch. Flowers in little axillary clusters or heads, usually surrounded by a scale-like three-leaved involucre. *Calyx* four-parted, and with two or three bractlets at its base. *Petals* four, strap-shaped, long and narrow, spirally involute in the bud. *Stamens* eight, very short; the four alternate with the petals anther-bearing, the others imperfect and scale-like. *Styles* two, short. *Pod* opening loculicidally from the top. *Gray's Manual.*

H. Virginica. L. *Witch-hazel* is an indigenous shrub, from five to fifteen feet high, growing in almost all sections of the United States, usually on hills or in stony places, and often on the banks of streams. It is the only species of the genus found in Eastern North America, and is specifically characterized by its leaves being obovate or oval, wavy-toothed, and somewhat downy when young. The seeds are black and shining externally, white, oily, and farinaceous within, and edible like the hazelnut. It is remarkable for the late appearance of its yellow flowers, which expand in September or October, and continue till the weather becomes very cold in winter. The fruit, which is a nut-like capsule not unlike the hazelnut, ripens in the following autumn, and is often mingled on the same plant with the new blossoms.

Properties. The leaves of the witchhazel are officinally described as "short-petiolate, about four inches (10 cm.) long, obovate or oval, slightly heart-shaped and oblique at the base, sinuate-toothed, nearly smooth; inodorous; taste astringent and bitter." *U. S.* The bark, which is sometimes used, has a bitter, astringent, somewhat sweetish, and pungent taste.

Medical Properties. The bark of the witchhazel is said to have first attracted notice as a remedy of the Indians, who are said to have used it as a sedative and discutient in painful tumors, and in other cases of external inflammation. It is used in the shape of poultice, or as a wash in the form of decoction, in hemorrhoidal affections and ophthalmia. It has been highly recommended by Dr. James Fountain and N. S. Davis (*N. Y. Journ. Med.*, x. 208; *Trans. Am. Med. Assoc.*, i. 350) in hemorrhage of the lungs and stomach. Dr. Fountain also commends, as one of the best applications in external piles, an ointment prepared from lard and a decoction of equal parts of this bark, white-oak bark, and that of the apple-tree, and believes the witchhazel to possess anodyne properties. The leaves are said to possess similar properties, and, in the state of infusion, to be given internally in bowel complaints and hemórrhages. They have probably been introduced into the Pharmacopœia on account of the enormous sale of a much-vaunted proprietary medicine, said to be made by distilling the bark with very dilute alcohol (6 per cent.), which has been used externally as a remedy for sprains and bruises, and internally in most diseases to which flesh is heir. The pecuniary success of the remedy probably is in no wise dependent upon any virtues of the witchhazel, of the nature of whose medical properties we have no certain knowledge. The dose of the officinal fluid extract is one to two teaspoonfuls (3·75 to 7·5 C.c.).

Off. Prep. Extractum Hamamelidis Fluidum. *U. S.*

HEDEOMA. *U. S.* *Hedeoma.* [*Pennyroyal.*]

(HĔD-Ẹ-Ō′MẠ.)

"The leaves and tops of Hedeoma pulegioides. Persoon. (*Nat. Ord.* Labiatæ.)" *U. S.*

Herbe de Pouliot américaine, *Fr.;* Amerikanischer Poley, *G.*

This herb, first attached to the genus *Melissa*, and afterwards to *Cunila*, is at present universally considered by botanists as belonging to the *Hedeoma* of Persoon. It has been confounded by some with *Mentha Pulegium*, or European pennyroyal.

Gen. Ch. Calyx bilabiate, gibbous at the base, upper lip three-toothed, lower two; dentures all subulate. *Corolla* ringent. *Stamens* two, sterile; the two fertile stamens about the length of the corolla. *Nuttall.*

Hedeoma pulegioides. Barton, *Med. Bot.* ii. 165.—*Cunila pulegioides.* Willd *Sp. Plant.* i. 122. This is an indigenous annual plant, from nine to fifteen inches high, with a small, branching, fibrous, yellowish root, and a pubescent, quadrangular stem, which sends off numerous slender erect branches. The leaves are opposite, having short petioles, about half an inch long, oblong-lanceolate or oval, nearly acute, attenuated at the base, remotely serrate, rough or pubescent, and prominently veined and glandular on the under surface. The flowers are very small, pale blue, supported on short peduncles, and arranged in axillary whorls along the whole length of the branches. They have a tubular-ovoid, two-lipped and five-toothed calyx, and a pale blue, spotted, two-lipped corolla, containing two sterile and two fertile exserted stamens. The plant is common in all parts of the United States, preferring dry grounds, and, where abundant, scenting the air for a considerable distance with its grateful odor. Both in the recent and dried state it has a pleasant aromatic smell, and a warm, pungent, mint-like taste. It readily imparts its virtues to boiling water. The volatile oil upon which they depend may be separated by distillation, and employed instead of the herb itself.

Medical Properties and Uses. Pennyroyal is a gently stimulant aromatic, and may be given in flatulent colic and sick stomach, or to qualify the action of other medicines. Like most of the aromatic herbs, it possesses the property, when administered in warm infusion, of promoting perspiration, and of exciting the menstrual flux when the system is predisposed to the effort. A large draught of the warm tea is in popular practice often given at bedtime, in recent cases of suppression of the menses, the feet having been previously bathed in warm water.

Off. Prep. Oleum Hedeomæ, *U. S.*

HEMIDESMI RADIX. *Br.* *Hemidesmus Root.* *Indian Sarsaparilla.*

(HĔM-Ị-DĔŞ′MĪ RĀ′DĬX.)

"The dried root of Hemidesmus indicus. D. C. Imported from India." *Br.* (*Nat. Ord.* Asclepiadaceæ.)

Nunnari, *E.;* Racine de Hemidesmus, *Fr.;* Hemidesmus-Wurzel, *G.*

Gen. Ch. *Corolla* rotate. *Filaments* connate at the base, not united above, inserted into the tube of the corolla. *Anthers* cohering separate from the stigma, with twenty pollen-masses. *Stigma* flattish, pointless.

Hemidesmus Indicus. R. Brown, *Hort. Kew.* ii. 75; Lindley, *Flor. Med.* p. 543.—*Periploca Indica.* Willd. *Sp. Plant.* i. 1251. This is a climbing plant, with twining, woody, slender stems, and opposite petiolate leaves, which are entire, smooth, shining, and of a firm consistence. The leaves vary much in size and shape, some being linear and acute, others broad-lanceolate, and others again oval or ovate. The flowers are small, green on the outside, purple within, and disposed in axillary racemes. The calyx is five-parted, with acute divisions; the corolla flat, with oblong, pointed divisions. The fruit consists of two long, slender, spreading follicles.

This plant is common over the whole peninsula of Hindostan. The officinal portion is the root, which has long been used in India as a substitute for sarsaparilla. It is long, slender, tortuous, cylindrical, and little branched, consisting of a ligneous centre, and a brownish, corky bark, marked with longitudinal furrows and transverse fissures. The microscopic characters of this root are curious and of much interest to the structural botanist. (See *P. J. Tr.*, 1872, p. 62.) It has an aromatic odor and bitter taste. Mr. Garden obtained from it a peculiar volatilizable acid principle, which he named *smilasperic acid*, under the erroneous impression that the root was derived from *Smilax aspera.* Pereira proposed to call it *hemidesmic acid.* Scott (*Chem. Gazette*, 1843, p. 378) also obtained a stearopten by distillation with water, presumably the same material. It has not been further investigated.

Medical Properties and Uses. Indian sarsaparilla is said to be tonic, diuretic, and alterative. It was introduced into Great Britain from India, and was employed for some time under the name of *smilax aspera.* It is used for the same purposes as sarsaparilla. In some instances it is said to have proved successful in syphilis when that medicine had failed; but it cannot be relied on. The native practitioners in India are said to employ it in nephritic complaints, and in the sore mouth of children. It is used in the form of infusion or decoction, made in the proportion of two ounces of the root to a pint of water. A pint may be given in wineglassful doses, in the course of the day. A syrup is directed in the British Pharmacopœia. (See *Syrupus Hemidesmi.*)

Off. Prep. Syrupus Hemidesmi, *Br.*

HIRUDO. *Br* *The Leech.*

(HỊ-RÛ′DŌ.)

"Sanguisuga medicinalis, the *Speckled Leech;* and S. officinalis, the *Green Leech.*" *Br.*

Hirudines, *P.G.;* Sangsue, *Fr.;* Blutegel, *G.;* Mignátta, *It.;* Sanguijuela, *Sp.*

HIRUDO. *Class* 1, Annelides. *Order* 3, Abranchiatæ. *Family* 2, Asetigeræ. *Cuvier.*

The leech belongs to that class of invertebrated articulated animals called *Annelides.* This class contains the worms with red blood, having soft retractile bodies composed of numerous segments or rings, breathing generally by means of branchiæ, with a nervous system consisting in a double knotted cord, destitute of feet, and supplying their place by the contractile power of their segments or rings. The third order of this class—*Abranchiatæ*—comprehends those worms which have no apparent external organ of respiration. This order is again divided into two families, to the second of which—the *Asetigeræ,* or those not having setæ to enable them to crawl—the leech belongs.

It is an aquatic worm with a flattened body, tapering towards each end, and terminating in circular flattened disks, the hinder one being the larger of the two. It swims with a vertical undulating motion, and moves when out of the water by means of these disks or suckers, fastening itself first by one and then by the other, and alternately stretching out and contracting its body. The mouth is placed in the centre of the anterior disk, and is furnished with three cartilaginous lens-shaped jaws at the entrance of the alimentary canal. These jaws are lined at their edges with fine sharp teeth, and meet so as to make a triangular incision in the flesh. The head is furnished with small raised points, supposed by some to be eyes. Respiration is carried on through small apertures ranged along the inferior surface. The nervous system consists of a cord extending the whole length, furnished with numerous ganglions. The intestinal canal is straight, and terminates in the anus, near the posterior disk. Although hermaphrodite, leeches mutually impregnate each other. They are oviparous; and the eggs, varying from six to fifteen, are contained in a sort of spongy, slimy cocoon, from half an inch to an inch in diameter. These are deposited near the edge of the water, and hatched by the heat of the sun. The leech is torpid during the winter, and casts off from time to time a thick slimy coating from its skin. It can live a considerable time in sphagnous moss, or in moistened earth, and is frequently transported in this manner to great distances.

Savigny has divided the genus Hirudo of Linnæus into several genera. The true leech is the Sanguisuga of this author, and is characterized by its three lenticular jaws, each armed with two rows of teeth, and by having ten ocular points. Several species are used for medical purposes, of which the most common are the gray and the green leech of Europe, both of which are varieties of the *Hirudo medicinalis* of Linnæus; and the *Hirudo decora* of this country.

1. *Hirudo medicinalis.* Linn. *Ed. Gmel.* i. 3095.—*Sanguisuga officinalis.* Savigny, *Mon. Hir.* p. 112, t. 5, f. 1. *The green leech.* — *Sanguisuga medicinalis.* Savigny, *Mon. Hir.* p. 114, t. 5, f. 2. *The gray leech.* Many of the best zoologists regard the *Sanguisuga officinalis* and *S. medicinalis* of Savigny as mere varieties. They are both marked with six longitudinal dorsal ferruginous stripes, the four lateral ones being interrupted or tessellated with black spots. The color of the black varies from a blackish to a grayish green. The belly in the first variety is of a yellowish green color, free from spots, and bordered with longitudinal black stripes. In the second it is of a green color, bordered and maculated with black. This leech varies from two to four inches in length. It inhabits marshes and running streams, and is abundant throughout Europe.*

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* A variety of the leech has come into use in Europe, called in commerce *African leeches.* They are of a beautiful light green color, varying to a deep green, and often inclining to red, with black points on the back, and broad streaks of a bright orange yellow, which are black towards the abdomen. They correspond perfectly with the *Sanguisuga interrupta* of Moquin-Tandon. These leeches draw very well. (*P. J. Tr.*, x. 38.) The leeches from Algiers, called in French commerce *dragons* (*Sanguisuga troctena* of Moquin-Tandon), of which considerable numbers have been taken

The great use made of leeches in the modern practice of medicine has occasioned them to become a considerable article of commerce. They are collected in Spain, France, Italy, Germany, and Sweden, and carried in large numbers to London and Paris. They are also frequently brought to this country; as the practitioners in some of our large cities use only the foreign leech, although our own waters furnish an inexhaustible supply of this useful worm.*

2. *Hirudo decora.* Say, *Colonel Long's Second Expedition*, ii. 268. The medicinal leech of America has been described by Say under the name of *Hirudo decora*, in the Appendix to the Second Expedition of Colonel Long. Its back is of a deep pistachio-green color, with three longitudinal rows of square spots. These spots are placed on every fifth ring, and are twenty-two in number. The lateral rows of spots are black, and the middle range, of a light brownish orange color. The belly is of the latter color, variously and irregularly spotted with black. The American leech sometimes attains the length of four or five inches, although its usual length is from two to three. It does not make so large and deep an incision as the European leech, and draws less blood.

The indigenous leech is much used in the city of Philadelphia. The practitioners of New York and Boston are supplied chiefly from abroad. The leeches employed in Philadelphia are generally brought from Bucks and Berks Counties, in Pennsylvania, and occasionally from other parts of the State.

The proper preservation of leeches is an object of importance to the practitioner, as they are liable to a great and sudden mortality. They are usually kept in jars, in clear, soft water, which should be changed twice a week in winter, and every other day in summer. The jar must be covered with a linen cloth, and placed in a situation not liable to sudden changes of temperature. They will live a long time and continue active and healthy, without any other attention than that of frequently changing the water in which they are kept. M. Derheims has proposed the following excellent method of preserving them. In the bottom of a large basin or trough of marble he places a bed, six or seven inches deep, of a mixture of moss, turf, and fragments of wood. He strews pebbles above, so as to retain them in their place without compressing them too much, or preventing the water from freely penetrating them. At one end of the trough, and about midway of its height, is placed a thin slab of marble or earthenware, pierced with numerous holes, and covered with a bed of moss, which is compressed by a thick layer of pebbles. The reservoir being thus disposed is half filled with water, so that the moss and pebbles on the shelf shall be kept constantly moist. The basin is protected from the light by a linen cover stretched over it. By this arrangement the natural habits of the leech are not counteracted. One of these habits, essential to its health, is that of drawing itself through the moss and roots to clear its body from the slimy coat which forms on its skin and is a principal cause of its disease and death. Mr. James Banes recommends that, when kept in jars, they should be cleansed by means of a whisk of very fine broom

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to France, are said by M. A. de Quatrefages, contrary to former opinion, to be quite equal to the European. (*Journ. de Pharm.*, 3e sér., xxxiii. 105.) It is stated (*P. J. Tr.*, June, 1867, p. 735) that great numbers of leeches are collected in Australia, and sent to Melbourne, whence a large proportion are exported to Europe and America, chiefly to London and Paris in the former continent, and San Francisco, Panama, and New York in the latter. It is estimated that two or three millions annually pass through the hands of the Murray River Fishing Company. The leech is said (*Ibid.*, March, 1865, p. 481) to abound in almost every river and lagoon in Australia, and to differ from the ordinary English leech only, that the olive streaks are much lighter in the former. They are collected by throwing into the water a fresh sheep-skin, to which they attach themselves. They bear transportation wonderfully well. In Hindostan and the island of Ceylon, where the varieties of leeches are said to be more numerous than in any other part of the world, it is stated by Mr. P. L. Simmonds, that the propagation of the kind used in medicine is carefully kept secret. (*P. J. Tr.*, Dec. 1870, p. 522.)

* Attempts have been made, in France, on a large scale, to propagate leeches for sale. This is done by means of natural meadows, in which numerous small ponds are made, where the leeches, with certain cautions as to nourishment and preservation, multiply and grow so rapidly as to become a source of profit. In order that they may propagate, it is necessary that they should be fed on blood, which is given them either by causing animals, as horses, cows, etc., to be driven into the meadows, or by obtaining blood from slaughter-houses, and, after depriving it of fibrin by agitation, immersing the animals for a time in it while yet warm. (See *Journ. de Pharm.*, Jan. 1854, p. 5, and Mai, 1854, p. 336.)

or willow, when the water is changed. M. Lahache, an apothecary at Bruyères, strongly recommends the carrageen or Irish moss (*Chondrus crispus*), as admirably adapted to the habits and wants of the leech, furnishing the animal, as he supposes, with nutriment, as it does not die of inanition when thus kept. The water should be renewed in the jars daily. (*Journ. de Pharm. et de Chim.*, 4e sér., iii. 128.) Mr. Alfred Allchin keeps them in aquaria with growing water-plants and snails, which keep the water pure.* (*A. J. P.*, xxviii. 222.)

Medical Uses. Leeches afford the least painful and in many instances the most effectual means for the local abstraction of blood. They are often applicable to parts which, either from their situation or their great tenderness when inflamed, do not admit of the use of cups; and, in the cases of infants, are under all circumstances preferable to that instrument. They are indeed a powerful therapeutic agent, and give to the physician, in many instances, a control over disease which he could obtain in no other way. Their use is in great measure restricted to the treatment of local inflammation; and, as a general rule, they should not be resorted to until the force of the circulation has been diminished by bleeding from the arm, or in the natural progress of the complaint.

In applying leeches to the skin, care should be taken to shave off the hair, if there be any, and to have the part well cleansed with soap and water, and afterwards with pure water. If the leech do not bite readily, the skin should be moistened with a little blood, or milk and water. It is said to bite more freely if the skin is previously reddened by a sinapism, and then washed perfectly clean. Sometimes the leech is put into a large quill open at both ends, and applied with the head to the skin until it fastens itself, when the quill is withdrawn. If it be desirable that the leech shall bite in a particular spot, this end may be attained by cutting a small hole in a piece of blotting-paper, and then applying this moistened to the skin, so that the hole shall be immediately over the spot from which the blood is to be taken. Leeches continue to draw blood until they are gorged, when they drop off.† The quantity of blood which they draw varies with the part to which they are applied, and the degree of inflammation existing in it. From the loose and vascular textures they will abstract more than from those which are firm and compact, and more from an inflamed than from a healthy part. As a general rule, our leechers apply six for every fluidounce of blood. A single European leech will draw from half an ounce to an ounce. The quantity may often be much increased by bathing the wound with warm water. Leeches will continue to suck after their tails are cut off, which is sometimes done, although it is a barbarous practice.‡ It is said that they will draw better if put into cold beer, or diluted wine, and allowed to remain until they become very lively. They may be separated from the skin at any time by sprinkling a little salt upon them. After they drop off, the same application will make them disgorge the blood they have swallowed. Some leechers draw the leeches from the tail to the head through their fingers, and thus squeeze out the blood, after which all that is necessary is to put them in clean water, and change it frequently.§ Leeches which are gorged with blood should be kept in a vessel by themselves; as they are more subject to disease, and often occasion a great mortality among the others. They should not be again used until they have recovered their activity. In cases where the bleeding from leech-bites continues longer than is desirable, it may be stopped by continued pressure, with the application of lint, by the use of collodium, or by touching the wounds with lunar caustic. A little cotton, impregnated with a saturated solution of alum in boiling-hot water, and, after it has become sufficiently cool, but before the alum has begun to crystallize, pressed upon the wound, will often prove effectual. Another mode of repressing the hemorrhage is to press upon the bite a piece of thin caoutchouc, previously softened upon one side by heat, so as to become adhesive. If lunar caustic be applied, the stick must first be brought to a fine point, which is to be inserted in the wound. Some have even recommended the use of a fine wire made red hot. When the part wounded is without a bony basis, pressure may be made by pinching the wound between the fingers. It may sometimes be necessary, in the case of a deep bite, to sew the wound, which is readily done with a single stitch of the needle, that need not penetrate deeper than the cutis.*

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* For other methods of keeping leeches, also for raising them, see *U. S. D.*, 14th ed., p. 472.

† As a very efficient mode of applying leeches, it is recommended, after having moistened the skin with pure warm water, to put the leeches into a tumbler half full of cold water, and by an adroit movement invert it upon the part. The leeches are said to attach themselves so rapidly that it seems to the patient as though they made but a single bite. When they are all attached, the glass is to be carefully removed, the water being absorbed, as it runs off on one side, by a sponge or linen cloths.

‡ Under the name of *bdellatomy*, a practice has been introduced into Germany, of making a small incision in the side of the leech while drawing. The blood escapes through the wound, and the animal will continue to suck for a long time, so that one will perform the office of many in the quantity of blood taken.

§ MM. Soubeiran and Bouchardat, after numerous experiments upon the different modes of fitting the gorged leeches for use again, came to the conclusion that a carefully managed pressure is the best. Two conditions, however, are necessary to success; one that they should be disposed to disgorge the blood, and the other that they should be immersed in warm water previously to the stripping. The first object is effected by common salt. The following plan is recommended. The leeches are to be thrown into a solution of 16 parts of common salt in 100 of water, from which they are to be taken out one by one, and, being held by the tail, are to be dipped into water which feels hot to the hand, but yet can be borne by it, and then passed lightly between the fingers. Thus treated, they easily give up the blood. After being stripped, they should be placed in ves-

HORDEUM DECORTICATUM. *Br.* *Pearl Barley.*

(HÖR'DẸ-ŬM DẸ-CÖR-TỊ-CĀ'TŬM.)

"The husked seeds of Hordeum distichon." *Br.* (*Nat. Ord.* Graminaceæ.)

Hordeum, *U. S.* 1870; Hordeum Perlatum; Orge perlé, Orge, *Fr.;* Perlgerste, Perlgraupen, Gerstengraupen, *G.;* Orzo, *It.;* Cebada, *Sp.*

Gen. Ch. Calyx lateral, two-valved, one-flowered, three-fold. *Willd.*

Several species of Hordeum are cultivated in different parts of the world. The most common are *H. vulgare* and *H. distichon*, both of which have been introduced into the United States.

1. *Hordeum vulgare.* Willd. *Sp. Plant.* i. 472; Loudon's *Encyc. of Plants*, p. 73. The culm or stalk of common barley is from two to four feet in height, fistular, and furnished with alternate, sheathing, lanceolate, roughish, and pointed leaves. The flowers are all perfect, and arranged in a close terminal spike, the axis of which is dentate, and on each tooth supports three sessile flowers. The calyx or outer chaff has two valves. The corolla or inner chaff is also composed of two valves, of which the interior is larger than the other, and terminates in a long, rough, serrated awn or beard. The seeds are arranged in four rows.

2. *H. distichon.* Willd. *Sp. Plant.* i. 473; Loudon's *Encyc. of Plants*, p. 73. This species is distinguished by its flat spike or ear, which on each flat side has a double row of imperfect or male florets without beards, and on each edge, a single

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sels containing fresh water, which should be renewed once a day. At the end of eight or ten days, they are fit for reapplication. (*Journ. de Pharm.*, 3e sér., xi. 343 and 350.) It is said that, in the French military hospitals, a mixture of one part of vinegar with eight parts of water is preferred to salt water for promoting disgorgement. (*Lond. Med. Times and Gaz.*, Oct. 1856, p. 375.) It has been stated that, if the leeches, after being stripped, be put into water sweetened with a little white sugar, and the solution be renewed several times, at intervals of six or twelve hours, they will speedily recover their activity, and may be reapplied two or three times in the course of a few days. Immersion in camphor-water, for a few moments, is said by Mr. Boyce to cause them to vomit the blood. They should afterwards be put into clean water, to be changed in half an hour. Dr. Frodsham, of England, has found camphor-water preferable either to salt water or diluted vinegar, for disposing the gorged leech to part with blood. M. Grannat, a French military pharmaceutist, has found the natural process of disgorging preferable to all others. He placed some gorged leeches in wooden tubs, containing at bottom a little clay and water, and renewed the water every forty-eight hours. After eight days, the leeches, now in good health, were transferred to a pond prepared for the purpose, where they propagated. He put 1000 leeches in the pond, and at the end of a year had taken out 850 fit for service, without interfering with the reproduction. (*Journ. de Pharm.*, 3e sér., xx. 186.) M. Vayson's plan of preserving leeches has been highly recommended. It consists simply in putting them, after stripping, if they have been used, in an earthenware vessel of the shape of an inverted truncated cone, with holes in the bottom so small as to prevent the escape of the leech, and filled with turfy earth. After the introduction of the leech, the opening is to be closed with a coarse cloth. The vessel is then placed in a tub containing water four inches deep. If to be sent to a distance, the earth in the vessel should be moistened throughout.

* An instrument has been invented called the *mechanical leech*, by which the attempt has been made to imitate the action of the leech in drawing blood. It consists essentially of two parts, one for making the puncture, and the other for abstracting blood through the agency of atmospheric pressure. In other words, it is a minute cupping instrument. (*Am. Journ. Med. Sci.*, xvi. 207.)

row of bearded perfect or hermaphrodite florets. The seeds, therefore, are in two rows, as indicated by the specific name of the plant.

The original country of the cultivated barley is unknown. The plant has been found growing wild in Sicily, and various parts of the interior of Asia. *H. vulgare* is said by Pursh to grow in some parts of the United States, apparently in a wild state. The seeds are used in various forms.

1. In their natural state they are oval, oblong, pointed at one end, obtuse at the other, marked with a longitudinal furrow, of a yellowish color externally, white within, having a faint odor when in mass, and a mild sweetish taste. Careful analyses of barley have been made, which agree in the main, though differing in some details, especially as to whether any sugar exists in the barley before malting.

Lermer (*Vierteljahresschrift für pr. Pharm.*, 1863, pp. 4–23) states that the grains contain 13 to 15 per cent. of water; after drying, they yield to ether 3 per cent. of fatty oil and traces of tannin. He found, also, in the whole grains 63 per cent. of starch, 7 of cellulose, 6·6 of dextrin, 2·5 of nitrogen (corresponding to about 16 per cent. of albuminous matters), a small amount of lactic acid, and 2·4 per cent of ash.

Pillitz found (*Zeit. für Anal. Chem.*, 1872, p. 62) in the dry barley 14·3 per cent. of insoluble albuminates, 2·1 per cent. of soluble albuminates, 62·6 per cent. of starch, 1·9 per cent. of dextrin, 2·7 per cent. of sugar, 1·7 per cent. of extractive material, 3·1 per cent. of fat, 1·4 per cent. of soluble ash, 1·2 per cent. of insoluble ash, and 8·9 per cent. of lignin. The presence of sugar seems to have been shown by Kühnemann (*Deutsch. Chem. Ges.*, 1875, p. 387, and 1876, p. 1385), who found a crystallized dextrogyrate sugar which did not reduce alkaline copper solution, and an amorphous lævogyrate mucilaginous substance called *sinistrin.* According to Kühnemann, barley does not contain dextrin.

2. *Malt* consists of the seeds made to germinate by warmth and moisture, and then baked so as to deprive them of vitality. It is in the form of malt that barley is so largely consumed in the manufacture of malt liquors. (See *Maltum.*)

An interesting substance, called *diastase*, was discovered by MM. Payen and Persoz in the seeds of barley, oats, and wheat, and in the potato. It is found, however, only after germination, in which process the production of it appears to be the first step. Germinated barley seldom contains it in larger proportion than two parts in a thousand. It is obtained by bruising freshly germinated barley, adding about half its weight of water, expressing strongly, treating the viscid liquid thus obtained with sufficient alcohol to destroy its viscidity, then separating the coagulated albumen, and adding a fresh portion of alcohol, which precipitates the diastase in an impure state. To render it pure, it must be redissolved as often as three times in water, and precipitated by alcohol. For an account of the mode of preparing diastase from malt, recommended by M. Perrot, see the *Journal de Pharmacie*, Juillet, 1874, p. 43. It is solid, white, tasteless, soluble in water and weak alcohol, but insoluble in the latter fluid when concentrated. Though without action upon gum and sugar, it has the extraordinary property, when mixed, in the proportion of only one part to 2000, with starch suspended in water, and maintained at a temperature of about 71·1° C. (160° F.), of converting that principle into dextrin and *maltose.* This latter is a variety of sugar produced only by this action of malt. It was first recognized by Dubrunfaut, but has been more thoroughly studied by O'Sullivan and by Schulze. Its formula is $C_{12}H_{22}O_{11} + H_2O$, which molecule of water of crystallization it loses at 100°–110° C. (or, as Richter proposes, it may have the formula $C_{18}H_{34}O_{17}$). O'Sullivan explains the action of diastase upon starch by the following reactions:

At 63° C. — $C_{13}H_{30}O_{15} + H_2O = C_{12}H_{22}O_{11} + C_6H_{10}O_5$.
" 64°–70° C. — $2(C_{18}H_{30}O_{15}) + H_2O = C_{12}H_{22}O_{11} + 4(C_6H_{10}O_5)$.
" 70° C. — $4(C_{18}H_{30}O_{15}) + H_2O = C_{12}H_{22}O_{11} + 10(C_6H_{10}O_5)$. (*Chem. Soc. Journ.*, 10, p. 597.)

The crystals of maltose, $C_{12}H_{22}O_{11} + H_2O$, are soluble in water and alcohol, they reduce Fehling's solution, and, according to O'Sullivan, are equal to 63·9–65·5 per cent. of dextrose, but, according to Schulze, they are equal to 66–67 per cent. dextrose, and show a specific rotatory power of $[a] = 150°$ to the right.

The whole of the starch undergoes this change, except the teguments of the granules, amounting to about 4 parts in 1000. The change which barley undergoes during germination, and in malting, is of a similar character. The purity of diastase may be tested by mixing 0·05 parts of it with 200 parts of paste containing 10 parts of starch; after standing, the resulting liquid should filter rapidly, and decolorize five times its volume of Fehling's solution. The name of *maltine* has been given to the diastase of malt; and this principle has been found identical with the salivary ferment in its action on alimentary substances. Indeed, according to M. Contara, the two ferments, vegetable and animal, appear to be identical, not only in the action referred to, but in their chemical and physical properties; and consequently there is but one diastase, whether vegetable or animal. (*Arch. Gén.*, Avril, 1870, p. 501.)

3. *Hulled barley* is merely the grain deprived of its husk, which, according to Einhoff, amounts to 18·75 parts in the hundred.*

4. *Barley meal* is formed by grinding the seeds, previously deprived of their husk. It has a grayish white color, and contains, according to Fourcroy and Vauquelin, an oleaginous substance, sugar, starch, nitrogenous matter, acetic acid, phosphates of calcium and magnesium, silica, and iron. It may be made into a coarse, heavy, hard bread, which in some countries is much used for food.

5. *Pearl barley* (*hordeum perlatum*) is the seed deprived of all its investments, and afterwards rounded and polished in a mill. It is in small round or oval grains, having the remains of the longitudinal furrow of the seeds, and of a pearly whiteness. It is wholly destitute of hordein, and abounds in starch, with some gluten, sugar, and gum. This is the proper form of barley for medicinal use.

Medical Properties. Barley is one of the mildest and least irritating of farinaceous substances, and, though not medically used in its solid state, forms, by decoction with water, a drink admirably adapted to febrile and inflammatory complaints, and much employed from the time of Hippocrates to the present. Pearl barley is the form usually preferred for the preparation of the decoction, made by pouring four pints of boiling water on two troyounces of pearl barley and boiling away to two pints, and straining. Malt affords a liquor more demulcent and nutritious, and the decoction of malt may be prepared by boiling from two to four ounces in a quart of water and straining. When hops are added, the decoction takes the name of wort, and acquires tonic properties, which render it useful in debility, especially when attended with suppuration.

HUMULUS. *U. S.* *Hops.*

(HŪ′MŬ-LŬS.)

"The strobiles of Humulus Lupulus. Linné. (*Nat. Ord.* Urticaceæ, Cannabineæ.)" *U. S.* "The dried strobiles of the female plant of Humulus Lupulus." *Br.*

Lupulus, *Br.;* Hop; Strobili Humuli, s. Lupuli; Hop; Houblon, *Fr.;* Hopfen, *G.;* Luppolo, *It.;* Lupolo Hombrecillo, *Sp.*

Gen. Ch. Male. *Calyx* five-leaved. *Corolla* none. Female. *Calyx* one-leafed, obliquely spreading, entire. *Corolla* none. *Styles* two. *Seed* one, within a leafy calyx. *Willd.*

Humulus Lupulus. Willd. *Sp. Plant.* iv. 769; Bigelow, *Am. Med. Bot.* iii. 163. The root of the hop is perennial, and sends up numerous annual, angular, rough, flexible stems, which twine around neighboring objects in a spiral direction, from left to right, and climb to a great height. The leaves are opposite, and stand upon long footstalks. The smaller are sometimes cordate; the larger have three or five lobes; all are serrate, of a deep green color on the upper surface, and, together with the petioles, extremely rough, with minute prickles. At the base of the footstalks are two or four smooth, ovate, reflexed stipules. The flowers are numerous, axillary, and furnished with bracts. The male flowers are a yellowish white, and arranged in panicles; the female, which grow on a separate plant, are pale green, and disposed in solitary, peduncled aments, composed of membranous scales, ovate, acute, and tubular at the base. Each scale bears near its base, on its inner surface, two flowers, consisting of a roundish compressed germ, and two styles, with long filiform stigmas. The aments are converted into ovate membranous cones or strobiles, the scales of which contain, each, at its base, two small seeds, surrounded by a yellow, granular powder.

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* M. Lemoine, a French pharmaceutist, proposes a chemical method of decorticating barley and other seeds. Putting 100 parts of the seeds into a wooden vessel, he pours upon them 15 parts of sulphuric acid, stirs the mixture for 15 or 20 minutes, applying in the case of barley a gentle heat, then adds 50 parts of water, which he decants after a very few moments of constant agitation. After sufficient washing, and the neutralization of the last remains of acid by solution of carbonate of sodium or potassium, he puts the grain upon a piece of cloth with large meshes stretched upon a frame, where he allows it to drain for about an hour, then transfers it to a similar cloth, and exposes it to a current of air for several days to dry. (*Journ. de Pharm.*, Mars, 1863, p. 223.)

The hop is a native of North America and Europe. It is occasionally found growing wild in the Eastern States, and, according to Mr. Nuttall, is abundant on the banks of the Mississippi and the Missouri. In parts of New England, New York, and Michigan, it is extensively cultivated, and most of the hops consumed in the United States are supplied by those districts. The part of the plant used is the fruit or strobiles. These when fully ripe are picked, dried by artificial heat, packed in bales, and sent into the market under the name of hops.

Hops consist of numerous thin, translucent, veined, leaf-like scales, which are of a pale greenish yellow color, and contain near the base two small, round, black seeds. They are officinally described as "ovate, about an inch and a quarter (3 cm.) long, consisting of a thin, hairy, undulated axis and many obliquely ovate, membranous, greenish scales, in the upper part reticulately veined, and toward the base parallel-veined, glandular and surrounding a sub-globular achene." *U. S.* Though brittle when quite dry, they are pulverized with great difficulty. Their odor is strong, peculiar, somewhat narcotic, and fragrant; their taste very bitter, aromatic, and slightly astringent. Their aroma, bitterness, and astringency are imparted to water by decoction; but the first-mentioned property is dissipated by long boiling. The most active part of hops is a substance formed on the surface of the scales, and, in the dried fruit, existing in the state of very small granules. This substance was called *lupulin* by the late Dr. A. W. Ives, of New York, by whom its properties were first investigated and made generally known; though it was previously noticed by Sir J. E. Smith, of England, and M. Planche, of France. The scales themselves, however, are not destitute of virtues, and contain, as shown by MM. Payen and Chevallier, the same active principles as the lupulin, though in less proportion.*

LUPULINA. *U. S. Lupulin.* This is obtained separate by rubbing or threshing and sifting the strobiles, of which it constitutes from one-sixth to one-tenth by weight. It is in the state of a yellowish powder, mixed with minute particles of the scales, from which it cannot be entirely freed when procured by a mechanical process. It has the peculiar flavor of hops, and appeared to MM. Lebaillif and Raspail, when examined by the microscope, to consist of globules filled with a yellow matter, resembling in this respect the pollen of vegetables; but, from the investigations of M. Personne, it would seem to be of the nature of a gland, commencing in a cell formed among those of the epidermis, and, when fully developed, secreting a resinous matter. (*Journ. de Pharm.*, 3e sér., xxvi. 242.) It is inflammable, and when moderately heated becomes somewhat adhesive. The odor of lupulinic grains resides in the essential oil. This is obtained to the extent of 0·9 per cent. by distilling hops with water. Personne stated that it contained *valerol*, $C_6H_{10}O$, which passes into valerianic acid; the latter in fact occurs in the glands, yet, according to Mehn, only to the extent of 0·1 to 0·17 per cent. When distilled from the fresh strobiles the oil has a greenish color, but a reddish brown when old hops have been employed. It is devoid of rotatory power, neutral to litmus paper, and gives no remarkable coloration with concentrated sulphuric acid. The bitter principle formerly called *lupulin* or *lupulite* was first isolated by Lermer (*Journ. für pr. Chem.*, 101, p. 137), who called it the *bitter acid of hops* (*Hopfenbittersaüre*). It crystallizes in large brittle rhombic prisms, and possesses the peculiar bitter taste of beer. Its composition is $C_{32}H_{50}O_7$. The main contents of the hop gland consists of wax (*myricyl palmitate* according to Lermer) and resins, one of which is crystalline and unites with bases. Besides the constituents of the glands, hops contain, according to Etti, *humulo-tannic acid* and *phlobaphene*. The former is a whitish, amorphous mass, soluble in alcohol, hot water, or acetic ether, not in ether. By heating the humulo-tannic acid to 130° C., or by boiling its aqueous or alcoholic solution, it gives off water and is transformed into phlobaphene, a dark red amorphous substance, $(C_{25}H_{24}O_{13})^2 - H_2O = C_{50}H_{46}O_{25}$. The latter substance, on boiling it with dilute mineral acids, again loses water, and furnishes glucose. From raw phlobaphene, ether removes the bitter principles of hops, a colorless crystallizable and a brown amorphous resin, besides chlorophyll and essential oil. (*Pharmacographia*, 2d ed., pp. 553 and 555.)

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* Hops are often subjected in Germany to the fumes of burning sulphur, from the supposition that they keep better when thus treated. Besides, by being partially bleached by the process, old hops, which have suffered from time, having become darker, generally spotted, and weaker, assume a brighter appearance, as if fresher, and generally command a better price in the market. To detect the consequent presence of sulphurous acid, the brewers put a silver spoon in a mixture of hops and water, under the impression that it will produce a black stain upon the silver. But this test will answer only when applied within a fortnight after the use of the sulphur. A more delicate method is that of Dr. Heidenreich, who puts 20 or 30 cones of the hops in a flask with zinc and hydrochloric acid, and passes the hydrogen evolved through solution of acetate of lead. If sulphurous acid be present, sulphuretted hydrogen will be produced, which will occasion a dark precipitate with the solution. But even this plan often fails when the hops have been kept more than three or four weeks. A modification of this test has been proposed by Dr. R. Wagner. For the solution of acetate of lead used in Heidenreich's method, there is to be substituted a solution of nitro-prusside of sodium, so weak as to have a very light brown color, to which have been added a few drops of solution of potassa. If the gas evolved contain the minutest proportion of sulphur, a violet color will be produced when the first bubble passes into the solution; and this will by a continuance of the process become a magnificent purple. The least trace of sulphurous acid may thus be found; but, a few months after the sulphuring of hops, none at all can be detected. (*Chem. Gaz.*, April 1, 1856; from *Comptes-Rendus.*)

Hops are said to be sometimes threshed in order to separate the lupulin, which is sold separately. Their efficiency is thus, no doubt, greatly impaired. Hops thus treated have the scales more or less broken; and any parcel presenting this appearance may be suspected. Hops often contain a variable quantity of lupulin, in consequence of the granules of this substance separating, especially on agitation, and seeking the lower portion of the mass, which thus becomes richer, while the upper is poorer. They should always be examined in reference to the lupulin they contain, and, if nearly or quite destitute of it, should be deemed of inferior value, and not to be used medicinally, though not worthless.

The existence of a peculiar alkaloid in hops, suggested by Lermer in 1863, has been determined by Griessmayer. A concentrated decoction of hops was distilled with potassa or magnesia, the distillate neutralized with hydrochloric acid, evaporated to dryness, and treated with cold absolute alcohol to remove ammonium chloride; the alcoholic liquid was heated to boiling and cooled, when much trimethylamine chloride crystallized. The residuary liquid was filtered, the filtrate evaporated, first by a water-bath and then spontaneously, the residue was redissolved in water in a narrow cylinder, agitated with potassa and ether, and the ethereal liquid allowed to evaporate spontaneously. The remaining alkaline liquid had a peculiar odor recalling that of conine, and a cooling but not bitter taste. It soon exhibited small crystals, and finally solidified completely. The author supposed that these crystals were impurities, and that the pure alkaloid is liquid or gaseous. He proposes for it the name of *lupuline.* (*A. J. P.*, 1874, p. 360.)

Lastly, Etti found arabic (pectic) acid, phosphates, nitrates, malates, citrates, and also sulphates, chiefly of potassium, to occur in hops. The amount of ash afforded by hops dried at 100° C. would appear to be on an average about 6–7 per cent.

Medical Properties and Uses. Hops are tonic and slightly narcotic, and have been highly recommended in diseases of general or local debility, associated with morbid vigilance, or other nervous derangement. Diuretic properties have also been ascribed to them, but are by no means obvious. The complaints in which they have been found most useful are dyspepsia, and the nervous tremors, wakefulness, and delirium of drunkards.

An *infusion*, prepared with half an ounce of hops and a pint of boiling water, may be given in the dose of two fluidounces (60 C.c.) three or four times a day. The tincture is now the only officinal preparation of hops, but the alcohol probably acts more decidedly upon the system than the hops. (See *Tinctura Humuli.*) A pillow of hops has proved useful in allaying restlessness and producing sleep in nervous disorders. They should be moistened with water containing a trace of glycerin previously to being placed under the head of the patient, in order to prevent rustling. Fomentations with hops, and cataplasms made by mixing them with some emollient substance, are often beneficial in local pains and tumefactions.

The effects of hops may be obtained most conveniently by the use of *lupulin*, though Dr. Fronmüller, having after two trials with it obtained no soporific effect, denies it a place among the narcotics with hypnotic properties. (*B. and F. Med.-Chir. Rev.*, April, 1867, pp. 526–7.) Dr. Wm. Byrd Page, of Philadelphia, has found this substance very effectual as an antaphrodisiac, in the treatment of gonorrhœa, spermatorrhœa, and other irritated conditions of the genito-urinary apparatus; and the same result has been obtained by other practitioners. We have found it apparently effectual in irritable bladder, when other narcotics had failed. The dose of lupulin in substance is from six to twelve grains (0·4–0·8 Gm.), given in the form of pills, which may be made by simply rubbing the powder in a warm mortar till it acquires the consistence of a ductile mass, and then moulding it into the proper shape.* Lupulin may be incorporated with poultices, or formed into an ointment with lard, and used externally for the same purposes as hops.

Off. Prep. of Hops. Extractum Lupuli, *Br.;* Infusum Lupuli, *Br.;* Tinctura Humuli, *U. S.;* Tinctura Lupuli, *Br.*

Off. Prep. of Lupulin. Extractum Lupulinæ Fluidum, *U. S.;* Oleoresina Lupulinæ, *U. S.*

HYDRARGYRI CHLORIDUM CORROSIVUM. *U.S.* *Corrosive Chloride of Mercury.* [*Corrosive Sublimate. Mercuric Chloride.*]

Hg Cl_2; 270·5. (HȲ-DRÄR′ĢỴ-RĪ ȻHLŌ′RỊ-DŬM CŎR-RỌ-SĪ′VŬM.) Hg Cl; 135·25.

Hydrargyri Perchloridum, *Br.;* Hydrargyrum Bichloratum Corrosivum, *P.G.;* Sublimatus Corrosivus, Chloruretum (Chloretum) Hydrargyricum, Hydrargyrum Corrosivum Sublimatum, Hydrargyri Bichloridum; Corrosive Chloride of Mercury, Perchloride of Mercury, Bichloride of Mercury; Deuto-chlorure de Mercure, Sublimé corrosif, Chlorure mercurique, *Fr.;* Ætzendes Quecksilberchlorid, Ætzender Quecksilbersublimat, *G.*

A formula for this salt has been very properly omitted from the U. S. Pharmacopœia. The process of 1870 will be found in the foot-note.†

"Take of Sulphate of Mercury *twenty ounces* [avoirdupois]; Chloride of Sodium, dried, *sixteen ounces* [avoird.]; Black Oxide of Manganese, in fine powder, *one ounce* [avoird.]. Reduce the Sulphate of Mercury and the Chloride of Sodium each to fine powder, and, having mixed them and the Oxide of Manganese thoroughly by trituration in a mortar, put the mixture in an apparatus adapted for sublimation, and apply sufficient heat to cause vapors of perchloride of mercury to rise into the less heated part of the apparatus which has been arranged for their condensation." *Br.*

In order to understand the above process and that of the U. S. P. 1870, which is the same in principle, it is necessary to premise that corrosive sublimate is mercuric chloride, consisting of two atoms of chlorine and one of mercury. By boiling sulphuric acid in excess with mercury to dryness, a white salt (mercuric sulphate) is formed, according to the reaction, $2H_2SO_4 + Hg = HgSO_4 + SO_2 + 2H_2O$. (See *Hydrargyri Sulphas.*) When this is mixed with chloride of sodium (common salt), and the mixture exposed to a subliming heat, a mutual decomposition takes place, according to the reaction: $HgSO_4 + (NaCl)_2 = Na_2SO_4 + HgCl_2$. The mercuric chloride thus formed sublimes and the sodium sulphate remains behind. The quantities for mutual decomposition are two mols. of chloride of sodium and one mol. of mercuric sulphate. The British formula differs from that of the U. S. P. 1870 in ordering sulphate of mercury ready formed, instead of preparing it as the first step of the process, and in the use of a small proportion of black oxide of manganese, intended to convert into mercuric any mercurous salt that may be contained in the sulphate, and thereby prevent the formation of mercurous chloride or calomel. (See *Hydrargyri Sulphas.*)

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* Dr. Dyce Duckworth, of St. Bartholomew's Hospital, London, recommends, as the result of his own observation, the aromatic spirit of ammonia as a better solvent of lupulin than any other yet proposed. He offers the following formula. "Lupulin ℥ij, Aromatic Spirit of Ammonia Oj. Macerate for seven days, with occasional agitation, then filter, and add sufficient of the menstruum to make up a pint. The dose of this *Tinctura Lupulinæ Ammoniata* is from ♏xx to fʒj." (*P. J. Tr.*, Oct. 1868.)

† "Take of Mercury *twenty-four troyounces;* Sulphuric Acid *thirty-six troyounces;* Chloride of Sodium *eighteen troyounces.* Boil the Mercury with the Sulphuric Acid, by means of a sand-bath, until a dry white mass is left. Rub this, when cold, with the Chloride of Sodium in an earthenware mortar; then sublime with a gradually increasing heat." *U. S.*

The names given in the two Pharmacopœias to this important chloride do not exactly correspond. It is called the corrosive chloride of mercury in the U. S. Pharmacopœia, and perchloride in the British. We prefer the former, as indicating, beyond any possibility of mistake, the article intended, as well as its corrosive property. Perchloride and subchloride are hardly sufficiently distinctive, when a mistake may be so serious as that of confounding corrosive sublimate and calomel. In the first British Pharmacopœia corrosive sublimate was recognized as the officinal title, which was a sufficient guarantee of security; but, unfortunately, it was deemed proper, immediately after the officinal title, and in close connection with it, to define the salt as chloride of mercury, in conformity with the view, adopted in that work, of the atomic weight of mercury. With many persons calomel is still the chloride of mercury, so that there is some chance that, should calomel be prescribed by this title, corrosive sublimate may be dispensed for it, with dangerous if not fatal effects to the patient. Indeed, death has, at least in one recorded instance, occurred in consequence of this confusion of nomenclature; and our officinal guides should take especial care to guard against such mistakes, instead of contributing to them.

Preparation and Properties. The first step in making corrosive sublimate is to form mercuric sulphate, by heating sulphuric acid and the metal together in an iron pot, so arranged as to carry off the unwholesome fumes of sulphurous oxide, which are copiously generated. The dry salt obtained is then mixed with the common salt, and the mixture sublimed in an iron pot lined with clay, and covered by an inverted earthen pan. The late Dr. A. T. Thomson, of London, took out a patent for forming corrosive sublimate, on the large scale, by the direct combination, by combustion, of gaseous chlorine with heated mercury. The product is stated to be perfectly pure, and to be afforded at a lower price than the sublimate made in the usual way. In order that the combination may take place, the mercury need not be heated to its boiling point, but only to a temperature between 149° C. and 204° C. (300° and 400° F.). According to Dr. Maclagan, corrosive sublimate, made by this process, is liable to the objection that a proportion of calomel is always formed, occasionally amounting to 10 per cent.

It may sometimes be useful to know how to make a small quantity of corrosive sublimate on an emergency. This may be done by dissolving mercuric oxide (red precipitate) in hydrochloric acid, evaporating the solution to dryness, dissolving the dry mass in water, and crystallizing. Here a double decomposition takes place, resulting in the formation of water and the bichloride.

"Heavy, colorless, rhombic crystals or crystalline masses, permanent in the air, odorless, having an acrid and persistent, metallic taste, and an acid reaction. Soluble in 16 parts of water and in 3 parts of alcohol at 15° C. (59° F.); in 2 parts of boiling water, in 1·2 parts of boiling alcohol, and in 4 parts of ether. When heated to about 265° C. (509° F.), the salt fuses; at a higher temperature it sublimes unchanged, and without residue. The aqueous solution of the salt yields a reddish or yellowish precipitate on the addition of lime-water, and, on the addition of test-solution of nitrate of silver, a white precipitate insoluble in nitric acid, but soluble in ammonia. If 1 Gm. of the salt be dissolved in boiling water, then mixed with 5 C.c. of strong solution of soda (sp. gr. about 1·260) in a long test-tube, and about 0·5 Gm. of fine aluminium wire, cut into small pieces, be added (a loose plug of cotton being pushed a short distance down the tube), the generated gas should not impart any tint to paper wet with test-solution of nitrate of silver, and kept over the mouth of the test-tube for half an hour (abs. of arsenic)." *U. S.*

Ether is capable of removing corrosive sublimate, to a considerable extent, from its aqueous solution, when agitated with it. According to M. Mialhe, ether will not dissolve it when accompanied by a considerable quantity of mercuric oxide, and a chloride of an alkalifiable metal. Sulphuric, nitric, and hydrochloric acids dissolve it without alteration. When heated it melts, and readily sublimes in dense, white, acrid vapors, which condense, on cool surfaces, in white, shining needles. Its aqueous solution renders green the syrup of violets, and is precipitated brick-red, becoming yellow, by the fixed alkalies and alkaline earths, and white by ammonia. (See *Hydrargyrum Ammoniatum.*) The former precipitate is mercuric oxide, which has the property of evolving oxygen, and of being reduced to metallic globules when exposed to heat. This oxide is formed in the process for preparing *aqua phagedænica*, called also *lotio flava* or *yellow wash*, which is obtained by mixing half a drachm of corrosive sublimate with a pint of lime-water. Corrosive sublimate forms, with chloride of ammonium and chloride of sodium, compounds which are more soluble than the uncombined mercurial salt. It is on this account that aqueous solutions of sal ammoniac, or of common salt, dissolve much more corrosive sublimate than simple water. The combination of corrosive sublimate with chloride of ammonium was formerly called *sal alembroth*, or *salt of wisdom*. According to F. Hinterberger, corrosive sublimate is capable of combining with quinine and cinchonine. (*Chem. Gaz.*, ix. 211.) By dissolving one part of corrosive sublimate and a hundred parts of common salt in distilled water and evaporating to dryness, a soluble preparation is obtained which does not coagulate albumen. (*A. J. P.*, xliv. 11.)

Corrosive sublimate has the property of retarding putrefaction. Animal matters immersed in its solution shrink, acquire firmness, assume a white color, and become imputrescible. On account of this property it is usefully employed for preserving anatomical preparations.

Test of Purity and Incompatibles. Pure corrosive chloride of mercury sublimes, when heated, without residue, and its powder is entirely and readily soluble in ether. Consequently, if a portion of any sample should not wholly dissolve in ether, or if it should not evaporate entirely, the presence of some impurity is proved. If calomel be present, and it frequently is, it will not be wholly soluble in water.* Arsenic is reported to be a frequent impurity in corrosive sublimate. (See paper by J. Granville Smith, *A. J. P.*, 1877, p. 397.) It can be readily detected by the test of U. S. P. 1880. (See p. 748.) Corrosive sublimate is incompatible with many of the metals, the alkalies and their carbonates, soap, lime-water, tartar emetic, nitrate of silver, the acetates of lead, the sulphides of potassium and sodium, the soluble iodides, and all the sulphydrates. It is decomposed by many vegetable and some animal substances. According to Dr. A. T. Thomson, it produces precipitates in infusions or decoctions of chamomile, horseradish, columbo, catechu, cinchona, rhubarb, senna, simaruba, and oak-bark. MM. Mialhe and Lepage have shown that corrosive sublimate is slowly converted into calomel by syrup of sarsaparilla and syrup of honey, but is not changed by contact with pure syrup.

Medical Properties and Uses. Corrosive sublimate is a very powerful preparation, operating quickly, and, if not properly regulated, producing violent effects. It is less apt to salivate than most other mercurials. In minute doses, suitably repeated, it may exert its peculiar influence without any obvious alteration of the vital functions, except, perhaps, a slight increase in the frequency of the pulse, and in the secretions from the skin and kidneys. Sometimes, however, it purges; but this effect may be obviated by combining it with a little opium. In larger doses it occasions nausea, vomiting, griping pain in the bowels, diarrhœa, and other symptoms of gastric and intestinal irritation, and in still larger quantities produces all the effects of a violent corrosive poison. It has long been used as a remedy in syphilis, in all stages of which it has been highly recommended. It is said to remove the symptoms more speedily than other mercurials; whilst its action is less unpleasant, as the mouth is less liable to be made sore. It is especially useful in the advanced stages of the disorder, when there is no cachexia. When a very rapid impression is desired it is not as useful as calomel. It is also used advantageously in some chronic cutaneous affections, and in obstinate chronic rheumatism. It is usually associated with alterative or diaphoretic medicines, such as the antimonials, and the compound decoction or syrup of sarsaparilla; and, in order to obviate the irritation it is apt to produce, it may often be advantageously united with opium. There is no doubt that many of the substances, in connection with which it is employed, alter its chemical condition; but it does not follow that, even in its altered state, it may not be very useful as a remedy.

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* M. Bullot, having noticed in some corrosive sublimate an insoluble portion consisting of minute yellowish granules, found on examination that it was an aniline product. He surmised that the drug had been thrown into commerce after having been used in the preparation of aniline dyes. (*Journ. de Pharm.*, 4e sér., xviii. 414.)

Externally employed, corrosive sublimate is stimulant and escharotic. A solution in water, containing from an eighth to half a grain in the fluidounce, is employed as an injection in gleet, and as a collyrium in chronic venereal ophthalmia. A stronger solution, containing one or two grains in the fluidounce, is an efficacious wash in lepra, and other scaly eruptions. Dissolved in water, in the proportion of five to ten grains to the fluidounce, it may be used with much benefit in venereal ulcers of the throat, to which it should be applied by means of a camel's-hair pencil. With lime-water it forms the *aqua phagedænica* of the older writers, employed as a wash for ill-conditioned ulcers. The powdered chloride has been used as an escharotic, but is, in general, inferior to nitrate of silver or caustic potassa. In *onychia maligna*, however, it is employed with great advantage, mixed with an equal weight of sulphate of zinc, and sprinkled thickly upon the surface of the ulcer, which is then to be covered with a pledget of lint saturated with tincture of myrrh. The whole diseased surface is thus removed, and the ulcer heals. This practice originated, we believe, with the late Dr. Perkins, of Philadelphia, and was highly recommended by Dr. Physick. Dr. Geo. B. Wood often employed it with success. A solution of corrosive sublimate in collodion (four parts to thirty) has been used as a caustic, for the destruction of nævi materni, and for other purposes. It can be very accurately applied, but its use requires care, as fatal poisoning has followed a single application of the alcoholic solution of corrosive sublimate to a moderate surface of ringworm. (*London Lancet*, 1871, ii. 413.) It is applied by means of a camel's-hair pencil.

The dose of corrosive sublimate is from the twelfth to the eighth of a grain (0·005 to 0·007 Gm.) preferably given after meals, in pill, or solution. The pill is usually prepared with crumb of bread; and care should be taken that the medicine be equally diffused through the pilular mass before it is divided.

Toxicological Properties. Swallowed in poisonous doses, it produces burning heat in the throat, excruciating pain in the stomach and bowels, excessive thirst, anxiety, nausea and frequent retching with vomiting of bloody mucus, diarrhœa and sometimes bloody stools, small and frequent pulse, cold sweats, general debility, difficult respiration, cramps in the extremities, faintings, insensibility, convulsions, and death. The mucous membrane of the stomach exhibits, on dissection, signs of the operation of a violent corrosive poison. These symptoms are sometimes followed or conjoined with others indicating an excessive mercurial action upon the system, such as inflammation of the mouth and salivary glands, profuse salivation, fetid breath, etc. A case is on record of death, in an infant, from the constitutional effects of corrosive sublimate sprinkled upon an excoriated surface; and, in two instances of children, the one seven, and the other nine years old, death, with all the symptoms of internal poisoning, followed the application to the scalp of an ointment, said to consist of one part of the corrosive chloride to four parts of tallow. (*Dub. Quarterly*, Aug. 1854, p. 70.) In the inferior animals, in whatever mode introduced into the system, it produces symptoms and lesions similar to those which it causes in man. In the treatment of poisoning by corrosive sublimate, Orfila recommends the free use of the white of eggs beaten up with water. The albumen forms an insoluble and comparatively innocent compound with the corrosive sublimate; and the liquid by its bulk dilutes the poison, and distends the stomach so as to produce vomiting. It is, however, asserted by M. Lassaigne that this compound of albumen and corrosive sublimate, when recently precipitated, is soluble in acid and alkaline liquids, and in solutions of the chlorides of potassium, sodium, and calcium. (See *Journ. de Pharm.*, xxiii. 510.) It is also soluble in an excess of albumen, whether introduced into the stomach, or previously existing there. It is, therefore, important, at the same time that the antidote is used, to evacuate the stomach before the newly formed compound can be dissolved. If eggs cannot be procured, wheat flour may be substituted; gluten having, according to M. Taddei, the same effect as albumen. Milk also has been recommended, in consequence of the insoluble compound which casein forms with the poison. Besides the antidotes mentioned, Peruvian bark, meconic acid, ferrous sulphide, and iron filings have been proposed, all of which have the property of decomposing corrosive sublimate. The ferrous sulphide was found quite successful by M. Mialhe in experiments upon dogs, if given immediately after the poison was swallowed, but failed when delayed for ten minutes. Dr. T. H. Buckler, of Baltimore, made some successful experiments on lower animals upon the antidotal properties of a mixture of gold dust and iron filings (*Med. and Surg. Journ.*, 1843); and a case of poisoning by corrosive sublimate has been recorded by Dr. Chas. Johnston, of the same city, in which the antidote was employed with the apparent effect of saving life, after albumen had been used without effect. Dr. Johnston, however, employed the reduced iron of the Pharmacopœia, and gold leaf, arranging them in alternate layers, so as to make boluses of convenient size. (*Am. Journ. of Med. Sci.*, April, 1863, p. 340.) The method of operating of this antidote will be understood when the action of gold and iron as a test for corrosive sublimate is explained in the succeeding paragraph. It is of the utmost importance that whatever antidote is used should be given without delay, and in this respect the one nearest at hand may be considered the best. Under all circumstances the stomach should be rapidly and thoroughly washed out by abundance of mucilaginous fluids, the stomach-pump being used if necessary. The after-effects should be treated like other forms of toxic gastro-enteritis, *i.e.*, by local bloodletting or counter-irritation, demulcent drinks, opiates, etc.

Tests for Corrosive Sublimate. On account of the extreme virulence of this chloride as a poison, the reagents by which it may be detected form a subject of study of the utmost importance, as connected with medico-legal investigations. The best tests for determining its mercurial nature, mentioned in the order of their delicacy, are ferrocyanide of potassium, lime-water, carbonate of potassium, iodide of potassium, ammonia, sulphuretted hydrogen, and stannous chloride. *Ferrocyanide of potassium* gives rise to a white precipitate (ferrocyanide of mercury), becoming slowly yellowish, and at length pale blue. *Lime-water* throws down a yellow precipitate of hydrated mercuric oxide. *Carbonate of potassium* causes a brick-red precipitate of carbonate mercuric. *Iodide of potassium* produces a very characteristic pale scarlet precipitate of mercuric iodide. This precipitate frequently appears at first yellow, especially if the corrosive sublimate be present in minute proportion. *Ammonia* gives rise to a white, flocculent precipitate, the officinal ammoniated mercury, or white precipitate. *Sulphuretted hydrogen* occasions a black precipitate of mercuric sulphide; and the same precipitate is thrown down by ammonium sulphydrate. Finally, *protochloride of tin* (stannous chloride) causes a grayish black precipitate (mercury in a finely divided state), and, as a test, is not liable to any fallacy. Taking the results of Devergie, the relative delicacy of these tests may be expressed numerically as follows: Ferrocyanide of potassium 1½; lime-water 4; carbonate of potassium 7; iodide of potassium 8; ammonia 36; sulphuretted hydrogen or ammonium sulphydrate 60; and stannous chloride 80. Wormley (*Microchemistry of Poisons*, p. 344) considers the ferrocyanide of potassium test as inferior to both the stannous chloride and the ammonia test. He especially commends, however, the copper test, which is as follows: *A bright plate of copper*, immersed in a solution containing corrosive sublimate, is instantly tarnished, and, after the lapse of half an hour, becomes covered with a grayish-white powder. *A polished piece of gold*, moistened with the *clear* mercurial solution, and touched through the liquid with a piece of iron, contracts a white stain. This test, which was proposed by Mr. Sylvester and simplified by Dr. Paris, is conveniently applied by moistening, with the suspected solution, a gold coin or ring, and touching it through the moistened spot with the point of a penknife. The object of the iron is to form with the gold a simple galvanic circle, which enables the latter metal to precipitate the mercury on its surface. Nearly all the above tests merely prove the presence of mercury. To determine whether the metal is united with chlorine, the mercurial liquid may be precipitated by lime-water, and the filtered solution, acidulated with nitric acid, then tested with nitrate of silver. If the mercury is in the state of chloride, the filtered solution will be one of chloride of calcium, which, with nitrate of silver, will yield a heavy, white precipitate (chloride of silver), insoluble in nitric acid, but soluble in ammonia. The nitrate of silver may be added directly to the mercurial liquid; and, if it contain corrosive sublimate, chloride of silver will fall, but probably mixed with calomel.

By the combined indications of the foregoing tests, corrosive sublimate may be infallibly detected, unless it exists in very minute quantity, associated with organic substances, by which its presence is often greatly obscured. When it exists in organic mixtures, made by boiling the contents or substance of the stomach in distilled water, Dr. Christison recommends that a preliminary trial be made with the protochloride of tin, on a small portion filtered for the purpose. If this causes a grayish black color, he shakes the mixture, as recommended by Orfila, with a fourth of its bulk of cold ether, which dissolves the corrosive sublimate, and rises to the surface. The ethereal solution is then evaporated to dryness, and the dry salt obtained is dissolved in hot water, whereby a pure solution is procured, in which the poison may be readily detected by the ordinary tests. In using ether, however, it must be borne in mind that, as ascertained by M. Mialhe, the presence of a considerable quantity of mercuric oxide, and of a chloride of an alkalifiable metal, prevents the solvent power of ether. If the trial test should produce a light gray color, the corrosive sublimate is indicated in still less quantity, and Dr. Christison recommends to proceed in the following manner. Treat the unfiltered mixture with protochloride of tin, as long as any precipitate is formed, which will have a slate-gray color. Collect, wash, and drain it on a filter, and, having removed it without being dried, boil it, in a glass flask, with a moderately strong solution of caustic potassa, until all the lumps disappear. The alkali will dissolve all animal and vegetable matter; and, on allowing the solution to remain at rest, a heavy grayish black powder will subside, which consists chiefly of metallic mercury, and in which small globules of the metal may sometimes be seen with the naked eye, or by the aid of a magnifier. Wormley (*loc. cit.*) suggests boiling the organic mixture with water acidulated with hydrochloric acid, and testing the filtered solution with a strip of copper foil. Probably advantage might be derived from the process of dialysis, in separating corrosive sublimate, among other crystallizable substances, from the colloidal matters contained in organic mixtures. (See *Dialysis.*)

Off. Prep. Hydrargyri Iodidum Rubrum; Hydrargyri Oxidum Flavum, *U. S.;* Hydrargyrum Ammoniatum; Liquor Hydrargyri Perchloridi, *Br.;* Lotio Hydrargyri Flava, *Br.*

HYDRARGYRI CHLORIDUM MITE. *U. S.* *Mild Chloride of Mercury.* [*Calomel. Mercurous Chloride.*]

Hg_2Cl_2; 470·2. (HȲ-DRĂR′ĢỴ-RĪ ȻHLŌ′RỊ-DŬM MĪ′TĒ.) Hg_2Cl; 235·1.

Hydrargyri Subchloridum, *Br.;* Hydrargyrum Chloratum Mite, *P.G.;* Hydrargyri Chloridum, Hydrargyrum Chloratum (Muriaticum), Mercurius Dulcis, Chloruretum Hydrargyrosum; Submuriate of Mercury, Protochloride of Mercury; Calomelas; Subchloride of Mercury; Protochlorure ou Sous-muriate de Mercure, Calomèle, *Fr.;* Quecksilberchlorür, *G.*

Very properly, a process for this compound has been omitted from the present Pharmacopœia, as it cannot be made by the pharmacist conveniently. For process of U. S. P. 1870, see foot-note.*

"Take of Sulphate of Mercury *ten ounces* [avoirdupois]; Mercury *seven ounces* [avoird.]; Chloride of Sodium, dried, *five ounces* [avoird.]; Boiling Distilled Water *a sufficiency*. Moisten the Sulphate of Mercury with some of the Water, and rub it and the Mercury together until globules are no longer visible; add the Chloride of Sodium, and thoroughly mix the whole by continued trituration. Sublime by a suitable apparatus into a chamber of such size that the Calomel, instead of adhering to its sides as a crystalline crust, shall fall as a fine powder on its floor. Wash this powder with boiling Distilled Water, until the washings cease to be darkened by a drop of sulphide of ammonium. Finally, dry at a heat not exceeding 212°, and preserve in a jar or bottle impervious to light." *Br.*

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* "Take of Mercury *forty-eight troyounces;* Sulphuric Acid *thirty-six troyounces;* Chloride of Sodium *eighteen troyounces;* Distilled Water *a sufficient quantity.* Boil, by means of a sand-bath, twenty-four troyounces of the Mercury with the Sulphuric Acid, until a dry white mass is left. Rub this, when cold, with the remainder of the Mercury, in an earthenware mortar, until they are thoroughly mixed. Then add the Chloride of Sodium, and, having rubbed it with the other ingredients until globules of Mercury cease to be visible, sublime the mixture into a large chamber so that the sublimate may fall in powder. Wash the sublimed matter with boiling Distilled Water, until the washings afford no precipitate with water of ammonia, and dry it." *U. S.*

The object of the above process is to obtain the mercurous chloride. This chloride, according to the view generally received by chemists, consists of two atoms of mercury combined with two of chlorine (some chemists consider it to contain only one atom of each), so that it has relatively only half as much chlorine as corrosive sublimate. In the U. S. process, as in the case of corrosive sublimate, mercuric sulphate is first formed; but instead of being immediately sublimed with the chloride of sodium, it undergoes a preparatory trituration with a quantity of mercury equal to that employed in forming it. This trituration may be conceived to take place between one mol. of mercuric sulphate and one atom of metallic mercury, which are thus converted into one mol. of mercurous sulphate, according to the reaction: $HgSO_4 + Hg = Hg_2SO_4$. The one mol. of mercurous sulphate thus formed, being heated with two of common salt, the two atoms of chlorine in the latter sublime in union with the two of mercury in the former, and generate one mol. of mercurous chloride, Hg_2Cl_2; while one molecule of sodium sulphate, Na_2SO_4, remains as a residue. It is hence apparent that the residue of this process and of that for corrosive sublimate is the same.

The calomel, as sublimed, is liable to contain a little corrosive sublimate; and hence the direction of the U. S. Pharmacopœia of 1870 to wash it with boiling distilled water until ammonia produces no precipitate with the washings. Ammonia occasions a white precipitate (ammoniated mercury) so long as the washings contain corrosive sublimate; and, when it ceases to produce this effect, the operator may rest satisfied that the whole of the poisonous salt has been removed. According to M. Berthé, calomel, in contact with hot water, is converted, to a small extent, into corrosive sublimate; and hence he recommends that the portion of water to be tested should be cold when passed through the calomel.

The British process is a modification of that of the old Dublin Pharmacopœia, including, like that, no directions for making the mercuric sulphate; because this salt is made by a separate formula, being designated as *sulphate of mercury.* It omits, however, as unnecessary, a partial preliminary sublimation, to test the production of corrosive sublimate, and, immediately after a thorough mixture of the materials, proceeds to the final sublimation. An improvement was to cause the vapors to enter for condensation a chamber of considerable size, so that they might fall in powder, instead of condensing on the sides of the receiver in a crystalline mass. The necessity of pulverizing the calomel is thus avoided. The Br. Pharmacopœia directs the powder to be washed; but, instead of using ammonia as a test of the absence of corrosive sublimate in the washings, directs for the purpose sulphide of ammonium, which throws down a black precipitate if corrosive sublimate is present.

Preparation on the Large Scale. The process for making calomel, by means of mercuric sulphate, was originally practised at Apothecaries' Hall, London. The proportions taken and the mode of proceeding in that establishment are, according to Mr. Brande, as follows: 50 lbs. of mercury are boiled to dryness with 70 lbs of sulphuric acid, in a cast-iron vessel; and 62 lbs. of the dry salt formed are triturated with 40½ lbs. of mercury till the globules disappear, and the whole is mixed with 34 lbs. of common salt. The mixture is sublimed from an earthenware retort into an earthenware receiver, and the product is from 95 to 100 lbs. of calomel in mass. This is then ground to an impalpable powder, and washed with a large quantity of distilled water.

The object of bringing calomel into a state of minute division is more perfectly accomplished by the method of Mr. Joseph Jewell, of London, improved by M. Ossian Henry. It consists in causing the calomel in vapor to come in contact with steam in a large receiver, whereby it is condensed into an impalpable powder, and perfectly washed from corrosive sublimate in the same operation. Calomel made by this process, sometimes called Jewell's or Howard's *hydrosublimate of mercury*, is free from all suspicion of containing corrosive sublimate, is much finer than when obtained by levigation and elutriation, and possesses more activity as a medicine. This kind of calomel is included in the French Codex under a distinct name (*mercure doux à la vapeur*). M. Soubeiran, of Paris, has perfected a process for obtaining calomel as an impalpable powder, by substituting the agency of cold air for that of steam for the purpose of condensing it; a process which he believes to be precisely the same as that pursued by the English manufacturers, and which produces a calomel equal to the best English. A description of his apparatus may be found in the *Journal de Pharmacie* (3e sér., ii. 507), and of the English apparatus, as described by F. C. Calvert, in the same journal (3e sér., iii. 121). Both these papers are copied into the *A. J. P.* (xv. 89 and 93). In the last revision of the Br. Pharmacopœia the suggestion of Soubeiran was adopted, and the calomel is obtained in a fine powder by condensation in a large chamber. Calomel is also prepared in the dry way by taking 4 parts of corrosive sublimate and rubbing it up in a mortar with 3 parts of mercury, after moistening the mass with alcohol. The powder is then dried and sublimed in glass flasks. The powder should be dried sharply before sublimation, so as to drive off any trace of uncombined mercury.

Prof. Wöhler has proposed to obtain calomel, in the humid way, by precipitating a solution of corrosive sublimate by a stream of sulphurous acid, taking advantage of a reaction first observed by Vogel. Calomel obtained in the humid way, called *precipitated calomel*, was formerly officinal with the Dublin College, and was adopted in the French Codex. This form of calomel is of doubtful utility; and, when obtained by Prof. Wöhler's process, it is a crystalline powder, which is unfit for use unless after elaborate levigation and elutriation.

Properties. When in mass its form and appearance depend on the shape and temperature of the subliming vessel. In this state it is generally in the form of a white, fibrous, crystalline cake, the interior surface of which is often studded with shining transparent crystals, having the shape of quadrangular prisms, and a texture somewhat horny and elastic. When the mass is scratched it yields a yellow streak, which is very characteristic. Its sp. gr. is 7·2. The officinal form of this chloride is that of powder, in which state it is always kept in the shops. The powder has a light buff or ivory color, if obtained by the levigation of sublimed masses; but if condensed at once in the form of an impalpable powder, as is the case with Jewell's calomel and in the officinal processes, it is perfectly white. To protect it from the action of the light, it should be kept in a dark place, or in bottles painted black, or covered with black paper. By the action of the fixed alkalies or alkaline earths it immediately becomes black, in consequence of the formation of mercurous oxide, reducible by heat to the metallic state. The preparation employed under the name of *lotio nigra* or *black wash*, as a local application to syphilitic ulcers, etc., is made by adding *a drachm* of calomel to *a pint* of lime-water. By double decomposition between the calomel and lime, the black suboxide precipitates, and chloride of calcium remains in solution, indicated by yielding a copious white precipitate with nitrate of silver. The oxide, however, is not pure, but associated with undecomposed calomel. Before being applied, the wash should be well shaken.

"A white, impalpable powder, permanent in the air, odorless and tasteless, and insoluble in water, alcohol, or ether. When strongly heated, it is wholly volatilized, without melting. The salt is blackened by water of ammonia. A portion heated in a dry glass tube with dried carbonate of sodium, yields metallic mercury. Distilled water or alcohol, after having been agitated with a portion of the salt, and filtered, should not be affected by hydrosulphuric acid nor by test-solution of nitrate of silver (abs. of mercuric chloride), nor should the aqueous or alcoholic filtrate leave any residue on evaporation (fixed soluble impurities). On heating the salt with solution of potassa, no odor of ammonia should be evolved; and acetic acid, agitated with the salt and filtered, should remain unaffected by hydrosulphuric acid or by test-solution of nitrate of silver (abs. of and difference from ammoniated mercury)." *U. S.*

Tests of Purity and Incompatibles. Calomel, when pure, completely sublimes on the application of heat, a property which detects all fixed impurities, such as carbonate, sulphate, and phosphate of calcium, sulphate of barium, and carbonate of lead. Under the influence of an elevated temperature, especially in the presence of alcohol or water, it gives rise to a small quantity of corrosive sublimate. (*M. Berthé.*) Calomel strikes a black color, free from reddish tinge, by the action of the fixed alkalies; and the black oxide thus produced is brought by heat to the metallic state. The buff color indicates the absence of corrosive sublimate; but whiteness by no means shows the presence of this impurity. Its freedom from the corrosive chloride may be determined by washing a portion of it in warm distilled water, and then testing the water with ammonia, which will cause a white precipitate (ammoniated mercury), should the water have taken up any of the poisonous chloride. (See also the *U. S. P.* 1880, *Tests*, p. 754.) An easy method of detecting corrosive sublimate, proposed by M. Bonnewyn, is to put some of the suspected powder upon a well-polished surface of iron, and then moisten it with a drop of alcohol or ether. If the calomel be pure the surface will remain quite unaffected, while it will be blackened by corrosive sublimate if present only in the proportion of one to 50,000. (*Journ. de Pharm. et de Chim.*, 4e sér., ii. 79.) The presence of any soluble chloride whatever in the calomel would be detected by the production of a precipitate with the washing by nitrate of silver. Soluble salts of mercury may be detected by rubbing the suspected calomel with ether on a bright surface of copper, when the metal will become amalgamated, and exhibit a white stain. When this test shows impurity, the soluble salt present is probably corrosive sublimate. Calomel, containing corrosive sublimate, acts violently on the bowels; and, when the impurity has been present in considerable amount, has been known to cause death. Besides being incompatible with the alkalies and alkaline earths, calomel is also decomposed by the alkaline carbonates, soaps, sulphydrates, and, according to some authorities, by iron, lead, and copper. By boiling with the alkaline formiates it is decomposed, and metallic mercury liberated. (H. Rose, *Annal. der Physik und Chem.*, cvi. 500.) Accordiug to M. Lebeaux, calomel should not be prescribed with iodine; unless the prescriber intends to give mercuric iodide (red iodide), when the dose must be reduced accordingly. (*Annuaire de Thérap.*, 1857, p. 180.) It should not be given at the same time with nitrohydrochloric acid, for fear of generating corrosive sublimate. One of the authors has been informed of a case in which death, with symptoms of violent gastro-intestinal irritation, followed their joint use. Agreeably to the experiments of M. Deschamps, calomel is decomposed by bitter almonds and by hydrocyanic acid. In the former case corrosive sublimate, mercuric cyanide, and chloride of ammonium are formed; in the latter, corrosive sublimate and mercuric cyanide only. Hence this writer considers it very dangerous to associate calomel with bitter almonds or hydrocyanic acid in prescription. This conclusion has been confirmed by M. Mialhe and M. Prenleloup; and, more recently, it has been shown by Dr. E. Riegel that cherry-laurel water has the power of converting calomel into corrosive sublimate. According to M. Mialhe, calomel is in part converted into corrosive sublimate and metallic mercury by chloride of ammonium, and by the chlorides of sodium and potassium, even at the temperature of the body; and hence he believes that the conversion may take place in the primæ viæ. Popular belief coincides with M. Mialhe's views in regard to the power of common salt to increase the activity of calomel. More recently M. Mialhe has extended his observations, and now believes that all the preparations of mercury yield a certain amount of corrosive sublimate by reacting with solutions of the chlorides of potassium, sodium, and ammonium. The mercuric oxide and similarly constituted compounds are most prone to undergo this change. Even metallic mercury digested with the chlorides named, is partly converted, under the influence of the air, into corrosive sublimate. Dr. Gardner denies the assertion of M. Mialhe, that calomel is converted into corrosive sublimate by chlorides of the alkali metals, maintaining that it is merely rendered soluble by their solutions. The results, however, of M. Mialhe have been confirmed experimentally by Dr. A. Fleming, of Pittsburg, Pa. (*A. J. P.*, Sept. 1857.) M. Bauwens, of Ghent, recognizing the conversion of calomel into corrosive sublimate in the body by these chlorides, explains by this fact the relatively less powerful action of large than of small doses of calomel. He also states that physicians near the sea, where the water is brackish, seldom prescribe calomel, and that naval surgeons have been obliged to abstain from giving it to sailors who eat salt meat. Dr. H. Peake, of Arkadelphia, Arkansas, has known many instances in which salivation has been induced by the joint use of calomel and vegetable acids, in the forms of sour fruit, vinegar, buttermilk, etc., where the mercurial alone would not have induced it. (*N. O. Med. and Surg. Journ.*, Nov. 1858, p. 724.)

Medical Properties and Uses. Calomel unites to the general properties of the mercurials those of a purgative and anthelmintic. It is the most valuable of the mercurial preparations. Whether the object is to bring the system under the general influence of mercury, or to produce its alterative action upon the hepatic or other secretory function, calomel, on account both of its certainty and its mildness, is preferred to all other preparations, with the single exception of the blue pill, which, though less certain, is still milder, and is sometimes preferably employed. When used with the above objects, the tendency to purge which it sometimes evinces, even in very small doses, must be restrained by combining it with opium.

As a purgative, calomel owes its chief value to its tendency to act on the liver, the secretory function of which it stimulates. It is usually slow and somewhat uncertain in its cathartic effect, and, though itself but slightly irritating, sometimes occasions severe griping pain with bilious vomiting, attributable to the acrid character of the bile which it causes the liver to secrete. It is peculiarly useful in the commencement of bilious fevers, in hepatitis, jaundice, bilious and painter's colic, dysentery, especially that of tropical climates, and all other affections attended with congestion of the portal system, or torpidity of the hepatic function. The difficulty with which it is thrown from the stomach renders it highly useful in some cases of obstinate vomiting, when other remedies are rejected. In the cases of children it is peculiarly valuable from the facility of its administration. In the treatment of worms, it is often useful as an aid to other remedies, acting probably not only as a purgative, but also as an irritant to the worms, either by its immediate influence, or that of the acrid bile which it causes to flow. The slowness and uncertainty of its action, and its liability to salivate if too long retained in the bowels, render it proper either to follow or combine it with other cathartics, in order to insure its purgative effect. When given alone, it should be followed, if it do not operate in six or seven hours, by a dose of castor oil or sulphate of magnesium. The cathartics with which it is most frequently combined are jalap, rhubarb, aloes, scammony, colocynth, and gamboge. It is often added in small quantities to purgative combinations, with a view to its influence on the liver.

In very large doses, calomel is supposed by some to act directly as a sedative, and with this view has been given in yellow and malignant bilious fevers, violent dysentery, malignant cholera, etc. The quantities which have been administered in such affections, with asserted impunity and even advantage, are almost incredible. A common dose is one or two scruples, repeated every half hour, or hour, or less frequently, according to the circumstances of the case. We have had no experience in this mode of administering calomel.

Certain conditions favor the formation of corrosive sublimate in calomel mixtures. G. Vulpius has investigated this subject, and reaches the following conclusions:

1. No sublimate forms in the course of twenty-four hours in mixtures of calomel with white sugar, milk sugar, magnesia, carbonate of magnesium, and sodium bicarbonate.

2. No such formation takes place in three months in mixtures of calomel with magnesia, magnesium carbonate, and sugar.

3. Minute traces of corrosive sublimate are found at the expiration of the same time in a mixture of calomel, bicarbonate of sodium, and sugar of milk.

4. A large quantity of corrosive sublimate forms in the same time in a mixture of calomel, bicarbonate of sodium, and cane sugar.

5. Calomel powders, containing magnesia or sodium bicarbonate alone, will contain corrosive sublimate, if digested with water.

6. The formation of corrosive sublimate in mixtures of calomel and alkalies digested in water for a short time is not favored, but on the contrary prevented, by the presence of hydrochloric acid in the water, the acid neutralizing, to a certain extent, the alkalies which cause the formation. (*A. J. P.*, July, 1879.)

Externally applied, calomel is often used as an efficient alterative and desiccant in venereal and other ulcers, herpetic eruptions, etc.

In syphilis, calomel vapor-baths once or twice a week are often of service. They may be extemporized by pouring an ounce and a half of water into a dish, putting a scruple of calomel in it, and heating by means of a spirit lamp, the patient being seated on a chair over the dish, and surrounded by blankets closely wrapped around the neck, spread out below.

The dose as an alterative, in functional derangement of the liver, is from half a grain to a grain (0·03 to 0·065 Gm.) every night, or every other night, followed in the morning, if the bowels are not opened, by a gentle saline laxative. When the stomach or bowels are very irritable, as in cholera and diarrhœa, from an eighth to a quarter of a grain (0·008 to 0·016 Gm.) may be given every hour or two, so as to amount to one or two grains (0·065 to 0·13 Gm.) in the course of the day. With a view to salivation, the dose is from half a grain to a grain (0·03 to 0·065 Gm.) three or four times a day, to be increased considerably in urgent cases. Sometimes, very minute doses, as the twelfth of a grain (0·005 Gm.) or less, given very frequently, so as to amount to the ordinary quantity in twenty-four hours, will operate more effectually as a sialagogue than larger doses. When large doses are given with this view, it is often necessary to combine them with opium. As a purgative, from five to fifteen grains (0·33 to 1 Gm.) or more may be exhibited. Calomel has the peculiarity that its cathartic action is not increased in proportion to the dose, and enormous quantities have been given with impunity. Even in very small doses of not more than one, two, or three grains (0·065, 0·13, or 0·20 Gm.), calomel purges some individuals briskly. In these persons, large doses, though they do not proportionably increase the evacuation, often occasion spasmodic pain in the stomach and bowels. For children larger doses are generally required in proportion than for adults. Not less than two or three grains (0·14–0·20 Gm.) should be given as a purge to a child two or three years old; and this quantity often fails to act, unless assisted by castor oil or some other cathartic. Calomel may be given in pill made with gum arabic and syrup, or in powder mixed with syrup or molasses.

Off. Prep. Lotio Hydrargyri Nigra, *Br.;* Pilulæ Antimonii Compositæ, *U. S.;* Pilula Hydrargyri Subchloridi Composita, *Br.;* Pilulæ Catharticæ Compositæ, *U. S.;* Unguentum Hydrargyri Subchloridi, *Br.*

HYDRARGYRI CYANIDUM. *U. S.* *Cyanide of Mercury.* [*Mercuric Cyanide.*]

$Hg(CN)_2$; 251·7. (HȲ-DRĂR′ĢY̩-RĪ CȲ-ĂN′I̩-DŬM.) Hg C_2N; 125·85.

Hydrargyri Cyanuretum, *U. S.* 1850; Hydrargyrum Cyanatum (Borussicum), Cyanuretum Hydrargyricum, Mercurius Cyanatus vel Borussicus; Cyanuret of Mercury, Bicyanide of Mercury, Prussiate of Mercury; Prussiate ou Cyanure ou Bicyanure de Mercure, *Fr.;* Cyanquecksilber, Quecksilber-Cyanid, *G.*

A process for this preparation is no longer officinal; that of U. S. P. 1870 is appended.*

The formula of U. S. P. 1870 is based upon that of Winckler. Hydrocyanic acid is generated by the action of sulphuric acid on the ferrocyanide of potassium, and, being received in a vessel containing water and a portion of red oxide of mercury, reacts with the oxide, according to the reaction: $(HCN)_2 + HgO = Hg(CN)_2 + H_2O$, generating, by double decomposition, water, and mercuric cyanide which is held in solution. Sufficient red oxide of mercury is not used at first to saturate the whole of the hydrocyanic acid generated, because, should there happen to be any excess of the red oxide, there would be produced on evaporation, instead of the substance wanted, a peculiar salt composed of cyanide and red oxide of mercury, which would crystallize in small acicular crystals. Hence, a portion of the water still containing uncombined hydrocyanic acid is set aside, to be added to the liquid in which the acid had been completely saturated by the addition of red oxide, and thus at least neutralize any oxide of mercury that might be present in it in excess. A surplus of hydrocyanic acid would be of no disservice, except the loss of material incurred, as it is evaporated in the subsequent concentration. "Cyanide of Mercury should be kept in well-stopped bottles, protected from light." *U. S.*

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* "Take of Ferrocyanide of Potassium *five troyounces;* Sulphuric Acid *four troyounces and one hundred and twenty grains;* Red Oxide of Mercury, in fine powder, Water, each, *a sufficient quantity.* Dissolve the Ferrocyanide of Potassium in twenty fluidounces of Water, and add the solution to the Sulphuric Acid, previously diluted with ten fluidounces of Water, and contained in a glass retort. Distil the mixture nearly to dryness into a receiver, containing ten fluidounces of Water and three troyounces of Red Oxide of Mercury. Set aside two fluidounces of the distilled liquid, and to the remainder add, with agitation, sufficient Red Oxide to destroy the odor of hydrocyanic acid. Then filter the solution, and, having added the reserved liquid, evaporate the whole in a dark place, in order that crystals may form. Lastly, dry the crystals, and keep them in a well-stopped bottle, protected from the light." *U. S.* 1870.

Properties, etc. "Colorless or white, prismatic crystals, becoming dark-colored on exposure to light, odorless, having a bitter, metallic taste, and a neutral reaction. Soluble in 12·8 parts of water and in 15 parts of alcohol at 15° C. (59° F.); in 3 parts of boiling water and in 6 parts of boiling alcohol. When slowly heated, the salt decomposes into metallic mercury and cyanogen gas, which is inflammable, burning with a purplish flame. On further heating, the blackish residue, containing globules of metallic mercury, is wholly dissipated. On adding hydrochloric acid to the aqueous solution, hydrocyanic acid vapor is evolved. A five per cent. aqueous solution of the salt, when mixed with a dilute aqueous solution of iodide of potassium, should not yield a red or reddish precipitate soluble in excess of either liquid (abs. of mercuric chloride)." *U. S.*

In composition, it is a normal cyanide of mercury, consisting of one atom of the metal 199·7, and two of cyanogen 52 = 251·7; its formula being $HgCy_2$, or $Hg(CN)_2$.

Cyanide of mercury acts on the animal economy as a potent poison. In medicinal doses it sometimes causes ptyalism, but does not produce epigastric pain like corrosive sublimate. It has been occasionally used as a remedy in syphilis. M. Desmartis, of Bordeaux, considers it superior to all the other preparations of mercury in the treatment of syphilitic complaints; particularly in cases in which the patients have suffered, for a long period, from obscure pains. The dose is from the sixteenth to the eighth of a grain (0·004 to 0·008 Gm.), which should not be exceeded, as the medicine may meet with free hydrochloric acid in the stomach.

HYDRARGYRI IODIDUM RUBRUM. *U.S., Br.* *Red Iodide of Mercury.* [*Biniodide of Mercury. Mercuric Iodide.*]

$Hg\,I_2$; 452·9. (HȲ-DRĂR′G̣Y̱-RĪ Ī-ŎD′Ị-DŬM RŪ′BRŬM.) Hg I; 226·45.

Hydrargyrum Biiodatum Rubrum, *P.G.;* Mercurius Iodatus Ruber, Deutoioduretum Hydrargyri, Ioduretum Hydrargyricum; Deuto-iodure (Bi-iodure) de Mercure, Iodure mercurique, *Fr.;* Quecksilberjodid, Rothes Jodquecksilber, *G.*

"Corrosive Chloride of Mercury, *nine parts* [or one ounce av.]; Iodide of Potassium, *eleven parts* [or five hundred and thirty-five grains]; Distilled Water, *a sufficient quantity.* Dissolve the Corrosive Chloride of Mercury in *one hundred and fifty parts* [or one pint] of warm Distilled Water, and the Iodide of Potassium in *thirty parts* [or three fluidounces] of Distilled Water, and filter the solutions separately. Add the solution of Corrosive Chloride of Mercury, when cold, to the solution of Iodide of Potassium, constantly stirring. Collect the precipitate on a filter, wash it with Distilled Water until the washings cease to give a precipitate with test-solution of nitrate of silver, and dry it, between sheets of bibulous paper, at a temperature not exceeding 40° C. (104° F.). Keep the product in well-stopped bottles." *U. S.*

"Take of Perchloride of Mercury *four ounces* [avoirdupois]; Iodide of Potassium *five ounces* [avoird.]; Boiling Distilled Water *four pints* [Imperial measure]. Dissolve the Perchloride of Mercury in three pints [Imp. meas.], and the Iodide of Potassium in the remainder of the Water, and mix the two solutions. When the temperature of the mixture has fallen to that of the atmosphere, decant the supernatant liquor from the precipitate, and, having collected the latter on a filter, wash it twice with cold distilled water, and dry it at a temperature not exceeding 212°." *Br.*

In the above processes for forming mercuric iodide, which may be considered as identical, a double decomposition takes place between corrosive sublimate and iodide of potassium, resulting in the formation of chloride of potassium which remains in solution, and mercuric iodide which precipitates. The precipitate is soluble in the reacting salts, and hence a loss of part of it is incurred by an excess of either. It is best, however, to have a slight excess of the iodide of potassium, which is furnished by the proportion taken in the formulas; as then the decomposition of the whole of the corrosive sublimate is insured, and any contamination of the mercuric iodide by it prevented. The late process of the Edinburgh College consisted in a combination of the ingredients by trituration in due proportion with the aid of alcohol; but, after the red powder was obtained, it was treated with a boiling solution of common salt, which dissolved the mercuric iodide to the exclusion of any contaminating mercurous iodide; and the solution, thus obtained, on cooling, deposited the pure mercuric salt in crystals. Mr. F. R. Williams states that in the manufacture of the red iodide on a large scale the amount of water required by the officinal processes is very troublesome. He remedies it by using chloride of ammonium, so as to get a very concentrated solution of corrosive sublimate, which he adds to a concentrated solution of the iodide. (*P. J. Tr.*, June, 1873.) Prof. Chas. L. Mitchell has improved upon the process of Williams, and we give his process in the foot-note.*

Properties. As obtained by the late Edinburgh process, it is in splendid crimson acicular crystals. Köhler has found, however, that it crystallizes better from boiling hydrochloric acid. (*Ber. der Deutsch. Chem. Ges.*, 1879, p. 608.) When heated it fuses readily into a yellow liquid at about 150° C. (302° F.), melting at 254° C. (489·2° F.) to a blood-red liquid, and sublimes in yellow rhombic scales, which become red on cooling. "It is entirely volatilized by a heat under redness." *Br.* Mercuric iodide is a dimorphous substance, having a different crystalline form in its red and yellow states. According to Schiff, it is only in its yellow form that it is soluble in alcohol; and hence it is that, when separated by water from its alcoholic solution, it falls in this condition. (*Ann. der Chem. und Pharm.*, cix. 371.) It forms definite compounds with the iodides of the alkali metals. The compound formed with iodide of potassium has been used as a medicine. (See *Iodohydrargyrate of Potassium*, in Part II.) "When digested with solution of soda it assumes a reddish brown color, and the fluid, cleared by filtration and mixed with solution of starch, gives a blue precipitate on being acidulated with nitric acid," showing that it is an iodide. Mercuric iodide consists of one atom of mercury 199·7, and two of iodine 253·2 = 452·9, and its formula is HgI_2. In the Br. Pharmacopœia, which recognizes 100 as the combining weight of mercury, it is considered as the neutral iodide, with the formula HgI. It combines with mercurous iodide, so as to form a yellow *sesquiodide*, represented by the formula $HgI + HgI_2$ or Hg_2I_3.

"A scarlet red, crystalline powder, permanent in the air, odorless and tasteless, almost insoluble in water, soluble in 130 parts of alcohol at 15° C. (59° F.), and in 15 parts of boiling alcohol; also soluble in solution of iodide of potassium, or of mercuric chloride. When heated, the salt turns yellow, but reassumes its red color on cooling. On ignition it is wholly dissipated. On heating the salt with solution of soda and adding a little sugar of milk, metallic mercury is precipitated. If the salt be heated with sulphuric acid and some black oxide of manganese, vapor of iodine will be given off. Water agitated with the salt, and filtered, should remain unaffected by test-solution of nitrate of silver (abs. of soluble iodide, chloride)." *U.S.*

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* *Hydrargyri Iodidum Rubrum, Mitchell's Process.* Mercury, 1000 grs.; Nitric Acid, 1700 grs. Iodide Potassium, 1662 grs. or q. s.; Distilled Water, q. s. (Instead of the mercury and nitric acid ℥v ʒi ℈ii of Liq. Hydrarg. Nit. can be used.) Dissolve the mercury in the nitric acid by the aid of a little heat (in large quantities this is not necessary, as the reaction between the acid and mercury generates sufficient heat), and dilute with an equal bulk of water. Then add the iodide potassium, dissolved in 8 fluidounces of water, until no farther precipitation ensues, being careful towards the last to add the solution very gradually, so as to avoid dissolving the mercuric iodide in an excess of the liquid. Collect the precipitate on a filter, wash well with distilled water, drain and dry. (*A. J. P.*, 1876, p. 116.)

Medical Properties and Uses. Mercuric iodide is a powerful irritant poison. It has been used in similar diseases with the mercurous iodide, namely, in scrofula and syphilis, but is much more active. Dr. Fuller, physician to St. George's Hospital, London, has found it a valuable remedy in rheumatism dependent on a syphilitic taint, having cured several cases in which corrosive sublimate had been given in vain. He also employed it with good results in two cases of epilepsy, dependent on injuries to the head, in which he suspected thickening of the dura mater, or deposit between it and the bone. (*Ranking's Abstract*, No. 25, p. 51.) The dose of this iodide is the sixteenth of a grain (0·004 Gm.), gradually increased to the fourth (0·016 Gm.), given in pill or dissolved in alcohol. A preferable mode of administering it, is dissolved in a solution of iodide of potassium.* This mode was adopted by Dr. Fuller, who attributes his success with the remedy, in great measure, to its having been given in this way. The preparation thus made is really a solution of iodohydrargyrate of potassium.

M. Cazenave considers mercuric iodide as the best topical application in lupus. He applies it in thin layers, every six or eight days, to small portions of the ulcerated surface at a time, in the form of a caustic ointment, made of equal parts of the iodide, oil, and lard. The application produces severe pain, and gives rise to a sharp inflammation, which soon terminates, leaving the ulcer in an improved condition, with a tendency to cicatrize smoothly, and on a level with the surrounding skin. (*Ann. de Thérap.*, 1852, p. 175.)

Off. Prep. Liquor Arsenii et Hydrargyri Iodidi, *U.S.;* Unguentum Hydrargyri Iodidi Rubri, *Br.*

HYDRARGYRI IODIDUM VIRIDE. *U.S., Br.* *Green Iodide of Mercury.* [*Protiodide of Mercury. Mercurous Iodide.*]

Hg_2I_2; 652·6. (HȲ-DRÄR′ĢỴ-RĪ Ī-ŎD′Ị-DŬM VĬR′Ị-DĒ.) Hg_2I; 326·3.

Hydrargyri Iodidum, *U.S.* 1850; Iodide of Mercury; Hydrargyrum Iodatum Flavum, *P.G.;* Hydrargyrum Iodatum, Hydrargyri Iodidum, Ioduretum Hydrargyrosum; Yellow Iodide of Mercury; Protiodure de Mercure, Iodure mercureux, *Fr.;* Quecksilberjodür, Gelbes Jodquecksilber, *G.*

"Mercury, *eight parts* [or one ounce av.]; Iodine, *five parts* [or two hundred and seventy-four grains]; Alcohol, *a sufficient quantity.* Pour about *three parts* [or half a fluidounce] of Alcohol into a mortar containing the Mercury, add the Iodine in several, successive portions, and triturate the mixture, adding sufficient Alcohol from time to time to keep the mass constantly moist, and taking care that it shall neither become too hot, nor be exposed to light during the various steps of the process. Continue the trituration until all globules of Mercury have disappeared, and the mixture has become nearly dry and has acquired a greenish yellow color. Then add sufficient Alcohol to reduce the whole to a thin paste, pour this into a bottle, let it stand for several days, and then wash the Iodide twice with about *fifty parts* [or half a pint] of Alcohol each time, and decant the washings. Transfer the Iodide to a filter and continue washing with Alcohol until the washings are no longer affected by hydrosulphuric acid. Lastly, dry the product in a dark place, between sheets of bibulous paper, at a temperature not exceeding 40° C. (104° F.). Keep the product in well-stopped bottles, protected from light." *U.S.*

"Take of Mercury, by weight, *one ounce* [avoirdupois]; Iodine *two hundred and seventy-eight grains;* Rectified Spirit *a sufficiency.* Rub the Iodine and Mercury in a porcelain mortar, occasionally moistening the mixture with a few drops of the Spirit, and continue the trituration until metallic globules are no longer visible, and the whole assumes a green color. The product thus obtained should be dried in a dark room, on filtering paper, by simple exposure to the air, and preserved in an opaque bottle." *Br.*

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* A syrup has been largely used in the French hospitals and in this country which has received the name of *Sirop Gibert.* It is made by dissolving *three* grains of *red iodide of mercury* and *one hundred and two grains* of *iodide of potassium* in *three fluidrachms* of water, filtering, and adding sufficient simple syrup to make *ten fluidounces.* Each tablespoonful contains about one-seventh of a grain of red iodide of mercury and five grains of iodide of potassium.

The present process for this preparation is an improvement over that of U. S. P. 1870, in directing the gradual addition of the iodine to the mixture of alcohol and mercury; this prevents volatilization.

This process for forming the mercurous iodide is a case of simple combination, the alcohol facilitating the union by dissolving the iodine. The drug may be prepared by precipitation, by adding a solution of iodide of potassium to one of mercurous nitrate; but, as it is difficult to prepare mercurous nitrate, without being mixed with some mercuric nitrate, the green iodide, when thus obtained, is apt to be contaminated with red iodide. M. Roland Seeger suggests double decomposition between mercurous acetate and iodide of potassium. (*A. J. P.*, 1859, p. 204.) M. Boutigny proposes to decompose calomel by iodide of potassium, and gives the following formula. Twenty-nine drachms of calomel are mixed with twenty of pulverized iodide of potassium in a glass mortar, and twelve ounces of boiling distilled water poured upon the mixture. After cooling the liquid is decanted, and the precipitate washed on a filter with distilled water, and dried in the shade. (See *A. J. P.*, viii. 326.) This process did not succeed with Mr. Charles Bullock, of this city, when he used the reacting ingredients in quantities six times those recommended by M. Boutigny. Mr. John Canavan, of New York, ascribes the failure to insufficient trituration, which, to insure complete reaction, must be long continued. If the reaction be imperfect, the water washes away not only chloride of potassium, but also iodide of potassium, holding in solution a part of the mercurous iodide formed, which is ultimately decomposed into mercuric iodide and metallic mercury. The experiments of Prof. J. M. Maisch, of this city, tend to confirm this view. He further found that a boiling temperature enables chloride of potassium to decompose the mercurous iodide perceptibly, and infers that the use of cold water would give a purer product. He therefore concludes that the process of Boutigny cannot be depended upon for giving a pure mercurous iodide, and that we must fall back on the Pharmacopœia process. As prepared by the U. S. formula of 1850, it was liable to contain a little red iodide; but this is obviated in the present edition by the direction to wash it, near the close of the operation, with alcohol. It is known to be free from the red iodide when the alcoholic washings produce no permanent cloudiness with a large quantity of water. According to Mr. F. R. Williams, a boiling solution of common salt is much more efficacious as well as much more economical than alcohol as a solvent for washing out the red from the green iodide. (*P. J. Tr.*, June, 1873, p. 1016.) Even when purified, however, it generally contains a little metallic mercury, and, according to Dr. Squibb, a considerable portion of the yellow iodide; but these are of little consequence compared with the red iodide, which should always be carefully sought for, and separated if found. (*A. J. P.*, Jan. 1857.) M. P. Yrou has prepared the green iodide by subliming iodine with an excess of mercury, and subsequently washing it with dilute nitric acid. (*Journ. de Pharm.*, 4e sér., xviii. p. 167.)

From experiments by Mr. C. H. Wood, it appears that the green powder resulting from the British formula is a mixture of the green iodide with a large proportion of red iodide and metallic mercury. By continuing the trituration, the powders become more and more yellow, and at length have only a tinge of green. He infers that the pure mercurous iodide is yellow, and that the green color is owing to an admixture of the blue of the mercury with the yellow of the mercurous iodide.* (*P. J. Tr.*, 1868, 503.)

Properties. "A dull green to greenish yellow powder, becoming more yellow by exposure to air, and darker by exposure to light, odorless and tasteless, almost insoluble in water, and wholly insoluble in alcohol or ether. When strongly heated, the salt is volatilized without residue. When added to a solution of iodide of potassium, the salt is decomposed into metallic mercury which precipitates and mercuric iodide which dissolves. If 10 C.c. of alcohol are shaken with 1 Gm. of the salt and filtered, the filtrate should not produce more than a very faint, transient opalescence, when dropped into water; and when 5 C.c. of the filtrate are evaporated from a white porcelain surface, not more than a very faint red stain should remain behind (abs. of more than traces of mercuric iodide)." *U. S.* Its sp. gr. is 7·75. If quickly and cautiously heated, it sublimes in red crystals, which afterwards become yellow. "Gradually heated in a test-tube, it yields a yellow sublimate, which, upon friction, or after cooling, becomes red, while globules of metallic mercury are left in the bottom of the tube." *Br.* It is generally considered to be composed of two atoms of mercury united with two atoms of iodine, Hg_2I_2, $399·4 + 253·2 = 652·6$, although some chemists make its formula HgI, consisting of one atom of mercury 199·7, and one of iodine $126·6 = 326·3$. The Br. Pharmacopœia considers it a subiodide, with the formula Hg_2I; the combining weight of mercury being 100.

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* Patrouillard recommends Dublanc's process, which consists in triturating together a mixture of mercuric (red) iodide and of metallic mercury, in the following proportions: Mercuric iodide 227 parts; mercury 100 parts. The red iodide may easily be obtained of absolute purity, and in a state of perfect dryness; besides, during the trituration there is no risk of loss by volatization. The mixture should merely be moistened with alcohol of eighty per cent., so as to form a thin paste, and well triturated; the reaction takes place in a very short time, and the product is of a dark greenish yellow color. By way of precaution, it should be washed with boiling alcohol. (*Rép. de Pharm.*, 1877, 549; *N. R.*, Nov. 1877.)

Medical Properties and Uses. Iodide of mercury has been given in scrofula and scrofulous syphilis. The dose is a grain (0·065 Gm.) daily, gradually increased to three or four grains (0·20 or 0·26 Gm.). It should never be given at the same time with iodide of potassium, which converts it immediately into red iodide and metallic mercury. (Mialhe, *Journ. de Pharm.*, 3e sér., iv. 36.)

HYDRARGYRI OXIDUM FLAVUM. *U.S., Br.* *Yellow Oxide of Mercury.* [*Yellow Mercuric Oxide.*]

Hg O; 215·7. (HȲ-DRĂR′ǤY̦-RĪ ŎX′I̦-DŬM FLĀ′VŬM.) Hg O; 107·85.

Hydrargyrum Oxydatum Via Humida Paratum, *P.G.;* Hydrargyrum Oxidatum Flavum vel Præcipitatum; Precipitated Oxide of Mercury; Oxide de Mercure jaune ou précipité, *Fr.;* Praecipitirtes (Gelbes) Quecksilberoxid, *G.*

"Corrosive Chloride of Mercury, *one part* [or one ounce av.]; Solution of Potassa, *nine parts* [or eight and a half fluidounces]; Distilled Water, *a sufficient quantity.* Dissolve the Corrosive Chloride of Mercury in *one hundred parts* [or about six pints] of warm Distilled Water and filter the solution. Pour the filtrate into the Solution of Potassa, previously diluted with *one hundred parts* [or six pints] of Distilled Water, stirring constantly, and set the liquid containing the precipitate aside for twenty-four hours. Then decant the supernatant, clear liquid from the precipitate, and wash the latter repeatedly by the affusion and decantation of Distilled Water, using about *one hundred parts* [or six pints] of Water each time. Continue the washing on a strainer until the washings cease to be affected by test-solution of nitrate of silver. Let the precipitate drain, and dry it, between sheets of bibulous paper, in a dark place, at a temperature not exceeding 40° C. (104° F.). Keep the product in well-stopped bottles, protected from light." *U. S.*

"Take of Perchloride of Mercury *four ounces;* Solution of Soda *two pints;* Distilled Water *a sufficiency.* Dissolve the Perchloride of Mercury in four pints of Distilled Water, aiding the solution by the application of heat, and add this to the Solution of Soda. Stir them together; allow the yellow precipitate to subside; remove the supernatant liquor by decantation; thoroughly wash the precipitated oxide on a calico filter with Distilled Water, and finally dry it by the heat of a water-bath." *Br.*

The process adopted for this preparation is that of Dr. Hoffmann. Both the Pharmacopœias direct the alkaline solution in excess, and the addition of the corrosive sublimate to the alkali. Both these points are important, for if the corrosive sublimate be in excess, brown oxychloride will be formed towards the last of the decomposition; and when the alkali is added to the solution of corrosive sublimate, the same compound will be formed from the first, and is with difficulty decomposed by an excess of alkali. The solution of potassa should be as free as possible from carbonate, to prevent the formation of brown carbonate of mercury. The mercuric chloride is precipitated by the alkalies, chloride of potassium or of sodium being left in solution. The object of the subsequent washing is to remove the chloride of potassium and the excess of the alkali.*

Properties. The officinal yellow oxide is of a yellow color similar to that of the yolk of eggs, and is a completely amorphous powder, exhibiting no evidence of crystalline particles even under the microscope. Yellow oxide of mercury differs only from the red, by being amorphous and in a much more minute state of division; the red oxide, by trituration, acquiring an orange and finally a yellow color. In consequence of its different state of aggregation, it presents some peculiarities in its chemical relations, and is much more quickly acted on by reagents than is the red oxide. Thus, oxalic acid, which acts on the red oxide only with the aid of heat, immediately combines with the yellow oxide at ordinary temperatures, producing the white oxalate; and while the latter oxide, in contact with chlorine, gives up oxygen to that element, forming hypochlorous acid and calomel, the former exercises scarcely any influence on the gas at common temperatures. It is described in the U. S. Pharmacopœia as "A light orange-yellow, heavy, impalpable powder, permanent in the air, and turning darker on exposure to light, odorless and tasteless, insoluble in water or alcohol, but wholly soluble in nitric or hydrochloric acid. When strongly heated it assumes a red color; at a higher temperature it is decomposed, giving off oxygen and separating metallic mercury, and is finally volatilized without leaving a residue. When digested, on a water-bath, for fifteen minutes, with a strong solution of oxalic acid, it forms mercuric oxalate of a white color (diff. from red mercuric oxide)." *U. S.*

Medical Properties. The attention which has been recently paid to the yellow oxide, is owing to its peculiar applicability to the local treatment of diseases of the eye, in consequence of its amorphous character. Mr. B. Squire, of England, was the first to notice publicly this use of the oxide (*P. J. Tr.*, 2d ser., vi. 512). At present the yellow oxide is very largely used by oculists throughout the world. The red oxide, however carefully it may be triturated, even though in a perfectly impalpable state, still shows under the microscope crystalline particles, which, in contact with the conjunctiva, cause more or less irritation; and it can, therefore, be readily understood that, in the ordinary mode of preparing it for use as an ointment, it may sometimes be productive of serious annoyance. From this objection the yellow oxide is entirely exempt.

Off. Prep. Oleatum Hydrargyri; Unguentum Hydrargyri Oxidi Flavi, *U. S.*

HYDRARGYRI OXIDUM RUBRUM. *U. S., Br.* *Red Oxide of Mercury.* [*Red Precipitate. Red Mercuric Oxide.*]

Hg O; 215·7. (HȲ-DRÄR′ĢỴ-RĪ ŎX′Ị-DŬM RÛ′BRŬM.) Hg O; 107·85.

Hydrargyri Nitrico-oxidum; Hydrargyrum Oxydatum Rubrum, *P.G.;* Hydrargyri Nitrico-oxydum, Mercurius Corrosivus Ruber vel Precipitatus, Oxidum Hydrargyricum; Deut-oxide ou Peroxide de Mercure, Oxide mercurique, Précipité rouge, Poudre de Jean de Vigo, *Fr.;* Rother Praecipitat, Quecksilber Praecipitat, Rothes Quecksilberoxid, *G.*

A process for this oxide has been omitted from the present Pharmacopœia; that of U. S. P. 1870 is appended.†

"Take of Mercury, by weight, *eight ounces* [avoirdupois]; Nitric Acid *four fluidounces and a half* [Imperial measure]; Water *two fluidounces* [Imp. meas.]. Dissolve half the Mercury in the Nitric Acid diluted with the Water, evaporate the solution to dryness, and with the dry salt thus obtained, triturate the remainder of the Mercury until the two are uniformly blended together. Heat the mixture in a porcelain dish, with repeated stirring, until acid vapors cease to be evolved, and, when cold, enclose the product in a bottle." *Br.*

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* Prof. Chas. L. Mitchell proposes an improvement on the officinal process, which avoids the use of large vessels when it is made on a large scale. He takes solution of mercuric nitrate (prepared by dissolving mercury in an excess of nitric acid), any convenient quantity; solution of soda, U. S. P., a sufficient quantity. The solution of mercuric nitrate is diluted with an equal bulk of water, and solution of soda added until in slight excess. The yellow precipitate is collected, washed well, and dried.

† "Take of Mercury *thirty-six troyounces;* Nitric Acid *twenty-four troyounces;* Water *two pints.* Dissolve the Mercury, with the aid of a gentle heat, in the Acid and Water previously mixed, and evaporate to dryness. Rub the dry mass into powder, and heat it in a very shallow vessel until red vapors cease to rise." *U. S.* 1870.

In this process the mercury is dissolved by the nitric acid, forming either mercuric nitrate, or a mixture of this with mercurous nitrate. The resulting mass when exposed to a strong heat is decomposed, giving out red nitrous fumes, and assuming successively a yellow, orange, and brilliant purple-red color, which becomes orange-red on cooling. These changes are owing to the gradual separation and decomposition of the nitric acid, by the oxygen of which the mercurous oxide, if any be present, is converted into mercuric oxide, while nitrogen dioxide gas escapes, and becomes hyponitric acid vapor on contact with the air. The mercuric oxide is left behind; but in general not quite free from the nitrate, which cannot be wholly decomposed by heat, without endangering the decomposition of the oxide itself, and the volatilization of the metal. The preparation is commonly called *red precipitate.* The name of *red oxide of mercury*, by which it is now designated in most of the Pharmacopœias, is appropriate, as nitrate of mercury exists in it merely as an accidental impurity; and there is no occasion to distinguish the preparation from the oxide obtained by calcining mercury, the latter not being officinal, and perhaps never employed.

In the preparation of this mercurial, various circumstances influence the nature of the product, and must be attended to, if we desire to procure the oxide with that fine bright orange-red color, and shining scaly appearance, usually considered desirable. Among these circumstances is the condition of the nitrate of mercury submitted to calcination. According to Gay-Lussac, it should be employed in the form of small crystalline grains. If previously pulverized, as directed in the officinal processes, it will yield an orange-yellow powder; if it be in the state of large and dense crystals, the oxide will have a deep orange color. Care must also be taken that the mercury and acid be free from impurities. It is highly important that sufficient nitric acid be employed fully to saturate the mercury. M. Payssé, who paid great attention to the manufacture of red precipitate, recommended 70 parts of nitric acid from 34° to 38° Baumé, to 50 parts of mercury. This, however, is an excess of acid. We have been told by a skilful practical chemist of Philadelphia that he has found, by repeated experiment, 7 parts of nitric acid of 35° Baumé, to be sufficient fully to saturate 6 parts of mercury. Less will not answer, and more will be useless. It is not necessary that the salt should be removed from the vessel in which it is formed; and it is even asserted that the product is always more beautiful when the calcination is performed in the same vessel. A matrass may be used with a large flat bottom, so that an extended surface may be exposed, and all parts heated equally. The metal and acid having been introduced, the matrass should be placed in a sand-bath, and covered with sand up to the neck. The solution of the mercury should be favored by a gentle heat, which should afterwards be gradually increased till red vapors appear, then maintained as equably as possible till these vapors cease, and at last slightly elevated till oxygen gas begins to escape. This may be known by the increased brilliancy with which a taper will burn if placed in the mouth of the matrass, or by its rekindling if partially extinguished. Too high a temperature must be carefully avoided, as it decomposes the oxide, and volatilizes the mercury. At the close of the operation, the mouth of the vessel should be stopped, and the heat gradually diminished, the matrass being still allowed to remain in the sand-bath. These last precautions are said to be essential to the fine red color of the preparation. It is best to operate upon a large quantity of materials, as the heat may be thus more uniformly maintained. The direction in the British, to rub a portion of mercury with the nitrate before decomposing it, renders the process more economical; as the nitric acid, which would otherwise be dissipated, is thus employed in oxidizing an additional quantity of the metal.

As the process is ordinarily conducted in laboratories, the nitrate of mercury is decomposed in shallow earthen vessels, several of which are placed upon a bed of sand, in the chamber of an oven or furnace, provided with a flue for the escape of the vapors. Each vessel may conveniently contain ten pounds of the nitrate. There is always loss in the operation thus conducted.*

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* Under the name of *Hydrargyri Oxydum Rubrum*, the Dublin College formerly directed a preparation, called by the elder chemists *hydrargyrum præcipitatum per se*, or *precipitate per se*, and

Properties, etc. Red precipitate, well prepared, has a brilliant red color, with a shade of orange, a shining scaly appearance, and an acrid taste. It is very slightly soluble in water, of which Dr. Barker found 1000 parts to take up 0·62 of the oxide. Dr. Christison found 1 part of the oxide to be dissolved by about 7000 parts of boiling water, and the solution to give a black precipitate with sulphuretted hydrogen. Tannic acid precipitates metallic mercury from an aqueous solution of the oxide, especially when heated. (Bullock, *Proc. A. P. A.*, 1858, p. 306.) It is insoluble in cold alcohol and ether. (*Ibid.*) Nitric and hydrochloric acids dissolve it without effervescence. "Heavy, orange-red, crystalline scales, or a crystalline powder, becoming more yellow the finer it is divided, permanent in the air, odorless and tasteless, insoluble in water or alcohol, but wholly soluble in nitric or hydrochloric acid. When strongly heated it turns darker, without emitting reddish fumes (abs. of nitrate); at a higher temperature it is decomposed, giving off oxygen and separating metallic mercury, and is finally volatilized without residue. When digested, on a water-bath with a strong solution of oxalic acid, it does not change color within two hours (difference from yellow mercuric oxide)." *U. S.* It is essentially mercuric oxide, consisting of one atom of the metal 199·7, and one of oxygen 16 = 215·7, or, according to the Br. Pharmacopœia, consisting of one atom of mercury 100, and one of oxygen 8 = 108; but, in its ordinary state, it always contains a minute proportion of nitric acid, probably in the state of subnitrate. According to Brande, when rubbed and washed with a solution of potassa, edulcorated with distilled water, and carefully dried, it may be regarded as nearly pure mercuric oxide. It is said to be sometimes adulterated with brickdust, red lead, etc.; but these may be readily detected, as the oxide of mercury is wholly dissipated if thrown upon red-hot iron. The disengagement of red vapors, when it is heated, indicates the presence of nitrate of mercury. The same or some other saline impurity would be indicated, should water, in which the oxide has been boiled, afford a precipitate with lime-water.

Medical Properties and Uses. This preparation is too harsh and irregular in its operation for internal use; but is still employed externally as a stimulant and escharotic either in the state of powder or of ointment, although to a great extent supplanted by the yellow oxide. In the former state it is sprinkled on the surface of chancres, and indolent, flabby, or fungous ulcers. The powder should be finely levigated.*

Off. Prep. Liquor Hydrargyri Nitratis, *U. S.;* Unguentum Hydrargyri Oxidi Rubri.

HYDRARGYRI SULPHAS. *Br.* *Sulphate of Mercury.*

Hg, SO_4; 295·4. (HȲ-DRÄR′ÇỴ-RĪ SŬL′PHĂS.) Hg O SO_3; 148.

Mercurius Vitriolatus, Hydrargyrum Sulphuricum, Sulphas Mercurins; Mercuric Sulphate, Persulphate of Mercury; Persulfate ou Deuto-sulfate de Mercure, Sulfate mercurique, *Fr.;* Schwefelsaures Quecksilberoxid, *G.*

"Take of Mercury, by weight, *twenty ounces* [avoirdupois]; Sulphuric Acid *twelve fluidounces* [Imperial measure]. Heat the Mercury with the Sulphuric Acid in a porcelain vessel, stirring constantly, until the metal disappears, then continue the heat until a dry white salt remains." *Br.*

Mercury is not acted on by cold sulphuric acid; but, when boiled with an excess of this acid to dryness, it is changed to mercuric sulphate at the expense of part of the acid, sulphurous acid being copiously evolved. Sulphate of mercury, as obtained by a separate formula, is peculiar to the British Pharmacopœia; it was

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sometimes *calcined mercury*, made by exposing the metal to a heat near its boiling point, or about 315·5°C (600° F.), in a matrass with a broad bottom and narrow mouth. The vapors rising were condensed in the upper part of the vessel; and a circulation was thus kept up within it, during which the mercury slowly combined with oxygen, being converted first into a black and then into a red powder. But the process was very slow, requiring several weeks for the complete oxidation of the metal; and, as the product, which was pure mercuric oxide, had no peculiar virtues to recommend it over the oxide procured in the ordinary mode, it was properly discarded by the College. The oxide made in this way is in minute, sparkling, crystalline scales, of a deep red color, becoming still deeper by heat.

* *Black Oxide of Mercury. Oxidum Hydrargyri Nigrum.* U.S. 1850. This preparation has been dropped from both Pharmacopœias, and is now very rarely used. For a full account of its preparation, uses, and properties, see U.S. Dispensatory, 14th edition, p. 1256.

formed as the first step of the processes of the U. S. P. 1870 for corrosive sublimate, calomel, and turpeth mineral. The adoption of a separate formula and distinct officinal name for this salt is certainly a convenience; as it obviates the necessity of repeating the directions for obtaining the same substance in several formulas. On account of its various uses, it requires to be made on a large scale by the manufacturing chemist; and the process is generally performed in a cast-iron vessel, which should be conveniently arranged for the escape and decomposition of the sulphurous acid fumes, which otherwise become a serious nuisance to the neighborhood. The best way to effect this purpose is to allow them to pass off through a very lofty chimney filled with coke, over which a stream of water is made to trickle.

Properties, etc. Mercuric sulphate is in the form of a white crystalline powder, becoming yellow by the affusion of water, and entirely volatilizable by heat. It consists of one atom of mercury 199·6, and one group, SO_4, characteristic of sulphates 96, or $HgSO_4 = 295{\cdot}4$. It has no medical uses.

Off. Prep. Hydrargyri Perchloridum, *Br.;* Hydrargyri Subchloridum, *Br.*

HYDRARGYRI SUBSULPHAS FLAVUS. *U. S.* *Yellow Subsulphate of Mercury.* [*Basic Mercuric Sulphate. Turpeth Mineral.*]

(HȲ-DRÄR′ḈY̦-RĪ SŬB-SŬL′PHĂS FLĀ′VŬS.)

$Hg(HgO)_2SO_4$; 727·1. $3HgO, SO_3$; 363·55.

Hydrargyri Sulphas Flava, *U. S.* 1870; Hydrargyri Subsulphas, Mercurius Emeticus Flavus, Sulphas Hydrargyricus Flavus, Hydrargyrum Sulphuricum Flavum, Turpethum Minerale; Sulfate jaune de Mercure, Turbith minéral, Sulfate trimercurique, *Fr.;* Basischwefelsaures Quecksilberoxyd, Mineralischer Turpeth, *G.*

"Mercury, *ten parts* [or four ounces av.]; Sulphuric Acid, *five parts* [or two ounces av.]; Nitric Acid, *four parts* [or nine fluidrachms]; Distilled Water, *a sufficient quantity.* Upon the Mercury, contained in a capacious flask, pour the Sulphuric Acid, then gradually add the Nitric Acid, previously mixed with *three parts* [or one fluidounce] of Distilled Water, and digest at a gentle heat until reddish fumes are no longer given off. Transfer the mixture to a porcelain capsule, and heat it on a sand-bath, frequently stirring, until a dry, white mass remains. Reduce this to a fine powder and throw it, in small portions at a time, and constantly stirring, into *two hundred parts* [or five pints] of boiling Distilled Water. When all has been added, continue the boiling for ten minutes, then allow the mixture to settle, decant the supernatant liquid, transfer the precipitate to a strainer, wash it with warm Distilled Water until the washings no longer have an acid reaction, and dry it in a moderately warm place." *U. S.*

By referring to the articles on corrosive sublimate and calomel, it will be found that the peculiar salt which is generated by boiling sulphuric acid with mercury to dryness, is directed to be made as the first step for obtaining these chlorides; and here the same salt is again directed to be formed in preparing turpeth mineral. The nitric acid assists in the process by hastening the formation of the sulphate. We have already stated that this salt is normal mercuric sulphate. When thrown into boiling or even warm water it is instantly decomposed, and an insoluble salt is precipitated, which is the turpeth mineral. Its composition is Hg_3SO_6, or, more clearly expressed, $HgSO_4 + 2HgO$; that is, a compound of one mol. of mercuric sulphate and two mols. of mercuric oxide.

Properties, etc. Yellow sulphate of mercury is a lemon-yellow powder, of a somewhat acrid taste. It dissolves in 2000 parts of cold, and about 600 of boiling water. "A heavy, lemon-yellow powder, permanent in the air, odorless, and almost tasteless, insoluble in water or alcohol, but soluble in nitric or hydrochloric acid. When heated, the salt turns red, becoming yellow again on cooling. At a red heat it is volatilized without residue, evolving vapors of mercury and of sulphurous acid. The salt should be soluble in 20 parts of hydrochloric acid without residue (abs. of mercurous salt)." *U. S.* It was originally called *turpeth* mineral, from its resemblance in color to the root of *Ipomæa Turpethum.*

Medical Properties and Uses. Turpeth mineral is alterative, and powerfully emetic and errhine. As an alterative, it has been given in leprous disorders and glandular obstructions. It has been usefully employed as an emetic, repeated every few days, in chronic enlargement of the testicle. It operates with great promptness, and sometimes excites ptyalism. Dr. Hubbard, of Maine, recommends it highly as an emetic in croup, on the ground of its promptness and certainty, and of its not producing catharsis, or the prostration caused by antimony. The dose for a child two years old is two or three grains (0·13 or 0·23 Gm.), repeated in fifteen minutes, if it should not operate. As an errhine, it has been used with benefit in chronic ophthalmia; but it sometimes produces salivation when thus employed. The dose as an alterative is from a quarter to half a grain (0·016 to 0·03 Gm.); as an emetic from two to five grains (0·13 to 0·33 Gm.). When employed as an errhine, one grain (0·065 Gm.) may be mixed with five (0·33 Gm.) of starch or powdered liquorice root.

Turpeth mineral, in an overdose, acts as a poison. One drachm (3·9 Gm.) of it is said to have killed a boy 16 years old. (*Lond. Med. Gaz.*, March, 1847.)

HYDRARGYRI SULPHIDUM RUBRUM. *U. S.* *Red Sulphide of Mercury.* [*Red Mercuric Sulphide. Cinnabar.*]

Hg S; 231·7. (HȲ-DRÄR′ÇY̨-RĪ SŬL′PHI̧-DŬM RŪ′BRŬM.) Hg S; 115·85.

Hydrargyri Sulphuretum Rubrum, *U. S.* 1870; Cinnabaris; Hydrargyrum Sulfuratum Rubrum. *P.G.;* Sulfuretum Hydrargyricum; Sulfure rouge de Mercure, *Fr.;* Rothes Schwefelquecksilber, Zinnober, *G.*

"Take of Mercury, *forty troyounces;* Sulphur, *eight troyounces.* To the Sulphur, previously melted, gradually add the Mercury, with constant stirring, and continue the heat until the mass begins to swell. Then remove the vessel from the fire, and cover it closely to prevent the contents from inflaming. When the mass is cold, rub it into powder, and sublime." *U. S.* 1870.

This preparation has been discarded, we think somewhat prematurely, by the British Council.

Mercury and sulphur, when heated together, unite with great energy, and a product is obtained, which by sublimation becomes the red or mercuric sulphide. In order to render the combination more prompt, the sulphur is first melted; and the addition of the mercury should be made gradually, while the mixture is constantly stirred. Dr. Barker recommends the addition of the metal by straining it upon the melted sulphur through a linen cloth, whereby it falls in a minutely divided state. When the temperature has arrived at a certain point, the combination takes place suddenly with a slight explosion, attended with the inflammation of the sulphur, which must be extinguished by covering the vessel. A black mass will thus be formed, containing generally an excess of sulphur, which, before the sublimation is performed, should be got rid of by gently heating the matter, reduced to powder, on a sand-bath. The sublimation is best performed, on a small scale, in a closely stopped glass matrass, which should be placed in a crucible containing sand, and, thus arranged, exposed to a red heat. The equivalent quantities for forming this sulphide are 32 of sulphur and 199·7 of mercury.

Preparation on the Large Scale. Cinnabar is seldom prepared on a small scale, being made in large quantities for the purposes of the arts. Until within a few years it was nearly all manufactured in Europe, but it is now made to an enormous extent in this country. In Holland, where it is largely manufactured, the sulphur is melted in a cast-iron vessel, and the mercury is added in a divided state, by causing it to pass through chamois leather. As soon as the combination has taken place, the iron vessel is surmounted by another, into which the cinnabar is sublimed. The larger the quantity of the materials employed in one operation, the finer will be the tint of the product. It is also important in the manufacture to use the materials pure, and to drive off any uncombined sulphur which may exist in the mass, before submitting it to sublimation. In the United States, Martin's method, consisting of the agitation together of quicksilver, sulphur, and an alkaline sulphide, appears to have the preference.*

Properties, etc. "Brilliant, dark red, crystalline masses, or a fine, bright, scarlet powder, permanent in the air, odorless, and tasteless, insoluble in water, alcohol, nitric or hydrochloric acid, or in dilute solutions of alkalies. It is dissolved by nitro-hydrochloric acid with separation of sulphur. When heated, the salt becomes brown and then black, but, on cooling, it reassumes its red color. At a higher temperature it takes fire, burns with a bluish flame, emitting the odor of burning sulphur, and is finally volatilized without residue. On dissolving the salt in nitro-hydrochloric acid and adding an excess of stannous chloride, metallic mercury is precipitated. If the salt be treated with warm solution of potassa, the filtrate, after being acidulated with hydrochloric acid, should not yield a yellow or orange-colored precipitate (arsenic, antimony), nor should it produce a colored precipitate with acetate of lead (chromates, iodides, or other sulphides). If the salt be digested with diluted nitric acid for five minutes, the filtrate, after being much diluted, should not be darkened by hydrosulphuric acid (abs of red oxide of mercury or of lead)." *U. S.* In close vessels at a red heat it sublimes without decomposition, and condenses in a mass, composed of a multitude of small needles. When duly levigated, it furnishes a brilliant red powder, which is the paint called *vermilion.* The same compound occurs native, being the sole ore from which mercury is extracted. The preparation, if purchased in powder, should be carefully examined; as, in that state, it is sometimes adulterated with red lead, dragon's blood, or chalk. If red lead be present, acetic acid, digested with it, will yield a yellow precipitate (iodide of lead) with iodide of potassium. Dragon's blood may be detected by alcohol, which will take up the coloring matter of that substance, if present; and, if chalk be mixed with it, effervescence will be excited on the addition of an acid. This sulphide consists of one atom of mercury 199·7, and one of sulphur 32 = 231·7.

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* For a modification of this method, see *Journ. de Pharm.*, Avril, 1875, p. 363.

Medical Properties and Uses. Cinnabar is at present only employed by fumigation, as a rapid sialagogue, in syphilitic affections, when it is desired to obtain an immediate mercurial impression. Half a drachm may be thrown on a red-hot iron, in a close apartment, the fumes inhaled as they arise. These consist of sulphurous acid gas and mercurial vapor, the former of which must prove highly irritating to the patient's lungs. A better substance for mercurial fumigation is the black oxide of mercury.*

HYDRARGYRUM. *U. S., Br.* *Mercury.* [*Quicksilver.*]

Hg; 199·7. (HȲ-DRĂR′G̣Y-RŬM.) **Hg; 99·85.**

Quicksilver; Mercurius, Argentum Vivum; Mercure, Vif Argent, *Fr.;* Quecksilber, *G.;* Mercurio, *It.;* Azógue, *Sp.* and *Port.*

Mercury is found pure, forming an amalgam with silver, in the form of protochloride (native calomel), but most abundantly as the sulphide or native cinnabar. Mines of this metal are found at Almaden in Spain, at Idria in Carniola, in the duchy of Deux-ponts, in Belluno a province of Venetia,† in Corsica, in the Philippine Islands and China, near Huancavelica in Peru, near Azogue in New Granada, at Durango in Mexico, and at New Almaden, New Idria, and other localities in Santa Clara County, California, about sixty-six miles from San Francisco. The most ancient mine is that of Almaden in Spain, which was worked before the Christian era. This mine, and the mines of California, are the most productive at the present day; the Spanish mine yielding about three millions of pounds, and the California more than this amount annually. The ore in all the mines mentioned is cinnabar. The cinnabar from old Almaden is of a dull red color in mass, of a dull brick-red color when in fine powder, and of the sp. gr. 3·6. That from New Almaden is of a bright red color, slightly inclining to purple, not so hard as the Spanish ore, of a brilliant vermilion color in powder, and having the sp. gr. 4·4. The California cinnabar is richer in mercury, because purer, than the Spanish; the former yielding about 70, the latter about 38 per cent. of mercury, according to the analysis of Mr. Adam Bealey. The California mine had been long known to the Indians, but its commercial value was first made known about 1843, by a Mexican, named Castillero, who became its first owner. At present it is in the hands of Americans. (See *P. J. Tr.*, Feb. 1855; also a paper by Dr. Ruschenberger, U.S.N., in *A. J. P.*, March, 1856.) Dr. Ruschenberger has detected selenium in California cinnabar. A quicksilver ore has been found in Macon County, Tennessee, where it is said to exist in vast quantities. According to Mr. E. S. Wayne, it is a talcose rock, and contains mercury in the metallic state, yielding 7·5 per cent. of the metal. (*A. J. P.*, 1868, p. 76.) Mercury has also been found in the island of Borneo, district of Sarawak. (*Chem. News*, Nov. 5, 1869, p. 224.)

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* *Black Sulphide of Mercury. Ethiops Mineral. Hydrargyri Sulphuretum Nigrum.* Though very properly discarded from the Pharmacopœias, this has too long occupied a place in the catalogue of the Materia Medica to be passed over without some notice. The following was the formula of the U. S. Pharmacopœia of 1850, for its preparation. "Take of Mercury, Sulphur, each, *a pound.* Rub them together till all the globules disappear." *U. S.* It is now very rarely used. For an account of its properties, see U. S. Dispensatory, 14th edition, p. 1259.

† For an account of these Italian mines and the mode of working them, see *P. J. Tr.*, March, 1873.

Extraction, etc. Mercury is obtained almost exclusively from the sulphide or native cinnabar. It is extracted by two principal processes. According to one process, the mineral is picked, pounded, and mixed with lime. The mixture is then introduced into cast-iron retorts, which are placed in rows, one above the other, in an oblong furnace, and connected with earthenware receivers, one-third full of water. Heat being applied, the lime combines with the sulphur, so as to form sulphide and sulphate of calcium; while the mercury distils over, and is condensed in the receivers. The other process is practised at Almaden in Spain. Here a square furnace is employed, the floor of which is pierced with many holes, for the passage of the flame from the fireplace beneath. In the upper and lateral part of the furnace, holes are made, communicating with several rows of *aludels*, formed of adapters passing into one another, which terminate in a small chamber that serves both as condenser and receiver. The mineral, having been picked by hand and pulverized, is kneaded with clay, and formed into small masses, which are placed on the floor of the furnace. Heat being applied, the sulphur burns, and the volatilized mercury passes through the aludels to be condensed in the chamber. The process pursued at New Almaden is described by Dr. Ruschenberger. (See *A. J. P.*, March, 1856.)

Mercury, as found in commerce, is contained in cylindrical wrought-iron bottles, called flasks, each containing 75 pounds. Since the regular working of the California mine of New Almaden, the importation of the metal from Spain and Austria has gradually diminished, and at present the domestic production is sufficient not only to supply the home consumption, but to give an excess for exportation. The different mines of California were, in the year 1862, said to be yielding mercury at the rate of four millions of pounds per annum (*A. J. P.*, Sept. 1862, p. 410), and in 1877 the yield had increased to over six million pounds, but in 1881 it had decreased to four and a half million pounds. The exports are made principally to China, Mexico, Chili, and Peru. The chief uses of the metal are in mining silver and gold, in preparing vermilion, in making thermometers and barometers, in silvering looking-glasses, and in forming various pharmaceutical compounds.

Properties. Mercury is "a shining, silver-white metal, liquid at temperatures above —40° C. (—40° F.), odorless and tasteless, and insoluble in ordinary solvents, but soluble in nitric acid without residue. Sp. gr. 13·5. At the common temperature it volatilizes very slowly, more rapidly as the temperature increases, and at 350° C. (662° F.) it boils, being finally volatilized without residue. When globules of Mercury are dropped upon white paper, they should roll about freely, retaining their globular form, and leaving no streaks or traces. It should be perfectly dry and present a bright surface. On boiling 5 Gm. of distilled water with 5 Gm. of Mercury, and 4·5 Gm. of hyposulphite of sodium, in a test-tube, for about one minute, the Mercury should not lose its lustre and should not acquire more than a slightly yellowish shade (abs. of more than slight traces of foreign metals)." *U. S.* When perfectly pure it undergoes no alteration by the action of air or water, but in its ordinary state suffers a slight tarnish. When heated to near the boiling point, it gradually combines with oxygen, and is converted into mercuric oxide; but at the temperature of ebullition it parts with the oxygen with which it had combined, and is reduced again to the metallic state. Its sp. gr. is 13·5, and its atomic weight 200. It boils at 357·25° C. (669° F.), yielding a colorless vapor, and congeals at

—39·4° C. (—39° F.), forming a malleable solid of tin-white color. It is a good conductor of heat, and its specific heat is small. It is not attacked by hydrochloric acid, nor by cold sulphuric acid; but boiling sulphuric acid or cold nitric acid dissolves it, producing mercurous sulphate and mercurous nitrate respectively; with the extrication, in the former case, of sulphurous acid; in the latter, of nitrogen dioxide becoming hyponitric acid fumes. Its combinations are numerous, and several of them constitute important medicines. It forms two series of compounds, the *mercurous* compounds containing the group $(Hg_2)^{II}$, and the *mercuric* compounds containing the single atom Hg^{II}.

Mercury, as it occurs in commerce, is in general sufficiently pure for pharmaceutical purposes. Occasionally it contains foreign metals, as lead, tin, zinc, and bismuth. Mr. Brande informs us that, in examining large quantities of this metal in the London market, he found it only in one instance intentionally adulterated. When impure, the metal has a dull appearance, leaves a trace on white paper, is deficient in due fluidity and mobility, as shown by its not forming perfect globules, is not totally dissipated by heat, and, when shaken in a glass bottle, coats its sides with a pellicle, or, if very impure, deposits a black powder. If agitated with strong sulphuric acid, the adulterating metals become oxidized and dissolved, and thus the mercury may to a limited extent be purified. Lead is detected by shaking the suspected metal with equal parts of acetic acid and water, and then testing the acid by sulphate of sodium, or iodide of potassium. The former will produce a white, the latter a yellow precipitate, if lead be present. Bismuth is discovered by dropping a nitric solution of the mercury, prepared without heat, into distilled water, when subnitrate of bismuth will be precipitated. The complete solubility of the metal in nitric acid shows that tin is not present; and, if sulphuretted hydrogen does not act upon hydrochloric acid previously boiled upon the metal, the absence of contaminating metals is shown.

Mercury may be purified by digesting it with a small portion of weak nitric acid, or with a solution of mercuric chloride (corrosive sublimate); whereby all the ordinary contaminating metals will be removed. The purification by nitric acid is, according to L. Meyer (*Zeit. Anal. Chem.*, ii. 241), best effected as follows. The metal is allowed to flow in a very thin stream from a small opening in a glass funnel into a wide glass tube 1·25 m. high aud 5 cm. in diameter, which contains a mixture of water and 100 C.c. of nitric acid. A narrow tube is fastened to the bottom of this, from which the pure metal flows; it has then only to be washed with water and dried. The above operation may have to be repeated several times, and the metal if pure must leave no residue when dissolved in pure nitric acid, evaporated to dryness and ignited. Mercury, however, is usually purified by distillation. To separate mechanical impurities, moisture, small quantities of oxide, mercury may be filtered by collecting it in a sound piece of chamois leather and gathering the corners together, forcibly squeezing the particles through the pores of the leather.

The British Pharmacopœia of 1864 gave the following process for the purification of mercury, using for this purpose an impure form of the metal, under the name of *Commercial Mercury* or *Quicksilver*.

"Take of Mercury of Commerce *three pounds* [avoirdupois]; Hydrochloric Acid *three fluidrachms;* Distilled Water *a sufficiency.* Place the Commercial Mercury in a glass retort or iron bottle, and applying heat cause two pounds and a half of the metal to distil over into a flask employed as a receiver. Boil on this for five minutes the Hydrochloric Acid diluted with nine fluidrachms of Distilled Water, and having, by repeated affusions of Distilled Water and decantations, removed every trace of acid, let the mercury be transferred to a porcelain capsule, and dried first by filtering paper, and finally on a water-bath." *Br.*

Mercury, being much more volatile than the contaminating metals, rises first in distillation, while they are left behind. But it is necessary to avoid pushing the distillation too far; for in that event, some of the foreign metals are apt to be carried over. The British Council, on account of this danger, directed only five-sixths of the mercury to be distilled. The distilled product is boiled for a few minutes with diluted hydrochloric acid, which, while it does not attack the mercury, dissolves any contaminating metals which may have passed over. The distillation is directed to be performed from a glass retort or iron bottle; but it is more conveniently conducted from the latter, over a common fire, into water contained in a receiver. In small operations a wash hand basin will answer for a receiver. Millon has ascertained the curious fact, that the presence of so small a quantity as one ten-thousandth of lead or zinc in mercury raises its boiling point. M. Violette has made known a method of distilling mercury, or amalgamated silver, which presents many advantages. It consists in subjecting the metal, in iron vessels, to a current of high-pressure steam, which serves the double purpose of imparting the necessary heat, and carrying over the mercurial vapor by a mechanical agency. (*Philos. Mag.*, Dec. 1850.) As it is difficult and troublesome to purify mercury by distillation, it is better to purchase pure samples of the metal, which may always be found in the market.

Medical Properties. Mercury in its uncombined state is inert; but, in combination, acts as a peculiar and universal stimulant. When exhibited in minute division, as it exists in several preparations, it produces its peculiar effects; but this does not prove that the uncombined metal is active, but only that the condition of minute division is favorable to chemical combination, and consequently to its solution in the stomach. Its compounds exhibit certain general medical properties and effects which belong to the whole as a class; while each individual preparation is characterized by some peculiarity in its operation. In this place we shall consider the physiological action of mercury, and the principles by which its administration should be regulated; while its effects as modified in its different combinations will be noticed under the head of the several preparations. Of the modus operandi of mercury we know nothing, except that it possesses a peculiar alterative power over the vital functions. This alterative power is sometimes exerted, without being attended with any other vital phenomenon than the removal of disease; while at other times it is accompanied with certain obvious effects, such as a quickened circulation, a frequent jerking pulse, and increased activity of all the secretory functions, particularly those of the salivary glands and the liver.

When mercury acts slowly as an alterative, there is not the least apparent disturbance of the circulation. When it operates decidedly and obviously, it is very prone to cause an immoderate flow of saliva, and produce the condition denominated ptyalism or salivation. Mercury has been detected in most of the solids and fluids of the body, including the blood. When in the blood it cannot be detected by the ordinary tests, on account of its intimate union with the organic matter of that liquid. To discover it, the blood must be subjected to destructive distillation. The liver is the organ which retains mercury the longest. It has been detected in that viscus, though absent in the lungs, heart, bile, and spinal marrow.*

Mercury has been used in almost every disease, but too often with evil results. In functional derangement of the digestive organs, mercurials in minute doses often exert a salutary operation, subverting the morbid action, and that, too, by their slow, alterative effect, without affecting the mouth. In these cases no decided disturbance of the vital functions takes place; but the alvine discharges, if clay-colored, are generally restored to their natural hue: whether the liver be torpid and obstructed as in jaundice, or pouring out a redundancy of morbid bile as in melæna, the judicious use of mercury seems equally efficacious in unloading the viscus, or restoring its secretion to a healthy state. In chronic inflammation of the mucous and serous membranes, the alterative effects of mercury are sometimes attended with much benefit. In many of these cases effusion has taken place; and, under these circumstances, the mercury often proves useful, as well by promoting absorption as by removing the chronic inflammation on which the effusion depends. Hence, it is often given with advantage in chronic forms of meningitis, bronchitis, pleuritis, pneumonia, dysentery, rheumatism, etc., and in hydrocephalus, hydrothorax, ascites, and general dropsy.

Mercury may also be advantageously resorted to in certain states of febrile disease. In some forms of remittent and typhoid fever, a particular stage is marked by a parched tongue, torpor of the bowels, scanty urine, and dryness of the surface.

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* For a method of detecting mercury in the urine, see *P. J. Tr.*, Aug. 1873, p. 145.

Here the very cautious employment of mercury is sometimes serviceable. It acts in such cases by increasing the secretions.

In syphilitic affections, mercury, until of late years, was held to be indispensable. Of its mode of action in these affections we know nothing. Without entering into the question of the necessity of mercury in venereal complaints, we are free to admit that the discussion which has grown out of it has shown that this remedy has frequently been unnecessarily resorted to in syphilis.

For inducing the specific effects of mercury on the constitution, blue pill or calomel is generally resorted to. In order to procure what we have called the slow alterative effects of the metal, from half a grain to a grain (0·03 to 0·067 Gm.) of blue pill may be given in the twenty-four hours, or from a sixth to a fourth of a grain (0·01 to 0·016 Gm.) of calomel; or, if a gentle ptyalism be our object, two or three grains (0·13 or 0·20 Gm.) of the former, or a grain of the latter (0·067 Gm.) two or three times a day. Where the bowels are peculiarly irritable, it is often necessary to introduce the metal by means of friction with mercurial ointment; and where a speedy effect is desired, the internal and external use of the remedy may be simultaneously resorted to.

The first observable effects of mercury in inducing ptyalism are a coppery taste in the mouth, a slight soreness of the gums, and an unpleasant sensation in the sockets of the teeth, when the jaws are firmly closed. Shortly afterwards the gums begin to swell, a line of whitish matter is seen along their edges, and the breath is infected with a peculiar and very disagreeable smell, called the mercurial fetor. The saliva at the same time begins to flow; and, if the affection proceed, the gums, tongue, throat, and face become much swollen; ulcerations attack the lining membrane of the mouth and fauces; the jaws become excessively painful; the tongue is coated with a thick whitish fur; and the saliva flows in streams from the mouth. It occasionally happens that the affection of the mouth proceeds to a dangerous extent, inducing extensive ulceration, gangrene, and even hemorrhage. The best remedies are astringent and detergent gargles, used weak at first, as the parts are extremely tender. In cases attended with swelling and protrusion of the tongue, the wash is best applied by injection, by means of a large syringe. We have found lead-water among the best applications in these cases; and dilute solutions of chlorinated soda or of chlorinated lime, while they correct the fetor, will be found to exert a curative influence on the ulcerated surfaces. A wash of nitrate of silver, made by dissolving eight grains (0·52 Gm.) in a fluidounce (30 C.c.) of water, has also been used with benefit. As excessive ptyalism and its frequent attendants of severe inflammation and ulceration of the mouth and fauces are not at all essential to the remedial constitutional effects of mercury, it becomes desirable if possible to moderate or prevent them; and for this purpose it is believed that the simultaneous use of chlorate of potassium is very effective. (See *N. R.*, Jan. 1873, p. 217.)

While the system is under the action of mercury, the blood is more watery than in health, less charged with albumen, fibrin, and red globules, and loaded with a fetid fatty matter. (*Dr. S. Wright*, quoted by *Christison.*) When drawn from a vein, it exhibits the same appearance as in inflammation.

In the foregoing observations, we have described the ordinary effects of mercury; but occasionally, in peculiar constitutions, its operation is quite different, being productive of a dangerous disturbance of the vital functions. The late Mr. Pearson gave a detailed account of this occasional peculiarity in the operation of mercury, in his work on the venereal disease. The symptoms which characterize it are a small and frequent pulse, anxiety about the præcordia, pale and contracted countenance, great nervous agitation, and alarming debility. Their appearance is the signal for discontinuing the mercury; as a further perseverance with it might be attended with fatal consequences. Mercury also produces a peculiar eruption of the skin, which is described by writers under the various names of *hydrargyria*, *eczema mercuriale*, and *lepra mercurialis*.

Those who work in mercury, and are, therefore, exposed to its vapor, such as water-gilders, looking-glass silverers, and quicksilver miners, are injured seriously in their health, and not unfrequently affected with shaking palsy, attended with vertigo and other cerebral disorders. The miners are often salivated.

Many plants, exposed to the influence of the vapor spontaneously rising from mercury in confined air, perish in a few days; while, if sulphur be placed by the side of the metal, no effect of the kind is experienced. (Boussingault, *Journ. de Pharm. et de Chim.*, Sept. 1867, p. 176.) A probable inference from this fact is, that workmen, necessarily exposed to the vapor of mercury, might be protected by the presence of sulphur in sufficient quantity.

Mercury is sometimes given in the metallic state, in the quantity of a pound or two, in obstruction of the bowels, to act by its weight; but the practice is of doubtful advantage.

Mercury is detected with great delicacy by Smithson's process, which consists in the use of a plate of tin, lined with one of gold, in the form of a spiral. When immersed in a mercurial solution, this galvanic combination causes the precipitation of the mercury on the gold, which consequently contracts a white stain. In order to be sure that the stain is caused by mercury, the metal must be volatilized in a small tube, so as to obtain a characteristic globule. MM. Danger and Flandin have improved on Smithson's process. (See *Chem. Gaz.*, No. 61, p. 191.) A minute portion of any of the preparations of mercury, either in the solid state or in concentrated solution, being placed on a bright plate of copper, and a drop of a strong solution of iodide of potassium added, a silvery characteristic stain will immediately appear on the copper.

Mercury is officinal:—

- I. IN THE METALLIC STATE.
  - Hydrargyrum, *U. S.*, *Br.—Mercury.*
    - Emplastrum Ammoniaci cum Hydrargyro, *U. S.*, *Br.—Plaster of Ammoniac with Mercury.*
    - Emplastrum Hydrargyri, *U. S.*, *Br.—Plaster of Mercury.*
    - Hydrargyrum cum Creta, *U. S.*, *Br.—Mercury with Chalk.*
    - Massa Hydrargyri, *U. S.;* Pilula Hydrargyri, *Br.—Mass of Mercury. Mercurial Pills. Blue Pills.*
    - Unguentum Hydrargyri, *U. S.*, *Br.—Mercurial Ointment.*
      - Linimentum Hydrargyri, *Br.—Liniment of Mercury.*
      - Suppositoria Hydrargyri, *Br.—Mercurial Suppositories.*
      - Unguentum Hydrargyri Compositum, *Br.—Compound Ointment of Mercury.*
- II. OXIDIZED.
  - Hydrargyri Oxidum Rubrum, *U. S.*, *Br.—Red Oxide of Mercury. Red Precipitate.*
    - Unguentum Hydrargyri Oxidi Rubri, *U. S.*, *Br.—Ointment of Red Oxide of Mercury. Red Precipitate Ointment.*
  - Hydrargyri Oxidum Flavum, *U. S.*, *Br.—Yellow Oxide of Mercury.*
    - Unguentum Hydrargyri Oxidi Flavi, *U. S.—Ointment of Yellow Oxide of Mercury.*
    - Oleatum Hydrargyri, *U. S.—Oleate of Mercury.*
- III. SULPHURETTED.
  - Hydrargyri Sulphidum Rubrum, *U. S. — Red Sulphide of Mercury. Cinnabar.*
- IV. AS MERCUROUS CHLORIDE.
  - Hydrargyri Chloridum Mite, *U. S.;* Hydrargyri Subchloridum, *Br.—Mild Chloride of Mercury. Mercurous Chloride. Calomel.*
    - Lotio Hydrargyri Nigra, *Br.—Black Mercurial Lotion.*
    - Pilulæ Antimonii Compositæ, *U. S.;* Pilula Hydrargyri Subchloridi Composita, *Br.—Compound Pills of Antimony. Compound Pills of Calomel. Plummer's Pills.*
    - Pilulæ Catharticæ Compositæ, *U. S.—Compound Cathartic Pills.*
- V. AS MERCURIC CHLORIDE.
  - Hydrargyri Chloridum Corrosivum, *U. S.;* Hydrargyri Perchloridum, *Br.—Corrosive Chloride of Mercury. Corrosive Sublimate.*

Hydrargyrum Ammoniatum, *U. S.*, *Br.—Ammoniated Mercury. White Precipitate.*
Unguentum Hydrargyri Ammoniati, *U. S.*, *Br.—Ointment of Ammoniated Mercury. White Precipitate Ointment.*
Liquor Hydrargyri Perchloridi, *Br.—Solution of Perchloride of Mercury.*
Lotio Hydrargyri Flava, *Br.—Yellow Mercurial Lotion.*

VI. COMBINED WITH IODINE.
Hydrargyri Iodidum Rubrum, *U. S.*, *Br.—Red Iodide of Mercury. Mercuric Iodide.*
Liquor Arsenii et Hydrargyri Iodidi, *U. S.—Solution of Iodide of Arsenic and Mercury. Donovan's Solution.*
Unguentum Hydrargyri Iodidi Rubri, *Br.—Ointment of Red Iodide of Mercury.*
Hydrargyri Iodidum Viride, *U. S.*, *Br.—Green Iodide of Mercury. Mercurous Iodide.*

VII. COMBINED WITH CYANOGEN.
Hydrargyri Cyanidum, *U. S.—Cyanide of Mercury.*

VIII. OXIDIZED AND COMBINED WITH ACIDS.
Liquor Hydrargyri Nitratis, *U. S.;* Liquor Hydrargyri Nitratis Acidus, *Br.—Solution of Nitrate of Mercury. Mercuric Nitrate.*
Unguentum Hydrargyri Nitratis, *U. S.*, *Br.—Ointment of Nitrate of Mercury. Citrine Ointment.*
Hydrargyri Sulphas, *Br.—Sulphate of Mercury. Mercuric Sulphate.*
Hydrargyri Sulphas Flava, *U. S.—Yellow Sulphate of Mercury. Turpeth Mineral. Mercuric Oxysulphate.*

HYDRARGYRUM AMMONIATUM. *U. S.*, *Br.* *Ammoniated Mercury.* [*White Precipitate. Mercurammonium Chloride.*]

$NH_2 Hg Cl$; 251·1. (HȲ-DRĂR′ǤỴ-RŬM ẠM-MŌ-NỊ-Ā′TŬM.) $NH_2 Hg_2 Cl$; 251·1.

Hydrargyri Precipitatum Album; Hydrargyri Ammonio-Chloridum.

"Corrosive Chloride of Mercury, *ten parts* [or one ounce av.]; Water of Ammonia, Distilled Water, each, *a sufficient quantity.* Dissolve the Corrosive Chloride of Mercury in *two hundred parts* [or twenty fluidounces] of warm Distilled Water; filter the solution and allow it to cool. Pour the filtrate gradually, and constantly stirring, into *fifteen parts* [or one and a half fluidounces] of Water of Ammonia, taking care that the latter shall remain in slight excess. Collect the precipitate upon a filter, and when the liquid has drained from it as much as possible, wash it twice with a mixture of *twenty parts* [or two fluidounces] of Distilled Water and *one part* [or fifty minims] of Water of Ammonia. Finally, dry the precipitate, between sheets of bibulous paper, in a dark place, at a temperature not exceeding 30° C. (86° F.)." *U. S.*

"Take of Perchloride of Mercury *three ounces* [avoirdupois]; Solution of Ammonia *four fluidounces;* Distilled Water *three pints* [Imperial measure]. Dissolve the Perchloride of Mercury in the Water with the aid of a moderate heat; mix the Solution with the Ammonia, constantly stirring; collect the precipitate on a filter, and wash it well with cold Distilled Water until the liquid which passes through ceases to give a precipitate when dropped into a solution of nitrate of silver acidulated with nitric acid. Lastly, dry the product at a temperature not exceeding 212°." *Br.*

The Pharmacopœias now agree in obtaining white precipitate by precipitating a solution of corrosive sublimate by ammonia. When ammonia, in slight excess, is added to a cold solution of corrosive sublimate, chloride of ammonium is formed in solution, and the white precipitate of the Pharmacopœias is thrown down. The precipitate is washed twice, according to the U. S. formula, according to the British, with greater precision, until they cease to give evidence of the presence of a chloride by producing a precipitate with nitrate of silver acidulated with nitric acid.

The matter washed away is chloride of ammonium and the excess of ammonia employed; and hence the washings, agreeably to the directions of the British formula, are tested with an acid solution of nitrate of silver. The white precipitate forms according to the following reaction: $HgCl_2 + 2NH_3 = NH_4Cl + NH_2HgCl$. In other words, one molecule of corrosive sublimate reacts with two of ammonia, and yields one molecule of ammonium chloride and one of *mercur-ammonium chloride*, or white precipitate. As the molecular weight of corrosive sublimate is 270·5, and of the ammonium needed 34, if water of ammonia be taken containing 10 per cent. of ammonia gas, the proportions would be 270·5 to 340. The Pharmacopœia directs 10 parts of sublimate to 15 of water of ammonia. A method of making white precipitate, said to be employed by large manufacturers, substitutes chloride of ammonium and carbonate of sodium for ammonia. As the product contains less mercury than the officinal preparation, and is in commerce, it is important to be able to distinguish the two. According to Prof. Redwood, this can be done by heating, the officinal preparation volatilizing without fusing, the unauthorized, fusing before volatilizing; Prof. Attfield has, however, shown that fusibility does not necessarily indicate that the specimen contains only 65 per cent. of mercury, or infusibility demonstrate that it contains the officinal proportion of 79½ per cent. The commercial variety differs somewhat from the present officinal preparation in composition, its formula being $N_2H_6HgCl_2$ (or *mercur-diammonium chloride*).

Properties. "White, pulverulent pieces, or a white powder, permanent in the air, odorless and tasteless, and insoluble in water or alcohol. At a temperature below a red heat the salt is decomposed without fusion, and at a red heat it is wholly volatilized. When heated with solution of potassa, the salt becomes yellow and evolves vapor of ammonia. It is completely soluble in a cold solution of hyposulphite of sodium, with evolution of ammonia; on heating this solution for a short time, it separates red mercuric sulphide, which, on protracted boiling, turns black. The salt should be soluble in hydrochloric acid without residue (mercurous salt), and without effervescence (carbonate). Its solution in acetic acid should not be rendered turbid by diluted sulphuric acid (lead)." *U. S.*

Adulteration with white lead, chalk, or sulphate of calcium may be detected by exposing a sample to a strong red heat, when these impurities will remain. Should starch be mixed with it, a charred residue will be obtained on the application of heat. Lead or starch may be found by digesting it with acetic acid, and testing the acetic solution with the compound solution of iodine, which will give a yellow precipitate if lead, and a blue one if starch be present. The absence of mercurous oxide is shown by its not being blackened when rubbed with lime-water. Ammoniated mercury is used only as an external application.

Mercur-diammonium chloride is said to produce an ointment more translucent and less beautifully white than the genuine, and more apt to become yellow on being kept. (Mr. J. Borland, *P. J. Tr.*, Dec. 1867, p. 262.)

Ammoniated mercury has been swallowed by mistake. It is highly poisonous, producing gastric pain, nausea, and purging. For an account of a recovery, after half a drachm was swallowed, see *London Lancet*, July 4, 1857. The remedies employed were an emetic of sulphate of zinc, and milk to allay the gastro-intestinal irritation.

Off. Prep. Unguentum Hydrargyri Ammoniati.

HYDRARGYRUM CUM CRETA. *U.S.* *Mercury with Chalk.*

(HȲ-DRÄR′ĢỴ-RŬM CŬM CRĒ′TẠ.)

Mercure avec la Craic, Poudre de Mercure crayeux. *Fr.;* Quecksilber mit Kreide, *G.*

"Mercury, *thirty-eight parts;* Sugar of Milk, in fine powder, *twelve parts;* Prepared Chalk, *fifty parts;* Ether, Alcohol, each, *a sufficient quantity*, To make *one hundred parts.* Mix the Mercury, Sugar of Milk, and *twelve parts* of the Chalk in a suitable mortar; moisten the mass with a mixture of *equal parts* of Ether and Alcohol, and triturate it briskly. Gradually add the remainder of the Chalk, dampen the powder occasionally with a mixture of Ether and Alcohol made in the same proportions as before, and continue the trituration until globules of Mercury are no longer visible under a magnifying power of ten diameters, and the powder is of a uniform, gray color, and dry." *U. S.*

When mercury is triturated with certain dry and pulverulent substances, such as chalk or magnesia, it gradually loses its fluidity and metallic lustre, and becomes a blackish or dark gray powder. A similar change takes place when it is rubbed with viscid or greasy substances, such as honey or lard. The globules disappear, so as in some instances not to be visible even through a good lens; and the mercury is said to be extinguished. It was formerly thought that the metal was oxidized in the process. At present, the change is generally ascribed to the mechanical division of the metal, which in this state is supposed to be capable of acting on the system. There is good reason, however, to believe that in this, as in all the analogous preparations of mercury, in which the metal is extinguished by trituration, a very small portion is converted into mercurous oxide, while by far the greater part remains in the metallic state.

Mercury with chalk is a smooth grayish powder, insoluble in water. Globules of mercury can generally be seen in it with the aid of a microscope; as the metal can scarcely be completely extinguished with chalk alone by any length of trituration. Mr. Jacob Bell found that, by powerfully pressing it, a considerable quantity of metal was separated in the form of globules. Mr. Phillips states that the extinguishment of the mercury is greatly accelerated by the addition of a little water. Dr. Stewart, of Baltimore, proposed the following process, by which he stated that the preparation might be completed in a short time, so that no globules should be visible with a powerful lens. Three ounces of mercury and six ounces of resin are to be rubbed together for three hours; five ounces of chalk are to be added, and the trituration continued for an hour; the mixture is then to be heated with alcohol so as to dissolve the resin; and the remaining powder is to be dried on bibulous paper, and well rubbed in a mortar. (*A. J. P.*, xv. 162.) But Professor Procter showed that the preparation thus made contains mercuric oxide, and is, therefore, injuriously harsh in its operation. (*Ibid.*, xxii. 113.) It is said that the precipitated black oxide is sometimes added with a view to save time in the trituration; but this must be considered as an adulteration, until it can be shown that the same oxide exists, in the same proportion, in the preparation made according to the officinal directions. Dr. Ed. Jenner Coxe, of New Orleans, found that the extinguishment of the mercury may be effected much more speedily than in the ordinary manner, by putting the ingredients into a quart bottle, to be well corked, and kept in constant agitation till the object is attained. A portion of the chalk may be thus shaken with the metal until no globules can be seen, and the process completed by trituration with the remainder of the chalk in a mortar. This mode of proceeding was suggested to Dr. Coxe by Mr. W. Hewson, of Augusta, Ga. (*Ibid.*, xxii. 317.) Dr. Squibb, having ascertained that the preparation cannot be satisfactorily made in this way on a large scale (*Proc. A. P. A.*, 1858, p. 424), has invented a machine for accomplishing the same object, by which the requisite motion is imparted to the materials contained in two large bottles, and which is said to answer the purpose well. By means of this apparatus, Dr. Squibb prepares mercury with chalk on a large scale, mixing the materials in the officinal proportions, but aiding the extinguishment of the metal by adding about one-seventh of its weight of honey, and adding this to the chalk made into a paste with water and afterwards drying. (*Ibid.*, 1859, p. 359.) It has been shown that the preparation thus made resists oxidation most effectually; owing probably to the presence of saccharine matter. (J. P. Remington, *A. J. P.*, Jan. 1869.) W. E. Bibby (*A. J. P.*, 1876, p. 269) recommends the rubbing of 3 troyounces of mercury, 4 troyounces of prepared chalk, and 1 troyounce of sugar of milk together in a mortar into an impalpable powder and passing through a fine sieve. As found in commerce, mercury with chalk, instead of being the mild preparation intended, sometimes acts very harshly, causing vomiting, gastric pains, etc. This has been ascribed to the presence of antimony or arsenic, which, however, must be rare; and the ordinary cause of the harshness is no doubt mercuric oxide, produced in minute proportion either during the trituration, or by the spontaneous change which occurs with time; mercurous oxide becoming mercuric oxide by the influence of light. The only sure method to guard against such results is to test the preparation carefully before dispensing it. (See *A. J. P.*, 1878, p. 325.) If the mercury contained in it be volatilized by heat, and the remaining chalk be dissolved by dilute acetic acid, the solution should not be colored by sulphuretted hydrogen. The presence of any probable metallic impurity may be detected in this way. To detect mercuric oxide, a portion of the powder may be treated with diluted hydrochloric acid with a moderate heat, and the solution tested by stannous chloride, which, if there be any mercuric oxide present, will cause a precipitation of metallic mercury as a black powder.

Medical Properties and Uses. Mercury with chalk is a very mild mercurial, similar in its properties to the blue mass, but much weaker. It is sometimes used as an alterative, particularly in the complaints of children attended with deficient biliary secretion, indicated by white or clay-colored stools. The chalk is antacid, and, though in small quantity, may sometimes be a useful accompaniment of the mercury in diarrhœa. Eight grains of the U. S. preparation contain about three grains of mercury. The dose is from five grains to half a drachm (0·33–1·95 Gm.) twice a day. Two or three grains (0·13–0·20 Gm.) is the dose for a child. It should not be given in pill with substances which become hard on keeping; as the contraction of the mass presses together the particles of mercury, which, in time, appear in globules in the interior of the pill.

HYDRASTIS. *U. S.* *Hydrastis.* [*Golden Seal.*]

(HȲ-DRĂS'TIS.)

"The rhizome and rootlets of Hydrastis Canadensis. Linné. (*Nat. Ord.* Ranunculaceæ.)" *U. S.*

Rhizoma Hydrastis; Golden Seal, Yellow Root, Yellow Puccoon, Orange Root, Indian Dye, Indian Turmeric; Racine d'Hydrastis de Canada, *Fr.;* Canadische Gelbwurzel, *G.*

Gen. Ch. Calyx of three petalloid sepals, falling when the flower opens. *Ovaries* in a roundish ovoid head. *Stigmas* subsessile, dilated, flat, rounded at the apex. *Carpels* fleshy, one or two-seeded, cohering in a compound berry.

Hydrastis Canadensis. Gray, *Manual of Bot.* p. 14; figured in Griffith's *Med. Bot.* p. 82.—*Yellow-root, Orange-root, Yellow Puccoon.* This is a small, herbaceous, perennial plant, with a thick, fleshy, yellow rhizome, from which numerous long radical fibres proceed, and an erect, simple, pubescent stem, from six inches to a foot in height. There are usually but two leaves, which are unequal, one sessile at the top of the stem, the other attached to it a short distance below by a thick roundish footstalk, causing the stem to appear as if bifurcate near the summit. The leaves are pubescent, roundish-cordate, with from three to seven, but generally five lobes, which are pointed and unequally serrate. A solitary flower stands upon a peduncle rising from the basis of the upper leaf. It is whitish, rose-colored, or purplish, without corolla, but with a colored calyx, the sepals of which closely resemble petals, and are very caducous, falling very soon after the flower has expanded. The fruit is a globose, compound, red or purple berry, half an inch or more in diameter, composed of many minute granules, each containing one, or more rarely two seeds. The plant grows in moist, rich woodlands, in most parts of the United States, but abundantly in the North and West. The fruit bears a close resemblance to the raspberry, but is not edible. The root is the part used. The Indians employed it for staining and dyeing yellow, and it is said to impart a rich and permanent yellow, and with indigo a fine green to wool, silk, and cotton.

Properties. The fresh root is juicy and loses much of its weight in drying. The dried caudex is officinally described as "about an inch and a half (4 cm.) long and a quarter of an inch (6 mm.) thick; oblique, with short branches, somewhat annulate and longitudinally wrinkled; externally yellowish gray; fracture short, waxy, bright reddish yellow, with a thickish bark, about ten narrow wood-wedges, broad medullary rays, and large pith. Rootlets thin, brittle, with a thick, yellow bark and subquadrangular, woody centre." *U. S.* Many of the detached rootlets are mixed with the rhizomes in mass. The color of the rhizome, though yellow in the recent root, becomes of a dark yellowish brown by age; that of the rootlets and the interior of the root is yellow, and of the powder still more so. The odor is strong, sweetish, and somewhat narcotic, the taste bitter and peculiar. The medicine imparts its virtues and coloring matters to water and alcohol. Examined by Mr. Alfred A. B. Durand, of Philadelphia, it was found to contain albumen, starch, fatty matter, resin, yellow coloring matter, sugar, lignin, and various salts. He also discovered a peculiar nitrogenous, crystallizable substance, for which he proposed the provisional name of *hydrastin*, until it should be determined whether it was, as he suspected, an alkaloid. (*A. J. P.*, 1851, p. 112.) Since that time it has been ascertained that the claims of this principle to be considered as an alkaloid were just, and it has definitely taken the name of *hydrastine*, of which *hydrastin* and *hydrastia* are merely synonymes. It has also been determined that the root contains another alkaloid, to which it owes its yellow color, and which is probably identical with the yellow coloring matter of Mr. Durand. Mr. F. Mahla first ascertained that this new alkaloid of hydrastis is *berberine* (*Am. Journ. of Sci. and Arts*, Jan. 1862, p. 43). For its mode of preparation and properties, see *Berberis*, Part II. It exists in large proportion in hydrastis, constituting, according to Perrins, nearly 4 per cent. There can be no doubt that this medicine owes much of its virtues to berberine. For a valuable paper by Prof. J. U. Lloyd on the preparation of Salts of Berberine, see *A. J. P.*, 1879, p. 11. A substance, obtained by the precipitation of an infusion of the root by hydrochloric acid, has been for some time known and used by the "Eclectics," under the name of hydrastin; it consists of variable proportions of hydrastine, berberine, and resin (*A. J. P.*, 1876, p. 386), and the reader must be cautious not to confound this substance with the alkaloid to which the name properly belongs.

Hydrastine, which is the characteristic alkaloid, may be obtained by exhausting the powdered root as far as possible with water by percolation, adding hydrochloric acid to the infusion so as to precipitate the berberine in the form of hydrochlorate, and treating the mother-liquor with solution of ammonia in slight excess. The hydrastine is precipitated, in an impure state, and may be purified by repeated solution in boiling alcohol, which deposits it in crystals on cooling. A little animal charcoal may be used towards the close of the process, in order to completely deprive the crystals of color. To Mr. Mahla, of Chicago, and Mr. Perrins, of London, is due the credit of having fully investigated the properties of this alkaloid.* Hydrastine crystallizes in brilliant, four-sided prisms, which are white or colorless when pure, inodorous, and almost tasteless in consequence of their insolubility in the saliva, but become bitter and somewhat acrid in saline combination. It melts at 135° C. (275° F.), is decomposed at a higher temperature, and is inflammable. It is nearly insoluble in water, but is readily dissolved by alcohol, ether, chloroform, and benzol. It has an alkaline reaction, and with the acids forms salts, most of which are readily soluble in water, and, according to Mr. Merrill, of Cincinnati, either uncrystallizable, or crystallizable with difficulty. The alkalies and tannic acid precipitate it from its saline solutions. With sulphuric acid and bichromate of potassium or red oxide of lead, it assumes a red color; but it differs from strychnine in exhibiting no tint of blue or violet. Its composition is $C_{22}H_{23}NO_6$ (*Mahla*). Mr. Perrins obtained 1·5 per cent. of it from the root, and, having given five grains of it to a rabbit, without any other effect than a slight uneasiness which soon ceased, concluded justly that it was not poisonous.

It is highly probable, from the odor of hydrastis, that, besides the two alkaloids here mentioned, it contains also an active volatile principle; but this has not yet been isolated. Mr. A. K. Hale, of Ann Arbor, Michigan, has ascertained that there is another alkaloid in hydrastis, somewhat resembling berberine, but quite distinct. To the neutral mother-liquor of hydrastine, he added water of ammonia in great excess, say 10 per cent., which caused a yellow precipitate, darker than berberine, and more soluble in water than this latter. Its alcoholic solution shows a neutral reaction; it dissolves in cold nitric acid less readily than berberine; the solution becomes red on heating. It dissolves in hot sulphuric acid with reddish brown color; is more easily soluble in cold potash solution than berberine, and gives with double potassium quicksilver iodide a slighter yellow precipitate. Mr. Hale did not name it, or determine its ultimate composition. (*A. J. P.*, 1873, p. 248.) Mr. Hale's results have since been confirmed by J. C. Burt (*A. J. P.*, 1875, p. 481), who states that the yield of the third alkaloid is less than that of hydrastine or berberine, and by H. Lerchen (*A. J. P.*, 1878, p. 470), who proposes the name of *xanthopuccine* for it.

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* For a paper by Mr. Mahla, see *Amer. Journ. of Sci. and Arts*, July, 1863, p. 57, and for another by Mr. J. Dyson Perrins, of London, *P. J. Tr.*, 1862, p. 546.

Medical Properties and Uses. Very diversified powers have been claimed for hydrastis. Thus, while all admit its tonic properties, it is considered by different practitioners as aperient, alterative in its influence on the mucous membranes, cholagogue, deobstruent in reference to the glands generally, diuretic, antiseptic, etc. It has been employed in dyspepsia and other affections requiring tonic treatment, in jaundice and other functional disorders of the liver, as a laxative in constipation and piles, and as an alterative in various diseases of the mucous membranes, as catarrh, chronic enteritis, cystirrhœa, leucorrhœa, gonorrhœa, etc., being used in the latter complaints both internally and locally. By some it is used as one of the best substitutes for quinine in intermittents. The experiments of Rutherford confirm the belief that it influences the liver; for he found that on dogs the resinous extract known as hydrastine acts as an "hepatic stimulant of moderate power and a feeble intestinal stimulant." In the form of infusion, it has been used in the Western States as a topical application in ophthalmia; and the Indians are said to employ it in the same manner in old ulcers of the legs. The notion of its efficacy in cancer, originating in a report which reached the late Professor Barton, that it was used in the cure of this complaint by the Cherokees, is probably altogether groundless. Dr. U. E. Ewing, of Lexington, Ky., and Dr. D. M. McCann, of Martinsburg, Ohio, have recommended an infusion or decoction of the root as an injection in gonorrhœa; and in the second stage of the disease the remedy is often of marked value. Later in the affection it is best combined with sulphate of copper or zinc. The strength of the solution should vary from half a drachm to a drachm of the fluid extract to the pint of water. The fluid extract is an excellent preparation for internal administration. In regard to other forms of preparation, the root may be treated like columbo or gentian. The impure hydrochlorate of berberina, obtained as above mentioned from hydrastis, is used by the "Eclectics," under the name of hydrastin, in the dose of from three to five grains (0·20–0·33 Gm.).

Off. Prep. Extractum Hydrastis Fluidum, *U. S.;* Tinctura Hydrastis, *U. S.*

HYOSCYAMINÆ SULPHAS. *U. S.* *Sulphate of Hyoscyamine.*

(HȲ-O̤S-CȲ-A̤-MĪ′NÆ SŬL′PHĂS.)

$(C_{17}H_{23}NO_3)_2.H_2SO_4$; 676. $C_{34}H_{23}NO_6.HO,SO_3$; 338.

"The neutral sulphate of an alkaloid prepared from Hyoscyamus." *U. S.*

Sulfate d'Hyoscyamine, *Fr.;* Hyoscyaminum Sulfuricum, Schwefelsaures Hyoscyamin, *G.*

Although Brandes announced the existence of an alkaloid in the seeds of Hyoscyamus niger, the process which he used to obtain it was not successful in other hands. The credit of first isolating the alkaloid *hyoscyamine* or *hyoscyamia* from the plant must be given to Geiger and Hesse, who obtained it as long ago as 1833. Höhn and Reichardt's process, in which the seed is used as the source, is as follows. They treat hyoscyamus seed, first with ether to separate fatty matter, then with alcohol acidulated with a few drops of sulphuric acid, and afterwards distil the alcoholic solution. The watery residue is to be neutralized by soda, and the liquid precipitated by a solution of tannin. The precipitate having been placed on a porcelain plate to dry, is mixed while yet moist with an excess of lime, and then exhausted by strong alcohol. The alcoholic solution is treated with sulphuric acid, then with soda, and finally with ether, which dissolves the liberated hyoscyamine. By distilling off the ether a colorless oleaginous liquid is left, which at length concretes. (*Journ. de Pharm.*, Mai, 1872, p. 385.)

These investigators gave to hyoscyamine the formula $C_{15}H_{23}NO_3$, but Ladenburg has shown by a study of its decomposition products that it is isomeric with atropine, $C_{17}H_{23}NO_3$. Ladenburg has made within the last few years what is the most complete study of atropine and hyoscyamine that we have, and has established their relations to each other in a clearer light. According to him (*Ber. der Chem. Ges.*, xiii., pp. 251, 909, and 1549), *Hyoscyamus* contains two alkaloids, a crystalline one, to which the name of *hyoscyamine* is given, and which is the one hitherto studied under that name, and an amorphous one, which remains in the mother-liquor after the removal of the crystallizable alkaloid, and comes into commerce as a brown thickish syrup. It can be extracted by the formation of the gold salt, which is less soluble than hyoscyamine gold chloride. This alkaloid, for which he proposes the name *hyoscine*, and which has the same formula ($C_{17}H_{23}NO_3$) as *hyoscyamine*, yields different decomposition products upon decomposition by baryta water. Hyoscyamine treated with boiling baryta water assimilates a molecule of water and splits up into what were called *hyoscinic acid*, $C_9H_{10}O_3$, and *hyoscine*, $C_8H_{15}NO$, but which Ladenburg shows to be simply identical with the decomposition products of atropine, *tropic acid* and *tropine*. Hyoscine, on the other hand, yields *tropic acid*, $C_9H_{10}O_3$, and *pseudotropine*, $C_8H_{15}NO$. Inasmuch as Ladenburg (*Ber. der Chem. Ges.*, xii., p. 941) has succeeded in effecting the synthesis of *atropine* by the combination of tropic acid and tropine (the two decomposition products which are common to the two alkaloids *atropine* and *hyoscyamine*), we must look for the differences between these two, to physical and molecular sources rather than chemical.

Hyoscyamine crystallizes in colorless, transparent, silky needles, is inodorous, of an acrid disagreeable taste, slightly soluble in water, very soluble in alcohol and ether, and volatilizable with little change if carefully distilled. It is quickly altered by contact with water and an alkali, and when heated with potassa or soda is completely decomposed, with the disengagement of ammonia. It neutralizes the acids, forming crystallizable salts, and is precipitated by infusion of galls. The alkaloid and its salts are very poisonous; and the smallest quantity, introduced into the eye, produces dilatation of the pupil, which continues long.

Hyoscine has been known in commerce as *amorphous hyoscyamine.* The best salts, according to Prof. Edlefsen, to prepare and dispense are the *hydrobromate* and *hydriodate.*

Hydriodate of hyoscine crystallizes from water, in which it is only moderately soluble, in small, hemihedral prisms, which mostly have a slight yellowish color. Dried at 100° C. (212° F.), the salt had the composition: $C_{17}H_{23}NO_3.HI.\frac{1}{2}H_2O$.

Hydrobromate of hyoscine is very easily soluble in water. It forms large colorless, transparent, and sharply defined crystals, sometimes of 1 to 2 cm. in length. They are rhombic, sphenoid, hemihedral prisms, which, when exposed in the desiccator over sulphuric acid, lose three molecules (12·27 per cent.) of water. Afterwards dried at 100° C. (212° F.) in vacuo, they yield nothing more. The composition is $C_{17}H_{23}NO_3.HBr.\frac{1}{2}H_2O$, when dry; when crystallized, the water amounts to $3\frac{1}{2}H_2O$. (*Ber. der Chem. Ges.*, 1881, p. 1870; *N. R.*, 1882, p. 51.)

Properties. The Pharmacopœia describes the sulphate of hyoscyamine as "small golden yellow, or yellowish white scales or crystals, or a yellowish white, amorphous powder, deliquescent on exposure to air, odorless, having a bitter and acrid taste, and a neutral reaction. Very soluble in water and in alcohol. When heated on platinum foil, the salt chars and is finally completely dissipated. An aqueous solution of the salt is not precipitated by test-solution of platinic chloride. With chloride of gold it yields a precipitate, which, when recrystallized from boiling water acidulated with hydrochloric acid, is deposited, on cooling (without rendering the liquid turbid) in brilliant, lustrous, golden yellow scales (difference from atropine). The aqueous solution yields, with test-solution of chloride of barium, a white precipitate insoluble in hydrochloric acid." *U. S.* The sulphate of hyoscyamine has been selected as the most suitable salt for use, on account of its being more soluble than the alkaloid.

Medical Properties. The medical properties of hyoscyamine sulphate are those of hyoscyamus; for which it has been to some extent substituted both by physiologists and clinicians, with very varying results, at least so far as the dose is concerned, the variability being evidently connected with the question of purity. This is principally due to the use of the commercial *amorphous hyoscyamine* salt, which is not hyoscyamine but hyoscine, as stated above; the white crystallized hyoscyamine sulphate is more expensive but much more reliable. It has been especially employed by alienists with asserted good results in quieting the restlessness of mania. When absolutely pure it probably is as active as atropine, but the commercial article is rarely entirely pure. The proper rule is to commence with the $\frac{1}{60}$ of a grain (0·001 Gm.), and increase the dose until some effects are perceptible.

HYOSCYAMUS. *U.S., Br.* *Hyoscyamus.* [*Henbane.*]

(HȲ-OS-CȲ'A-MŬS.)

"The leaves of Hyoscyamus niger, Linné (*Nat. Ord.* Solanaceæ), collected from plants of the second year's growth." *U. S.* "The fresh leaves, with the branches to which they are attached, of Hyoscyamus niger, Linn.; also the leaves separated from the branches and carefully dried; gathered from wild, or cultivated British, biennial plants, when about two-thirds of the flowers are expanded." *Br.*

Hyoscyami Folia, *Br., U.S.* 1870; Herba Hyoscyami; Feuilles de Jusquiame noir, *Fr.;* Bilsenkraut, *G.*

Gen. Ch. Corolla funnel-form, obtuse. *Stamens* inclined. *Capsules* covered with a lid, two-celled. *Willd.*

Hyoscyamus niger. Willd. *Sp. Plant.* i. 1010; Woodv. *Med. Bot.* p. 204, t. 76; Carson, *Illust. of Med. Bot.* ii. 19, pl. 66. Henbane is usually a biennial plant, with a long, tapering, whitish, fleshy, somewhat branching root, not unlike that of parsley, for which it has been eaten by mistake, with poisonous effects. The stem, which rises in the second year, is erect, round, branching, from one to four feet high, and thickly furnished with leaves. These are large, oblong-ovate, deeply sinuated with pointed segments, undulated, soft to the touch, and at their base embrace the stem. The upper leaves are generally entire. Both the stem and leaves are hairy, viscid, and of a sea-green color. The flowers form long, one-sided, leafy spikes, which terminate the branches, and hang downwards. They are composed of a calyx with five pointed divisions, a funnel-shaped corolla, with five unequal, obtuse segments at the border, five stamens inserted into the tube of the corolla, and a pistil with a blunt, round stigma. Their color is an obscure yellow, beautifully variegated with purple veins. The fruit is a globular two-celled capsule, covered with a lid, invested with the persistent calyx, and containing numerous small seeds, which are discharged by the horizontal separation of the lid. The whole plant has a rank offensive smell.

H. niger is susceptible of considerable diversity of character, causing varieties which have by some been considered as distinct species. Thus, the plant is sometimes annual, the stem simple, smaller, and less downy than in the biennial plant, the leaves shorter and less hairy and viscid, and the flowers often yellow without the purple streaks. It has been ascertained that much difference of medical properties is connected with these diversities of character; and the British Pharmacopœia directs the biennial variety as the most efficient.

The plant is found in the northern and eastern sections of the United States, occupying waste grounds in the older settlements, particularly graveyards, old gardens, and the foundations of ruined houses. It grows in great abundance about Detroit, in Michigan. It is not, however, a native of this country, having been introduced from Europe. In Great Britain, and on the continent of Europe, it grows abundantly along the roads, around villages, amidst rubbish, and in uncultivated places. Both varieties were formerly cultivated in England, but at present the biennial is solely or chiefly grown. The annual plant flowers in July or August, the biennial in May or June. For an account of the cultivation of the biennial variety of *H. niger* at Hitchen, Herts, England, see *P. J. Tr.*, Feb. 1860.

H. albus, so named from the whiteness of its flowers, is used in France indiscriminately with the former species, with which it appears to be identical in medicinal properties.

All parts of *Hyoscyamus niger* are active. The leaves are officinally described as "ovate, or ovate-oblong, sometimes ten inches (25 cm.) long and four inches (10 cm.) broad; sinuate-toothed, the teeth large, oblong or triangular; grayish green, glandular, hairy; midrib prominent; odor heavy, narcotic; taste bitter and somewhat acrid." *U. S.* Much of the efficacy of henbane depends upon the time at which it is gathered. The leaves should be collected soon after the plant has flowered. In the biennial plant, those of the second year are preferred to those of the first. The latter, according to Dr. Houlton, are less clammy and fetid, yield less extractive, and are medicinally much less efficient. It is said that the plant is sometimes destroyed by severe winters in England, and that no leaves of the second year's growth are obtainable. This is, perhaps, one of the causes of the great uncertainty of the medicine as found in commerce. The root also is said to be much more poisonous in the second year than in the first.*

Properties. The recent leaves have, when bruised, a strong, disagreeable, narcotic odor, somewhat like that of tobacco. Their taste is mucilaginous and very slightly acrid. When dried, they have little smell or taste. Thrown upon the fire, they burn with a crackling noise, as if they contained a nitrate, and at the same time emit a strong odor. Their virtues are completely extracted by diluted alcohol. The watery infusion is of a pale yellow color, insipid, with the narcotic odor of the plant. The leaves were analyzed by Lindbergsen, who obtained from them a narcotic principle. They contain a large proportion of nitrate of potassium; Mr. F. Mahla having obtained, as nearly as he could estimate from his experiments, 2 per cent. of that salt. (*A. J. P.*, 1859, p. 402.) The seeds are very small, roundish, compressed, somewhat kidney-shaped, a little wrinkled, of a gray or yellowish gray color, of the odor of the plant, and an oleaginous, bitterish taste. Analyzed by Brandes, they yielded 24·2 per cent. of fixed oil, 1·4 of a solid fatty substance, traces of sugar, 1·2 of gum, 2·4 of bassorin, 1·5 of starch, 3·4 of a substance soluble in water, insoluble in alcohol, and precipitated by infusion of galls (*phyteumacolla*, Brandes), 4·5 of albumen, 26·0 of vegetable fibre, 24·1 of water, and 9·7 of salts, including the malate of an alkaloid called *hyoscyamine* or *hyoscyamia.* But the process employed by Brandes for separating this principle has not succeeded in other hands; and it is doubtful whether the substance obtained by him was really what he supposed it to be. Geiger and Hesse (1833) were the first to demonstrate the existence of an alkaloid in hyoscyamus. Ladenburg has shown recently (1880) that there are two alkaloids in the plant—one crystallizable, *hyoscyamine*, and the other amorphous, *hyoscine.* (See *Hyoscyaminæ Sulphas*, p. 779.)

From experiments made by Mr. Hirtz upon the relative medicinal power of extracts from the seeds and from the leaves, he inferred that the former had ten times the strength of the latter.

Henbane leaves yield, by destructive distillation, a very poisonous empyreumatic oil.

Medical Properties and Uses. Hyoscyamus was known to the ancients, and was employed by some of the earlier modern practitioners, but had fallen into disuse, and was almost forgotten, when Baron Störck again introduced it into notice. By this physician and some of his successors it was prescribed in numerous diseases, and, if we may credit their testimony, with the happiest effects; but subsequent experience of its operation has been such as very much to narrow the extent of its application. It is at present used almost exclusively to relieve pain, procure sleep, or quiet irregular nervous action; and is not supposed to exercise any specific curative influence over particular diseases. It is so similar in its action upon the system to belladonna, that with our present knowledge we are unable to point out any physiological or therapeutic distinction between the two drugs. There are, however, some clinicians who believe that hyoscyamus is more of a hypnotic than is belladonna. The symptoms of poisoning produced by the two drugs are exactly similar; excepting in that hyoscyamus is distinctly the feebler of the two, containing a smaller percentage of alkaloid. Hyoscyamus is chiefly used in neuralgic and spasmodic affections, rheumatism, gout, hysteria, and various pectoral diseases, as catarrh, pertussis, asthma, phthisis, etc. It is also much used in connection with griping cathartics, the disagreeable effects of which it is thought to counteract. In Europe, where the fresh leaves are readily obtained, it is often applied externally in the shape of lotion, cataplasm, or fomentation, to allay pain and irritation, in scrofulous or cancerous ulcers, scirrhous, hemorrhoidal, or other painful tumors, gouty and rheumatic swellings, and nervous headache. The smoke of the leaves or seeds has also been used in toothache; but the practice is deemed hazardous. For further details in regard to the therapeutic employment of hyoscyamus, and the diagnosis and treatment of its poisoning, the reader is referred to the article on belladonna.

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* The several products of the henbane plants are placed by Mr. R. Usher (*P. J. Tr.*, Aug. 1867) in the following order, as to efficiency: 1, the leaves of the biennial plant of the second year's growth; 2, the biennial plant of the first year; 3, the British annual henbane; 4, the German annual henbane. The last two, though most extensively used, are really nearly valueless, and should always be rejected. The British annual so nearly resembles the biennial of the second year, having flowers, that the two may be easily mistaken for one another; but a sufficient distinction is that the annual plant "possesses no flavor or aroma." Besides, the leaves are much shorter; and occasionally there is a pure primrose blossom, which never happens with the biennial, which is beautifully streaked. The biennial plant is so liable to the attacks of worms, that at one time little of the second year's growth was collected, and the market was consequently supplied with a very inferior article.

Henbane may be given in fluid or solid extract or in tincture. The dose of the leaves is from five to ten grains (0·33–0·65 Gm.), of the seeds somewhat smaller. The common extract, or inspissated juice of the fresh leaves (*Extractum Hyoscyami, Br.*), is exceedingly variable in its operation, being sometimes active, sometimes almost inert. The usual dose is two or three grains (0·13–0·20 Gm.), repeated and gradually increased till its effects are obtained. The alcoholic extract, prepared from the recently dried leaves (*Extractum Hyoscyami Alcoholicum, U. S.*), is said to be more certain. The dose of this to begin with is one or two grains (0·065–0·13 Gm.), which may be increased gradually to twenty or thirty grains (1·3–1·95 Gm.). An extract from the seeds would, no doubt, be much more efficacious. The dose of the tincture is one or two fluidrachms (3·75–7·5 C.c.).

Off. Prep. Abstractum Hyoscyami, *U. S.;* Extractum Hyoscyami Alcoholicum, *U. S.;* Extractum Hyoscyami Fluidum, *U. S.;* Tinctura Hyoscyami.

ICHTHYOCOLLA. *U. S.* *Isinglass.*

(ĬCH-THY̦-O̦-CŎL′LA̦.)

"The swimming-bladder of Acipenser Huso, Linné, and of other species of Acipenser (*Class*, Pisces; *Order*, Sturiones)." *U. S.*

Calla Piscium, *P.G.;* Fish-glue: Ichthyocolle, Colle de Poisson, *Fr.;* Hausenblase, Fischleim, *G.;* Colla di Pesce, *It.;* Cola de Pescado, *Sp.*

Isinglass is a gelatinous substance, prepared chiefly from the sounds or swimming bladders of fishes, especially those of different species of sturgeon. Though not retained in the British Pharmacopœia, it still has a place in that of the United States, and is universally kept in the shops. In most fishes there is a membranous bag, placed in the anterior part of the abdomen, communicating frequently, though not always, by means of a duct, with the œsophagus or stomach, and containing usually a mixture of oxygen and nitrogen gases in various proportions. From the supposition that it was intended by its expansion or contraction to enable the fish to rise or sink in the water, it has been denominated *swimming bladder.* It is of different shape in different fishes, and consists of three coats, of which the two interior are thin and delicate, the outer tough and of a silvery whiteness.

The *Acipenser Huso*, or *beluga* of the Russians, is particularly designated by the Pharmacopœia as the species of sturgeon from which isinglass is procured; but three others, the *A. Ruthenus*, or sterlet, *A. sturio*, or common sturgeon, and *A. stellatus*, or starred sturgeon, also furnish large quantities to commerce. All these fish inhabit the interior waters of Russia, especially the Volga and other streams which empty into the Caspian Sea. Immense numbers are annually taken, and consumed as food by the Russians. The air-bags are removed from the fish, and, having been split open and washed in water in order to separate the blood, fat, and adhering extraneous membranes, are spread out, and when sufficiently stiffened are formed into cylindrical rolls, the ends of which are brought together and secured by pegs. The shape given to the roll is that of a staple, or more accurately that of a lyre, which it firmly retains when dried. Thus prepared it is known in commerce by the name of *staple isinglass*, and is distinguished into the *long* and *short staple*. Sometimes the membranes are dried in a flat state, or simply folded, and then receive the name of *leaf* or *book isinglass*. The scraps or fragments of these varieties, with various other parts of the fish, are boiled in water, which dissolves the gelatin, and upon evaporation leaves it in a solid state. This is called *cake isinglass*, from the shape which it is made to assume. It is sometimes, however, in globular masses. Of these varieties, the *long staple* is said to be the best; but the finest *book isinglass* is not surpassed by any brought to this country. It is remarkable for its beautiful iridescence by transmitted light. One hundred grains of this isinglass dissolve in ten ounces of water, forming a tremulous jelly when cold, and yield but two grains of insoluble residuum. That in *cakes* is brownish, of an unpleasant odor, and employed only in the arts. Inferior kinds, with the same commercial titles, are said to be prepared from the peritoneum and intestines of the fish. An inferior Russian product, known in English commerce by the name of *Samovey isinglass*, is procured, according to Pereira, from the *Silurus Glanis*. It comes, like the better kind, in the shape of *leaf*, *book*, and *short staple*.

Isinglass, little inferior to the Russian, is made in Iceland from the sounds of the cod and ling. It is said also to be prepared by the fishermen of Newfoundland. We receive from Brazil the air-bladders of a large fish, prepared by drying them in their distended state. They are oblong, tapering, and pointed at one end, bifid with the remains of their pneumatic duct at the other, and of a firm consistence. The Brazilian isinglass is inferior to the Russian. Considerable quantities have been manufactured in New England, as formerly supposed, from the intestines of the cod, and of other allied fishes. This sort is in the form of thin ribbons several feet in length, and from an inch and a half to two inches in width. One hundred grains dissolve almost entirely in water, leaving but two grains of insoluble membrane, and form a tremulous jelly when cold with eight ounces of water. It is, therefore, as pure and nearly as strong a gelatin as the Russian isinglass; but it retains a fishy taste and odor, which render it unfit for culinary or medicinal purposes. Isinglass of good quality has also been made in New York from the sounds of the weak-fish —*Otolithus regalis* of Cuvier (Storer, *Rep. on Fishes of Mass.*, p. 33)—and perhaps of other fishes caught in the neighborhood. The sounds are dried whole, or merely split open, and vary much in size and texture, weighing from a drachm to an ounce. An article called "*refined or transparent isinglass*" is made by dissolving the New England isinglass in hot water, and spreading the solution to dry on oiled muslin. It is in very thin transparent plates, and is an excellent glue, but retains a strong fishy odor. A variety of Ichthyocolla, called India or China Isinglass, has been consumed largely in China from time immemorial, and became known to the Europeans of India about 1839. It is now found in the markets of London, where it is chiefly employed in clarifying beer. (*Journ. de Pharm.*, Fév. 1870, p. 153.) It is the swimming bladder derived from two species of *Polynemus*, and from several other species of fish in the Indian waters. (*Ibid.*, Janv. 1873, p. 77.) A preparation called *Cooper's gelatin* has been introduced as a substitute for isinglass in making jellies. It appears to be the dried froth of a solution of pure bone glue.

Mr. C. T. Carney states that the New England isinglass is prepared, not as supposed from the intestines of fish, but from the sounds of the hake (*Gadus merluccius*), by the following process. Having been taken from the fish, split open, cleansed, and dried, they are soaked in water till sufficiently soft, then passed through rollers so as to form a large, homogeneous, dough-like sheet, which is cut into strips, and then again passed through rollers till reduced to a ribbon-like form. The pieces thus prepared are thoroughly dried, and folded into bundles. (*Proc. A. P. A.*, 1857.)

According to Dr. V. Griessmayer, the skin of the ray (*Raja*, a tribe of deep-sea fishes, with flat body and naked and often leather-like skin) has been much used recently, particularly in France, in place of isinglass, as clarifying agent in brewing. The skin of the thornback or rough ray (*Raja clavata*) is, according to Jericka, the best for this purpose. The clarifying mixture prepared from this is without color, odor, or taste, and clears any turbid liquid within 12 hours, or at least within 3 days if the liquid is kept in a very cold place. This new clarifier is said to be much superior to either Russian or American isinglass. (*Dingler's Pol. Journ.*, vol. 230, 335; *N. R.*, Feb. 1879.)

Isinglass is sometimes kept in the shops cut into fine shreds, and is thus more easily acted on by boiling water.

Properties. In its purest form it is "in separate sheets, sometimes rolled, of a horny or pearly appearance; whitish or yellowish, semi-transparent, iridescent, inodorous, insipid; almost entirely soluble in boiling water and in boiling diluted alcohol. The solution in 24 parts of boiling water forms, on cooling, a transparent jelly." *U. S.* The inferior kinds are yellowish and more opaque. In cold water it softens, swells up, and becomes opalescent. Boiling water entirely dissolves it, with the exception of a minute proportion of impurities, amounting, according to Mr. Hatchet, to less than 2 per cent. The solution on cooling assumes the form of a jelly, which consists of pure gelatin and water. Isinglass is in fact the purest form of *gelatin* with which we are acquainted, and may be used whenever this principle is required as a test. It is insoluble in alcohol, but is dissolved readily by most of the diluted acids, and by alkaline solutions. It has a strong affinity for tannin, with which it forms an insoluble compound. Boiled with sulphuric acid, it is converted into a peculiar substance, called *glycocoll* or *sugar of gelatin*, which is in reality *amido-acetic acid* $C_2H_3(NH_2)O_2$. Its aqueous solution speedily putrefies. (See *Glue*, Part II.)

An ingenious adulteration of isinglass has been practised in London, apparently by rolling a layer of gelatin between two layers of the genuine substance. This may be detected by the disagreeable odor and taste of the adulterated drug, and the effects of water upon it. Genuine isinglass, cut into shreds and treated with water, becomes opalescent and more opaque than before; while the shreds, though they soften and swell, remain unbroken, and, when examined by the microscope, are seen to be decidedly fibrous. Gelatin, on the contrary, when similarly treated, becomes more transparent than before; the shreds are disintegrated, and the structure appears amorphous under the microscope. In the adulterated article, both these characters are presented in layers more or less distinct. (*P. J. Tr.*, ix. 505.)

A *false isinglass* has been imported into England from Para, in Brazil, consisting of the dried ovary of a large fish. It has somewhat the form of a bunch of grapes, consisting of ovoid or roundish masses, attached by a footstalk to a central axis. It is not gelatinous, and is unfit for the purposes to which isinglass is applied. (See *A. J. P.*, xxv. 144.)[*]

Medical Properties and Uses. Isinglass has no peculiar medical properties. It may be given internally, in the form of jelly, as a slightly nutritious article of diet; but it has no advantage over the jelly made from calves-feet. Three drachms impart sufficient consistency to a pint of water. It is employed for clarifying liquors, and imparting lustre to various woven fabrics. Added in small quantities to vegetable jellies, it gives them a tremulous appearance, which they want when unmixed. As a test of tannin it is used in solution, in the proportion of a drachm to ten fluidounces of distilled water. It forms the basis of the *English court-plaster*.

Off. Prep. Emplastrum Ichthyocollæ.

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[*] *Japanese Isinglass.* Two forms of this substance are described by Mr. Hanbury, one in irregularly four-sided sticks, about eleven inches long, very light and porous, the other in long shrivelled strips about one-eighth of an inch thick. It is translucent, yellowish white, without smell or taste, insoluble in cold water, but swelling up and softening under its influence, and dissolved in great measure by boiling water, with which it gelatinizes on cooling. The peculiarities of this substance are owing to a principle denominated *gelose* by Payen, which resembles gelatin in its gelatinizing property, but differs in its chemical relations, and is probably peculiar. It resembles the carrageenin of Irish moss, but has a greater gelatinizing power. The jelly formed by dissolving it in boiling water, and allowing the solution to cool, requires a higher temperature to liquefy it than gelatin jelly, and does not melt in the mouth. Gelose differs from gelatin in not being precipitated by tannic acid, and from rice jelly in not being rendered blue by iodine. Japan isinglass is used for the same purposes as that of animal origin. It is derived, according to Mr. Hanbury, from different species of various genera of sea-weed, and especially *Gelidium corneum.* (See *A. J. P.*, 1860, p. 354.) The term *Agar Agar*, in the East Indies, is applied to several sea-weeds prepared for food. (See *Proc. A. P. A.*, xxvi. 173; *P. J. Tr.*, xi. 137.)

IGNATIA. *U. S.* *Ignatia.* [*Bean of Saint Ignatius.*]

(ĬG-NĀ′TỊ-Ạ—ĭg-nā′shẹ-ạ.)

"The seed of Strychnos Ignatii. Bergius. (*Nat. Ord.* Loganiaceæ.)" *U. S.*

Semen Ignatiæ, Faba Ignatii, Faba Sancti Ignatii, *Lat.;* Fève igasurique, Fève de Saint Ignace, *Fr.;* Ignatiusbohne, Bittere Fiebernuss, Ignazbohnen, *G.;* Fava di Santo Ignazio, *It.;* Haba de Santo Ignacio, *Sp.*

STRYCHNOS. See *Nux Vomica.*

Strychnos Ignatia. Lindley, *Flor. Med.* 530.—*Ignatia amara.* Linn. *Suppl.* This species of Strychnos is a tree of middling size, with numerous long, cylindrical, glabrous, vine-like branches, which bear opposite, nearly sessile, oval, pointed, entire, and very smooth leaves. The flowers are long, nodding, white, tubular, fragrant, and arranged in short, axillary racemes. The fruit is of the size and shape of a pear, with a smooth, whitish, ligneous rind, enclosing about twenty seeds, imbedded in a dry medullary matter, and lying one upon the other. The seeds are the part used. The tree is a native of the Philippine Islands, where the seeds were highly esteemed as a medicine, and, having attracted the attention of the Jesuits, were honored with the name of their founder.

Properties. The seeds are about an inch long, rather less in breadth, still less in thickness, convex on one side, obscurely angular, with two, three, or four faces on the other, and marked at one end with a small depression indicating their point of attachment. They are externally of a pale brown color, apparently smooth, but covered in fact with a short down or efflorescence, which may be removed by scraping them with a knife. They are somewhat translucent, and their substance is very hard and horny. They have no smell, but an excessively bitter taste. They are officinally described as "about an inch and a fifth (3 cm.) long, oblong or ovate, irregularly angular, dull brownish or blackish, very hard, horny; fracture granular, irregular; the albumen somewhat translucent, enclosing an irregular cavity with an oblong embryo; inodorous; very bitter." *U. S.* To Pelletier and Caventou they yielded the same constituents as nux vomica, and, among them, 1·2 per cent. of strychnine, and 0·5 per cent. of brucine. Analyzed by Mr. J. M. Caldwell, they were found to contain the two alkaloids, strychnine and brucine, combined with igasuric acid, and, besides these, a volatile principle, extractive, gum, resin, coloring matter, fixed oil, and bassorin, but no starch or albumen. (*A. J. P.*, 1857, p. 298.) Flückiger, on the other hand, found 1·78 per cent. of nitrogen, corresponding to about 10 per cent. of albuminoid matter. (*Pharmacographia*, p. 433.) In consequence of the relatively larger proportion of strychnine which they yield, they have been used instead of nux vomica, in the preparation of that alkaloid, when their cost would permit of the substitution, but the nux vomica bean has been imported in such large quantities, and is now so low in price, that the ignatia bean is rarely used for this purpose.

Medical Properties and Uses. MM. Magendie and Delile proved that ignatia acts on the human system in the same manner as nux vomica, and modern research has confirmed this, only showing that the preparations of ignatia are stronger than those of nux vomica. The two medicines are used for precisely similar purposes. (See *Nux Vomica.*) The dose of the officinal extract is from a half grain to a grain (0·03–0·065 Gm.) in pill three times a day. A *tincture* may also be used. Prof. Procter has given a formula for its preparation.*

Off. Prep. Abstractum Ignatiæ, *U. S.;* Tinctura Ignatiæ, *U. S.*

ILLICIUM. *U. S.* *Illicium.* [*Star-Anise.*]

(ỊL-LĬ′CỊ-ŬM—ịl-lĭsh′ẹ-ŭm.)

"The fruit of Illicium anisatum. Loureiro. (*Nat. Ord.* Magnoliaceæ.)" *U. S.*

Gen. Ch. Flowers hermaphrodite or rarely polygamously diœcious. *Sepals* two to three imbricate. *Carpels* in a verticillate simple series or single, compressed, dehiscent by their superior margin.

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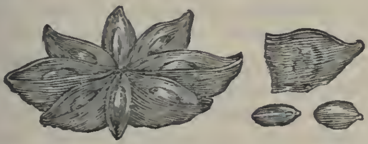
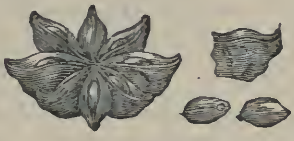
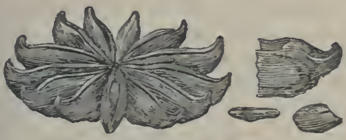
* Powder four troyounces of the beans coarsely by grinding, or in a mortar, add two fluidounces of water to the powder in a bottle, and heat by a water-bath until it swells up; then pour on it half a pint of alcohol, and, having continued the heat for three hours, put the whole into a percolator, and displace with alcohol until a pint of tincture is obtained. Or half an ounce of the extract may be dissolved in a pint of alcohol. The commencing dose, corresponding with that above stated of the extract, would be about sixteen minims (1 C.c.). (See *Tinctura Ignatiæ.*)

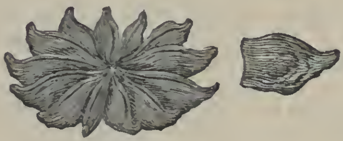
This genus inhabits Asia and America. Many of its species are possessed of aromatic properties. *I. Floridanum*, a small evergreen tree or shrub with oblong-lanceolate, acuminate leaves, which grows westward from Florida along the coast bounding the Gulf of Mexico, has its bark, leaves, and probably also seed vessels, endowed with a spicy odor and taste, analogous to those of anise, and might, perhaps, be substituted for the *Illicium anisatum*, or *star-aniseed*. Another species, *I. parviflorum*, a shrub found by Michaux in the hilly regions of Georgia and Carolina, has a flavor closely resembling that of sassafras root.

The *I. religiosum*, or *Shikimi*, of India, is very poisonous, causing vomiting, epileptiform convulsions, with dilated pupil and exceedingly cyanosed countenance.* The accompanying cuts portray the differences in the capsules of several allied species.


Illicium anisatum.


Illicium religiosum.


Illicium Griffithii.


Illicium magus.

Properties. "The fruit is pedunculate, and consists of eight stellately arranged carpels, which are boat-shaped, about half an inch (12 mm.) long, rather woody, wrinkled, straight-beaked, brown, dehiscent on the upper suture, internally red-

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* The following table gives the distinctive characters which, according to Mr. J. F. Eykman, distinguish the oil of *Illicium religiosum* from allied oils. (*P. J. Tr.*, xi. 1048.)

	Ol. Anisi Vulgaris.	Oleum Fœniculi.	Ol. Illicii Anisati.	Ol. Illicii Religiosi.
Constituents	Chiefly solid and liquid anethol.	Small quantity of terpene boiling at 190° C, and liquid and solid anethol.	Chiefly solid and liquid anethol.	Rather much of a terpene boiling at 173° to 176° C.; liquid anethol boiling at 232° to 233° C.
Melting Point ...	+6° to 18° C.	—2° to +18° C.	About 0° C.	Not solid when cooled 20° C.
Specific Gravity..	About 0·903.	0·94 to 0·998.	0·978.	1·006.
Molecular Rotation.	0° to +0·5°.	+13° to +19·6°	0° to —0·4.°	—8·6°.
Alcoholic Hydrochloric Acid.	Colorless, afterwards reddish, then pale red.	Colorless.	Colorless.	Colorless, afterwards blue.
Chloral Reagent	Colorless, afterwards yellow and brownish.	Colorless, then beautiful red.	Colorless, then beautiful red.	Colorless, afterwards dirty brown yellow.
Ammoniacal Silver Solution.	In 24 hours no reduction.	Like ol. anisi vulgaris.	Like ol. anisi vulgaris.	Reduction in a few hours.
Hager's Reaction	In alcohol, a portion of the sulphuric acid and oil mixture remains undissolved as a thick mass adhering to the sides of the tube.	Mixture of oil, sulphuric acid and alcohol is perfectly clear.	Like ol. anisi vulgaris.	Mixture is nearly clear; separation of a little reddish white deposit.
10 drops of oil, with 60 drops of ether and about 0·150 gramme of sodium.	Colorless; after 4 hours the mixture nearly colorless; deposit yellowish white.	....	Colorless; after 4 hours liquid and deposit yellow.	Colorless; quickly bluish; after 4 hours liquid pale yellow, deposit yellow.

brown, glossy, and with a single, flattish, oval, glossy, brown-yellow seed; odor anise-like; taste of the carpels sweet and aromatic, and of the seeds oily. Star-anise should not be confounded with the very similar but poisonous fruit of *Illicium religiosum*, Siebold, the carpels of which are more woody, shrivelled, and have a thin, mostly curved beak, a faint clove-like odor, and an unpleasant taste." *U. S.*

Star-anise is used principally as a source of oil of anise.

INFUSA. *U. S.* *Infusions.*

(ỊN-FŪ'ṢẠ.)

Tisanes, Infusions, *Fr.;* Infusionen, Aufgüsse, *G.*

These are aqueous solutions obtained by treating with water, without the aid of ebullition, vegetable products only partially soluble in that liquid. The water employed may be hot or cold, according to the objects to be accomplished. Infusions are generally prepared by pouring boiling water upon the vegetable substance, and macerating in a tightly closed vessel till the liquid cools. The soluble principles are thus extracted more rapidly, and, as a general rule, in a larger proportion than at a lower temperature. Some substances, moreover, are dissolved in this manner, which are nearly or quite insoluble in cold water. A prolonged application of heat is in some instances desirable; and this may be effected by placing the vessel near the fire. Cold water is preferred when the active principle is highly volatile, when it is injured by heat, or when any substance of difficult solubility at a low temperature exists in the vegetable, which it is desirable to avoid in the infusion. A longer continuance of the maceration is necessary in this case; and, in warm weather, there is sometimes danger that spontaneous decomposition may commence before the process is completed. When a strong infusion is required, the *process of percolation* may be advantageously resorted to. The water employed should be free from saline impurities, which frequently produce precipitates and render the infusion turbid. Fresh river, rain, or distilled water is usually preferable to that of pumps or springs.

The substance to be acted on should be sliced or bruised, or in the state of powder; but, unless when percolation is employed, this last condition is seldom requisite, and is always inconvenient, as it requires that the infusion should be filtered through paper in order completely to separate the undissolved portion. In other cases, it is sufficient to strain through fine linen or muslin. When percolation is resorted to, the substance should be more or less finely powdered. The United States Pharmacopœia furnishes a general formula for infusions, which is as follows.

"An ordinary infusion, the strength of which is not directed by the physician, nor specified by the Pharmacopœia, shall be prepared by the following formula.

"Take of
The Substance, coarsely comminuted, *ten parts* [or one ounce av.];
Boiling Water, *one hundred parts* [or ten fluidounces];
Water, *a sufficient quantity,*

To make *one hundred parts* [or ten fluidounces].

"Put the substance into a suitable vessel, provided with a cover, pour upon it the Boiling Water, cover the vessel tightly, and let it stand two hours. Then strain, and pass enough Water through the strainer to make the Infusion weigh *one hundred parts* [or measure ten fluidounces].

"*Caution.* The strength of infusions of energetic or powerful substances should be specially prescribed by the physician." *U. S.*

Infusions are usually prepared in glazed earthenware or porcelain vessels fitted with covers. Mr. Brande suggests the use of clean metallic vessels, which, when finely polished, retain the heat for a longer time; but they are also more liable to chemical alteration, and may sometimes injuriously affect the preparation. Vessels of block-tin are generally well adapted for the purpose.[*]

As infusions do not keep well, especially in warm weather, they should be made extemporaneously and in small quantities. In this country they are usually prepared in families, and the propriety of their introduction into the Pharmacopœia has been doubted; but it is desirable to have certain fixed standards for the regulation of the medical practitioner; and it is sometimes convenient to direct infusions from the apothecary, for whose guidance officinal formulas are necessary. Physicians would, indeed, find an advantage in more frequently directing them to be prepared by the pharmacist, instead of leaving their preparation to the carelessness or want of skill of attendants upon the sick. Infusions may be kept during hot weather, and for many months, by straining them *while hot*, and pouring them at once into bottles provided with accurately ground stoppers. The bottle must be full, the stopper being made to displace its bulk of the fluid. A common bottle with a cork stopper may be used, if the softened corks be forced into the full bottle, tied down and at once dipped into hot sealing wax. The hotter the liquid and freer from air, the better will the infusion keep. Prof. Almén (Upsala, Sweden) has proposed a very efficient method of preserving infusions. (*A. J. P.*, April, 1875.) It is as follows. The infusion or decoction is heated for some time in a water-bath at 100° C. (212° F.), and the bottle then fitted with a tight cork, through which a glass tube passes, lightly filled with cotton wool. The cork has a second opening, through which a glass tube passes nearly to the bottom of the bottle; this tube is bent at a

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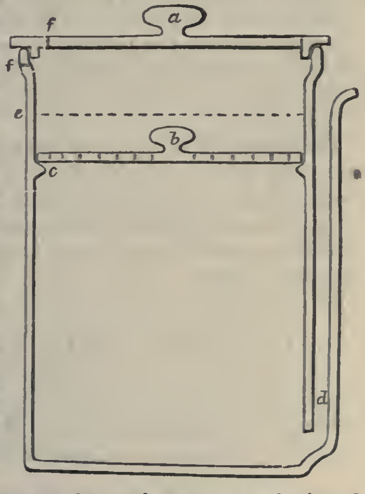
[*] *Alsop's Infusion Jar.* This presents a very neat and effectual method of making the hot infusions. It consists of an earthenware mug, represented in the marginal figure, with a spout (*d*) proceeding from the bottom, and placed closely to the side of the vessel to prevent fracture; a perforated plate or diaphragm (*b*), supported on a ledge (*c*), at about one-quarter or one-third of the height of the vessel from the top; and a lid (*a*), which may be fastened on by a string through holes (*ff*). The material to be submitted to infusion is placed on the perforated plate, and the hot water poured in so as to cover it, the vessel having been previously warmed so as not to chill the liquid. As the water becomes impregnated, it acquires an increased specific gravity, and sinks to the bottom, its place being supplied by the unsaturated portion; and this circulation goes on until the whole of the soluble matter is extracted. In order to maintain a due warmth, the vessel may be placed upon a stove or an iron plate near the fire. The advantage of the process is that the material is subjected to the solvent power of the least impregnated portion of the menstruum. Such jars may now be had in Philadelphia. In order that the vessel may be adapted for the preparation of different quantities of infusions, it would be an advantage to have ledges arranged within, at different heights, so that the diaphragm may be supported at any desirable point. The surface of the liquid (*e*) should of course always be above the medicinal substance placed upon the diaphragm. (See *A. J. P.*, viii. 89.)



Squire's Infusion Mug. Mr. Squire, of London, has modified this jar by adding a colander of queensware, which is closely covered with a lid, and descends into the jar so as to form a diaphragm for the support of the substance to be infused. It has the advantage that the material, after having been exhausted, may be lifted out without disturbing the infusion. In the margin is a figure of the mug. It is made of queensware, of the capacity of two pints, into which a thimble-shaped colander descends to somewhat less than half its depth, supported on the rim of the mug by a projecting ledge, with a carefully fitted cover, which closes the whole. The substance to be submitted to infusion is introduced into the colander either before or after it has been fitted to the mug; the water, hot or cold, as the case may be, is then poured in so as to fill the lower vessel, and cover the materials in the upper; and, the cover having been applied, the vessel is set aside for the length of time required. The colander is then to be lifted out, and the infusion is ready for use. For preparing small quantities of infusion, a half pint for example, the mug must be made of a smaller size.

sharp angle and has fitted to it a piece of india-rubber tubing, to which a pinchcock is attached, by means of which the contents may be drawn, as wanted. By making very concentrated infusions, as suggested by Mr. Donovan, with a mixture of three parts of water and one of alcohol, they may be long kept, and when used can be diluted with water to the proper strength. Thus, if made four times as strong as the officinal infusion, they may be diluted with three measures of water. The proportion of alcohol would thus be very small; but it might still be medically injurious; and infusions should not be prepared in this way unless with the cognizance of the prescriber.

Mr. Battley, of London, has introduced a set of preparations, which he calls *inspissated infusions*, the advantages of which are that the virtues are extracted by cold water, are not injured by heat used in the evaporation, are in a concentrated state, and are not impaired by time. To prepare them he macerates the material, coarsely powdered, bruised, or finely sliced, in twice its weight of cold distilled water, pressing the solid matter into the liquid repeatedly by a rammer or the hand; then allows the liquid to drain out, or expresses it in the case of highly absorbent substances; and repeats the process, with an amount of water equal to that which has been separated, until the strength is exhausted. Four or six hours of maceration are usually sufficient. The infusion is then to be concentrated by evaporation at a temperature not exceeding 71·1° C. (160° F.) to the sp. gr. 1·200, and as much alcohol is to be added as will make its sp. gr. 1·100. These preparations are very analogous to the *fluid extracts* already treated of. As a general rule, it would probably be preferable to prepare the infusion by the process of percolation. The inspissated infusions must be diluted when administered. The presence of alcohol, though in small quantity, would sometimes be a serious objection. (*P. J. Tr.*, x. 129.)

As we have already treated of the chemical relations and medical properties of the substances used in infusion, it would be useless repetition to enlarge upon these points in the following details. We shall touch upon them only in cases of peculiar interest, or where changes requiring particular notice may grow out of the nature of the process.

The former officinal preparations of this class, omitted in the present U. S. Pharmacopœia, are the infusions of Angustura, Chamomile, Buchu, Columbo, Capsicum, Cloves, Cascarilla, Catechu, Red Cinchona, Thoroughwort, Compound Gentian, Hops, Juniper, Rhatany, Compound Flaxseed, Pareira Brava, Tar, Quassia, Rhubarb, Compound Rose, Sage, Senna, Serpentaria, Spigelia, Tobacco, Dandelion, Valerian, Ginger.

INFUSUM ANTHEMIDIS. *Br.* *Infusion of Chamomile.*

(ỊN-FŪ'ŞŬM ẠN-THĔM'Ị-DĬS.)

Infusum Chamomillæ Romanæ; Tisane de Chamomille romaine, *Fr.;* Römisch-Kamillenthee, *G.*

"Take of Chamomile Flowers *half an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for fifteen minutes, and strain." *Br.*

As this preparation has been dismissed from the U. S. Pharmacopœia, it must now be made according to the general formula (see page 788), unless otherwise directed; if so made, it will be three times the strength of that of the Pharm. 1870. Under these circumstances the British preparation is to be preferred; even this is sufficiently concentrated to be quite unpalatable to most patients.

The infusion of chamomile has the odor and taste of the flowers. It affords precipitates with gelatin, yellow Peruvian bark, sulphate of iron, tincture of chloride of iron, nitrate of silver, corrosive chloride of mercury, and the acetates of lead. As a tonic it is given cold, in the dose of one or two fluidounces (30–60 C.c.) several times a day. To assist the operation of emetic medicines it should be administered in the tepid state, and in large draughts. The infusion prepared by maceration in cold water is more grateful to the palate and stomach than that made with boiling water, but is less efficient as an emetic.

INFUSUM AURANTII. *Br.* *Infusion of Orange Peel.*

(ỊN-FŪ'ŞŬM ÂU-RĂN'TỊ-Ī—âw-răn'shẹ-ī.)

Tisane d'Écorce d'Orange, *Fr.;* Pomeranzenschalen-Aufguss, *G.*

"Take of Bitter Orange Peel, cut small, *half an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for fifteen minutes, and strain." *Br.*

This infusion is given as a grateful stomachic, in the dose of two or three fluidounces (60 or 90 C.c.).

INFUSUM AURANTII COMPOSITUM. *Br.* *Compound Infusion of Orange Peel.*

(ỊN-FŪ'ŞŬM ÂU-RĂN'TỊ-Ī CỌM-PŎŞ'Ị-TŬM.)

Tisane d'Écorce d'Orange composée, *Fr.;* Pomeranzen- und Citronenschalen-Aufguss, *G.*

"Take of Bitter Orange Peel, cut small, *one quarter of an ounce* [avoirdupois]; Fresh Lemon Peel, cut small, *sixty grains;* Cloves, bruised, *thirty grains;* Boiling Distilled Water *ten fluidounces* [Imperial measure]. Infuse in a covered vessel for a quarter of an hour and strain." *Br.* A grateful stomachic in the dose of one or two fluidounces (30 or 60 C.c.).

INFUSUM BRAYERÆ. *U.S.* *Infusion of Brayera.*

(ỊN-FŪ'ŞŬM BRĀY-Ē'RÆ.)

Tisane de Cousso, *Fr.;* Kossotrank, *G.*

"Brayera, in No. 20 powder, *six parts* [or one ounce av.]; Boiling Water, *one hundred parts* [or one pint]. Pour the Boiling Water upon the Brayera, and let it macerate in a covered vessel until cool. This Infusion should be dispensed without straining." *U. S.*

This is a new officinal infusion, which has been introduced with a view of affording an efficient method of administering koosso. It is of the same strength as the British infusion (see *Infusum Cusso*). The unusual direction to dispense an infusion without straining, argues little faith in the ability of the menstruum to exhaust the drug. The dose would be half a pint (236 C.c.).

INFUSUM BUCHU. *Br.* *Infusion of Buchu.*

(ỊN-FŪ'ŞŬM BŪ'ÇHŪ—bū'kū.)

Infusum Diosmæ s. Barosmæ; Tisane de Bucco, *Fr.;* Buchuaufguss, *G.*

"Take of Buchu Leaves, bruised, *half an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for one hour, and strain." *Br.*

This infusion was dropped at the last revision. If made by the general formula (see page 788), it will be one and a half times the strength of the preparation of U. S. P. 1870. It has the odor, taste, and medical virtues of the leaves, and affords a convenient method of administering the medicine. The dose of the British preparation is one or two fluidounces (30 or 60 C.c.).

INFUSUM CALUMBÆ. *Br.* *Infusion of Calumba.*

(ỊN-FŪ'ŞŬM CẠ-LŬM'BÆ.)

Tisane de Colombo, *Fr.;* Kolombo-Infusion, *G.*

"Take of Calumba Root, cut small, *half an ounce* [avoirdupois]; Cold Distilled Water *ten fluidounces.* Macerate in a covered vessel, for one hour, and strain." *Br.*

This preparation was not retained in the present Pharmacopœia. When made by the general formula (see page 788), it will be three times stronger than the infusion of U. S. P. 1870.

The infusion of Columbo is apt to spoil very quickly, especially in warm weather. It has been generally supposed that the cold infusion would keep better than the hot, because it contains no starch. Mr. Thomas Greenish, however, upon comparing specimens of the two infusions, found that the spontaneous change began sooner in the cold than in the hot, though the former was clearer. Columbo contains starch and albumen. Cold water extracts the latter without the former; hot water the former with comparatively little of the latter, which is partially coagulated by the heat. Both starch and albumen are liable to spontaneous change; but the former is much the more permanent of the two. Hence it is, according to Mr. Greenish, that the hot infusion keeps best. Indeed, he ascribes the change which takes place in the starch of the hot infusion chiefly to the agency of a little albumen, which has escaped coagulation. According to these views, the best plan of preparing infusion of columbo is to exhaust the root with cold water, by which the starch is left behind, and then to heat the infusion to the boiling point in order to coagulate the albumen. (*A. J. P.*, xviii. 141; from *P. J. Tr.*) Upon comparing specimens of the cold and hot infusion, we have not found the results of Mr. Greenish fully confirmed. The cold infusion appeared to keep better than the hot. Nevertheless, the plan of preparing the infusion above proposed is probably the best. The infusion of columbo is not disturbed by salts of iron, and may be conveniently administered in connection with them. The dose of the British infusion is two fluidounces (60 C.c.) three or four times a day.

INFUSUM CARYOPHYLLI. *Br.* *Infusion of Cloves.*

(ỊN-FŪ'ŞŬM CĂR-Ỵ-Ọ-PHȲL'LĪ.)

Tisane de Girofle, *Fr.;* Gewürznelken-Infusion, *G.*

"Take of Cloves, bruised, *a quarter of an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for half an hour, and strain." *Br.*

It is fortunate that this infusion is rarely used, for it was dropped at the last revision of the U. S. Pharmacopœia. If made by the general formula (page 788), it will be at least six times the strength of the preparation of U. S. P. 1870.

The infusion of cloves affords precipitates with lime-water, and with the soluble salts of iron, zinc, lead, silver, and antimony. (*Phillips.*) The dose of the British infusion is about two fluidounces (60 C.c.).

INFUSUM CASCARILLÆ. *Br.* *Infusion of Cascarilla.*

(ỊN-FŪ'ŞŬM CĂS-CẠ-RĬL'LÆ.)

Tisane de Cascarilla, *Fr.;* Kaskarilla-Aufguss, *G.*

"Take of Cascarilla Bark, in coarse powder, *one ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for one hour, and strain." *Br.*

This infusion was also dropped at the last revision of the U. S. Pharmacopœia; a preparation made by the general formula (see page 788) will be one and a half times the strength of the infusion of cascarilla of U. S. P. 1870.

This infusion affords precipitates with lime-water, infusion of galls, nitrate of silver, acetate and subacetate of lead, sulphate of zinc, and sulphate of iron. The dose of the British infusion is two fluidounces (60 C.c.).

INFUSUM CATECHU. *Br.* *Infusion of Catechu.*

(ỊN-FŪ'ŞŬM CĂT'Ẹ-ȻHŪ—kăt'ẹ-kū.)

Infusum Catechu, *Br.;* Infusion of Catechu, *E.;* Tisane de Cachou composée, *Fr.;* Catechuaufguss mit Zimmt, *G.*

"Take of Catechu, in coarse powder, *one hundred and sixty grains;* Cinnamon Bark, bruised, *thirty grains;* Boiling Distilled Water *ten fluidounces* [Imperial measure]. Infuse in a covered vessel, for half an hour, and strain." *Br.*

This is an elegant mode of administering catechu. The dose is from one to three fluidounces (30 to 90 C.c.), repeated three or four times a day, or more frequently.

INFUSUM CHIRATÆ. *Br.* *Infusion of Chiretta.*

(ỊN-FŪ'ŞŬM ȻHỊ-RĀ'TÆ—kị-rā'tē.)

Tisane de Chirette, *Fr.;* Chiretta-Thee, *G.*

"Take of Chiretta, cut small, *a quarter of an ounce* [avoirdupois]; Distilled Water, at 120°, ten *fluidounces.* Infuse in a covered vessel, for half an hour, and strain." *Br.*

The dose of this simple bitter is from one to three fluidounces (30 to 90 C.c.).

INFUSUM CINCHONÆ. *U.S.* *Infusion of Cinchona.*

(ỊN-FŪ′ṢŬM CĬN-ȻHŌ′NÆ—sĭn-kō′nē.)

Infusum Cinchonæ Flavæ, *Br.;* Infusion of Yellow Bark; Infusion of Calisaya Bark; Tisane de Quinquina jaune, *Fr.;* Kalisaya-Rindenaufguss, *G.*

"Cinchona, in No. 40 powder, *six parts* [one ounce av.]; Aromatic Sulphuric Acid, *one part* [seventy-two minims]; Water, *a sufficient quantity,* To make *one hundred parts* [or one pint]. Mix the Acid with *fifty parts* [or half a pint] of Water, and moisten the powder with *three parts* [or half a fluidounce] of the mixture; pack it firmly in a conical glass percolator, and gradually pour upon it, first, the remainder of the mixture, and afterward, Water, until the Infusion weighs *one hundred parts* [or measures one pint]. When no variety of Cinchona is specified by the physician directing this Infusion, use Yellow Cinchona." *U. S.*

"Take of Yellow Cinchona Bark, in coarse powder, *half an ounce* [avoirdupois]; Boiling Distilled Water, *ten fluidounces.* Infuse in a covered vessel, for two hours, and strain." *Br.*

Though the infusion with boiling water is more quickly prepared than the cold infusion, and therefore better adapted to cases of emergency, yet the former is a more elegant preparation, not turbid like the latter, and at least equally efficient. We, therefore, prefer the process of the U. S. Pharmacopœia, provided it be skilfully conducted.

The U. S. infusion is an efficient preparation. Water extracts from bark the kinates of quinine and cinchonine, but leaves behind the compounds which these principles form with the cinchotannic acid. The simple infusion, therefore, is rather feeble. But the addition of the acid insures the solution of all or nearly all the active matter. Dr. Geo. B. Wood placed much reliance in this infusion. It would be best to macerate the bark with the acidulated water some time before it is introduced into the percolator.

The infusion of cinchona, made without acid, affords precipitates with the alkalies, alkaline carbonates, and alkaline earths; the soluble salts of iron, zinc, and silver; corrosive chloride of mercury, arsenious acid, and tartar emetic; gelatinous solutions; and various vegetable infusions and decoctions, as those of galls, chamomile, columbo, cascarilla, horseradish, cloves, catechu, orange-peel, foxglove, senna, rhubarb, valerian, and simaruba. In some instances the precipitate occurs immediately, in others not for several hours. Few, however, of these substances diminish the efficacy of the infusion, as they do not affect the active principles. The alkalies, alkaline earths, and vegetable astringents are really incompatible. As gallic, tartaric, and oxalic acids form salts with quinine of somewhat difficult solubility, the neutral and soluble gallates, tartrates, and oxalates produce in the infusion slight precipitates of corresponding salts of the alkaloids; but these are redissolved by an excess of the acid. Tartrate of antimony and potassium does not precipitate the alkaloids. Solutions of iodine are incompatible, forming with the alkaloids insoluble compounds. For an account of the chemical reactions of the infusions of different varieties of Peruvian bark, see *A. J. P.* (ix. 128).

The simple infusion of cinchona may be advantageously administered in cases which require tonic treatment, but do not call for the full powers of the bark. The acid infusion has all the powers of cinchona itself. The medium dose is two fluidounces (60 C.c.), equivalent to a drachm of the bark.

INFUSUM CUSPARIÆ. *Br.* *Infusion of Cusparia.*

(ỊN-FŪ′ṢŬM CŬS-PĀ′RỊ-Æ.)

Tisane d'Angusture, *Fr.;* Angustura-Aufguss, *G.*

"Take of Cusparia bark, in coarse powder, *half an ounce* [avoirdupois]; Distilled Water, at 120°, *ten fluidounces.* Infuse in a covered vessel, for two hours, and strain." *Br.*

Under the name of *Infusum Angusturæ* this preparation was officinal in the U. S. Pharm. 1870, made in the proportion of half a troyounce of angustura bark in a pint of water. Made according to the general formula, page 788, it would be three times the strength of the infusion formerly officinal. The dose of the British infusion is two fluidounces (60 C.c.), repeated every two, three, or four hours.

INFUSUM CUSSO. *Br.* *Infusion of Kousso.*

(ỊN-FŪ′ŞŬM CŬS′SŌ.)

Tisane de Cousso, *Fr.;* Kossotrank, *G.*

"Take of Kousso, in coarse powder, *one half of an ounce* [avoirdupois]; Boiling Distilled Water *eight fluidounces.* Infuse in a covered vessel, for fifteen minutes, without straining." *Br.* The whole may be taken for a dose. (See *Inf. Brayera.*)

INFUSUM DIGITALIS. *U. S., Br.* *Infusion of Digitalis.*

(ỊN-FŪ′ŞŬM DĬĢ-Ị-TĀ′LĬS.)

Tisane de Digitale, *Fr.;* Fingerhutaufguss, *G.*

"Digitalis, in No. 20 powder, *three parts* [or fifty-five grains]; Cinnamon, in No. 20 powder, *three parts* [or fifty-five grains]; Boiling Water, *one hundred and eighty-five parts* [or seven and a half fluidounces]; Alcohol, *fifteen parts* [or six and a half fluidrachms]; Water, *a sufficient quantity,* To make *two hundred parts* [or half a pint]. Pour the Boiling Water upon the mixed powders, and macerate for two hours in a covered vessel. Then strain, add the Alcohol, and pass enough Water through the strainer to make the Infusion weigh *two hundred parts* [or measure half a pint]." *U. S.*

"Take of Digitalis Leaves, dried, *thirty grains;* Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for one hour, and strain." *Br.*

The U. S. P. infusion does not differ essentially from that formerly officinal. Mr. D. E. Prall (*A. J. P.*, 1878, p. 423) proved that the abundant precipitate in the old infusion was caused by the tincture of cinnamon, and recommended a simple infusion without any aromatic. The present process affords a preparation which keeps moderately well, but it is not entirely free from precipitation.

The U. S. infusion is essentially the same as that employed by Withering. It affords precipitates with sulphate of iron, acetate of lead, tannic acid, and infusion of cinchona. The dose has usually been stated at half a fluidounce (15 C.c.), repeated twice a day under ordinary circumstances, every eight hours in urgent cases, until the system is affected. The proportion of digitalis is scarcely half as great in the British preparation, and the dose is proportionably larger. It will not escape the close observer, that the stated dose of digitalis in infusion is much larger than in substance, for which there does not appear to be a good reason, but which accounts for the fact that many physicians assert that they get better results from the infusion than from the digitalis itself. The British Pharmacopœia, though its infusion has only about half the strength of ours, gives its dose as from two to four fluidrachms (7·5 to 15 C.c.).

INFUSUM DULCAMARÆ. *Br.* *Infusion of Dulcamara.*

(ỊN-FŪ′ŞŬM DŬL-CẠ-MĀ′RÆ.)

Tisane de Douce-amère, *Fr.;* Bittersüssaufguss, *G.*

"Take of Dulcamara, bruised, *one ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for one hour, and strain." *Br.*

The dose is one or two fluidounces (30 or 60 C.c.) three or four times a day.

INFUSUM ERGOTÆ. *Br.* *Infusion of Ergot.*

(ỊN-FŪ′ŞŬM ẸR-GŌ′TÆ.)

Tisane de Seigle ergoté, *Fr.;* Mutterkornaufguss, *G.*

"Take of Ergot, in coarse powder, *a quarter of an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for half an hour, and strain." *Br.*

The dose of this infusion is two fluidounces (60 C.c.).*

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* *Infusum Eupatorii.* U. S. 1870. *Infusion of Thoroughwort.* "Take of Thoroughwort or Boneset [the dried herb] *a troyounce;* Boiling Water *a pint.* Macerate for two hours in a covered

INFUSUM GENTIANÆ COMPOSITUM. *Br.* *Compound Infusion of Gentian.*

(ỊN-FŪ'ṢŬM ÇĔN-TỊ-Ā'NÆ CỌM-PŎṢ'Ị-TŬM—jĕn-shẹ-ā'nē.)

Tisane de Gentiane composée, *Fr.;* Enzianaufguss, *G.*

"Take of Gentian Root, sliced, Bitter-Orange Peel, cut small, of each, *sixty grains;* Fresh Lemon Peel, cut small, *one quarter of an ounce;* Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for one hour, and strain." *Br.*

"Take of Gentian, in moderately coarse powder, *half a troyounce;* Bitter Orange Peel, in moderately coarse powder, Coriander, in moderately coarse powder, each, *sixty grains;* Alcohol *two fluidounces;* Water *a sufficient quantity.* Mix the Alcohol with fourteen fluidounces of Water, and, having moistened the mixed powders with three fluidrachms of the menstruum, pack them firmly in a conical percolator, and gradually pour upon them first the remainder of the menstruum, and afterwards Water, until the filtered liquid measures a pint." *U. S.* 1870.

It is, in our opinion, unfortunate that this, the most esteemed of all infusions, should have been dropped by the Committee of Revision of the Pharm. 1880. We have inserted the formula of the U. S. P. 1870, as it will doubtless continue to be largely prescribed. It should be designated, however, as U. S. P. 1870. It has been the custom with some physicians to prescribe a concentrated infusion made with one-fourth the quantity of menstruum directed by the formula of U. S. P. 1870. This permits the use of a valuable tonic with the presence of but a trifling amount of alcohol. This concentrated preparation keeps well, and it may be diluted with the right quantity of the proper menstruum by the pharmacist to make the infusion of U. S. P. 1870.

The use of the alcohol is to assist in dissolving the bitter principle, and at the same time to contribute towards the preservation of the infusion, which, without this addition, is very apt to spoil. It has, however, been abandoned by the British Pharmacopœia, and lemon peel substituted; this is a very doubtful improvement. The dose is a fluidounce (30 C.c.) repeated three or four times a day.

INFUSUM LUPULI. *Br.* *Infusion of Hop.*

(ỊN-FŪ'ṢŬM LŪ'PŪ-LĪ.)

Infusum Humuli, *U. S.* 1870; Tisane de Houblon, *Fr.;* Hopfenaufguss, *G.*

"Take of Hop *half an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for two hours, and strain." *Br.*

The infusion of hops U. S. P. 1870 was made exactly like the above, except that the strength was half a troyounce to a pint. As it was dropped at the last revision, it must now be made by the general formula, page 788 (unless otherwise directed), which will make it three times the strength of the former infusion.

The dose of the British infusion is one or two fluidounces (30 or 60 C.c.).*

INFUSUM KRAMERIÆ. *Br.* *Infusion of Rhatany.*

(ỊN-FŪ'ṢŬM KRẠ-MĒ'RỊ-Æ.)

Tisane de Ratanhia, *Fr.;* Ratanha-Aufguss, *G.*

"Take of Rhatany Root, bruised, *half an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for one hour, and strain." *Br.*

The infusion of rhatany is undoubtedly most efficient when prepared by the mode of percolation, with cold water, from the root in a state of moderately coarse powder, as directed in the U. S. process of 1870. The dose of the infusion is one or two fluidounces (30 or 60 C.c.).

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vessel, and strain." *U. S.* 1870. As a tonic, this infusion should be taken cold in the dose of one or two fluidounces (30 or 60 C.c.) three or four times a day, or more frequently; as an emetic and diaphoretic, in large tepid draughts. It is popularly called *boneset tea.*

* *Infusum Juniperi.* U. S. 1870. *Infusion of Juniper.* "Take of Juniper, bruised, *a troyounce;* Boiling water *a pint.* Macerate for an hour in a covered vessel, and strain." *U. S.* 1870. The whole quantity may be taken in twenty-four hours, in doses of two or three fluidounces (60 or 90 C.c.).

INFUSUM LINI. *Br.* *Infusion of Linseed.*

(Ị̣N-FŪ′ŞŬM LĪ′NĪ.)

Tisane de Lin, *Fr.;* Leinsamen-Aufguss, *G.*

"Take of Linseed *one hundred and sixty grains;* Fresh Liquorice Root, sliced, *sixty grains;* Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for four hours, and strain." *Br.*

This is nearly identical with the *Compound Infusion of Flaxseed* of the U. S. P. 1870.* It is a useful demulcent drink in inflammatory affections of the mucous membrane of the lungs and urinary passages. It may be taken *ad libitum.*

INFUSUM MATICÆ. *Br.* *Infusion of Matico.*

(Ị̣N-FŪ′ŞŬM MẠ-TÎ′ÇÆ—mạ-tē′sē.)

Tisane de Matico, *Fr.;* Matico-Aufguss, *G.*

"Take of Matico Leaves, cut small, *half an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for half an hour, and strain." *Br.*

The dose of this infusion is two fluidounces (60 C.c.).†

INFUSUM PRUNI VIRGINIANÆ. *U. S.* *Infusion of Wild-cherry.*

(Ị̣N-FŪ′ŞŬM PRÛ′NĪ VĬR-ÇĬN-Ị-Ā′NÆ.)

Tisane d'Écorce de Cerisier sauvage, *Fr.;* Wildkirschen-Thee, *G.*

"Wild-cherry, in No. 40 powder, *four parts* [or half an ounce av.]; Water, *a sufficient quantity,* To make *one hundred parts* [or twelve fluidounces]. Moisten the powder with *six parts* [or six fluidrachms] of Water, and macerate for one hour; then pack it firmly in a conical glass percolator, and gradually pour Water upon it until the Infusion weighs *one hundred parts* [or measures twelve fluidounces]." *U. S.*

This is a peculiarly suitable object for officinal direction, as, in consequence of the volatile nature of one of its active ingredients, and for another reason (see *Prunus Virginiana*), it is better prepared with cold water than in the ordinary mode. The infusion of wild-cherry bark is one of the preparations to which the process of percolation or displacement is well adapted. In this way the virtues of the bark can be more rapidly and thoroughly exhausted than by maceration alone. In order to allow time for the reaction necessary to the production of the hydrocyanic acid, an hour's preliminary maceration is directed, which might perhaps be advantageously somewhat lengthened. If kept in a warm place this preparation undergoes a rapid alteration, and even under the best of circumstances is unstable. According to the experiments of Mr. J. B. Moore (*A. J. P.*, 1873, p. 242) two fluidounces of glycerin to the pint of menstruum is of great advantage in delaying the change. When properly made, infusion of wild-cherry bark is beautifully transparent, has the color of Madeira wine, and the agreeable bitterness and peculiar flavor of the bark. The dose is two or three fluidounces (60 or 90 C.c.) three or four times a day, or more frequently when a strong impression is required.

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* "Take of Flaxseed *half a troyounce;* Liquorice Root, bruised, *one hundred and twenty grains;* Boiling water *a pint.* Macerate for two hours in a covered vessel, and strain." *U. S.* 1870.

† *Infusum Pareiræ.* U. S. 1870. *Infusion of Pareira Brava.* "Take of Pareira Brava, bruised, *a troyounce;* Boiling Water *a pint.* Macerate for two hours in a covered vessel, and strain." *U. S.* 1870. The infusion of pareira brava is highly esteemed by some English practitioners as a remedy in irritation and chronic inflammation of the urinary passages, and has been found useful in catarrh of the bladder. The dose is one or two fluidounces (30 or 60 C.c.). Brodie employed a *decoction* of the root, which he prepared by boiling half an ounce in three pints of water down to a pint, and gave in the quantity of from eight to twelve fluidounces daily. The Br. Pharmacopœia has substituted the decoction for the infusion.

Infusum Picis Liquidæ, U. S. 1870; *Infusion of Tar. Tar Water.* "Take of Tar *a pint;* Water *four pints.* Mix them, and shake the mixture frequently during twenty-four hours. Then pour off the infusion, and filter through paper." *U.S.* Water takes from tar a small portion of acetic acid, empyreumatic oil including creasote, and resinous matter, acquiring a sharp empyreumatic taste, the odor of tar, and the color of Madeira wine. Thus impregnated it is stimulant and diuretic, and may be taken in the quantity of one or two pints daily. It is also used as a wash in chronic cutaneous affections, and is said to have proved beneficial, by injection into the bladder, in some cases of chronic cystitis.

INFUSUM QUASSIÆ. *Br.* *Infusion of Quassia.*

(Ị̣N-FŪ'ŞŬM QUAS'SỊ-Æ—kwŏsh'ẹ-ē.)

Tisane de Quassie, *Fr.;* **Quassia-Aufguss,** *G.*

"Take of Quassia Wood, in chips, *sixty grains;* Cold Distilled Water *ten fluidounces.* Macerate in a covered vessel, for half an hour, and strain." *Br.*

The dropping of this infusion at the last revision of the U. S. Pharm., and the substitution of the general formula in its place (p. 788), will result in making a preparation six times the strength of that of the U. S. P. 1870. Boiling water may be employed when it is desirable to obtain the preparation quickly; but cold water affords a clearer infusion. The half-hour maceration directed in the British Pharmacopœia, considering that cold water is used, appears to us to be too short for the exhaustion of the wood. The dose is two fluidounces (60 C.c.) three or four times a day.

INFUSUM RHEI. *Br.* *Infusion of Rhubarb.*

(Ị̣N-FŪ'ŞŬM RHĒ'Ī.)

Tisane de Rhubarbe, *Fr.;* **Rhabarber-Aufguss,** *G.*

"Take of Rhubarb Root, in thin slices, *a quarter of an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for one hour, and strain." *Br.*

In order that the rhubarb may be exhausted, it should be digested with the water near the fire, at a temperature somewhat less than that of boiling water. It is customary to add some aromatic, such as cardamom, fennel-seed, or nutmeg, which improves the taste of the infusion, and renders it more acceptable to the stomach. One drachm of either of these spices may be digested in connection with the rhubarb.

This infusion may be given as a gentle laxative, in the dose of one or two fluidounces (30 or 60 C.c.), every three or four hours till it operates. It is occasionally used as a vehicle for tonic, antacid, or more active cathartic medicines. The stronger acids and most metallic solutions are incompatible with it.

As infusion of rhubarb was not retained in the present Pharmacopœia, the general formula, page 788, must be used (unless otherwise directed), which will make a preparation six times the strength of that of the U. S. P. 1870.

INFUSUM ROSÆ ACIDUM. *Br.* *Acid Infusion of Roses.*

(Ị̣N-FŪ'ŞŬM RŌ'ŞÆ AÇ'Ị-DŬM.)

Infusum Rosæ Compositum, *U. S.* 1870; Compound Infusion of Rose; Acid Infusion of Rose; Tisane de Rose composée, *Fr.;* Saurer Rosenaufguss, *G.*

"Take of Dried Red-rose Petals, broken up, *a quarter of an ounce* [avoirdupois]; Diluted Sulphuric Acid *one fluidrachm;* Boiling Distilled Water *ten fluidounces.* Add the Acid to the Water, infuse the Petals in the mixture in a covered vessel, for half an hour, and strain." *Br.*

The formula of the U. S. P. 1870 is preferable to that of the British Pharm. on account of the presence of sugar. It is unfortunate, in our opinion, that this elegant infusion was dropped at the last revision of the U. S. Pharmacopœia. We append the formula of the U. S. P. 1870. "Take of Red Rose [dried petals] *half a troyounce;* Diluted Sulphuric Acid *three fluidrachms;* Sugar [refined], in coarse powder, *a troyounce and a half;* Boiling Water *two pints and a half.* Pour the Water upon the Rose in a covered glass or porcelain vessel; add the Acid, and macerate for half an hour. Lastly, dissolve the Sugar in the liquid, and strain." *U. S.*

The red roses serve little other purpose than to impart a fine red color and a slight astringent flavor to the preparation, which owes its medicinal virtues almost exclusively to the sulphuric acid. According to Mr. J. B. Barnes, one part of glycerin added to eight or nine parts of infusion of rose increases greatly its brightness and transparency. It is refrigerant and astringent, and affords a useful and not unpleasant drink in hemorrhages and colliquative sweats. It is much used by British practitioners as a vehicle for saline medicines, particularly sulphate of magnesium, the taste of which it serves to cover. It is also employed as a gargle, usually in connection with acids, nitre, alum, or tincture of Cayenne pepper. The dose is from two to four fluidounces (30 to 118 C.c.).*

INFUSUM SENEGÆ. *Br.* *Infusion of Senega.*

(ỊN-FŪ′ŞŬM SĔN′Ẹ-ÇÆ—sĕn′ȩ-jē.)

Tisane de Polygale de Virginie, *Fr.;* Senega-Aufguss, *G.*

"Take of Senega Root, bruised, *half an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for one hour, and strain." *Br.*

The efficacy of the officinal decoction of seneka has been proved by so long an experience, that we should be cautious in allowing it to be superseded by the infusion on hypothetical grounds. The dose of the preparation is from one to three fluidounces (30 to 90 C.c.).

INFUSUM SENNÆ. *Br.* *Infusion of Senna.*

(ỊN-FŪ′ŞŬM SĔN′NÆ.)

Tisane de Séné, *Fr.;* Senna-Aufguss, *G.*

"Take of Senna *one ounce* [avoirdupois]; Ginger, sliced, *thirty grains;* Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for one hour, and strain." *Br.*

"Take of Senna *a troyounce;* Coriander, bruised, *sixty grains;* Boiling Water *a pint.* Macerate for an hour in a covered vessel, and strain." *U. S.* 1870.

We prefer the coriander of the U. S. Pharmacopœia, 1870, to the ginger of the British. The strength of the British preparation has been doubled in the present edition of the Pharmacopœia, and is now nearly twice as great as that of the U. S. infusion of 1870. The infusion deposits, on exposure to the air, a yellowish precipitate, which is said to aggravate its griping tendency; it should, therefore, not be made in large quantities. It is customary to connect with it manna and some one of the saline cathartics, which increase its efficacy, and render it less painful in its operation. (See *Infusum Sennæ Compositum.*) The dose of the infusion is about four fluidounces (118 C.c.). The cold infusion, especially if made by percolation from the coarsely powdered leaves, while probably not inferior in strength to that prepared with boiling water, is said to be less unpleasant to the taste.

INFUSUM SENNÆ COMPOSITUM. *U. S.* *Compound Infusion of Senna.* [*Black Draught.*]

(ỊN-FŪ′ŞŬM SĔN′NÆ CỌM-PŎS′Ị-TŬM.)

Tisane de Séné composée, *Fr.;* Senna-Aufguss, *G.*

"Senna, *six parts* [or half an ounce av.]; Manna, *twelve parts* [or one ounce av.]; Sulphate of Magnesium, *twelve parts* [or one ounce av.]; Fennel, bruised, *two parts* [or seventy-three grains]; Boiling Water, *one hundred parts* [or half a pint]; Water, *a sufficient quantity,* To make *one hundred parts* [or half a pint]. Pour the Boiling Water upon the solid ingredients and macerate in a covered vessel until cool. Then strain, and add enough Water through the strainer to make the Infusion weigh *one hundred parts* [or measure half a pint]." *U. S.*

This preparation is the Black Draught of English Pharmacy, and it is an excellent form of administering these cathartics in a liquid condition. The simple infusion of senna has been dropped in the last revision; and the above, which more closely corresponds with *senna tea,* used as a popular purgative draught, substituted. The dose is about four fluidounces (118 C.c.).

INFUSUM SERPENTARIÆ. *Br.* *Infusion of Serpentary.*

(ỊN-FŪ′ŞŬM SĔR-PẸN-TĀ′RỊ-Æ.)

Tisane de Serpentaire, *Fr.;* Schlangenwurzel-Aufguss, *G.*

"Take of Serpentary Root, bruised, *a quarter of an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel for two hours, and strain." *Br.*

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* *Infusum Salviæ.* U. S. 1870. *Infusion of Sage.* "Take of Sage *half a troyounce;* Boiling Water *a pint.* Macerate for half an hour in a covered vessel, and strain." *U. S. P.* 1870. This preparation is less used internally than as a gargle, or as a vehicle for other substances, such as alum, employed in this way.

The infusion of serpentaria having been dropped at the last revision of the U. S. Pharmacopœia, the general formula, page 788, must be used (unless otherwise specified), which will make an infusion three times the strength of the U. S. 1870 preparation. The dose of the British preparation is one or two fluidounces (30 or 60 C.c.), every two hours in low forms of fever, but less frequently in chronic affections.*

INFUSUM UVÆ URSI. *Br.* *Infusion of Bearberry.*

(ĮN-FŪ'ṢŬM Ū'VÆ ŬR'SĪ.)

Tisane d'Uva Ursi, *Fr.;* Bärentraubenblätter-Aufguss, *G.*

"Take of Bearberry Leaves, bruised, *half an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel for two hours, and strain through calico." *Br.* The dose is one or two fluidounces (30 or 60 C.c.) three or four times a day.

INFUSUM VALERIANÆ. *Br.* *Infusion of Valerian.*

(ĮN-FŪ'ṢŬM VẠ-LĒ-RỊ-Ā'NÆ.)

Tisane de Valériane, *Fr.;* Baldrian-Aufguss, *G.*

"Take of Valerian Root, bruised, *one hundred and twenty grains;* Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel for one hour, and strain." *Br.*

This is another of the infusions dropped at the last revision of the U. S. Pharmacopœia. It must now be made by the general formula, page 788 (unless otherwise specified), and it will therefore be six times the strength of that of the U. S. P. 1870.

The dose of the British infusion is two fluidounces (60 C.c.), repeated three or four times a day, or more frequently.†

INULA. *U. S.* *Inula.* [*Elecampane.*]

(ĬN'Ụ̇-LẠ.)

"The root of Inula Helenium. Linné. (*Nat. Ord.* Compositæ.)" *U. S.*

Aunée, *Fr.;* Alantwurzel, *G.;* Enula Campana, *It., Sp.*

Gen. Ch. Receptacle naked. *Seed-down* simple. *Anthers* ending in two bristles at the base. *Willd.*

Inula Helenium. Willd. *Sp. Plant.* iii. 2089; Woodv. *Med. Bot.* p. 64, t. 26. Elecampane has a perennial root, and an annual stem, which is round, furrowed, villous, leafy, from three to six feet high, and branched near the top. The leaves are large, ovate, serrate, crowded with reticular veins, smooth and deep green upon the upper surface, downy on the under, and furnished with a fleshy midrib. Those which spring directly from the root are petiolate, those of the stem sessile and embracing. The flowers are large, of a golden-yellow color, and stand singly at the ends of the stem and branches. The calyx exhibits several rows of imbricated ovate scales. The florets of the ray are numerous, spreading, linear, and tridentate at the apex. The seeds are striated, quadrangular, and furnished with a simple somewhat chaffy pappus.

This large and handsome plant is a native of Europe, where it is also cultivated for medical use. It has been introduced into our gardens, and has become naturalized in some parts of the country, growing in low meadows, and on the roadsides, from New England to Pennsylvania. It flowers in July and August. The roots, which are the officinal part, should be dug up in autumn, and in their second year. When older they are apt to be stringy and woody.

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* *Infusum Spigeliæ.* U.S. 1870. *Infusion of Spigelia.* "Take of Spigelia *half a troyounce;* Boiling Water *a pint.* Macerate for two hours in a covered vessel, and strain." U.S. 1870. The dose of this infusion, for a child two or three years old, is from four fluidrachms to a fluidounce (15 to 30 C.c.); for an adult, from four to eight fluidounces (118 to 236 C.c.), repeated morning and evening. A quantity of senna equal to that of the spigelia is usually added, in order to insure a cathartic effect.

Infusum Taraxaci. U. S. 1870. *Infusion of Dandelion.* "Take of Dandelion, bruised, *two troyounces;* Boiling Water *a pint.* Macerate for two hours in a covered vessel, and strain." *U. S.* 1870. The dose is a wineglassful two or three times a day, or oftener.

† *Infusum Zingiberis.* U. S. 1870. *Infusion of Ginger.* "Take of Ginger, bruised, *half a troyounce;* Boiling Water *a pint.* Macerate for two hours in a covered vessel, and strain." *U. S.* 1870. The dose of this infusion is two fluidounces (60 C.c.).

The fresh root of elecampane is very thick and branched, having whitish cylindrical ramifications, furnished with thread-like fibres. It is externally brown, internally whitish and fleshy; and the transverse sections present radiating lines. The dried root is "in transverse, concave slices or longitudinal sections, with overlapping bark, externally wrinkled and brown, flexible in damp weather; when dry, breaking with a short fracture; internally grayish, fleshy, slightly radiate and dotted with numerous shining, yellowish brown resin-cells; odor peculiar, aromatic; taste bitter and pungent." *U. S.* Its medical virtues are extracted by alcohol and water, the former becoming most strongly impregnated with its bitterness and pungency. A peculiar principle, resembling starch, was discovered in elecampane by Valentine Rose, of Berlin, in 1804, who named it *alantin;* but the title *inulin*, proposed by Dr. Thomson, has been generally adopted. It differs from starch in being deposited unchanged from its solution in boiling water when the liquor cools, and in giving a yellowish instead of a blue color with iodine. It has been found in the roots of several other plants. It may be obtained white and pure by precipitating a concentrated decoction with twice its volume of alcohol, dissolving the precipitate in a little distilled water, treating the solution with purified animal charcoal, and again precipitating with alcohol. (*A. J. P.*, xxxi. 69.)* It readily dissolves in about three parts of boiling water; the lævogyre solution is perfectly clear and fluid, not paste-like, but on cooling deposits nearly all the inulin. With nitric acid, inulin affords no explosive compound, as starch does. It is easily transformed into uncrystallizable sugar.

The amount of inulin varies according to the season, but is most abundant in autumn. Dragendorff obtained from the root in October not less than 44 per cent., but in spring only 19 per cent.

A crystallizable substance was long since noticed to collect in the head of the receiver when the elecampane root is submitted to distillation with water. Similar crystals may also be observed after carefully heating a thin slice of the root, and are even found as a natural efflorescence on the surface of a root that has been long kept. They can be extracted from the root by means of alcohol, and precipitated with water.

Kallen (*Deutsch. Chem. Ges.*, 1873, p. 1506, and 1876, p. 154) has found that these crystals consist chiefly of the anhydride, $C_{15}H_{20}O_2$, of *alantic acid*, melting at 66° C., and that what was formerly known as *helenin* was a mixture of these with a liquid, *alantol*, $C_{10}H_{16}O$, boiling at 200° C., the true *helenin* and *alant camphor.* The crystals of *helenin*, C_6H_8O, have a bitterish taste, but no odor, and melt at 110° C. The camphor melts at 64° C., and in taste and smell is suggestive of peppermint.

Medical Properties and Uses. Elecampane is tonic and gently stimulant, and has been supposed to possess diaphoretic, diuretic, expectorant, and emmenagogue properties. By the ancients it was much employed, especially in the complaints peculiar to females; and it is still occasionally resorted to in amenorrhœa. In this country it is chiefly used in chronic diseases of the lungs, and is sometimes beneficial when the affection of the chest is attended with weakness of the digestive organs, or with general debility. From a belief in its deobstruent and diuretic virtues, it was formerly prescribed in chronic engorgements of the abdominal viscera, and the dropsy to which they so often give rise. It has also been highly recommended both as an internal and external remedy in tetter, psora, and other diseases of the skin. The usual modes of administration are in powder and decoction. The dose of the powder is from a scruple to a drachm (1·3–3·9 Gm.). The decoction may be prepared by boiling half an ounce of the root in a pint of water, and given in the dose of one or two fluidounces (30–60 C.c.).

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* Another interesting paper, giving an account of the modifications which inulin undergoes in the plant producing it, and by the agency of heat and water, by M. Lefranc, is contained in the *Journal de Pharmacie* (Sept. 1870, p. 166), to which the reader is referred.

IODOFORMUM. *U.S.* *Iodoform.*

CHI_3; 392·8. (Ī-Ọ-DỌ-FÖR'MŬM.) $C_2 HI_3$; 392·8.

"Iodoform should be kept in well-stopped bottles, in a cool place." *U. S.*

Iodoformium, *P.G.;* Iodoforme, *Fr.;* Iodoform, *G.*

This compound, discovered by Sérullas in 1822, was introduced as a remedy, about the year 1837, by Dr. R. M. Glover, of London, and M. Bouchardat, of Paris, and was first adopted as officinal in the U. S. Pharmacopœia of 1870.

Preparation. Cornélis and Gille published a process in *Journ. de Pharm.*, 1852, p. 196. (See U. S. D., 14th ed., p. 511.) Wittstein's process is an improvement on this. Take two parts of carbonate of potassium, two of iodine, one of 95 per cent. alcohol, and five of water, mix them in a retort, and heat the mixture by means of a water-bath, until perfectly colorless; then, after the cooling of the liquid, pour it into a suitable vessel, and allow it to settle. The yellow scaly mass deposited is collected on a filter, washed thoroughly with water, and dried between folds of bibulous paper. As iodoform is very volatile, it must be prepared in closed vessels. The liquid remaining after the deposition of iodoform contains iodate and iodide of potassium, which may be decomposed with renewed formation of iodoform by adding potassium dichromate 2 to 3 parts, and hydrochloric acid 16 to 24 parts; this liberates iodine. 32 parts of carbonate of soda, 6 parts of iodine. and 16 parts of alcohol are now added, the liquid is then again poured off from the iodoform produced, and the operation again repeated if necessary. The formation of the iodoform is represented by the following equation: $C_2H_5.OH + 4I_2 + 6KOH = CHI_3 + CHKO_2 + 5KI + 5H_2O$. Other products, such as potassium iodate, are, however, formed. Mr. G. R. Bell (*N. R.*, March, 1882) has practically tried nearly all of the processes for the preparation of iodoform, and recommends Filhol's, which is as follows. Put into a long-necked matrass or flask which is supplied with a perforated cork and long supply-tube, a solution of 200 parts of crystallized carbonate of sodium and 1000 parts of distilled water, and add 100 parts of alcohol, heat in a water-bath from 60° C. to 71·1° C. (140° to 160° F.), then gradually add 100 parts of iodine, about 10 parts at a time. When the liquid has become colorless, remove the flask from the water-bath, and allow it to cool three or four hours, then pour out on a filter; return the filtrate to the flask, add 200 parts of carbonate of sodium, 100 parts of alcohol, heat to 71·1° C. (160° F.), and pass a slow current of chlorine gas through the mixture as long as iodine is separated, continuing until the brown liquid is again decolorized. A small excess of chlorine is of no consequence (Hager states that for every 100 parts of iodine it requires the chlorine which can be evolved from about 200 parts of hydrochloric acid by means of manganese dioxide). Let the flask stand twenty-four hours, then throw the contents on a filter and examine the filtrate with chlorine water to see whether it still contains an appreciable amount of iodine compounds, then if necessary subject the filtrate to a second treatment of chlorine gas, adding previously only 20 parts of carbonate of sodium and 10 parts of alcohol. Collect the iodoform after twenty-four hours. The filtrate may be concentrated and decomposed by excess of nitric acid, according to the method recommended in Bouchardat's process. The collected crystals of iodoform are now well washed with the smallest quantity of cold distilled water, spread out on pieces of bibulous paper, and dried in the open air.

Properties. It is in the form of "small, lemon-yellow, lustrous crystals of the hexagonal system, having a saffron-like and almost insuppressible odor, and an unpleasant, slightly sweetish, iodine-like taste. Not perceptibly soluble in water, to which it imparts a slight odor and taste; soluble in 80 parts of alcohol at 15° C. (59° F.), in 12 parts of boiling alcohol, in 5·2 parts of ether, and in chloroform, benzol, benzin, disulphide of carbon, and in fixed or volatile oils. Its solutions have a neutral reaction. Sp. gr. 2.000. It sublimes slightly at ordinary temperatures, and distils slowly with water; at about 115° C. (239° F.) it melts to a brown liquid, and at a higher temperature yields vapors containing iodine and carbonaceous matter. If Iodoform be digested with an alcoholic solution of potassa, the mixture, when acidulated with diluted nitric acid, will give a blue color with gelatinized starch.

Distilled water shaken with Iodoform should not change the color of blue litmus paper, and when filtered, should give no precipitate with test-solution of nitrate of silver (abs. of iodide). Upon full combustion, Iodoform should leave no residue." *U. S.* It is a volatile substance, soft to the touch, and totally devoid of corrosive properties. With potassa in solution, it is decomposed, yielding formiate and iodide of potassium. Hence these two principles are incompatible in prescriptions.

Medical Properties and Uses. M. Maitre, who has studied the physiological effects of iodoform on men, states that from a dose of 30 or 40 centigrammes (about 5 or 6 grains) no effects are observed except a slight increase of appetite. Two hours after it has been taken, the presence of iodine can be detected in the urine and the saliva, and nearly three days elapse before the whole is eliminated. (See also Höyges, *Journ. de Pharm.*, Juillet, 1867.) It passes off also with the lacteal secretion. Given to dogs in much larger doses, several grammes for example, it produces narcotic effects; and two stages in its operation have been noticed; the first marked with more or less prostration, with symptoms of intoxication, the animal tottering, inclining to one side with the head falling, with loss of appetite, but without vomiting. The next day, unless a very large dose has been given, complete recovery takes place. A still larger dose induces the second stage, characterized by a remarkably intense excitation, with anxious breathing, strong and short pulse, a true opisthotonus, sometimes very striking, and convulsive movements of the paws, especially the hinder. After death fatty degeneration of the heart, liver, and kidneys may be found. (*A. Höyges.*) The very free use of iodoform in Germany as an antiseptic dressing to wounds, ulcers, etc., has led to many cases of poisoning, and, it is said (*La France Méd.*, Nos. 30 and 31, 1882), eleven deaths. The principal symptoms are general malaise and depression, faintness, headache, loss of appetite, and a persistent iodoform taste in the mouth. In some cases there is a slight temporary increase of temperature. Mental depression or excitement is especially noticed. Finally the pulse becomes accelerated, soft, and feeble; in some cases the pulse is very rapid,—150–180,—while the temperature remains normal, or only slightly elevated. The cerebral phenomena are commonly those of delirium; but there have been observed, especially in children, symptoms resembling those of meningitis, such as coma, contracture and inequality of the pupils, and rapid pulse, without marked elevation of temperature. In adults a suicidal tendency has been noticed.

Iodoform, though containing 29 parts in 30 of its weight of iodine, is not locally irritant, but anæsthetic and antiseptic. It is said, when employed as a suppository, to produce unconsciousness of the act of defecation. In the form of vapor, it possesses anæsthetic properties, but inferior to those of chloroform. On account of its large proportion of iodine, it was supposed to be capable of replacing that element and the iodides as a remedy, with the advantages of being non-irritant, and of having an organic nature, qualities which favor its absorption and assimilation. The principal diseases in which it has been tried are goitre, rickets, scrofula, phthisis, amenorrhœa, syphilis, glandular tumors, inflammatory disease of the fauces, with or without venereal taint, etc., and cutaneous eruptions. It may be given in from one to three grains, three or four times a day, in pill form; but it has not met the expectation of its early advocates, and is not much used internally. Externally it is much employed as a stimulant anæsthetic application to painful or irritable ulcers, and has been found especially useful in both primary and secondary venereal ulcerations. It also often affords relief in cancerous sores and in uterine cancer. It may be used in powder, ointment, or in solution with glycerin and alcohol. In uterine affections vaginal suppositories may be made by incorporating 7·5 grains of iodoform with 2·5 drachms of cacao butter. The ointment may vary in strength from one to three drachms to the ounce of lard or simple cerate. Iodoform suppositories have also been employed with asserted advantage in enlargement of the prostate gland, and in fissures of the anus. (*N. R.*, July, 1873, p. 226.) On the continent of Europe it has recently been much used as an antiseptic surgical dressing. The powder is usually sprinkled freely upon the wounds and secured in place by a dry dressing. An *iodoform gauze* may be made by saturating suitable material with a concentrated ethereal solution and afterwards drying. Sometimes absorbent cotton may be treated with iodoform in a similar manner.

One of the principal obstacles to its employment is the odor, which, to some patients, is unbearable. Many methods of disguising the odor have been recommended, but in our experience the large quantity required of each deodorizing agent would preclude its employment. Tannin has been recommended, but, as this operates by decomposing the iodoform, it is not to be thought of in this connection. Probably the best class of substances to use are the volatile oils, such as anise, peppermint, fennel, bergamot, almond, etc., and balsam of Peru, although the latter acts by forming a compound, and the aim should be not to destroy the odor, but so to modify it as to remove its objectionable features.

Off. Prep. Unguentum Iodoformi, *U. S.*

IODUM. *U. S., Br.* *Iodine.*

I; 126·6. (Ī-Ō′DŬM.) **I; 126·6.**

"A non-metallic element, obtained principally from the ashes of sea-weeds." *Br.*

Iodinium, *U. S.* 1870; Iode, *Fr.;* Jod, *G;* Iodina, *It., Sp.*

The Iodine of the U. S. and Br. Pharmacopœias is considered as pure; and in both, the tests are given by which its purity may be determined. "Iodine should be preserved in glass-stoppered bottles, in a cool place." *U. S.*

Iodine is a non-metallic element, discovered in 1812 by Courtois, a soda manufacturer of Paris. It exists in certain marine vegetables, particularly the fuci or common sea-weeds, which have long been its most abundant natural source. It has been detected in some fresh-water plants, among which are the water-cress, brooklime, and fine-leaved water-hemlock; also in the ashes of tobacco, and of Honduras sarsaparilla. (*Chatin.*) It has been found in the beet-root of the grand-duchy of Baden. (*Lamy.*) Dr. Macadam detected a trace of iodine in 100 gallons of water used for domestic purposes in Edinburgh, in several of the domestic animals, and in man. He detected it also in potatoes, beans, peas, wheat, barley, and oats. (*P. J. Tr.*, Nov. 1854, p. 235.) Iodine is, moreover, found in the animal kingdom, as in the sponge, the oyster, various polypi, cod-liver oil, and eggs; and, in the mineral kingdom, in sea-water in minute quantity, in certain salt springs, as iodide of silver in a rare Mexican mineral, in a zinc ore of Silesia, in native nitrate of sodium, and in some kinds of rock salt. It is now obtained commercially from one of these sources,—viz., from the native sodium nitrate, or Chili saltpetre, with which it occurs as sodium iodate. The production of the province of Tarapaca (Peru) has assumed large dimensions within the last few years, as a result of higher prices established by a combination of Scotch, French, and Peruvian producers. In 1878, eight chemical factories were extracting the iodine from the mother-liquors left after the nitre crystallization, producing 2800 centner (138 tons) of iodine, and three new factories were building. so that the production for 1879 was estimated at 3500 to 3800 centner (182–187 tons). An additional factory then building in the Bolivian port Auto-Lagesta promised, from the richness in iodine of its raw material, to put on the market some 2000 centner (98 tons) more. (*Dingler's Polytech. Journ.*, 231, p. 375.) M. Bussy has obtained iodine, in the proportion of one part in five thousand, from the coal-gas liquor of the gas-works of Paris. It was first discovered in the United States in the water of the Congress Spring, at Saratoga, by Dr. William Usher. It was detected in the Kanawha saline waters by the late Professor Emmet; and it exists in the bittern of the salt-works of Western Pennsylvania, in the amount of about eight grains to the gallon. In sea-weeds the iodine exists in the state probably of iodide of sodium. In different countries, sea-weeds are burned for the sake of their ashes, the product being a dark-colored fused mass called *kelp.* This substance, besides carbonate and iodide of sodium, contains more or less common salt, chloride of potassium, sulphate of sodium, etc. The deep-sea fuci contain the most iodine; and, when these are burned at a low temperature for fuel, as is the case in the island of Guernsey, their ashes furnish more iodine than ordinary kelp. (*Graham.*) According to Dr. Geo. Kemp, the laminarian species, especially *Lami-*

naria digitata, *L. saccharina*, and *L. bulbosa*, which are deep-water sea-weeds, and contain more potassium than sodium, are particularly rich in iodine.

Preparation. Although most largely produced in South America, iodine is still obtained from kelp, and in Great Britain is manufactured chiefly at Glasgow. The kelp, which on an average contains a 224th part of iodine, is lixiviated with water, in which about half dissolves. The solution is concentrated to a pellicle and allowed to cool; whereby nearly all the salts, except iodide of sodium, are separated, they being less soluble than the iodide. The remaining liquor, which is dense and dark-colored, is made very sour by sulphuric acid, which causes the evolution of carbonic acid, sulphuretted hydrogen, and sulphurous acid, and the deposition of sulphur. The liquor is then introduced into a leaden still, and distilled with manganese dioxide into a series of glass receivers, inserted into one another, in which the iodine is condensed. In this process the iodide of sodium is decomposed, and the iodine evolved according to the reaction $2NaI + 2H_2SO_4 + MnO_2 = MnSO_4 + Na_2SO_4 + 2H_2O + I_2$ which leaves as residue manganous sulphate and sulphate of sodium.*

The methods for the separation of the iodine from its combinations in the mother-liquors as practised in South America, may be divided essentially into three classes. (1.) The mother-liquors after the crystallization of the saltpetre without further concentration are treated with a solution of sodium sulphite of strength corresponding to the amount of iodine present; the iodine thus separated from the sodium iodate is filtered through linen cloth, washed, pressed, and sublimed. (2.) The mother-liquors are treated with sodium sulphite or bisulphite until the precipitated iodine is converted into HI, and this is precipitated as copper iodide by a solution of copper sulphate and sodium sulphite. (3.) The percentage of iodine is increased by fractional evaporation and crystallization of the mother-liquors, and then, after adding the calculated amount of sodium bisulphite, the iodine is distilled off from the acidified liquor. (*Dingler's Polytech. Journ.*, 231, p. 375.)

The British Pharmacopœia of 1864 purified iodine as follows. "Take of Iodine of Commerce *one ounce*. Introduce the Commercial Iodine into a porcelain capsule of a circular shape, cover this as accurately as possible with a glass matrass filled with cold water, and apply to the capsule the heat of boiling water for twenty minutes. Let the matrass be now removed, and should colorless acicular prisms of a pungent odor be found attached to its bottom, let them be separated from it. This being done, the matrass is to be restored to its previous position, and a gentle and steady heat (that of a gas lamp answers well) applied, so as to sublime the whole of the iodine. Upon now allowing the capsule to cool, and lifting off the matrass, the purified product will be found attached to the bottom of the latter. When separated it should be immediately enclosed in a bottle furnished with an accurately ground stopper."

In this process, which is that of the former Dublin Pharmacopœia, a short preliminary sublimation by the heat of a water-bath is ordered, in which the bottom of a glass matrass filled with cold water is the refrigerator. The object of this is to separate any iodide of cyanogen that may happen to be present. This impurity is sometimes present in considerable amount. Klobach obtained from eighty avoirdupois pounds of commercial iodine twelve ounces of this iodide, which is in the proportion of nearly one per cent. (*Chem. Gaz.*, April 15, 1850.) Should the matrass, upon its removal, have attached to its bottom white acicular crystals, these will be the iodide in question, and must be rejected. The matrass having been replaced, heat is again applied until the whole of the iodine has sublimed, and attaches itself to the cool bottom of the matrass.

Water has sometimes been found in iodine to the extent of 15 or 20 per cent. If considerable, it is easily discovered by the iodine adhering to the inside of the bottle.

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* The methods formerly practised for obtaining iodine from sea-weeds were accompanied with great loss. Much detail as to the various improvements which have been from time to time suggested may be found in the 14th edition of the U. S. Dispensatory, but is here omitted. At the Paris Exhibition of 1878 a continuous furnace was shown by Messrs. Pellieux and Mazé-Launay, in which the fresh weed is introduced in a wet state and made largely to burn itself, care being taken to avoid loss of volatile principles. The yield of iodine is said by this means to be increased eight-fold, with a great saving of fuel.

M. Bolley estimates its amount by rubbing together, until the smell of iodine disappears, 30 grains of iodine with about 240 of mercury, in a small weighed porcelain dish, using a small weighed agate pestle. When complete combination has been effected, the whole is placed in a water-bath to dissipate the water. The loss of weight gives the amount of water in the iodine. (*Chem. Gaz.*, March 15, 1853, p. 118.) The presence of water is injurious only as it renders all the preparations of iodine weaker than they should be. In the former Ed. Pharmacopœia, directions were given to dry it, by placing it "in a shallow basin of earthenware, in a small confined space of air, with ten or twelve times its weight of fresh-burnt lime, till it scarcely adheres to the inside of a dry bottle."

Properties. Iodine is described by the U. S. Pharmacopœia as "heavy, bluish black, dry and friable, rhombic plates of a metallic lustre, a distinctive odor, a sharp and acrid taste, and a neutral reaction. Iodine imparts a deep brown, slowly evanescing stain to the skin, and slowly destroys vegetable colors. It is sparingly soluble in water, soluble in about 11 parts of alcohol at 15° C. (59° F.); very soluble in ether, disulphide of carbon and chloroform. It is slowly volatilized at ordinary temperatures. When heated to 114° C. (237·2° F.) it melts, and then rises in purple vapor, being gradually dissipated without leaving a residue. With gelatinized starch, in a cold solution, it produces a dark blue color." *U. S.* Its sp. gr. is 4·9. It is a volatile substance, and evaporates even at common temperatures. Its vapor has the sp. gr. 8·7, being the heaviest aëriform substance known. If inhaled mixed with air, it excites cough and irritates the nostrils. When it comes in contact with cool surfaces, it condenses in brilliant steel-gray crystals. Iodine is freely soluble in alcohol and ether, but requires 7000 times its weight of water to dissolve it. If water stands on iodine for some time, especially in a strong light, it apparently dissolves more iodine; but the result depends upon the formation of hydriodic acid, in a solution of which iodine is more soluble than in water. The solution of iodine in water has no taste, a feeble odor, and a light brown color; in alcohol or ether, is nearly black. Its solubility in water is very much increased by the addition of certain salts, as the chloride of sodium, nitrate of ammonium, or iodide of potassium; and the same effect is produced, to some extent, by tannic acid. Its solution in tannic acid is called *iodo-tannin*, of which MM. Socquet and Guillermond make a syrup for internal, and an aqueous solution for external use. For the formulas, see the *B. and F. Medico-Chir. Rev.*, 1854, p. 181. It is also soluble in glycerin, as ascertained by M. Cap in 1854. According to Dr. I. Walz, glacial acetic acid is an excellent solvent of iodine, at least equal to alcohol. When the acid is heated by boiling with excess of iodine, and then allowed to cool slowly, it deposits iodine in beautiful large slender crystals, sometimes half an inch long, much larger and more abundant than those formed from the alkaline solution. (*Chem. News*, May 9, 1873, p. 233; from the *Journal of the Franklin Institute.*) In chemical habitudes iodine resembles chlorine, but its affinities are weaker. It combines with most of the non-metallic, and nearly all the metallic elements, forming a class of compounds called *iodides.* Some of these are officinal, as the iodides of iron, mercury, lead, potassium, and sulphur. It forms with oxygen one oxide, *iodic oxide* I_2O_5, and three acids, *iodous*, *iodic*,* and *periodic*, and with hydrogen a gaseous acid, called *hydriodic acid.*

Tests, etc. Iodine, in most cases, may be recognized by its characteristic purple vapor; but where this cannot be made evident, it is detected unerringly by starch, which produces with it a deep blue color. This test was discovered by Colin and Gaultier de Claubry, and is so delicate that it will indicate the presence of iodine in 450,000 times its weight of water. In order that the test may succeed, the iodine must be free, and the solutions cold. To render it free when in combination, as it always is in the animal fluids, a little nitric acid, free from iodine, must be added to the solution suspected to contain it. Thus, in testing urine for iodine, the secretion is mixed with starch, and acidulated with a drop or two of nitric acid; when, if iodine be present, the color produced will vary from a light purple to a deep indigo-blue, according to the amount of the element present. Sometimes, in mineral waters, the proportion of iodine is so minute that the starch test, in connection with nitric acid, gives a doubtful coloration. In such cases, Liebig recommends the addition to the water of a very small quantity of iodate of potassium, followed by a little starch and hydrochloric acid. Assuming the iodine to be present as hydriodic acid, the liberated iodic acid sets free from the iodine of the mineral water, and becomes itself deoxidized, thus increasing the amount of the free iodine ($HIO_3 + 5HI = 3I_2 + 3H_2O$). This test would be fallacious, if iodic acid, mixed with hydrochloric acid, colored starch; but this is not the case. Still, Liebig's test is inapplicable in the presence of reducing agents, such as sulphurous acid, which would give rise to free iodine from the test itself, independently of the presence of the element in the water tested. (*Dr. W. Knop.*) The U. S. Pharmacopœia furnishes the following tests. "A solution of Iodine in chloroform should be perfectly clear and limpid (abs. of moisture). When shaken with distilled water, it should not communicate to the latter more than a light brownish tinge, and no deep brown color (abs. of chloride of iodine). If the iodine be removed from this dilute aqueous solution by agitation with disulphide of carbon, and, after the separation of the latter, some dilute solution of ferrous sulphate with a trace of ferric chloride be added, finally solution of soda, and the whole supersaturated with hydrochloric acid, no blue precipitate should make its appearance (abs. of cyanide of iodine). If Iodine be dissolved in sulphurous acid, the solution strongly supersaturated with ammonia, and completely precipitated by nitrate of silver, the filtrate, on being supersaturated with nitric acid, should not at once become more than faintly cloudy (abs. of more than traces of chlorine or bromine). If 0·633 Gm. of Iodine, with 1 Gm. of iodide of potassium, be dissolved in 25 C.c. of water, it should require 50 C.c. of the volumetric solution of hyposulphite of sodium to fully decolorize the liquid (corresponding to 100 per cent. of absolute Iodine)." *U. S.* The British Pharmacopœia states that "12·7 grains, dissolved in an ounce [fluidounce] of water containing 15 grains of iodide of potassium, require for complete discoloration 1000 grain-measures of the *volumetric solution of hyposulphite of soda.*" Mr. M. Carey Lea proposes chromic acid as a substitute for the nitric, for the liberation of iodine, as a more delicate test. It may be most conveniently applied by first adding starch to the liquid to be tested, and then a little dilute solution of bichromate of potassium, enough to cause a pale yellow color, followed by a few drops of hydrochloric acid. (*Am. Journ. of Sci. and Arts*, xlii. 109.) Another test for iodine, proposed by M. Rabourdin, is chloroform, by the use of which he supposes that the element may be not only detected in organic substances, but approximately estimated. Thus, if 150 grains of a solution, containing one part in one hundred thousand of iodide of potassium, be treated with 2 drops of nitric and 15 or 20 of sulphuric acid, and afterwards shaken with 15 grains of chloroform, the latter acquires a distinct violet tint. M. Rabourdin applies his test to the detection of iodine in the several varieties of cod-liver oil. For this purpose he incinerates, in an iron spoon, 50 parts of the specimen of oil with 5 of *pure* caustic potassa, dissolved in 15 of water, and exhausts the cinder with the smallest possible quantity of water. The solution is filtered, acidulated with nitric and sulphuric acids, and agitated with 4 parts of chloroform. After a time the chloroform subsides, of a violet color more or less deep according to the proportion of iodine present. M. Lassaigne considers the starch test more delicate than that of chloroform. For detecting iodine in the iodides of the metals of the alkalies, he considers bichloride of palladium as extremely delicate, producing brownish flocks of biniodide of palladium. According to M. Moride, benzin is a good test for free iodine, which it readily dissolves, forming a solution of a bright red color, deeper in proportion to the amount of iodine taken up. As benzin does not dissolve chlorine or bromine, it furnishes the means of separating iodine from these elements. Mr. D. S. Price has pointed out the nitrites as exceedingly sensitive tests of iodine, combined as an iodide. The suspected liquid is mixed with starch paste, acidulated with hydrochloric acid, and treated with solution of nitrite of potassium. The iodine set free, and a blue color appears, more or less deep, according to the proportion of iodine present. By this test, iodine may be detected in an aqueous solution containing only one in 400,000 parts. A similar test had been previously proposed by M. Grange.

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* Dr. R. H. Brett, of Liverpool, has found that when a small portion of the alkaloids, or their salts, is mixed with about an equal portion of iodic acid and a few drops of water, and the mixture gently heated, a succession of distinct explosions, attended by the evolution of gas, takes place. Dr. Brett finds that this phenomenon does not occur with other organic substances, and suggests it as a general test for alkaloids. (*P. J. Tr.*, Nov. 1854.)

It has been long known that, when a mixture of iodine and starch in water is subjected to heat, the blue color disappears, and, if the heat be not too long continued, so as to volatilize the iodine, or convert it into hydriodic acid, the color will return on the cooling of the liquid. Various explanations have been given of this curious fact by Personne and others, but none quite satisfactory, until that by M. Magnes Lahens, which he supports by experiment, that during the continuance of the heat the particles of starch and iodine separate, to unite again on refrigeration. (*Journ. de Pharm.*, 4e sér., iii. 405.)*

Adulterations. Iodine is said to be occasionally adulterated with mineral coal, charcoal, plumbago, and black oxide of manganese. These are easily detected by their fixed nature, while pure iodine is wholly volatilized by heat. Herberger found native sulphide of antimony in one sample, and plumbago in another; and Righini has detected as much as 25 per cent. of chloride of calcium. The presence of iodide of cyanogen and of water has already been referred to, and the modes of detecting and separating them pointed out. (See page 806.) Besides the test given at page 806, the British Pharmacopœia directs that officinal iodine should be soluble in alcohol, ether, and a solution of iodide of potassium, and should sublime without residue, and that the part which first comes over should contain no colorless prisms of a pungent odor.

Medical Properties. Iodine was first employed as a medicine in 1819, by Dr. Coindet, Sr., of Geneva. It operates as a general excitant of the vital actions, especially of the absorbent and glandular systems. Its effects are varied by its degree of concentration, state of combination, dose, etc.; and hence, under different circumstances, it may prove corrosive, irritant, or simply alterative. It is absorbed into the circulation, and may be found in all the secretions, but is chiefly eliminated by the kidneys, not, however, uncombined, but in the state of hydriodic acid or an iodide. Cantu detected it not only in the urine and saliva, but also in the sweat, milk, and blood. According to Dr. John C. Dalton, Jr., of New York, iodine, taken in a single moderate dose, appears in the urine in thirty minutes, and may be detected for nearly twenty-four hours. In two cases in which large doses of iodide of potassium had been taken for six or eight weeks, and the medicine intermitted, all trace of iodine disappeared from the urine in eighty-four hours.

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* *The estimation of iodine.* The following method of estimating the quantity of iodine in any mixture is given by M. Adolphe Bobierre, Doctor of Science and Chief Director of the School of Science, at Nantes, in the *Journ. de Pharm.* (Jan. 1869, p. 8), as the most direct and convenient yet employed, while its accuracy may be relied on.

Preparation of the reagents. A concentrated solution of iodide of potassium is made, which should remain invariable under a fixed series of trials. This solution is intended to receive the iodine to be tried. The normal solution of arsenite of sodium is obtained, by combining 4·95 grammes of arsenious acid with 14·5 grammes of bicarbonate of sodium crystallized, and bringing the aqueous liquid to the volume of one litre. This solution destroyed an iodized liquid containing 12·688 grammes of iodine to the litre; and even granting that the arsenical solution has not exactly this reducing power, the trial would not be less exact, since at the moment of making it the relation of a given weight of the iodine to the arsenite would be determined.

Performance of the analysis. This is executed advantageously in a little stoppered glass bottle such as is usually employed for hydrometrical experiments. The operator introduces into it 10 cubic centimetres of the solution of arsenite of sodium, to which he adds 5 cubic centimetres of the solution of the bicarbonated alkali; adding to the whole about 4 cubic centimetres of perfectly colorless benzin.

Next, a certain quantity of very pure iodine is weighed between two watch-glasses, and dissolved in the concentrated solution of iodide of potassium already prepared. A vial of 100 cubic centimetres is filled with this colored liquid, and, after shaking, is emptied into a graduated measure.

On causing the iodized solution to fall, drop by drop, into the arsenical, and shaking vigorously, the brown color is seen instantly to disappear; but hardly has the arsenite been transformed, when the traces of liberated iodine give rise to a double phenomenon. In the first place, the benzin becomes rose-colored; and, secondly, the watery liquid, perfectly colorless at the beginning of the process, assumes a very sensible yellowish shade, the significant character of which may justly cause surprise, when the minute quantity of the iodine is considered which determines it.

It is readily comprehended, for the rest, that a second trial made with the iodine to be examined, employed in the same weight, immediately gives the result sought for, since the volume of solution necessary to destroy the alkaline arsenite, is invariably proportionate to the real quantity of iodine which it is purposed to determine.

The tonic operation of iodine is evinced by its increasing the appetite, which is a frequent effect of its use. Salivation is occasionally caused by it, and sometimes soreness of the mouth only. In some cases, pustular eruptions and coryza have been produced; especially when the remedy has been given in the form of iodide of potassium. In an overdose it acts as an irritant poison. Doses of two drachms, (7·8 Gm.) administered to dogs, have produced irritation of the stomach, and death in seven days; and the stomach was found studded with numerous little ulcers of a yellow color. From four to six grains (0·26 to 0·4 Gm.) in man, cause a sense of constriction in the throat, sickness and pain at the stomach, and at length vomiting and colic. Even in medicinal doses, it sometimes causes alarming symptoms; such as fever, restlessness, disturbed sleep, palpitations, excessive thirst, acute pain in the stomach, vomiting and purging, violent cramps, frequent pulse, and, finally, progressive emaciation, if the medicine be not laid aside. Such violent symptoms are, however, very rare, but where iodine or iodide of potassium is given freely a mild *iodism* is not unfrequent. It is usually characterized by pain or heaviness in the region of the frontal sinuses, with or without coryza; in some instances soreness of the mucous membrane of the mouth and throat, or a mild ptyalism, is the prominent symptom; or a papular eruption may be the first manifestation of the constitutional action of the remedy.

Testimony is not wanting to the effect, that a long course of the remedy has in some instances occasioned absorption of the mammæ and wasting of the testicles, but such result is extremely rare. Dr. Lebert, who has practised both in Switzerland and France, states that, under his observation, the accidents produced by iodine, with scarcely an exception, were in those cases of goitre in which the remedy acted rapidly in removing the tumor; while in scrofulous, tuberculous, and syphilitic patients, free from goitre, though the medicine was given in considerable doses, no injury to the system ensued. He supposes that the bad effects, in the goitre cases, arose from the too prompt absorption of the abnormal material of the tumor, which, entering the circulation in the course of its elimination, produced the poisonous effect, and not from the iodine itself. (*Ann. de Thérap.*, 1855, p. 228)

Iodine has been principally employed in diseases of the absorbent and glandular systems. It has been used with success in ascites, especially when connected with diseased liver. It acts most efficiently immediately after tapping. In glandular enlargements and morbid growths, it has proved more efficacious than in any other class of diseases, and instances of its successful use in cases of ovarian tumor have even been reported. Dr. Coindet discovered its extraordinary power in curing goitre;* and it has been used with more or less advantage in enlargements and indurations of the liver, spleen, mammæ, testes, and uterus. In hepatic affections of this kind, where mercury has failed or is inadmissible, iodine is our best resource. Dr. Morell Mackenzie reports very favorably of the effects of iodine injected hypodermically into the thyroid. (*Am. Journ. of Med. Sci.*, Oct. 1873, p. 553.) In chronic diseases of the uterus, with induration and enlargement, and in hard tumors of the cervix and indurated puckerings of the edges of the os tincæ, iodine has occasionally effected cures, administered internally, and rubbed into the cervix, in the form of ointment, for ten or twelve minutes every night. The emmenagogue power of iodine has been noticed by several practitioners. It has been recommended in gleet; also in gonorrhœa and leucorrhœa, after the inflammatory symptoms have subsided. In the latter complaint, iodine rendered soluble by iodide of potassium has been used successfully, in the form of injection, by Dr. T. T. Russell, of Pattersonville, La.

* M. Chatin, finding, according to his observations, a great variation in the amount of iodine in the air, water, and soil of different localities, has founded on this supposed fact an explanation of the prevalence of goitre and cretinism in some places, and their absence in others. Thus, in certain parts of France, near Paris, which he calls the Paris zone, the amount of iodine thus distributed is comparatively large, and goitre and cretinism are unknown; while, in the Alpine valleys, where only one-tenth the amount of iodine is found, these affections are endemic. These conclusions are controverted by M. Lohmeyer, of Göttingen, and M. Kletzinsky, of Vienna, who failed to detect iodine in the air of those cities the inhabitants of which are free from goitre.

He joined to the local treatment the internal use of the tincture of chloride of iron. (*Am. Journ. of Med. Sci.*, April, 1854.) In the form of iodide of potassium, in tertian syphilis, mercurial cachexy, and the poisonous effects of lead, it is one of our best remedies. It is habitually employed in scaly skin affections, and in chronic rheumatism. The tincture has been strongly recommended in diabetes by M. Bérenger-Féraud. (*Ann. de Thérapeutique*, 1866, p. 243.) Dr. Menzel obtained great success in a severe epidemic of diphtheria prevalent in Trieste, from the local application of iodine to the mouth and fauces. Wonderfully curative effects resulted in some of these cases from the injection of solution of iodine into the substance of the inflamed tonsil. (*Med. Record*, Feb. 2, 1874, p. 67.)

But it is in scrofulous diseases that the most striking results have been obtained by the use of iodine. Dr. Coindet first directed attention to its effects in scrofula, and Dr. Manson reported a number of cases of this affection, in a large proportion of which the disease was either cured or ameliorated. We are indebted, however, to Dr. Lugol for the most extended early researches in relation to the use of iodine in scrofula. This physician began his trials in the Hospital Saint Louis, in 1827, and published his results in 1829, 1830, and 1831. The scrofulous affections cured by Dr. Lugol by the iodide treatment were glandular tubercles, ophthalmia, ozæna, lupus, and fistulous and carious ulcers. Since the publication of the three memoirs of Lugol, the use of iodine in scrofulous affections has become universal.

The most eligible form of iodine for internal administration is its solution in water, aided by iodide of potassium. (See *Liquor Iodi Compositus.*) The solutions employed by Dr. Lugol contained one part of iodine, and two of iodide of potassium; and the doses given by him were equivalent to half a grain (0·03 Gm.) of iodine daily for the first fortnight, three-quarters of a grain (0·05 Gm.) daily for the second and third fortnights, one grain (0·065 Gm.) daily during the fourth and fifth, and, in some cases, a grain and a quarter (0·081 Gm.) daily for the remainder of the treatment; always largely diluted. The tincture of iodine is not eligible for internal use; for, when freshly prepared, the iodine is precipitated from it by dilution with water; and, as a consequence, the irritating solid iodine will come in contact with the stomach when the dose is swallowed. The same objection is not applicable to the compound tincture, or to the simple tincture after having been long kept.

A mode of safely bringing and maintaining the system under the influence of iodine, proposed by M. Boinet, and called by him *iodic alimentation*, is to mix the medicine with the food, as with bread and other farinaceous substances, so that the patient may take daily a due quantity, which, with this mode of administration, may be large, if desirable, without inconvenience. (See *Amylum Iodatum.*)*

* *Iodized Oil.* The following is the original process of M. Personne. Five parts of iodine are mixed with a thousand of almond oil, and the mixture is subjected to a jet of steam, until decolorized. The same operation is repeated with five additional parts of iodine. The oil is then washed with a weak alkaline solution, to remove the hydriodic acid, developed in the process. By this mode of proceeding, it may be presumed that the iodine is intimately united with the oil, along with which it would find an easy entrance into the system; and that, while about half of the iodine is lost as hydriodic acid, the remainder takes the place of the hydrogen eliminated from the oil. In 1851, the French Academy appointed MM. Guibourt, Soubeiran, Gibert, and Ricord, to report upon the therapeutic value of a definite combination of iodine and oil. The reporter (Guibourt) approved of M. Personne's process; and MM. Gibert and Ricord reported favorably of the therapeutic effects of the preparation. M. Personne's iodized oil differs little in appearance and taste from almond oil, and is easily taken alone or in emulsion. The dose is two fluidounces (60 C.c.) daily, which may be increased to three fluidounces (90 C.c.) or more. (*Am. Journ. of Med. Sci.*, xxiii. 502.)

M. Berthé and M. Lepage have objected to M. Personne's iodized oil, that it is of variable iodine strength, and that it is liable to become rancid, in consequence of the use of steam in its preparation. M. Berthé makes an iodized oil, which he alleges to be free from these objections, by heating, to about 176°, five parts of iodine with a thousand parts of almond oil, in a water-bath, until decoloration shall have taken place. The resulting oil is colorless, perfectly transparent, without odor or rancidity, not acted on by starch, and of a constant composition. To shorten the time in preparing the oil, M. Lepage dissolves the iodine in three times its weight of ether, before adding it to the oil, and briskly shakes the mixture for eight or ten minutes. The preparation is then heated in a water-bath, to decolorize it and drive off the ether. M. Hugounenq objects to this process that, if the oil be completely deprived of the odor of ether, the heating must be continued for several hours. He also objects to any process which requires the continued application of heat, as rendering the oil liable to become quickly rancid. His plan is to rub up the iodine, for five or six minutes, in a porcelain mortar, with a small portion of the oil, and then gradually to add the re-

According to M. Hutet, one grain of iodine is deprived entirely of taste and smell by one teaspoonful of a strong infusion of coffee. (*P. J. Tr.*, Dec. 1870.)

The external treatment by iodine may be divided into general and topical. By its use in this way it does not create a mere local effect, but, by its absorption, produces its peculiar constitutional impression. The external treatment, when general, consists in the use of the *iodine bath.* This for adults should contain from two to four drachms of iodine, with double that quantity of iodide of potassium, dissolved in water, in a *wooden* bath-tub; the proportion of the water being about a gallon for every three grains of iodine employed. The quantity of ingredients for the baths of children is one-third as much as for adults, but dissolved in about the same proportional quantity of water. The quantity of iodine and iodide for a bath having been determined upon, it is best to dissolve them in a small quantity of water (half a pint, for example) before they are added to the water of the bath; as this mode of proceeding facilitates their thorough diffusion. The iodine baths, which may be directed three or four times a week, usually produce a slight rubefacient effect, but occasionally a stronger impression, causing the epidermis to peel off, particularly of the arms and legs. The skin at the same time acquires a deep yellow tinge, which usually disappears in the interval between the baths.

The topical application of iodine is made by means of several officinal preparations. (See *Unguentum Iodi* and *Tinctura Iodi.*) Besides these, several others have been employed topically. Lugol's *iodine lotion* consists of from two to four grains of iodine, and double that quantity of iodide of potassium, dissolved in a pint of water. It is used as a wash or injection in scrofulous ophthalmia, ozæna, and fistulous ulcers. His *rubefacient iodine solution* is formed by dissolving half an ounce of iodine and an ounce of iodide of potassium in six fluidounces of water. This is useful for exciting scrofulous ulcers, for touching the eyelids, and as an application to recent scrofulous cicatrices, to render them smooth. The rubefacient solution, added to warm water in the proportion of about a fluidrachm to the gallon, makes a convenient local bath for the arms, legs, feet, or hands; and, mixed with linseed meal or some similar substance, it forms a cataplasm useful in certain eruptions, especially where the object is to promote the falling off of scabs. External applications of iodine have been recommended for the removal even of internal plastic exudations, as to the side, for example, in protracted pleurisy. The rubefacient preparation of iodine at present most commonly employed is the tincture. (See *Tinctura Iodi.*) The preparation called *iodine paint* is a tincture twice as strong as the officinal tincture, and is made by dissolving a drachm of iodine in a fluidounce of alcohol, and allowing the solution to stand in a glass-stoppered bottle for several months before it is used, when it will become thick and syrupy. It is applied with a glass or a camel's-hair brush, in one or more coatings, according to the degree of effect desired. Iodine paint is used as a counter-irritant, with advantage, in pains of the chest; in aphonia, applied to the front of the throat; in chronic pleuritic effusion, or consolidated lung, applied extensively opposite to the diseased part; in periostitis, whether syphilitic, strumous, or the result of injury; in inflammation of the joints; in serous effusion into bursæ; and in the cicatrices of burns. When thus used, it must be borne in mind that the iodine acts also by being absorbed. Another valuable application of it is for the removal of cutaneous nævi. Lugol's *caustic iodine solution* is made of iodine and iodide of potassium, each, an ounce, dissolved in two fluidounces of water. This is used to destroy soft and fungous granulations, and has been employed with decided benefit in lupus. The *Liniment of Iodine* of the British Pharmacopœia is intermediate in strength between the two solutions last mentioned. (See *Linimentum Iodi.*) Another caustic solution of iodine, under the name of *iodized glycerin*, is made by dissolving one part of iodide of potassium in two parts of glycerin, and adding the solution to one part of iodine,

mainder. A red limpid liquor is obtained, which may be completely decolorized by exposure for fifteen minutes to the sun's rays. Iodized oil; thus prepared, has the odor and taste of almond oil, is not more liable to become rancid than the pure oil, and is free from hydriodic acid. (*Journ. de Pharm.*, Mars, 1856.) From the above statements it is not easy to determine which is the best method of preparing iodized oil; but the preparation may be made with good olive oil, instead of the more expensive almond oil.

which it completely dissolves. Dr. Max Richter, of Vienna, to whom the credit belongs of having introduced into practice the solution of iodine in glycerin, found this caustic particularly useful in lupus, non-vascular goitre, and scrofulous and constitutional syphilitic ulcers. The solution is applied by means of a hair-pencil to the diseased surface, which must then be covered with gutta-percha paper, fixed at the edges by strips of adhesive plaster, in order to prevent the evaporation of the iodine. The application produces burning pain, which rarely lasts for more than two hours. The dressing is removed in twenty-four hours, and pledgets dipped in cold water applied. This iodine caustic is too strong for ordinary local use. A weaker solution is recommended by Dr. Szukits, formed of one part of iodine to five of glycerin, for application to the neck, female breast, abdomen, etc. After four or five paintings it causes excoriation, which requires its discontinuance, and the use of cold applications. A mode of applying iodine locally has been suggested by Dr. R. Greenhalgh, of London, which consists in thoroughly impregnating raw cotton with a solution in glycerin of iodide of potassium and of iodine, in the proportion of two ounces of the former and one ounce of the latter to eight ounces of the menstruum, and then drying the "*iodized cotton.*" It is intended for application to the cervix or os uteri, which is effected through a speculum. (*Lancet*, May 26, 1866, p. 582.) Mehn's method of making iodized cotton is as follows. Finely divided iodine (5 to 10 parts) is sprinkled between layers of loose cotton (100 parts) introduced into a tall glass vessel, and the latter placed horizontally on a water or sand-bath. As soon as vapors of iodine are seen to rise, and the air has been expelled from the vessel, the latter is tightly stoppered. On continuing to apply a moderate and uniform heat, the iodine vapors penetrate the cotton, and color it yellow. After about two hours, the cotton will have assumed the color of burnt coffee, and the operation is finished. Cotton iodized in other ways, as by immersion in concentrated solutions of iodine in ether or carbon disulphide, retains merely traces of iodine. (*N. R.*, April, 1867.)

Iodine is used by injection into various cavities. It has been employed in this way for the cure or relief of hydrocephalus, pleuritic effusion, hydropericardium, ascites, ovarian dropsy, hernia, hydrocele, spina bifida, dropsy of the joints, large cystic bronchocele, and chronic abscesses. The discussion of the indications for the use of the injections in these cases, and of the precautions and the methods to be adopted, belongs rather to treatises upon the practice of medicine and surgery than to a work like the present. To such treatises, therefore, the reader is referred. Much information may be found in the 14th edition of the Dispensatory.

Enemata containing iodine have been used, by several practitioners, in the chronic dysentery and diarrhœa of both adults and children, with decided benefit, a prominent effect being the relief of tenesmus. They are supposed to act locally on ulcers in the colon and rectum, and generally by absorption. The injection should be made of Lugol's solution, one to ten fluidrachms in one or two quarts of water. It should be preceded by an emollient enema to empty the intestine, and should be repeated once or twice daily, gradually increasing its strength. If the pain be severe, a laudanum injection will bring immediate relief.

Iodine, in the state of vapor, has been employed by inhalation; and the experiments, as yet tried, have been in the treatment chiefly of phthisis and chronic bronchitis. Although very extraordinary results were claimed for the method, yet it has entirely failed to fulfil expectations, and is at present very rarely practised. For details as to methods, the reader is referred to the 14th edition U. S. D.

M. Barrère has proposed the use, for inhalations, of *iodized camphor*, which is to be taken like snuff. This is prepared by putting powdered camphor in a snuff-box, with a hundredth part in bulk of iodine, contained in a muslin bag. In the course of a few hours, the substances, by occasional shaking, unite, forming a powder resembling iodine in color. The difficulty in practising ordinary iodine inhalation depends chiefly on the irritation caused by the vapor, which excites cough and fatigues the patient. According to M. Barrère, this inconvenience is avoided by the use of the iodized camphor. A pinch of it produces sneezing and some smarting in the nostrils; but when the vapor reaches the lungs, it causes a refreshing sensation, which induces the patient to draw a long and deep breath. (*Ann. de Thérap.*, 1855, p.

232.) M. Hutet recommends the inhalation of hydriodic ether in affections of the lungs.

Dr. Brainard employs the vapor of iodine, with great advantage, in the treatment of indolent ulcers, first dressing the ulcer with simple cerate spread on lint, then applying over this several layers of lint in which from one to four grains of iodine have been folded, and covering the whole with oiled silk and tin foil, secured by a bandage, so as to prevent the escape of the iodine, which is vaporized by the heat of the body. (*Chicago Med. Journ.*, Jan. 1860.)

Iodine or an iodide should not be given in solution with an alkaloid, as it forms insoluble compounds, and in Philadelphia death has been produced by the iodide of strychnine which had crystallized out of a mixture. It has even been suggested by Mr. R. F. Fairthorne (*A. J. P.*, 1856) and Dr. H. W. Fuller (*Lancet*, March 21, 1868, p. 373) as an antidote to alkaloids; but the insoluble compounds of these substances would by no means be inert in the stomach.

In cases of poisoning by iodine, the stomach must be first evacuated, and afterwards drinks administered containing an amylaceous substance, such as flour, starch, or arrow-root.

Iodine is officinal:—

I. AS SIMPLE TINCTURE AND OINTMENT.
- Tinctura Iodi, *U. S.—Tincture of Iodine.*
- Unguentum Iodi, *U. S.—Ointment of Iodine.*

II. COMBINED WITH SULPHUR.
- Sulphuris Iodidum, *U. S., Br.—Iodide of Sulphur.*

III. COMBINED WITH METALS.
- Arsenii Iodidum, *U. S.—Iodide of Arsenic.*
  - Liquor Arsenii et Hydrargyri Iodidi, *U. S—Solution of Iodide of Arsenic and Mercury. Donovan's Solution.*
- Cadmii Iodidum, *Br.—Iodide of Cadmium.*
  - Unguentum Cadmii Iodidi, *Br.—Ointment of Iodide of Cadmium.*
- Ferri Iodidum, *Br.—Iodide of Iron.*
- Syrupus Ferri Iodidi, *U. S., Br.—Syrup of Iodide of Iron.*
- Pilulæ Ferri Iodidi, *U. S.;* Pilula Ferri Iodidi, *Br.—Pills of Iodide of Iron.*
- Hydrargyri Iodidum Rubrum, *U. S., Br.—Red Iodide of Mercury.*
  - Unguentum Hydrargyri Iodidi Rubri, *Br.—Ointment of Red Iodide of Mercury.*
- Hydrargyri Iodidum Viride, *U. S., Br.—Green Iodide of Mercury.*
- Plumbi Iodidum, *U. S., Br.—Iodide of Lead.*
  - Unguentum Plumbi Iodidi, *Br.—Ointment of Iodide of Lead.*
- Potassii Iodidum, *U. S., Br.—Iodide of Potassium.*
  - Unguentum Potassii Iodidi, *U. S., Br.—Ointment of Iodide of Potassium.*

IV. ASSOCIATED WITH IODIDE OF POTASSIUM.
- Linimentum Iodi, *Br.—Liniment of Iodine.*
- Linimentum Potassii Iodidi cum Sapone, *Br.—Liniment of Iodide of Potassium with Soap.*
- Liquor Iodi Compositus, *U. S.;* Liquor Iodi, *Br.—Compound Solution of Iodine.*
- Tinctura Iodi, *Br.—Tincture of Iodine.*
- Unguentum Iodi, *U. S., Br.—Iodine Ointment.*

V. IN THE STATE OF VAPOR.
- Vapor Iodi, *Br.—Vapor of Iodine.*

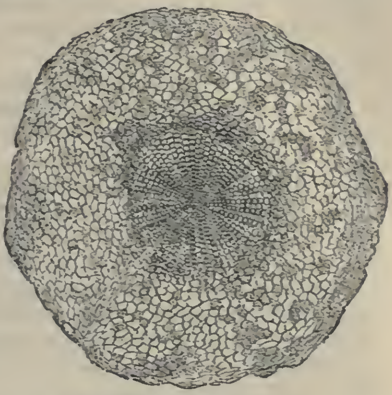
IPECACUANHA. *U. S., Br.* *Ipecac.*

(ĬP-Ẹ-CĂC-U̇-ĂN′HẠ.)

"The root of Cephaëlis Ipecacuanha. A. Richard. (*Nat. Ord.* Rubiaceæ, Coffeæ.)" *U. S.*

Radix Ipecacuanhæ, *P.G.;* Ipecac; Racine brésilienne, Ipecacuanha, *Fr.;* Ruhrwurzel, Brechwurzel, Ipecacuanha, *G.;* Ipecacuana, *It., Sp.*

The term *ipecacuanha*, derived from the language of the aborigines of Brazil, has been applied to various emetic roots of South American origin.* The U. S. and British Pharmacopœias recognize only that of *Cephaëlis Ipecacuanha;* and no other is known by the name in the shops of this country. Our chief attention will, therefore, be confined to this root, and the plant which yields it; but, as others are employed in South America, are occasionally exported, and may possibly reach our markets mingled with the genuine drug, we shall, in a note, give a succinct account of those which have attracted most attention.


Ipecacuanha, transverse section.

The botanical character of the ipecacuanha plant was long unknown. Pison and Maregrav, who were the first to treat of this medicine, in their work on the Natural History of Brazil, published at Amsterdam, 1648, described in general terms two plants; one producing a whitish root, distinguished by the name of white ipecacuanha, the other, a brown root, which answers in their description precisely to the official drug. But their account was not sufficiently definite to enable botanists to decide upon the character of the plants. The medicine was generally thought to be derived from a species of *Viola*, which Linnæus designated as *V. Ipecacuanha.* Opinion afterwards turned in favor of a plant, sent to Linnæus by Mutis from New Granada, as affording the ipecacuanha of that country and of Peru. This was described in the *Supplementum* of the younger Linnæus, 1781, under the name of *Psychotria emetica*, and was long erroneously considered as the source of the true ipecacuanha. Dr. Gomez, of Lisbon, was the first who accurately described and figured the genuine plant, which he had seen in Brazil, and specimens of which he took with him to Portugal; but Brotero, professor of botany at Coimbra, with whom he had left specimens, having drawn up a description, and inserted it with a figure in the Linnæan Transactions without acknowledgment, enjoyed for a time the credit due to his countryman. In the paper of Brotero the plant is named *Callicocca Ipecacuanha;* but the term *Callicocca*, having been applied by Schreber, without sufficient reason, to the genus already established and named, has been universally abandoned for the *Cephaëlis* of Swartz, though this also, it appears, is a usurpation upon the previous rights of Aublet.

Gen. Ch. Flowers in an involucred head. *Corolla* tubular. *Stigma* two-parted. *Berry* two-seeded. *Receptacle* chaffy. *Willd.*

Cephaëlis Ipecacuanha. Richard, *Hist. Ipecac.* p. 21, t. i.; Martius, *Spec. Mat. Med. Brazil*, t. i. p. 4; *Curtis's Bot. Mag.*, N. S., vol. xvii. pl. 4083, 1844.—*Callicocca Ipecacuanha.* Brotero, *Linn. Trans.* vi. 137. This is a small shrubby plant, with a root from four to six inches long, about as thick as a goose-quill, marked with annular rugæ, simple or somewhat branched, descending obliquely into the ground, and here and there sending forth slender fibrils. The stem is two or three feet long, but, being partly under ground, and often procumbent at the base, usually rises less than a foot in height. It is slender; in the lower portion leafless, smooth, brown or ash-colored, and knotted, with radicles frequently proceeding from the knots; near the summit, pubescent, green, and furnished with leaves seldom exceeding six in number. These are opposite, petiolate, oblong-obovate, acute, entire, from three to four inches long, from one to two broad, obscurely green and somewhat rough on their upper surface, pale, downy, and veined on the under. At the insertion of each pair of leaves are deciduous stipules, embracing the stem, membranous at the base, and separated above into numerous bristle-like divisions. The flowers are very small, white, and collected to the number of eight, twelve, or more, each accompanied with

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* M. Weddell states that the word ipecacuanha is nowhere in Brazil used to designate the Cephaëlis, which is generally called *poaya.* (*Journ. de Pharm.*, 3e sér., xvi. 34.)

a green bract, into a semi-globular head, supported upon a round, solitary, axillary footstalk, and embraced by a monophyllous involucre, deeply divided into four, sometimes five or six obovate, pointed segments. The fruit is an ovate, obtuse berry, which is at first purple, but becomes almost black when ripe, and contains two small plano-convex seeds.

The plant is a native of Brazil, flourishing over a very wide extent of territory in moist, thick, and shady woods, and abounding most within the limits of the eighth and twentieth degrees of south latitude. According to Humboldt, it grows also in New Granada. It flowers in January and February, and ripens its fruit in May. The root is active in all seasons, but, as it has to be dried rapidly, collection during the rainy season is relaxed. The native collector, or *poayero*, seizes all the stems of a clump, loosens them by a zigzag motion, and then, thrusting a pointed stick under the roots, tears up the whole mass. The roots, freed from dirt by shaking, are then dried. The amount gathered daily varies from 8 to 30 pounds, according to skill and locality. Extirpation does not take place, because, as shown by the Edinburgh gardeners McNab and Lindsay, a very small fragment of the root, or even a petiole of a leaf, will rapidly produce a new plant. Weddell, indeed, many years since, stated that the remains of the root, often purposely left in the ground, serve the purpose of propagation, each fragment giving rise to a new plant. Ipecacuanha of commerce comes chiefly from the interior province of Matto-Grosso, upon the upper waters of the Paraguay, although some is said to be gathered near Philadelphia, north of Rio Janeiro.* The chief places of export are Rio Janeiro, Bahia, and Pernambuco. It is brought to the United States in large bags or bales.

Properties. Genuine ipecacuanha is in pieces two or three lines thick, variously bent and contorted, simple or branched, consisting of an interior slender, light straw-colored, ligneous cord, with a thick, brittle, brownish, finely wrinkled, cortical covering, which presents on its surface a succession of circular, unequal, prominent rings or rugæ, separated by very narrow fissures, frequently extending nearly down to the central fibre. This appearance of the surface has given rise to the term *annelé* or *annulated*, by which the true ipecacuanha is designated by French pharmaceutists. The cortex is hard, horny, and semi-transparent, breaks with a resinous fracture, and easily separates from the tougher ligneous fibre, which possesses the medicinal virtues of the root in a much inferior degree. On microscopic examination the very thick bark is seen to be formed of uniform parenchymatous cells, without traces of the medullary rays, which are very distinct in the woody central cylinder. Attached to the root is frequently a smoother and more slender portion, which is the base of the stem, and should be separated before pulverization. Pereira has met, in the English market, with distinct bales composed of these fragments of stems, with occasionally portions of the root attached. Much stress has been laid upon the color of the external surface of the ipecacuanha root; and diversity in this respect has even led to the formation of distinct varieties. Thus, the epidermis is sometimes deep brown, or even blackish, sometimes reddish brown or reddish gray, and sometimes light gray or ash-colored. Hence the distinction into *brown*, *red*, and *gray ipecacuanha*. But these are all derived from the same plant, are essentially the same in properties and composition, and probably differ only in consequence of difference in age, place of growth, or mode of desiccation. The colors are often so intermingled that it would be impossible to decide in which variety a particular specimen should be placed. The *brown* is the most abundant in the packages brought to our market. The *red*, besides the color of its epidermis, presents a rosy tint when broken, and is said to be somewhat more bitter than the preceding variety. The *gray* is much lighter-colored externally, usually rather larger, with less prominent rings and wider furrows, and is still more decidedly bitter. Many years ago there was imported from Caraccas into the United States a large gray ipecacuanha with badly-marked rings. This variety disappeared for a time, but is probably the *Colombian* or *Carthagena Ipecacuanha* of modern commerce, which is distinguished from the Brazilian drug by being a little larger, with less conspicuous annuli and more marked medullary rays. According to Lefort, it contains rather less emetine than does the Brazilian ipecacuanha; but this is not at all certain. When the bark in either variety is opaque, with a dull amylaceous aspect, the root is less active. As the woody part is nearly inert, and much more difficult of pulverization than the cortical, it often happens that, when the root is powdered, the portion last remaining in the mortar possesses scarcely any emetic power; and care should be taken to provide against any defect from this cause. The color of the powder is a light grayish fawn.

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* Strenuous efforts have been made by the British authorities to establish the cultivation of ipecacuanha in India. Some thousands of plants have been grown, under very varying conditions, but, according to latest reports, the indications of practical success were not very encouraging.

Ipecacuanha has little smell in the aggregate state, but when powdered has a peculiar nauseous odor, which in some persons excites violent sneezing, in others dyspnœa resembling an attack of asthma. The taste is bitter, acrid, and very nauseous. Water and alcohol extract its virtues, which are injured by decoction. Its emetic property resides in an alkaloid called *emetine*, discovered by Pelletier in the year 1817. The cortical portion of the brown ipecacuanha, analyzed by this chemist under the erroneous name of *Psychotria emetica*, yielded, in 100 parts, 16 of an impure salt of emetine, which was at first considered the pure emetic principle, 2 of an odorous fatty matter, 6 of wax, 10 of gum, 42 of starch, 20 of lignin, with 4 parts loss. The root yields of the alkaloid less than 1 per cent. The formula, according to Lefort and F. Würtz (*Ann. Ch. Phys.*, [5] 12, p. 277), is $C_{28}H_{40}N_2O_5$, while according to Glenard (*Ann. Ch. Phys.*, [5] 8, p. 233) it is $C_{15}H_{22}NO_2$. In addition to these principles, Bucholz found extractive, sugar, and resin; and Erwin Willigk, afterwards, traces of a disagreeably smelling volatile oil, phosphatic salts, and a peculiar acid, *ipecacuanhic acid*, which had previously been mistaken for the gallic. It resembles caffeotannic and quinic acids, and has been shown by Reich (*Arch. Pharm.*, [2] 113, p. 208) to be a glucoside. (See *A. J. P.*, xxiii. 352.) Good ipecacuanha contains about 80 per cent. of cortical and 20 of ligneous matter.

Attempts have been made to adulterate powdered ipecacuanha with the powder of almonds; but the fraud is readily detected by forming a paste with a little water, and putting it into a hot place for half an hour, when, if the ipecacuanha be pure, only its own odor will be perceived, but, if adulterated, a decided odor of almonds will be noticed. (*Journ. de Pharm.*, Juin, 1874, p. 479.)

Emetine, when perfectly pure, is whitish, inodorous, slightly bitter, pulverulent, unalterable in the air, very fusible, sparingly soluble in cold water, more soluble in hot water, and very soluble in alcohol and chloroform, and in solution of potassa and soda, though less so in water of ammonia. It is readily soluble in ether, acetic ether, amylic alcohol, carbon bisulphide, oil of turpentine. With sulphuric, phosphoric, and acetic acids, it forms very soluble and uncrystallizable salts; but Flückiger prepared a crystallized hydrochlorate; and nitric acid has the remarkable property of forming with it a nitrate, at first bulky, and very slightly soluble in water, but soon agglutinating into a brown, pitch-like matter, very soluble in water, and uncrystallizable. (*Lefort.*) According to Lefort, this insoluble nitrate, which equally forms by double decomposition between the acetate or sulphate of emetine and nitrate of potassium, forms the most distinctive character of emetine. (*Journ. de Pharm.*, 1869, p. 244.) It is precipitated by gallic and tannic acids from its solutions, and contains nitrogen. It is, however, very difficult to procure it in this state of purity, and the proportion afforded by the root is exceedingly small. Dr. F. B. Power has shown that an intense yellow color is produced when emetine is brought in contact with chlorinated lime and acetic acid. *Impure emetine* is in transparent scales of a brownish red color, almost inodorous, of a bitterish acrid taste, deliquescent, very soluble in water and alcohol, insoluble in ether, precipitated from its solutions by gallic acid and the acetates of lead, but not by tartar emetic or the salts of iron.

The taste of its compounds is very bitter. When exposed to light and air, emetine soon turns yellow, but it remains white when protected from the light. On very slowly evaporating its solutions in ether or alcohol, emetine is deposited in thin agglutinating scales, but if the solutions are rapidly evaporated, it is separated in fine uniform granules. It melts at 62° to 65° C. (143·6° to 149° F.), has a strong alkaline reaction, and is neutralized by acids forming salts, which on evaporation *in* *vacuo* form brilliant, colorless, irregular crystals. Various methods of preparing emetine will be found in U. S. D., 14th edition, but Podwyssotzki's process is probably the best for obtaining it. He recommends to treat the powdered ipecacuanha first with ether and then with petroleum benzin, in order to remove the liquid oil, the white fatty or waxy matter, and those coloring matters which are soluble in the solvents named, then extract the powdered root two or three times successively, at a moderate heat, with 85 per cent. alcohol, without adding any acid; evaporate the mixed tinctures to a syrupy consistence, add after cooling a very concentrated solution of as much ferric chloride as corresponds to from 10 to 13 per cent. of the weight of the powdered ipecac used, mix the mass well, add sodium carbonate in excess, boil the mass in a flask, on a water-bath, with successive small portions of petroleum benzin (in which the emetine dissolves), shaking frequently, and continue to use fresh portions of the menstruum until no more emetine goes into solution; the filtered benzin solutions are mixed, and, if concentrated, the mixture is allowed to stand for twelve hours in a very cool place, when almost all of the emetine will separate pure as a white precipitate. If, however, the mixture is not very concentrated, atmospheric air is blown through it for some time, when pure emetine will separate in white flakes. By concentrating or evaporating the benzin solution, however slowly, pure white emetine is *never* obtained. The emetine should be collected quickly on a filter and dried over sulphuric acid. (*A. J. P.*, April, 1880.)*

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* NON-OFFICINAL IPECACUANHAS. When ipecacuanha began to be popular in Europe, the roots of several other plants were imported and confounded with the genuine; and the name came at length to be applied to almost all emetic roots derived from America. Several of these are still occasionally met with, and retain the name originally given to them. The two most worthy of notice are the ipecacuanha of Colombia and Peru, and the white ipecacuanha of Brazil. On each of these we shall offer a few remarks.

1. *Peruvian Ipecacuanha. Striated Ipecacuanha. Black Ipecacuanha.* This is the root of *Psychotria emetica*, a plant belonging to the Rubiaceæ. A description of it, sent by Mutis, was published by Linnæus, the younger, in his Supplement. It has since been described in the *Plant. Æquin.* of Hum. and Bonpl.; and has been figured by A. Richard in his History of the Ipecacuanhas, and by Hayne in the eighth volume of his Medical Botany published at Berlin. It is a small shrub, with a stem twelve or eighteen inches high, simple, erect, round, slightly pubescent, and furnished with opposite, oblong-lanceolate, pointed leaves, narrowed at their base into a short petiole, and accompanied with pointed stipules. The flowers are small, white, and supported in small clusters towards the end of an axillary peduncle. The plant flourishes in Peru and Colombia, and was seen by Humboldt and Bonpland growing in abundance near the river Magdalena. The dried root is said to have been exported from Carthagena. It is cylindrical, somewhat thicker than the root of the Cephaëlis, usually simple, but sometimes branched, not much contorted, wrinkled longitudinally, presenting here and there deep circular intersections, but without the annular rugæ of the true ipecacuanha. The longitudinal direction of the wrinkles has given it the name of *striated ipecacuanha.* It consists of an internal woody cord, and an external cortical portion; but the former is usually larger in proportion to the latter than in the root of the Cephaëlis. The bark is soft and easily cut with a knife, and when broken exhibits a brown, slightly resinous fracture. The epidermis is of a dull reddish gray color, which darkens with age and exposure, and ultimately becomes almost black. Hence the root has sometimes been called *black ipecacuanha.* The ligneous portion is yellowish, and perforated with numerous small holes visible by the microscope. Peruvian ipecacuanha is nearly inodorous, and has a flat taste, neither bitter nor acrid. From 100 parts Pelletier obtained 9 of impure emetine, 12 of fatty matter, with an abundance of starch, besides gum and lignin. The dose, as an emetic, is from two scruples to a drachm.

2. *White Ipecacuanha. Amylaceous Ipecacuanha. Undulated Ipecacuanha.* This variety is produced by different species of *Richardsonia*, the *Richardia* of Linnæus. *R. scabra*, or *R. Braziliensis* of Gomez, and *R. emetica* are especially indicated by Martius. For the root usually called *white ipecacuanha*, Guibourt has proposed the name of *undulated ipecacuanha*, derived from the peculiar character of the surface, which presents indentations or concavities on one side, corresponding with prominences or convexities on the other, so as to give a wavy appearance to the root. It differs little in size from the genuine; is of a whitish gray color externally; and, when broken, presents a dull white farinaceous fracture, offering by the light of the sun shining points, which are nothing more than small grains of fecula. Like the other varieties, it has a woody centre. It is inodorous and insipid, and contains, according to Pelletier, a very large proportion of starch, with only 6 per cent. of impure emetia, and 2 of fatty matter. Richard found only 3·5 parts of emetine in the hundred. It is said to be sometimes mixed with the genuine ipecacuanha.

According to Martius, different species of *Ionidium* (*Viola*, Linn.) also produce what is called *white ipecacuanha.* The roots of all the species of Ionidium possess emetic or purgative properties. The root of *I. ipecacuanha* is described by Guibourt as being six or seven inches long, as thick as a quill, somewhat tortuous, and exhibiting at the point of flexion semicircular fissures, which give it some resemblance to the root of the Cephaëlis. It is often bifurcated at both extremities, and terminates at the top in a great number of small ligneous stalks. It is wrinkled longitudinally, and of a light yellowish gray color. The bark is thin, and the interior ligneous portion very thick. The root has little taste or smell. According to Pelletier, 100 parts contain 5 of an emetic sub-

Various other methods of separating pure emetine from the root have been proposed, the best, probably, being that of M. J. Lefort. (*Journ. de Pharm.*, Avril, 1869.)

Medical Properties and Uses. Ipecacuanha is in large doses emetic, in smaller doses diaphoretic and expectorant, and in still smaller, stimulant to the stomach, exciting appetite and facilitating digestion. In quantities not quite sufficient to vomit, it produces nausea, and frequently acts on the bowels. As an emetic, it is mild but tolerably certain, and, being free from corrosive or narcotic properties and usually thrown from the stomach by one or two efforts, never produces dangerous effects. It was employed as an emetic by the natives of Brazil when that country was first settled by the Portuguese; but, though described in the work of Pison, it was not known in Europe till 1672, and did not come into use till some years afterwards. John Helvetius, grandfather of the famous author of that name, having been associated with a merchant who had imported a large quantity of ipecacuanha into Paris, employed it as a secret remedy, and with so much success in dysentery and other bowel affections, that general attention was drawn to it; and the fortunate physician received from Louis XIV. a large sum of money and public honors on the condition that he should make it public.

As an emetic it is peculiarly adapted, by its mildness and efficiency, to cases in which the object is merely to evacuate the stomach, or where a gentle impression only is desired; and, in most other cases in which emetics are indicated, it may be advantageously combined with the more energetic medicines, which it renders safer by insuring their discharge. It is especially useful where narcotic poisons have been

stance, 35 of gum, 1 of nitrogenous matter, and 37 of lignin. (*Hist. abrégée des Drogues simples*, i. 514.)

The root of a species of Ionidium growing in Quito has attracted some attention as a remedy in elephantiasis, under the South American name of *cuichunchulli*. The plant received from Dr. Bancroft the name of *I. Marcucci;* but Sir W. Hooker found the specimen, received from Dr. Bancroft, to be the *I. parviflorum* of Ventenat. Lindley thinks a specimen he received under the same name from Quito, to be the *I. microphyllum* of Humboldt. If useful in elephantiasis, it is so probably by its emeto-purgative action. (See *A. J. P.*, vii. 186.)

The reader is referred to a paper on Ipecacuanha by the late R. E. Griffith, M.D., in the *Journ. of the Phila. Coll. of Pharm.* (iii. 181), for a more extended account of the roots which have been used under that name.

M. Planchon (*Journ. de Pharm.*, Dec. 1872) finds that there are two distinct striated ipecacuanhas, the *larger* and the *lesser*, of which the first is the product of *Psychotria emetica*, the second being of unknown origin.

1. *Larger striated ipecacuanha.* This presents itself in rather long fragments, sometimes 9 or 10 centimetres (3 or 4 inches), with a thickness of from 5 to 9 millimetres ($\frac{1}{5}$ to $\frac{1}{3}$ of an inch). The pieces are for the most part almost straight, sometimes sinuous, more rarely tortuous. At distant intervals they are marked by contractions, or simply circular furrows. Their whole surface is largely striated longitudinally. At their upper part are often attached one or more remaining portions of the stem, distinguished from the root by their much smoother surface. Their color is a grayish brown, tending sometimes to reddish brown. Like other ipecacuanhas, they have an outer cortical and central ligneous portion. The former is soft, so that it may even be penetrated by the nail. It has a horny aspect, and a variable color, passing from whitish, by shades of rose, violaceous, and blackish violet. Its thickness is at least two-thirds of the root, and becomes still greater when this is immersed in water. The central part is yellowish white. The root has little odor, and a taste scarcely nauseous, sometimes flat, and often sweetish. As to the microscopic characters, the most striking is probably the total absence of the starch granules, and the relatively very small diameter of the vessels in the central part. Chemically this variety is characterized by the presence of a principle capable of reducing the cupro-potassic reagent. It is so abundant in the cortical part, that a simple digestion in water gives a liquid with strong reducing powers, but without deviating action on polarized light. The larger striated ipecacuanha comes from Colombia.

2. *Lesser striated ipecacuanha.* This is in very short fragments, 2 or 3 centimetres at most long, and 2 or 3 millimetres in thickness; some nearly cylindrical, others narrowly fusiform; others again formed of roundish or pyriform segments, somewhat thicker than the preceding, placed end to end. The color is generally of a gray brown, darker than that of the other kind. The longitudinal striæ are fine, and regular on the transverse section. The cortical portion is as it were horny, and its consistence firmer than in the larger kind; the central part is yellowish, and under the microscope exhibits numerous pores. The ligneous centre is at once distinguished by the size of its vessels, which give it a porous appearance. The presence of the starch granules is another of the distinguishing characters of this variety. It contains a larger proportion of emetine than the preceding, yielding, according to the analysis of Pelletier, 9 per cent.

The commercial variety of ipecacuanha examined by Mr. Attfield, of London, which had been sent to London from Bogota, and was no doubt the root of *Psychotria emetica*, was probably identical with the larger variety of M. Planchon, although its highly elastic quality, which induced Mr. Attfield to give it the distinctive name of *elastic striated ipecacuanha*, had not been given as a property of the larger striated by Planchon. In its very small yield of emetine, only 2·75 per cent., it corresponds with the large variety.

swallowed; as, under these circumstances, it may be given in almost indefinite doses, with little comparative risk of injury. In tropical or typhoid dysentery it is of very great value. As a nauseating remedy it is used in asthma, hooping-cough, and the hemorrhages; as a diaphoretic combined with opium, in numerous diseases. (See *Pulvis Ipecacuanhæ et Opii.*) Its expectorant properties render it useful in catarrhal and other pulmonary affections. It has been given, also, with supposed advantage, in very minute doses, in dyspepsia, and in chronic disease of the gastro-intestinal mucous membrane, and as an antemetic. It has been found especially useful in winter coughs and asthmatic catarrh, inhaled in the form of spray; the wine of ipecacuanha being the preparation used.*

Ipecacuanha is most conveniently administered, as an emetic, in the form of powder suspended in water. The dose is about twenty grains (1·3 Gm.), repeated, if necessary, at intervals of twenty minutes till it operates. In some persons much smaller quantities prove emetic, and we have known an individual who was generally vomited by the fraction of a grain. The operation may be facilitated, and rendered milder, by draughts of warm water, or warm chamomile tea. An infusion in boiling water, in the proportion of two drachms to six fluidounces, may be given in the dose of a fluidounce repeated as in the former case. For the production of nausea, the dose in substance may be two grains (0·13 Gm.), repeated more or less frequently according to circumstances. As a diaphoretic it may be given in the quantity of a grain (0·065 Gm.); as an alterative, in diseases of the stomach and bowels, in that of a quarter or half a grain (0·016–0·03 Gm.) two or three times a day.

Emetine has been used, but its operation on the stomach is more violent and continued than that of ipecacuanha; and, if given in overdoses, it may produce dangerous and even fatal consequences. The dose of impure emetine is about a grain (0·065 Gm.), of the pure not more than an eighth (0·008 Gm.) of a grain, repeated at proper intervals till it vomits. In proportional doses, it may be applied to the other purposes for which ipecacuanha is used. It will excite vomiting when applied to a blistered surface after the removal of the cuticle.

An ointment, made with one part of the powder, one of olive oil, and two of lard, rubbed once or twice a day for a few minutes upon the skin, produces a copious and very permanent eruption, but is at present only very rarely employed as a counter-irritant.

Off. Prep. Extractum Ipecacuanhæ Fluidum, *U. S.;* Pilula Conii Composita, *Br.;* Pilula Ipecacuanhæ cum Scilla, *Br.;* Pulvis Ipecacuanhæ et Opii, *U. S.;* Pulvis Ipecacuanhæ Compositus, *Br.;* Trochisci Ipecacuanhæ; Trochisci Morphinæ et Ipecacuanhæ; Vinum Ipecacuanhæ, *Br.*

IRIS. *U. S.* *Iris.* [*Blue Flag.*]

(Ī'RĬS.)

The rhizome and rootlets of Iris versicolor. Linné. (*Nat. Ord.* Iridaceæ.)" *U. S.*
Rhizome d'Iris varié, Glaïeul bleu, *Fr.;* Verschiedenfarbige Schwertlilie, *G.*

Gen. Ch. *Corolla* six-parted; the alternate segments reflected. *Stigmas* petal-shaped. *Willd.*

In all the species belonging to this genus, so far as examined, the roots are more or less acrid, and possessed of cathartic and emetic properties. In Europe, *Iris fœtidissima*, *I. Florentina*, *I. Germanica*, *I. pseudo-acorus*, and *I. tuberosa* have at various times been admitted into use, and the unpeeled roots of *I. Germanica* are still sold in the Indian bazaars under the name of *Irisia*. Florentine Iris is of sufficient importance to demand careful consideration.†

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* Sidney Ringer, M.D., and Wm. Murrell. The *Lancet*, Sept. 5, 1874, p. 338.

† *Iris Florentina.* U. S. Secondary List, 1870. (*Rhizoma Iridis*, P.G.; *Radix Iridis Florentinæ*, *Radix Ireos*; *Orris Root*, *Iris de Florence*, Fr.; *Florentinische Violenwurzel*, *Veilchenwurzel*, G.; *Ireos*, It.: *Liro Florentina*, Sp.) The root (rhizome) of the Florentine Iris is perennial, horizontal, fleshy, fibrous, and covered with a brown epidermis. The leaves, which spring directly from the root, are sword-shaped, pointed, nerved, and shorter than the stem, which rises from the midst of them, more than a foot in height, round, smooth, jointed, and bearing commonly two large white or bluish white terminal flowers. The calyx is a spathe with two valves. The corolla divides into six segments or petals, of which three stand erect, and the remaining three are bent

Iris versicolor. Willd. *Sp. Plant.* i. 233; Bigelow, *Am. Med. Bot.* i. 155. This indigenous species of Iris has a perennial, fleshy, horizontal, fibrous root or rhizome, and a stem two or three feet high, round on one side, acute on the other, and frequently branching. The leaves are sheathed at the base, sword-shaped, and striated. The flowers are from two to six in number, and are usually blue or purple, though varying much in color. The capsule has three valves, is divided into three cells, and when mature is oblong, three-sided, with obtuse angles, and contains numerous flat seeds. The blue flag is found in all parts of the United States, flourishing in low wet places, in meadows, and on the borders of swamps, which it serves to adorn with its large and beautiful flowers. These make their appearance in June. The root is the medicinal portion. The flowers afford a fine blue infusion, which serves as a test for acids and alkalies.

Properties. The recent root is without odor, and has a nauseous, acrid taste, which is imparted to water by decoction, and still more perfectly to alcohol. The acrimony as well as medicinal activity is impaired by age. If cut when fresh into slices, dried at the temperature of about 100° F., then powdered and kept in bottles excluded from the air, the root retains its virtues unimpaired for a considerable time. (*Andrews.*) It is officinally described as follows. "Rhizome horizontal, consisting of joints, two to four inches (5 to 10 cm.) long, cylindrical in the lower half, flattish near the upper extremity, and terminated by a circular scar, annulated from the leaf-sheaths, gray-brown; rootlets long, simple, crowded near the broad end; odor slight; taste acrid, nauseous." *U. S.*

D. W. Cressler found in this plant starch, gum, tannin, sugar, an acid resin, fixed oil, and indications of an alkaloid. (*A. J. P.*, 1881, p. 602.)

Blue flag possesses the cathartic, emetic, and diuretic properties common to most of its congeners. It was said by Mr. Bartram to be much esteemed by the southern

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backward, and bearded within at their base with yellow-tipped white hairs. The fruit is a three-celled capsule, containing many seeds. This plant is a native of Italy and other parts of the south of Europe, where it is also cultivated. The root is dug up in spring, and prepared for the market by the removal of its cuticle and fibres. It is cultivated for commerce chiefly in the neighborhood of Florence, and is exported from Leghorn in large casks.

Florentine orris is in pieces of various form and size, often branched, usually about as thick as the thumb, knotty, flattened, white, heavy, of a rough though not fibrous fracture, an agreeable odor resembling that of the violet, and a bitterish, acrid taste. The acrimony is greater in the recent than in the dried root; but the peculiar smell is more decidedly developed in the latter. The pieces are brittle and easily powdered, and the powder is of a dirty white color. Vogel obtained from Florentine orris, gum, a brown extractive, fecula, a bitter and acrid fixed oil or soft resin, a volatile crystallizable oil, and vegetable fibre. According to Landerer, the acrid principle is volatile, separating in the form of a stearopten from water distilled from the root. (*Arch. der Pharm.*, lxv. 302.) The solid oil which is prepared in Europe from orris root by distillation has been examined by Prof. Flückiger. By repeated crystallization from alcohol and treatment with animal charcoal, inodorous crystals were obtained, having the composition ($C_{14}H_{28}O_2$) and the properties of myristic acid, whilst the odorous principle remained in the mother-liquor, so that oil of orris must be regarded as myristic acid, impregnated with some volatile oil. The acid does not pre-exist in orris root, and is probably liberated from a fat by the influence of steam. (*Archiv d. Pharm.*, June, 1876; *A. J. P.*, 1876, p. 411.) According to Hager, the commercial oil has the following properties. At the ordinary temperature it is a pea-yellow acid, resembling the basilicon ointment (*Phar. Germ.*) in color and consistence. It is lighter than water, fuses at 38° to 40° C. (100·4° to 104° F.) to a transparent liquid, and commences to congeal at about 28° C. (82·4° F.). Two drops of the fused oil dissolve in 10 or 12 drops of warm stronger alcohol, and the solution does not separate at a medium temperature. Three drops of the oil and 20 to 25 drops of concentrated sulphuric acid carefully heated to 30° C. (86° F.) yield a clear red-brown liquid, which, after ten minutes, dissolves in 7 C.c. of 90 per cent. alcohol, with a light violet color, gradually becoming darker. Two drops of a solution of the oil in petroleum benzin evaporated spontaneously leave a residue, which, with a magnifying power of 50 to 100 diameters, has a ramifying appearance after a few hours, and shows distinct crystals after a day. One part of orris oil yields, with 3000 to 4000 parts of weaker alcohol, a solution of which a few drops put upon a handkerchief develop a persistent odor of violets. (*A. J. P.*, 1877, p. 302.) In order to preserve the root from the attacks of insects, it is recommended to put a little chloroform in the bottle in which it may be kept. (*A. J. P.*, 1858, p. 310.)

Orris Root is cathartic, and in large doses emetic, and was formerly employed to a considerable extent on the continent of Europe. It is said also to be diuretic, and to have proved useful in dropsies. At present it is valued chiefly for its agreeable odor. It is occasionally chewed to conceal an offensive breath, and enters into the composition of tooth-powders. In the form of small round balls, about the size of a pea, it is used by the French for maintaining the discharge from issues, a purpose to which it is adapted by its odor, by the slight acrimony which it retains in its dried state, and by the property of swelling very much by the absorption of moisture.

Indians; and Dr. Bigelow states that he has found it efficacious as a purgative, though inconvenient from the distressing nausea and prostration which it is apt to occasion; but other practitioners have employed it with less unpleasant effects. It may be given in substance, decoction, or tincture. The dose of the dried root is from ten to twenty grains (0·65–1·3 Gm.). Under the unscientific name of *iridin* or *irisin*, which should be reserved for the pure active principle when discovered, the "Eclectics" have for some time used an oleoresin, obtained by precipitating a tincture of the root with water, and mixing the precipitate with an equal weight of some absorbent powder, for which purpose powdered liquorice root would probably answer well. Wm. E. Jenks (*A. J. P.*, 1881, p. 601) prepares the *oleoresin of iris* by exhausting the root with alcohol sp. gr. 835, and distilling off the alcohol. The so-called irisin is undoubtedly purgative, and is believed by some practitioners to have a very decided action upon the liver,—a belief which is confirmed by the researches of Prof. Rutherford, who proved that in dogs it is a powerful stimulant to the liver, and has also a decided influence upon the intestinal glands; he ranks it as less irritant to the intestines than podophyllin, and more purgative than euonymin. It may be given in pill in the dose of three or four grains (0·20 or 0·26 Gm.).

Off. Prep. Extractum Iridis, *U. S.;* Extractum Iridis Fluidum, *U. S.*

JALAPA. *U. S., Br.* *Jalap.*

(JẠ-LĀ′PẠ.)

"The tuberous root of Exogonium Purga. Bentham. (*Nat. Ord.* Convolvulaceæ.)" *U. S.* "The dried tubercles of Exogonium Purga. Bentham, *Bot. Mag.*, vol. lxxiii. plate 4280. Imported from Mexico." *Br.*

Tuber Jalapæ, *P. G.;* Radix Jalapæ; Jalap, *Fr.;* Jalape, Jalapenknollen, Jalapenwurzel, *G.;* Sciarappa, *It.;* Jalapa, *Sp.*

The precise botanical origin of jalap remained long unknown. It was at first ascribed by Linnæus to a Mirabilis, and afterwards to a new species of Convolvulus, to which he gave the name of *C. Jalapa.* The correctness of the latter reference was generally admitted; and, as the *Ipomæa macrorrhiza* of Michaux, growing in Florida and Georgia, was believed to be identical with the *C. Jalapa* of Linn., it was thought that this valuable drug, which had been obtained exclusively from Mexico, might be collected within the limits of the United States. But the error of this opinion was soon demonstrated. Dr. John R. Coxe, of Philadelphia, received living roots of jalap from Mexico in 1827, and succeeded in producing a perfect flowering plant, of which a description, by Mr. Nuttall, was published in the *Am. Journ. of Med. Sci.* for January, 1830. The same plant has since been cultivated in various parts of Europe,* and has been introduced into the Neilgherry Hills of India, where it grows vigorously. J. H. Balfour (*Curtis's Bot. Mag.*, Feb. 1847) maintains that the plant belongs to the genus Exogonium of Choisy, as defined in De Candolle's *Prodromus*, being distinguished from Ipomæa by its exserted stamens; and this view has been taken by the framers of the Pharmacopœias. The highest authorities, however, Bentham and Hooker, do not acknowledge the validity of the various genera into which Ipomæa has been broken up by Choisy (*Genera Plantarum*, ii. 871), and the genus Exogonium does not seem to us worthy of the rank assigned it.

Gen. Ch. Sepals five. *Corolla* campanulate. *Stamens* included. *Style* one. *Stigma* two-lobed; the lobes capitate. *Ovary* two-celled; cells two-seeded. *Capsule* two-celled. Lindley.

Exogonium Purga. Balfour, *Curtis's Bot. Mag.*, 3d ser., vol. iii. tab. 4280; *B. & T.* 186.—*Ipomæa Jalapa.* Nuttall. Carson, *Illust. of Med. Bot.* ii. 13, pl. 61. —*Ipomæa Purga.* Hayne, *Darstel. und Beschreib.*, etc., xii. 33 and 34; Lindley, *Flor. Med.* 396. The root of this plant is a roundish somewhat pear-shaped tuber, externally blackish, internally white, with long fibres proceeding from its lower part, as well as from the upper rootstalks. A tuber produced by Dr. Coxe was, in its third year, between two and three inches in diameter. The stem is round, smooth, much disposed to twist, and rises to a considerable height upon neighboring objects, about which it twines. The leaves are heart-shaped, entire, smooth, pointed, deeply sinuated at the base, prominently veined on their under surface, and supported upon long footstalks. The lower leaves are nearly hastate, or with diverging angular points. The flowers, which are large and of a lilac-purple color, stand upon peduncles about as long as the petioles. Each peduncle supports two, or, more rarely, three flowers. The calyx is without bracts, five-leaved, obtuse, with two of the divisions external. The corolla is funnel-form. The stamens are five in number, with oblong, white, somewhat exserted anthers. The stigma is simple and capitate. The above description is taken from that of Mr. Nuttall, published in Dr. Coxe's paper in the *American Journal of the Med. Sciences.*

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* The Jalap grows freely in the south of England, but the season is too short for the production of seed by it, although the root has yielded 11·97 per cent. of resin. (*P. J. Tr.*, Feb. 1869.)

The jalap-plant is a native of Mexico, where it is dug during the whole year, and mostly dried over the hearths of the Indian huts. It derives its name from the city of Jalapa, in the state of Vera Cruz, in the neighborhood of which it grows, at the height of about 6000 feet above the ocean. The drug is brought from the port of Vera Cruz in bags, containing usually between 100 and 200 pounds.*

Properties. The tuber comes either whole, or divided longitudinally into two parts, or in transverse circular slices. The entire tubers are irregularly roundish, or ovate and pointed, or pear-shaped, usually much smaller than the fist, and the larger ones marked with circular or vertical incisions, made to facilitate their drying. The root is preferred in this state, as it is less apt to be defective, and is more easily distinguished from the adulterations than when sliced. A much larger proportion comes entire than formerly, indicating a greater scarcity of the older roots, which it is necessary to slice in order to dry them properly. The tuber is heavy, compact, hard, brittle, with a shining undulated fracture, not fibrous, but exhibiting numerous resinous points, distinctly visible with the microscope. It is externally brown and wrinkled, internally of a grayish color, diversified by concentric darker circles, in which the matter is denser and harder than in the intervening spaces. Jalap is always kept by pharmacists in the state of powder, which is of a yellowish gray color, and when inhaled irritates the nostrils and throat, and provokes sneezing and coughing. The odor of the root, when cut or broken, is heavy, sweetish, and rather nauseous; the taste is sweetish, somewhat acrid, and disagreeable. It yields its active properties partly to water, partly to alcohol, and completely to diluted alcohol, and the U. S. P. gives the following test of its efficiency. "On exhausting 100 parts of jalap by alcohol, concentrating the tincture, and pouring it into water, a precipitate of resin should be obtained, which, after washing with water, and drying, should weigh not less than 12 parts, and of which not over 10 per cent. should be soluble in ether." M. Cadet de Gassicourt obtained from 500 parts of jalap, 24 of water, 50 of resin, 220 of gummy extract, 12·5 of fecula, 12·5 of albumen, 145 of lignin, 16·3 of saline matters, 2·7 of silica, with a loss of 17 parts. Buchner and Herberger supposed that they had discovered a basic substance, which they called *jalapin.* G. A. Kayser found that the resin of jalap consists of two portions, one of which, amounting to seven parts out of ten, is hard and insoluble in ether, the other is soft and soluble in that menstruum. The hard resin he named *rhodeoretin*, and found to be identical with the jalapin of Buchner and Herberger. By reaction with the alkalies it is converted into an acid, called *rhodeoretinic acid.* Rhodeoretin is slightly soluble in water, freely so in alcohol, and insoluble in ether, chloroform, or benzol; and the alcoholic solution is precipitated both by ether and water. It is dissolved by solutions of the alkalies, more quickly if heated, and is not precipitated by acids, having become soluble by conversion into the acid above referred to. It purges violently in the dose of three or four grains, and is supposed to be the active principle of jalap. Mayer confirmed and extended the observations of Kayser. He gave the name of *convolvulin* to Kayser's rhodeoretin, and announced its formula as $C_{31}H_{50}O_{16}$. This substance is colorless when pure, dissolving easily in ammonia, is not reprecipitated by acids, because of its conversion into *convolvulic acid*, which is a hydrate of the glucoside convolvulin. This, on being treated with nitric acid, yields *sebacic acid.* Convolvulin possesses in a high degree the purgative properties of jalap. Mayer obtained from *Ipomœa Orizabensis* a resin which he called *jalapin*, which was afterwards shown by Keller to be identical with the resin of scammony. Mayer's jalapin differs from convolvulin in being soluble in ether. A. F. Stevenson (*N. R.*, 1879, p. 359) has studied the two resins found in jalap, and furnishes a tabular statement of the differences between the soft resin jalapin and the hard resin convolvulin, which we give in a foot-note.* The proportion of resin to the other ingredients of the root varies considerably in different specimens. According to Gerber, the root contains 7·8 per cent. of hard resin, 3·2 of soft resin, 17·9 of extractive, 14·5 of gummy extract, 8·2 of a coloring substance which becomes red under the influence of the alkaline carbonates, 1·9 of uncrystallizable sugar, 15·6 of gum mixed with some saline matters, 3·2 of bassorin, 3·9 of albumen, 6·0 of starch, 8·2 of lignin, with some water, and various salts. For the method of obtaining the resin of jalap pure, see *Resina Jalapæ.*†

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* The root of *I. pandurata, Man Root, Man of the Earth*, of this country, is sometimes met with in American commerce. Mr. C. Manz found a resin in it. (*A. J. P.*, 1881, p. 384.)

Jalap is apt to be attacked by worms, which, however, are said to devour the amylaceous or softer parts, and to leave the resin; so that the worm-eaten drug is more powerfully purgative than that which is sound. Thus, out of 397 parts of the former, M. Henry obtained 72 parts of resin, while from an equal quantity of the latter he procured only 48 parts. Hence worm-eaten jalap should be employed for obtaining the resin, but should not be pulverized, as it would afford a powder of more than the proper strength. The drug is also liable to various adulterations, or fraudulent substitutions, which, however, can usually be detected without difficulty. Those which have attracted particular attention are mentioned in the note below.‡

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* 1. *Solvents.*

Solvent.	Jalapin.	Convolvulin.
Chloroform.	Readily soluble.	Slightly soluble.
Ether.	Very soluble.	Insoluble.
Petrol. naphtha.	Slightly soluble.	Insoluble.
Oil turpentine.	Slightly soluble.	Insoluble.
Benzol.	Slightly soluble.	Insoluble.
Carbon disulp.	Easily soluble.	Insoluble.
Water.	Slightly soluble.	Slightly soluble.
Hydrochloric acid.	Slightly soluble.	Readily soluble.
Sulphuric acid.	Very soluble, with production of maroon color, changing to black.	Readily soluble, with production of bright red coloration.
Caustic potassa.	Easily soluble.	Easily soluble, with production of odor of whisky when heated.
Ammonia.	Readily soluble, more so than couvolvulin.	Slightly soluble.

2. *Reactions with Oxidizing Agents on convolvulin and jalapin dissolved in concentrated sulphuric acid.*

Agent.	Jalapin.	Convolvulin.
Potassium bichromate.	Produces odor of rancid butter and reddish brown color.	Produces odor of rancid butter and olive-green color.
Potassium permanganate.	Same reactions.	Same reactions.
Potassium nitrate.	Same reactions, but not so strong.	Same reactions.
Potassium chlorate.	Same reactions, but not so strong.	Same reactions.
Manganese dioxide.	Same odor, and color dark green.	Same odor, and color rose-pink.

† True jalap varies much in the proportion of resin, and consequently in purgative power. Dr. E. R. Squibb has found the proportion to vary from 11 to 16·25 per cent. (*A. J. P.*, 1868, p. 65); but others have obtained a greater proportion than the largest mentioned; and Mr. Charles Umney states that, in a fine selected specimen, he had found 21·5 per cent. (*P. J. Tr.*, Dec. 1867.)

‡ Among the inferior kinds of jalap are specimens of the genuine root which appear to have been partially exhausted in their aggregate state before pulverization. From a pound of this kind, Dr. Squibb obtained only 1·8 per cent. of resin. The rootlets of the tubers are sometimes mixed in large proportion with the tubers themselves. The same chemist found in a lot of this kind 2·2 per cent. of resin. (*A. J. P.*, 1868, pp. 65–6.)

Tampico Jalap. (*Purga de Sierra Gorda*, Mexican.) This drug closely resembles the true jalap, but the tubers are somewhat smaller, more elongated and shrivelled. The odor and taste resemble those of true jalap. According to Mr. Ambrose Andouard, it is the *jalap digité majeur* of M. Guibourt. Through the efforts of Mr. Daniel Hanbury, of London, aided by two Prussian officials in Mexico, Mr. Hugo Finck, vice-consul at Cordova, and Mr. E. Bonecke, consul-general at Mexico, Jalap should be rejected when it is light, of a whitish color internally, of a dull fracture, spongy, or friable. Powders of calomel and jalap, taken on long voyages

the origin of the drug was traced to the state of Guanajuato, where it grows along the Sierra Gorda, near San Luis de la Paz. In this place it is purchased from the Indians, and conveyed by mules to Tampico, where it enters into commerce. Through the agency of the same gentleman, Mr. Hanbury, after some failures, succeeded in obtaining a living tuber, from which he raised a flourishing plant that proved to be an undescribed species of the genus *Ipomæa*, differing from *I. purga* by its bell-shaped corolla and pendulous flower buds. To it Mr. Hanbury gave the name of *I. simulans.* (*A. J. P.*; July, 1870.) Prof. H. Spirgatis, of Königsberg, obtained a resin by preparing a tincture of the Tampico jalap, evaporating, washing, boiling the residue in water, redissolving in alcohol, and decolorizing by charcoal. He gave it the name of *tampicin.* Its physical properties are similar to those of the jalap resin. It is brittle, tasteless, inodorous, insoluble in water, soluble in ether and alcohol, and in solution has a feeble acid reaction. By strong alkalies it is changed into a soluble acid, which Prof. Spirgatis calls *tampicic acid.* By the action of dilute sulphuric, nitric, or hydrochloric acid, it is converted, slowly if cold, but rapidly with heat, into a peculiar acid called *tampicolic*, with sugar. For the mode of preparing these acids, and their properties, the reader is referred to an article in *N. R.* (July, 1871, p. 50). The melting point of tampicin is 130° C.; its formula $C_{34}H_{54}O_{14}$. The percentage of it yielded by the drug varies from a minimum of 10 per cent. (Hanbury) to a maximum of 15 per cent. (Umney). Andouard states that it is purgative.

Mechoacan. Jalap is said to be sometimes adulterated with *bryonia root*; but no instance of the kind has come under our notice; and the two drugs are so widely different that the fraud should be instantly detected. (See *Bryonia*, page 301.) It is probable, however, that the adulteration which has been considered as bryonia root is the *mechoacan*, which in Europe is sometimes called American bryony, and was formerly erroneously supposed to be derived from a species of Bryonia. Mechoacan is a product of Mexico, which was taken to Europe even before the introduction of jalap. The plant producing it has been conjectured to be *Ipomæa macrorrhiza* of Michaux, which is believed to grow in Mexico near Vera Cruz, as well as in our Southern States, and the root of which is said to weigh, when of full size, from fifty to sixty pounds, and, according to Dr. Baldwin, has little or no purgative power. But this origin is quite uncertain; and Guibourt states, in one of his communications to the journals, that what is sold in Europe under the name of mechoacan is certainly the product of *Asclepias Contrayerva* of the Mexican flora. (*Journ. de Pharm. et de Chim.*, 4e sér., iv. 98, 1866.) Mechoacan is in circular slices, or fragments of various shapes, white and farinaceous within, and, as found in the European markets, generally destitute of bark, of which, however, portions of a yellowish color sometimes continue to adhere. The larger slices are sometimes marked with faint concentric striæ; and upon the exterior surface are brown spots and ligneous points, left by the radicles after removal. (*Guibourt.*) Though tasteless when first taken into the mouth, it becomes after a time slightly acrid. It is very feebly purgative. We have seen flat circular pieces of root, mixed with jalap, altogether answering this description, except that the cortical portion still remained, between which and the starchy parenchyma there was an evident line of division.

Orizaba Root. Male Jalap. Light, Woody, or Fusiform Jalap. Jalap Stalks. Purgo Macho (Mexican). This is the product of a plant named by M. Ledanois *Convolvulus Orizabensis*, from the city of Orizaba, in the neighborhood of which it grows abundantly. A description of it was first published in this country by Mr. D. B. Smith, in a paper in *A. J. P.* (ii. 22). For an account of the plant, the reader is referred to the same journal (x. 224). The recent root is large, spindle-shaped, sometimes twenty inches in length, branched at its lower extremity, yellow on its outer surface, and white and milky within. The drug, as described by Guibourt, is in circular pieces, two or three inches in diameter, or in longer and more slender sections. As we have seen it, the shape of the pieces is often such as to indicate that the root was sliced transversely, and each circular slice divided vertically into quarters. The horizontal cut surface is dark from exposure, unequal from the greater shrinking in desiccation of some parts than others, and presents the extremities of numerous fibres, which are often concentrically arranged, and run in the longitudinal direction of the root. Internally the color is grayish, and the texture, though much less compact than that of jalap, is sometimes almost ligneous. The taste is at first slight, but after a time becomes somewhat acrid and nauseous. The root, analyzed by M. Ledanois, yielded, in 1000 parts, 80 of resin, 256 of gummy extract, 32 of fecula, 24 of albumen, and 580 of lignin. It has cathartic properties similar to those of the true jalap, but feebler, requiring to be given in a dose of from thirty to sixty grains in order to operate effectively. (*Journ. de Pharm.*, xxiv. 166.) The resin of *C. Orizabensis*, which has been unfortunately named *jalapin* by Meyer, is, according to that chemist, changed by boiling with baryta-water into an acid called *jalapic* acid; and both jalapin and jalapic acid are glucosides, being resolved by boiling dilute acid into glucose, and a peculiar substance which he designates as *jalapinol.* (See *Journ. de Pharm.*, 3e sér., xxix. 123.) It differs from jalap resin in consisting of only one principle, which is entirely soluble in ether. But both resins are distinguished from all others by being gradually dissolved in concentrated sulphuric acid, and deposited again after some hours in a soft state. (*Chem. Gaz.*, No. 53; from Liebig's *Annalen.*) Its formula is $C_{34}H_{56}O_{16}$, and it is homologous with convolvulin, or true jalap resin. Hanbury and Flückiger obtained 11·8 per cent. of it from the root, and state that it is probably the jalapin of English pharmacy. It is considered by chemists identical with the resin of scammony, and is affirmed to have similar drastic properties.

Rose-scented Jalap. Overgrown Jalap. A false jalap was some years since brought into market, imported from Mexico into New York in considerable quantities, and was offered for sale under the name of *overgrown jalap.* A specimen, brought to Philadelphia, and examined by a Committee of the College of Pharmacy, presented the following characters. It was in light, entire or vertically sliced tubers, of different form and magnitude, spindle-shaped, ovate and kidney-form, some as much as six inches long and three thick, others much smaller, externally somewhat wrinkled, with broad, flattish, light brown ridges, and shallow darker furrows, internally grayish white, with dis-to southern climates, are said, when brought back, to have become consolidated, and so far chemically altered as plainly to exhibit globules of mercury. This change is ascribed by Schacht and Wackenroder to a fungous growth. (*Arch. der Pharm.*, xxxix. 239.) The best criterion of good quality in jalap is the proportion of its resinous constituent; and all specimens intended for use in the powdered form, or in any liquid preparation, should be rejected if they contain less than 12 per cent. of resin.

Medical Properties and Uses. Jalap is an active cathartic, operating briskly and sometimes painfully upon the bowels, and producing copious watery stools. The aqueous extract purges moderately, without much griping, and is said to increase the flow of urine. The portion not taken up by water gripes severely. The watery extract obtained from jalap, previously exhausted by rectified spirit, is said to have no cathartic effect, but to operate powerfully by urine. (*Duncan.*) The alcoholic extract, usually called resin of jalap, purges actively, and often produces severe griping. From these facts, it would appear that the virtues of this cathartic do not depend exclusively upon any one principle. Experiments, however, by Mr. John C. Long, of Philadelphia, seem to show that the gummy extract, which he took in the quantity of a drachm without any effect, is inert; while the soft resin, or that soluble in ether, which was thought to have but feeble power, if any, acted powerfully as a hydragogue cathartic, in the dose of three grains. (*A. J. P.*, 1861, p. 489.) Jalap was introduced into Europe in the latter part of the sixteenth or the beginning of the seventeenth century, and now ranks among the purgative medicines most extensively employed. It is applicable to most cases in which an active cathartic is required, and from its hydragogue powers is especially adapted to the treatment of dropsy. It is generally given in connection with other medicines, which assist or qualify its operation. In dropsical complaints it is usually combined with bitartrate of potassium. With calomel it forms a cathartic compound, which has long been highly popular, in the United States, in bilious fever and other complaints attended with congestion of the liver or portal circle. In overdoses it may produce dangerous hypercatharsis. It is said to purge when applied to a wound.

The dose of jalap in powder is from fifteen to thirty grains (1–1·95 Gm.); of the resin, or alcoholic extract, from four to eight grains (0·26–0·52 Gm.); of the extract of the Br. Pharmacopœia, from five to fifteen grains (0·33–1 Gm.); of the new officinal abstract, from ten to fifteen grains (0·65 to 1 Gm.). The dose of calomel

tant darker concentric circles, sometimes uniformly amylaceous, of a dull rough fracture, a loose texture, a slight, peculiar, and sweetish odor, and a feeble jalap-like taste. The powder was of a light gray color, and did not irritate the nostrils or throat during pulverization. The root differed from mechoacan by the absence of the marks of rootlets, and from male jalap by the want of a fibrous structure. It yielded by analysis, in 100 parts, 3 of a soft and 4 of a hard and brittle resin, 17 of gummy extractive, 28 of starch and inulin, 10 of gum and albumen, 23·2 of lignin, and 14·8 of saccharine matter and salts of lime, including loss. In doses of from fifteen to twenty grains it produced no effect on the system. A similar root was described by Guibourt by the name of *rose-scented jalap*. It was taken to France from Mexico, mixed with genuine jalap. It proved equally inefficacious as a purgative, and probably had the same origin. This spurious drug is probably the product of a Convolvulus or Ipomæa. (See *A. J. P.*, xiv. 289.)

Two varieties of false jalap, imported into New York, are described by Mr. John H. Currie in the *N. Y. Journ. of Pharm.* for Jan. 1852. The first corresponds with the root above described as that of *Convolvulus Orizabensis*, or *male jalap*, both in appearance and in the character of its resinous ingredient. The second is a tuberous root, resembling in shape, color, and size, the butternut, or fruit of *Juglans cinerea*, being black or nearly so externally, dull over most of the surface but glossy in spots, with deep longitudinal incisions, internally yellow or yellowish white, with a horny fracture, and upon the transversely cut surface marked with sparse dots, as if from delicate fibres. It contains no resin, and appears to be inert.

In *Journal de Pharmacie* (Dec. 1863, p. 477, and March, 1864, p. 212) three other tubers are described by M. Guibourt, which have been offered in the market for jalap; one named *false jalap of New Orleans*, because imported into France from that city, the second *digitate jalap* (*jalap digité*) from the arrangement of its component tubers, and the third *radiated false-jalap* (*faux-jalap rayonné*) from the stellate appearance of the cut surface. These jalaps do not closely resemble in physical properties the true root.

Another false jalap, some tubers of which were exhibited to Prof. Procter by Mexicans, who stated that they were produced on grounds in Mexico belonging to them, is described by him in *A. J. P.* (Sept. 1868, p. 389), to which the reader is referred for a particular account of it. Though differing in shape and interior structure from genuine jalap, they had precisely the odor of that product, and a similar wrinkled appearance and mottled brown color externally, and were probably derived from a plant either of the same genus as jalap or one closely related to it.

and jalap is ten grains (0·65 Gm.) of each; of bitartrate of potassium and jalap, two drachms (7·8 Gm.) of the former and ten or fifteen grains (0·65–1·0 Gm.) of the latter.

Off. Prep. Abstractum Jalapæ, *U. S.;* Extractum Jalapæ, *Br.;* Pulvis Jalapæ Compositus; Pulvis Scammonii Comp., *Br.;* Resina Jalapæ.

JUGLANS. *U. S.* *Juglans.* [*Butternut.*]

(JŬG′LĂNŞ.)

"The inner bark of the root of Juglans cinerea, Linné (*Nat. Ord.* Juglandaceæ), collected in autumn." *U. S.*

Écorce de Noyer gris, *Fr.;* Graue Wallnussrinde, *G.*

Gen. Ch. MALE. *Amentum* imbricated. *Calyx* a scale. *Corolla* six-parted. *Filaments* four to eighteen. FEMALE. *Calyx* four-cleft, superior. *Corolla* four-cleft. *Styles* two. *Drupe* coriaceous, with a furrowed nut. *Willd.*

Several products of *Juglans regia*, or common *European walnut*, are used medicinally in Europe. The hull of the fruit has been employed as a vermifuge from the times of Hippocrates, and has been recommended in syphilis and old ulcers. The expressed oil of the fruit has been deemed efficacious against the tape-worm, and is also used as a laxative injection. The *leaves*, long occasionally employed for various purposes both in regular and domestic practice, have been found by Professor Négrier, of Angers, in the highest degree efficacious in scrofula. He gave to children a teacupful of a pretty strong infusion, or six grains of the aqueous extract, or an equivalent dose of a syrup prepared from the extract, two, three, or four times a day; and at the same time applied a strong decoction to the ulcers, and as a collyrium when the eyes were diseased. No injury ever resulted from a long-continued use of the remedy. It appears to act as a moderately aromatic bitter and astringent. (*Arch. Gen.*, 3e série, x. 399 and xi. 41.) They are said also to have proved useful as a topical application in malignant pustule. (*Ibid.*, 5e sér., x. 609.)* The leaves of our *J. nigra*, or common *black walnut*, and those of *J. cinerea*, the only officinal species, probably possess the same properties.

Juglans cinerea. Willd. *Sp. Plant.* iv. 456; Bigelow, *Am. Med. Bot.* ii. 115; Carson, *Illust. of Med. Bot.* ii. 42, pl. 86; *B. & T.* 247.—*J. cathartica.* Michaux, *N. Am. Sylva*, i. 160. This is an indigenous forest tree, known in different sections of the country by the names of *butternut*, *oilnut*, and *white walnut.* In favorable situations it attains a great size, rising sometimes fifty feet, with a trunk three or four feet in diameter at the distance of five feet from the root. The stem divides, at a short distance from the ground, into numerous nearly horizontal branches, which spread widely, and form a large tufted head. The young branches are smooth and of a grayish color, which has given origin to the specific name of the plant. The leaves are very long, and consist of seven or eight pairs of sessile leaflets, and a single petiolate leaflet at the end. These are two or three inches in length, oblong-lanceolate, rounded at the base, acuminate, finely serrate, and somewhat downy. The male and female flowers are distinct upon the same tree. The former are in large aments, four or five inches long, hanging down from the sides of the shoots of the preceding year's growth, near their extremity. The fertile flowers are at the end of the shoots of the same spring. The germ is surmounted by two large feathery, rose-colored stigmas. The fruit is sometimes single, suspended by a thin pliable peduncle; sometimes several are attached to the sides and extremity of the same peduncle. The drupe is oblong-oval, with a terminal projection, hairy, viscid, green in the immature state, but brown when ripe. It contains a hard, dark, oblong, pointed nut, with a rough, deeply and irregularly furrowed surface. The kernel is thick, oily, and pleasant to the taste.

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* *Nucitannic Acid.* In the walnut, between the kernel and the shell, is a thin membrane, which closely embraces the cotyledon, called the *episperm*, which consists of two layers, the inner very thin, colorless, translucent, and perfectly tasteless, the outer coarser, somewhat colored, and of a bitter, disagreeable taste. The latter, examined chemically by Dr. T. L. Phipson, was found to contain, among other principles, as gallic and ellagic acid, etc., a new variety of tannic acid, which he proposes to name *nucitannic acid* or *nucitannin*, to which the outer membrane chiefly owes its unpleasant taste. It is a glucoside; as when boiled for some hours, with dilute hydrochloric acid, it splits into glucose and a peculiar red acid substance, which he calls *rothic acid*, and the properties of which he has pretty thoroughly investigated. (*Chem. News*, Sept. 3, 1869, p. 116.)

The butternut grows in Upper and Lower Canada, and throughout the whole northern, eastern, and western sections of the old United States. In the Middle States, the flowers appear in May, and the fruit ripens in September. The tree, if pierced immediately before the leaves unfold, yields a richly saccharine juice, from which sugar may be obtained, nearly if not quite equal to that from the sugar maple. The wood, though neither strong nor compact, is useful for some purposes on account of its durability, and exemption from the attacks of worms. The fruit, when half-grown, is sometimes made into pickles, and, when ripe, affords in its kernel a grateful article of food. The bark is used for dyeing wool a dark brown color, though inferior for this purpose to that of the black walnut. It is said, when applied to the skin, to be rubefacient. The inner bark is the medicinal portion, and that of the root, being considered most efficient, is directed by the Pharmacopœia. It should be collected in May or June.

On the living tree, the inner bark, when first uncovered, is of a pure white, which becomes immediately on exposure a fine lemon color, and ultimately changes to deep brown. It has a fibrous texture, and is officinally described as follows. "In flat or curved pieces, from an eighth to a quarter of an inch (3 to 6 mm.) thick; the outer surface nearly free from soft cork, deep brown; the inner surface smooth and striate; transverse fracture short, delicately checkered, whitish and brown; odor feeble; taste bitter and somewhat acrid." *U. S.* Its medical virtues are extracted by boiling water. Dr. Bigelow could detect no resin in the bark; and the presence of tannin was not evinced by the test of gelatin, though a brownish black color was produced by sulphate of iron. Mr. Charles O. Thiebaud found the bark to be destitute of tannic acid, and of any vegetable alkaloid, but to contain bitter extractive oily matter in large proportion, a volatilizable acid, crystallizing in bright, orange-yellow crystals, and appearing to bear some analogy with chrysophanic acid, named *juglandic acid*, another acid crystallizing in tabular colorless crystals, and a volatile acid, with ashes, potassium largely, with traces of sodium, calcium, and aluminium. (*A. J. P.*, 1872, p. 253.) In a subsequent analysis, Mr. E. S. Dawson found resin in very small proportion, a volatile acid, and in addition to the bases discovered by Mr. Thiebaud, magnesium, combined, as were the other bases, with carbonic, hydrochloric, phosphoric, and silicic acids. Prof. Maisch has no doubt that the juglandic acid of Mr. Thiebaud is the *nucin* of A. Vogel, Jr., found in green walnut peel. (*Ibid.*, April, 1874, p. 167.)

Medical Properties and Uses. Butternut is a mild cathartic, operating without pain or irritation, and resembling rhubarb in the property of evacuating without debilitating the alimentary canal. It was much employed, during our Revolutionary war, by Dr. Rush and other physicians attached to the army. It is especially applicable to cases of habitual costiveness and other bowel affections, particularly dysentery, in which it has acquired considerable reputation. In connection with calomel it has sometimes been used in our intermittent and remittent fevers, and other complaints attended with congestion of the abdominal viscera. It is given in the form of decoction or extract, never in substance. The extract is officinal, and is almost always preferred. The dose of it is from twenty to thirty grains (1·3–1·95 Gm.) as a purge, from five to ten grains (0·33–0·65 Gm.) as a laxative. Mr. E. S. Dawson, G. P., states, as the result of his own experience, that a tincture containing the virtues of two troyounces of the bark in a pint of diluted alcohol will act decidedly as a cathartic in the dose of from one to two fluidrachms (3·75–7·5 C.c.). (*A. J. P.*, 1874, p. 169.)

Off. Prep. Extractum Juglandis, *U. S.*

JUNIPERUS. *U. S.* *Juniper.*

(JÚ-NĬP'Ẹ-RŬS.)

"The fruit of the Juniperus communis. Linné. (*Nat. Ord.* Coniferæ.)" *U. S.*

Fructus Juniperi, *P.G.;* Baccæ Juniperi; Juniper Berries; Genièvre, Genévrier commun, Baies de Genièvre, *Fr.;* Gemeiner Wachholder, Wachholderbeeren, *G.;* Ginepro, *It.;* Enebro, Bayas de Enebro, *Sp.*

Gen. Ch. MALE. *Amentum* ovate. *Calyx* a scale. *Corolla* none. *Stamens* three. FEMALE. *Calyx* three-parted. *Petals* three. *Styles* three. *Berry* three-seeded, irregular, with the three tubercles of the calyx. *Willd.*

Juniperus communis. Willd. *Sp. Plant.* iv. 853; Woodv. *Med. Bot.* p. 13, t. 6; *B. & T.*, 255. This is an erect evergreen shrub, usually small, but sometimes twelve or fifteen feet high, with numerous very close branches. The leaves are narrow, longer than the fruit, entire, sharply pointed, channelled, of a deep green color, somewhat glaucous on their upper surface, spreading, and attached to the stem or branches in threes, in a verticillate manner. The flowers are diœcious, and disposed in small, ovate, axillary, sessile, solitary aments. The fruit is formed of the fleshy coalescing scales of the ament, and contains three angular seeds.

The common juniper is a native of Europe, but has been introduced into this country, in some parts of which it has become naturalized. It is not uncommon in the neighborhood of Philadelphia. The plant described in Bigelow's American Medical Botany, under the title of *J. communis*, and very common in certain parts of New England, deserves, perhaps, to be considered a distinct species. It is a trailing shrub, seldom more than two or three feet high, spreading in all directions, throwing out roots from its branches, and forming beds which are often many rods in circumference. The name of *J. depressa* has been proposed for it. The common juniper flowers in May, but does not ripen its fruit till late in the following year. All parts of the plant contain a volatile oil, which imparts to them a peculiar flavor. The wood has a slight aromatic odor, and was formerly used for fumigation. A terebinthinate juice exudes from the tree and hardens on the bark. This has been erroneously considered as identical with *sandarach.* The peasantry in the south of France prepare a sort of tar, which they call "*huile de cade*," from the interior reddish wood of the trunk and branches, by a distillation *per descensum.* The *Oil of Cade* is now a commercial article, and has properties analogous to those of oil of tar. (See *Oleum Juniperi.*) The fruit and tops of juniper are the only officinal parts.

The berries, as the fruit is commonly called, are sometimes collected in this country, and parcels are occasionally brought to the Philadelphia market from New Jersey. But, though equal to the European in appearance, they are inferior in strength, and are not much used. The best come from the south of Europe, particularly from Trieste and the Italian ports. They are globular, more or less shrivelled; about as large as a pea; marked with three furrows at the summit, and at the base with tubercles from the persistent calyx; and covered with a glaucous bloom, beneath which they are of a shining blackish purple color. They contain a brownish yellow pulp, and three ovate, long, bony, angular seeds. They have an agreeable somewhat aromatic odor, and a sweetish, warm, bitterish, slightly terebinthinate taste. These properties, as well as their medical virtues, they owe chiefly to a volatile oil. (See *Oleum Juniperi.*) The other ingredients, according to Trommsdorff, are resin, sugar, gum, wax, lignin, water, and various saline substances. The proportion of these ingredients varies according to the greater or less maturity of the berries.* The volatile oil is most abundant in those which have attained their full growth and are still green, or in those which are on the point of ripening. In the latter, Trommsdorff found one per cent. of the oil. In those perfectly ripe it has been partly changed into resin, and in those quite black, completely so. The berries impart their virtues to water and alcohol. They are very largely consumed in the preparation of gin.

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* Franz Steer, of Cashau, in a more recent analysis, found the sugar to be glucose, and, besides the principles discovered by Trommsdorff, obtained pectin, malic acid, and a peculiar resin-like substance, which he names *juniperin.* This is black, with a yellow tint in thin layers by transmitted light, brittle, easily pulverizable, tasteless, insoluble in water and ether, but soluble in alcohol, and without acid or alkaline reaction. A singular property is that, when rubbed with a little water, it changes into a yellow powder, which is perfectly soluble in 66 parts of water, and has in solution an unpleasant bitter taste. It is obtained by distilling a tincture of the berries until nearly all the alcohol has passed over, pouring the residue while hot into a vessel, in which it deposits a gum-resin on cooling, decanting the clear liquid and reducing it with a gentle heat to a small volume, and allowing it to stand. A yellow powder separates, resembling powdered rhubarb, which disappears by further evaporation, and is followed by resinous drops, which, separated and washed, constitute the substance in question. (*Chem. Centralb.*, Dec. 31, 1856, p. 951.)

M. E. Donath gives as the composition of the berries, 29·44 of water, 0·91 of volatile oil, 1·86 of formic, 0·94 acetic, 0·21 malic, and traces of oxalic acid, 0·64 was like fatty matter, 8·46 green resin, 1·29 brown resin, 0·37 bitter matter (the juniperin of Steer), 0·73 of pectin, 4·45 of protein substances, 29 69 sugar, 15·83 of cellulose, and 2·33 of mineral substances. (*Journ. de Pharm.*, Janv. 1874, p. 84.)

The tops of juniper were formerly directed by the *Edinburgh* and *Dublin Colleges.* Their odor is balsamic, their taste resinous and bitterish, and they possess similar virtues with the berries.

Medical Properties and Uses. Juniper berries are gently stimulant and diuretic, imparting to the urine the smell of violets, and producing occasionally, when largely taken, disagreeable irritation in the urinary passages. They are chiefly used as an adjuvant to more powerful diuretics in dropsical complaints, but have been recommended also in scorbutic and cutaneous diseases, catarrh of the bladder, and atonic conditions of the alimentary canal and uterus. They may be given in substance, triturated with sugar, in the dose of one or two drachms (3·9–7·8 Gm.) three or four times a day. But the infusion is more convenient. It is prepared by macerating an ounce of the bruised berries in a pint of boiling water, the whole of which may be taken in the course of twenty-four hours. Extracts are prepared from the berries, both bruised and unbruised, and given in the dose of one or two drachms (3·9–7·8 Gm.); but, in consequence of the evaporation of the essential oil, they are probably not stronger than the berries in substance.

Off. Prep. Oleum Juniperi.

KAMALA. *U. S., Br.* *Kamala.*

(KẠ-MĀ'LẠ.)

"The glands and hairs from the capsules of Mallotus philippinensis. Mueller Arg. (*Nat. Ord.* Euphorbiaceæ.)" *U. S.* "A powder which consists of the minute glands that cover the capsules of Rottlera tinctoria. *Roxb. Corom.* Imported from India." *Br.*

Rottlera, *U. S.* 1870; Kameela, Spoonwood; Kalmie, *Fr., G.*

The genus Rottlera was named in honor of the Rev. Dr. Rottler, a Danish missionary, and as now recognized was established by Roxburgh. It belongs to the Natural Order of Euphorbiaceæ, and, besides the British officinal *R. Tinctoria,* includes another species having medical virtues, the *Rottlera Schimperi,* a large tree of Abyssinia, the bark of which, under the name of *cortex musenæ* or *musena bark,* has attracted some attention from its presumed anthelmintic virtues.[*]

Rottlera tinctoria (*Mallotus Philippinensis,* De Cand. *Prodrom.* xv. 980), which is described and figured by Roxburgh in his treatise on *The Plants of the Coast of Coromandel* (ii. 36), is a small tree from 15 to 20 feet in height, growing in Abyssinia and Southern Arabia, throughout Hindostan, in several of the East India islands, and in China, Australia, and New South Wales. The fruit is a roundish three-valved, three-celled capsule, of about the size of a small cherry, marked externally with three furrows, and thickly covered with a red powder. This is the officinal part of the plant. Very large quantities of it are collected in Hindostan. The berries, placed in large baskets, are rolled about and rubbed with the hands, and the powder thus freed sifts through the open wicker-work.[†]

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[*] *Cortex Musenæ.* This bark is in quills several inches long, an inch or more in diameter, rough and fissured externally, with a brown epidermis, and beneath this successively a thin greenish cellular coat, a thicker pale yellow periderm, and a tough, very fibrous liber. It is inodorous, but has a sweetish nauseous taste, followed by an enduring sense of acrimony in the fauces. It was found by Mr. C. Thiel to contain an acrid substance analogous to saponin, a bitter principle, a fatty wax-like substance, yellow coloring matter, extractive, and various salts. It is said to be used in Abyssinia, in connection with koosso, in the treatment of the tape-worm. (*Neues Jahrb. für Pharm.,* Jan. 1863, p. 374.)

[†] A peculiar kind of kamala, evidently not the product of *Rottlera tinctoria,* has been imported from Aden. Under the microscope the grains are cylindrical or subconical, 170 to 200 mm. long by 70 to 100 broad, with oblong resin-cells arranged perpendicularly in three or four tiers. When heated to 212° F. the powder turns black. Under the name of *Vars,* this drug is said to be used in Southern Arabia for the same purposes that kamala is employed elsewhere. Its source is unknown.

Properties. Kamala, as brought to our market, is a light, finely granular, and very mobile powder, of a brownish red or madder color, with little smell or taste, but producing a slight sense of acrimony in the mouth, and feeling gritty under the teeth. (When the grittiness is excessive, it probably has been adulterated with earthy matters.) It is inflammable, and flashes almost like gunpowder when dropped into the flame of a candle. It is insoluble in cold, and but very slightly soluble in boiling water; but alkaline solutions, alcohol, and ether dissolve a large proportion of it, forming a deep red solution, from which water precipitates resinous matter. Under the microscope, it consists of garnet-red, semi-transparent, roundish, glandular granules, from $\frac{1}{500}$ to $\frac{1}{250}$ of an inch in diameter, and containing numerous red, club-shaped vesicles, more or less mixed with minute stellate hairs, and the remains of stalks and leaves. the latter of which are easily removed by careful sifting. It has been examined chemically by Dr. Thos. Anderson, of Glasgow, and by G. Leube, in Germany. As given by the former, the constituents are, in 100 parts, 78·19 of resinous coloring matter, 7·34 of albumen, 7·14 of cellulose, etc., a trace of volatile oil and volatile coloring matters, 3·84 of ashes, and 3·49 of water. "When heated in a crucible to redness, it should leave not more than 8 per cent. of ash." *U. S.* Of the resinous coloring substances, Dr. Anderson obtained one in a pure state by allowing a concentrated ethereal solution to stand for two days, draining and pressing in bibulous paper the resulting mass of granular crystals, and purifying them from adhering resin by repeated solution in ether and crystallization. To this substance he gave the name of *rottlerin.* It is in the form of minute crystalline plates, of a yellow color and a satin-like lustre, insoluble in water, sparingly soluble in cold, but more so in boiling alcohol, and readily dissolved by ether, and by alkaline solutions, which assume a dark red color. Rottlerin melts when heated moderately, and at a higher heat is decomposed, giving off pungent vapors. Its formula, according to Dr. Anderson, is $C_{11}H_{10}O_3$. (*Ibid.*, p. 407.) Leube found a resin soluble in ether and cold alcohol, another resin soluble in ether and boiling alcohol, starch, gum, extractive, tannin, albumen, and citric acid. He failed in obtaining the rottlerin of Dr. Anderson. The ashes were in the extraordinary proportion of 25·85 per cent., and of the ashes 83·8 per cent. consisted of insoluble silica. (*Ibid.*, Sept. 1860, p. 168.) Silica probably enters essentially into the constitution of the minute granules, and its presence accounts for their grittiness under the teeth. The existence of rottlerin, which had come into some doubt by the failure of Leube to find it, has been abundantly confirmed by Mr. Thos. B. Groves, who, however, states that it is changed by exposure, and may, therefore, not be detected in old specimens. (*P. J. Tr.*, 1872, p. 228.) The active constituent is supposed to be the resin extracted by ether.

Medical Properties and Uses. Kamala is actively or even violently purgative in full doses, occasionally causing nausea, but seldom vomiting. It has been long used in India in the treatment of tape-worm, but its properties were first brought to general notice by Dr. C. Mackinnon, a British army surgeon in India. (*Indian Annals Med. Sci.*, 1854.) He found it extraordinarily efficient in the treatment of tænia, having used it in 50 cases, and failed in bringing away the worm only in two. The testimony of other practitioners in India and Great Britain goes to confirm the statements of Dr. Mackinnon, and there can be little doubt of the vermifuge powers of the medicine. It is given without previous preparation of the patient, in the dose of from one to three drachms (3·9–11·65 Gm.), suspended in water, mucilage, or syrup. In the latter dose it sometimes acts violently. The worm is usually expelled dead at the third or fourth stool. If the first dose fails to operate on the bowels, it may be repeated in four hours, or followed by a dose of castor oil. Dr. Anderson, a British army surgeon in India, has employed the medicine successfully in the form of tincture, made in the proportion of six ounces to sixteen fluidrachms of rectified spirit, of which the dose is from one to four fluidrachms (3·75–15 C.c.). As an external remedy, kamala is used by the people of India in various affections of the skin, particularly scabies. Dr. Wm. Moore, of Dublin, has employed it usefully in herpetic ringworm. (*Dub. Hosp. Gaz.*, Nov. 15, 1857.)

KINO. *U.S., Br.* *Kino.*

(KĪ′NŌ.)

"The inspissated juice of Pterocarpus Marsupium. Roxburgh. (*Nat. Ord.* Leguminosæ, Papilionaceæ.)" *U.S.* "The inspissated juice obtained from incisions made in the trunk of Pterocarpus Marsupium. D.C. Imported from Malabar." *Br.*

Gummi (s. Resina) Kino; Kino, *Fr., G., It.;* Quino, *Sp.*

The term kino was originally applied to a vegetable extract or inspissated juice, taken to London from the western coast of Africa, and introduced to the notice of the profession by Dr. Fothergill. Vegetable products obtained from various other parts of the world, resembling kino in appearance and properties, afterwards received the same name; and much confusion and uncertainty have existed, and in some degree still exist, in relation to the botanical and commercial history of the drug. We shall first give an account of the general properties of the medicines denominated kino, and then treat of the several varieties.

General Properties. Kino, as found in the shops, is usually in small, irregular, angular, shining fragments, seldom so large as a pea, of a dark reddish brown or blackish color, very brittle, easily pulverizable, and affording a reddish powder, much lighter colored than the drug in its aggregate state. If in large masses, it may be reduced without difficulty into these minute fragments. It is without odor, and has a bitter, highly astringent taste, with a somewhat sweetish after-taste. It burns with little flame, and does not soften with heat. It imparts its virtues and a deep red color to water and alcohol, but is nearly insoluble in ether. Cold water forms with it a clear infusion. Boiling water dissolves it more largely; and the saturated decoction becomes turbid on cooling, and deposits a reddish sediment. The tincture is not disturbed by water. When long kept, it often gelatinizes, and loses its astringency. (See *Tinctura Kino.*) Kino undoubtedly consists chiefly of a modification of tannic acid or tannin, which has received the name of *kino-tannic acid*, with extractive, gum, and sometimes probably a little resin; but we need a careful analysis of the different well-ascertained varieties. The aqueous solution is precipitated by gelatin, the soluble salts of iron, silver, lead, and antimony, bichloride of mercury, and sulphuric, nitric, and hydrochloric acids. The precipitate with iron is of an olive or greenish black color. The alkalies favor the solubility of kino in water, but essentially change its nature, and destroy its astringency.

1. EAST INDIA KINO. MALABAR KINO. This is the variety at present probably most used, and most highly esteemed, and the only one recognized by the British Pharmacopœia. Its origin was long unknown. It is now ascertained, through the united researches of Drs. Pereira, Royle, Wight, and others, to be the product of *Pterocarpus Marsupium*, a lofty tree, growing upon the mountains of the Malabar coast of Hindostan. Kino is the juice of the tree, extracted through longitudinal incisions in the bark, and afterwards dried in the sun. Upon drying it breaks into small fragments, and is put into wooden boxes for exportation. It is collected near Tellicherry, and exported from Bombay. It is sometimes imported into this country directly from the East Indies, but more commonly from London. From a communication in the Journal of the Asiatic Society of Bengal, by the Rev. F. Mason, it appears that kino is also collected in the Tenasserim provinces, in Farther India, and has been exported from Maulmain to Europe. It is produced by a tree called *Pa-douck*, which was supposed to be a species of Pterocarpus; although its precise characters were not certainly known. (*A. J. P.*, xxi. 134.) Dr. Christison subsequently recognized, in a description of this tree furnished to him by Mr. Begbie, of Maulmain, the precise characters of *Pterocarpus Marsupium;* so that this kino has the same origin as that from Malabar.

East India kino is in small, angular, glistening fragments, of a uniform consistence, appearing as if formed by the breaking down of larger masses. The larger fragments are opaque and nearly black; but minute splinters are sometimes translucent, and of a deep garnet redness when viewed by transmitted light. This variety of kino is very brittle, readily breaking between the fingers, and easily pulverized, affording a dark reddish powder, a portion of which, resulting from the mutual attrition of the fragments, is often found interspersed among them. When chewed, it softens in the mouth, adheres somewhat to the teeth, and tinges the saliva of a blood-red color. In odor, taste, and chemical relations, it corresponds with the account already given of kino in general. According to Vauquelin, it contains 75 per cent. of tannin and peculiar extractive, 24 of red gum, and 1 of insoluble matter. But new views have been advanced as to its composition. When kino is boiled in water, the decoction deposits, on cooling, a bright red substance; and a similar deposition takes place when a cold filtered aqueous solution is long exposed with a broad surface to the air. Dr. Gerling considers this deposit as the result of the combination of oxygen with kino-tannic acid, and calls it *kino-red.* (*Chem. Gaz.*, ix. 260; from Liebig's *Annalen.*) Hennig, who has examined East India kino with some care, considers this kino-red as a coloring matter in intimate combination with the tannic acid, which he is disposed to think identical in its pure state with the tannic acid of galls; and he extends the same views to the other forms of this astringent principle which give greenish precipitates with the ferric salts, and which are generally believed to be somewhat different as they occur in different plants. Finding this red coloring matter to possess acid properties, he has named it *kinoïc acid.* According to Hennig, kino consists of tannic acid with a trace of gallic acid, kinoic acid, pectin, ulmic acid, and inorganic salts with excess of earthy bases. (See *A. J. P.*, xv. 544.) C. Etti obtained a new constituent, *kinoïn*, by extracting kino with ether. He finally adopted the following method as more practicable. 1 part of gum kino is added to 2 parts of boiling diluted (1·5) hydrochloric acid. Kino-red immediately separates as a soft mass, becoming gradually solid on cooling, while the *kinoïn* mixed with a small quantity of kino-red remains in solution. The solid residue is once more boiled with water, the liquids are united and shaken with ether. The ethereal solution, on evaporation, leaves a crystalline reddish residue, which is dissolved in hot water, on the cooling of which tolerably pure crystals of *kinoïn* are obtained. By continued recrystallization they are obtained colorless. Kino contains about 1·5 per cent. of the substance, the composition of which is $C_{14}H_{12}O_6$. (*Ber. d Deutsch. Chem. Ges.; N. R.*, Feb. 1879.)

2. WEST INDIA, OR JAMAICA KINO. This is believed to be the product of the *Coccoloba uvifera*, or *sea-side grape*, a tree twenty feet or more in height, bearing beautiful broad shining leaves, and large bunches of purple berries, to which it owes its vernacular name. It grows in the West Indies and neighboring parts of the continent. The kino is said to be obtained by evaporating a decoction of the wood and bark, which are very astringent. Many years since, a thick reddish brown liquid was imported into Philadelphia from the West Indies, which, when dried by exposure to the air in shallow vessels or by heat, afforded an extract having all the properties of kino, for which it was sold by the druggists. This has been long exhausted; but some years since, a considerable quantity of West India kino was brought into this market, which may still enter into the consumption of the country. It was contained in large gourds, into which it was evidently poured while in a liquid or semi-liquid state, and then allowed to harden. When taken from the gourd, it breaks into fragments of various sizes, upon an average about as large as a hazelnut, and having some tendency to the rectangular form. The consistence of these fragments is uniform, their surface smooth and shining, and their color a dark reddish brown, approaching to black. They are, however, neither so glistening nor so black as the East India kino. In mass they are quite opaque, but in thin splinters are translucent and of a ruby redness. They are readily broken by the fingers into smaller fragments, are easily pulverized, and yield a dull reddish powder, considerably lighter colored than that of the former variety. The West India kino is without color, and has a very astringent, bitterish taste, with a scarcely observable sweetish aftertaste. It adheres to the teeth when chewed, though rather less than the East India variety, and colors the saliva red. The solubility of Jamaica kino was very carefully examined by Prof. Robert Bridges, who found that cold water dissolved 89 per cent., and ordinary officinal alcohol 94 per cent. The portion dissolved by alcohol and not by water was probably of a resinous nature, as it appeared to be viscid, and very much impeded the filtration of the watery solution. Considering the nature of this substance, the form of kino in which it was found is probably,

like that from the East Indies, an inspissated juice. Guibourt, who states that Jamaica kino is but slightly dissolved by cold water, must have operated on a different product.

3. SOUTH AMERICAN KINO. CARACCAS KINO. In 1839, when the 4th edition of this Dispensatory was published, an astringent extract was described, which had recently been introduced into our market, derived from Caraccas, and known by that name to the druggists. Since that period it has come much more extensively into use. It is probably the same as that described by Guibourt, in the last edition of his History of Drugs, as the kino of *Colombia.* As imported, this variety of kino is in large masses, some weighing several pounds, covered with thin leaves, or exhibiting marks of leaves upon their unbroken surface, externally very dark, and internally of a deep reddish brown or dark port-wine color. It is opaque in the mass, but translucent in thin splinters, very brittle, and of a fracture always shining, but in some masses wholly rough and irregular, in others rough only in the interior, while the outer portion, for an inch or two in depth, breaks with a rather smooth and uniform surface, like that of the West India kino. This outer portion is easily broken into fine angular fragments, while the interior crumbles quite irregularly. Some of the masses are very impure, containing pieces of bark, wood, leaves, etc.; others are more homogeneous, and almost free from impurities. The masses are broken up by means of a mill so as to resemble East India kino, from which, however, this variety differs in being more irregular, less sharply angular, more powdery, and less black. On comparing the finer and more angular portions of the masses with the West India kino, the late Dr. Geo. B. Wood could discover no difference between the two varieties either in color, lustre, taste, or other sensible property. The colors of the powders were also identical. South American kino was found by Dr. Bridges to yield 93·5 per cent. to cold water, and 93 per cent. to alcohol; so that, while it has almost the same solubility as Jamaica kino in alcohol, it is somewhat more soluble in cold water. The aqueous solution, in this case, was not embarrassed by the adhesive matter which impeded the filtration in the former variety; and the want of a minute proportion of resinous matter in the South American kino is the only apparent difference between the two drugs. It is not improbable that they are derived from the same plant; and there is no difficulty in supposing that this may be the *Coccoloba uvifera*, as that tree grows as well upon the continent as in the islands.

4. AFRICAN KINO. The original kino employed by Dr. Fothergill was known to be the product of a tree growing in Senegal, and upon the banks of the Gambia, on the western coast of Africa; but the precise character of the tree was not ascertained until a specimen, sent home by Mungo Park during his last journey, enabled the English botanists to decide that it was the *Pterocarpus erinaceus* of Lamarck and Poiret.* The Edinburgh and Dublin colleges accordingly referred kino in chief to this plant, but, in so doing, overlooked the fact that not one of the varieties now used is brought from Africa. The importation of African kino has long ceased.† It is said to be still used by the Portuguese of Angola, under the name of *Sangue de Drago.*

* A particular account of *Pterocarpus erinaceus* and its concrete juice, with a figure, by Dr. W. F. Daniell, is contained in the *P. J. Tr.* for August, 1854 (vol. xiv. p. 55).

† *Butea gum*, which has sometimes been mistaken for African kino, is the concrete juice of the *Butea frondosa*, or *Dhak-tree* of Hindostan, and also to some extent of *B. superba.* The juice flows from natural fissures, and from wounds made in the bark of the tree, and quickly hardens. It is in small elongated tears, or irregular angular masses, less in size than a grain of barley, apparently black and opaque, but translucent and of a ruby-red color when examined in small fragments by transmitted light; in some specimens the tears are much paler than described, and of a very beautiful ruby tint. Many of the tears have small portions of bark adhering to them. They are very brittle, and readily pulverizable, yielding a reddish powder. They are very astringent to the taste, do not adhere to the teeth when chewed, and tinge the saliva red. The relations of this product to water, alcohol, and other chemical reagents are nearly the same as those of ordinary kino. When freed from impurities, consisting of from 15 to 25 per cent. of wood, bark, sand, etc., it contains, according to Mr. E. Solly, 73·26 per cent. of tannin, 5·05 of soluble extractive, and 21·67 of gum and other soluble substances. It is used in the arts in India, and might undoubtedly be employed as kino in medicine. It is, however, very seldom imported into England, and never, at present, into this country. Dr. Pereira found a quantity in an old drug-store in London, and sent a portion to Guibourt, from which that writer drew up his description of African kino. It is pos-

As described by Fothergill, the African kino, for which he proposed the name of *gummi rubrum astringens Gambinense*, was in lumps of about the size of those of gum Senegal or dragon's blood, and so similar in appearance to the latter that a good judge might easily be deceived. These lumps were hard, brittle, opaque, and almost black; but minute fragments were reddish and transparent like garnet. The drug was inodorous, of a strongly astringent and sweetish taste, and soluble in water to the extent of about five or six parts out of seven, forming a deep red astringent infusion. There can be little doubt that this variety of kino is a concrete juice, which exudes either spontaneously or from wounds in the bark, and hardens in the air. (*Med. Obs. and Inq.*, i. 358.)

5. AUSTRALIAN KINO. BOTANY BAY KINO. This kino has been especially attributed to *Eucalyptus resinifera*, but has been shown by Wiesmer (*P. J. Tr.*, Aug. 1871) to be yielded by at least fourteen species of the genus. The kino is largely gathered by the wood-choppers, who find it in dried masses in crevices in the trees, but is also obtained by incisions into the bark. After such incisions the juice flows very freely, and, according to Mr. White (*White's Voyage*), a single tree is capable of furnishing 500 pounds of kino in one year. Duncan states that in 1802 the deep reddish brown, somewhat viscid fluid juice not only reached England but was common, constituting the finest kino. It is now, however, only occasionally met with in London.* Australian kino usually occurs in dark reddish brown masses or grains, which, when in thin fragments, are translucent and garnet-like. Eucalyptus kino varies in composition according to its source, but contains catechin, pyrocatechin, and kinoïn, and in the best varieties probably equals East Indian kino. According to the *Pharmacographia*, both Botany Bay and Malabar kino give an aromatic odor when treated with hydrochloric acid.

The specimen examined by Pereira was in irregular masses, many of them in the form of tears as large as those of Senegal gum. "The purer pieces were vitreous, almost black in the mass, but transparent and of a beautiful ruby-red in small and thin fragments. Some of the pieces, however, were opaque and dull, from the intermixture of wood and other impurities." This variety of kino is brittle, with a resinous unequal fracture, and yields a reddish brown powder. It is infusible, without odor, of an astringent taste followed by sweetness, and when long chewed adheres to the teeth. (*Duncan.*) It swells up and becomes gelatinous with cold water, yielding a red solution, which gives precipitates with lime-water, gelatin, and sesquichloride of iron, but not with alcohol or tartar emetic. With rectified spirit it also becomes gelatinous, and forms a red tincture, which is not precipitated by water. (*Pereira.*) White states that only one-sixth of this kino is soluble in water; Guibourt found it wholly soluble with the exception of foreign matters; and Dr. Thomson informs us that water at 60° dissolves more than one-half. These writers must have experimented with different substances. According to Dr. Duncan, alcohol dissolves the whole except impurities; and the tincture, with a certain proportion of water, lets fall a copious red deposit, but with a large proportion it only becomes slightly turbid.

It is said that catechu, broken into small fragments, has sometimes been sold as kino. Fortunately, little injury can result from the substitution, as the medical virtues of the two substances are very nearly the same.

Medical Properties and Uses. Kino is powerfully astringent, and in this country is much used for the suppression of morbid discharges. In diarrhœa, not attended with febrile excitement or inflammation, it is often an excellent adjunct to

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sible that the kino which formerly reached us, full of small pieces of wood, bark, etc., may have been the *Butea gum*.

* *Kino juice* has a fine deep red color, a slightly aromatic odor, and a decidedly astringent taste, and on evaporation yields a genuine kino. It is not, however, always equally strong, the richest yielding 40 per cent. of extract. Catechu is sometimes added to it during evaporation. The fraud, however, is revealed by the sweet taste imparted to the mixture.

Prof. Procter examined some liquid Botany Bay kino, with the following results. Evaporated to dryness, it yielded 13 per cent. of solid product, resembling kino in appearance and taste. With reagents it acted like a solution of kino. Dr. Pereira found in Botany Bay kino a peculiar pectin-like substance, which he named *eucalyptin*, a characteristic property of which was that it was precipitated from the tincture by solution of ammonia. (*A. J. P.*, 1859, p. 228.)

opium and the absorbent medicines, and is a favorite addition to the chalk mixture. It is also used in chronic dysentery when astringents are admissible; in leucorrhœa and diabetes; and in passive hemorrhages, particularly those from the uterus and intestines. The dose of the powder is from ten to thirty grains (0·65–1·95 Gm.). The infusion may be made by pouring eight fluidounces of boiling water on two drachms of the extract, and straining when cool. Aromatics may be added, if deemed advisable. The dose is a fluidounce (30 C.c.). The proportion of alcohol in the tincture renders it frequently an unsuitable preparation. Locally applied, kino is often productive of benefit. Its infusion is useful as an injection in leucorrhœa and obstinate gonorrhœa, and thrown up the nostrils we have found it very efficacious in suppressing epistaxis. The powder is also a very useful application to indolent and flabby ulcers.

Off. Prep. Pulvis Catechu Compositus, *Br.;* Pulvis Kino Compositus, *Br.;* Tinctura Kino. *U. S.*

KRAMERIA. *U. S.* *Krameria.* [*Rhatany.*]

(KRẠ-MĒ′RỊ-Ạ.)

"The root of Krameria triandra, Ruiz et Pavon, and of Krameria tomentosa, St. Hilaire. (*Nat. Ord.* Polygalaceæ, Krameriæ.)" *U. S.* "The dried root of Krameria triandra (Ruiz and Pavon, *Flor. Peruv.*). Imported from Peru." *Br.*

Krameriæ Radix, *Br.;* Rhatany Root; Radix Ratanhæ, *P.G.;* Radix Ratanhiæ; Ratanhia, *Fr.;* Ratanhiawurzel, *G.;* Ratania, *It., Sp.*

Gen. Ch. Calyx none. *Corolla* four-petalled; the superior nectary three-parted, and inferior two-leaved. *Berry* dry, echinated, one-seeded. *Willd.*

Krameria triandra. Ruiz and Pavon, *Flor. Peruv.* i. 61. The rhatany plant is a shrub, having a long, much branched, spreading root, of a blackish red color; with a round, procumbent, very dark-colored stem, divided into numerous branches, of which the younger are leafy and thickly covered with soft hairs, giving them a white, silky appearance. The leaves are few, sessile, oblong-ovate, pointed, entire, presenting on both surfaces the same silky whiteness with the young branches. The flowers are lake-colored, and stand singly on short peduncles at the axils of the upper leaves. There are only three stamens. The nectary consists of four leaflets, of which the two upper are spatulate, the lower roundish and much shorter; it does not correspond with the generic character of Willdenow, which was drawn from the *Krameria Ixina.* The fruit is globular, of the size of a pea, surrounded by stiff reddish brown prickles, and furnished with one or two seeds. The name *rhatany* is said to express, in the language of the Peruvian Indians, the creeping character of the plant.

This species of Krameria is a native of Peru, growing in dry argillaceous and sandy places, and abundant about the city of Huanuco. It flowers at all seasons, but is in the height of its bloom in October and November. The root is dug up after the rains. Tschudi states that most of the rhatany now exported is obtained in the southern provinces of Peru, particularly in Arica and Islay. (*Trav. in Peru*, Am. ed., p. 214.)*

* There are two false rhatanies in European commerce. *Savanilla*, or *New Granada Rhatany*, is yielded by the *K. tomentosa*, St. Hil. (*K. Ixina*, var. β), growing in Colombia, British Guiana, and Northern Brazil. According to Flückiger and Hanbury, it is never so knotty and irregular as the true rhatany, and is well distinguished by its dull, purplish brown color, its thick, smooth bark (⅓ to ¼ the diameter of the wood), marked with longitudinal furrows, and here and there with deep transverse cracks, and by the bark not easily splitting off. Its tannic acid is different from that of the Peruvian drug. If the powdered root be shaken with water and reduced iron, filtered, and the liquid diluted with distilled water, an intense violaceous color is produced. *Peruvian Rhatany*, similarly treated, makes a dingy brown. Thin sections of true rhatany, moistened with a ferrous salt, become grayish; Savanilla rhatany, violet. *Para Rhatany* was described by Berg in 1865, and is believed to be the root of *K. Argentea.* It is in long pieces (some 16 to 20 inches), from an eighth to three-quarters of an inch in thickness, of a dark gray or brownish color, and, like the Savanilla, becoming bluish black when immersed in a solution of sulphate of iron, owing to the presence of tannic acid in the bark. In this variety, the root has a peculiar elasticity distinguishing it from the Peruvian and Savanilla varieties. Some of the pieces exhibited numerous corky warts. There are also microscopical characters which distinguish it. Two forms of rhatany which M. Cotton has described as *black and brown Antilles Rhatany*, because produced in these islands, though admitted also to be derived from different places on the neighboring continent, have

We receive rhatany in pieces of various shapes and dimensions, some being simple, some more or less branched, the largest as much as an inch in thickness, derived from the main body of the root, the smallest not thicker than a small quill, consisting of the minute ramifications. The pieces are often nearly cylindrical, and as much as two or three feet in length. Sometimes many of the radicles are united in a common head, which is short, and from half an inch to two inches or more in diameter. The roots are composed of a dark, reddish brown, slightly fibrous, easily separable bark, and a central woody portion, less colored, but still reddish or reddish yellow: "Bark smooth or scaly, deep rust-brown, about one-twelfth of an inch (2 mm.) thick, very astringent, inodorous; wood pale brownish, tough, with fine, medullary rays, nearly tasteless. The root of *Krameria tomentosa* (Savanilla Rhatany) is less knotty and more slender, and has a dark purplish brown bark, about one-eighth of an inch (3 mm.) thick." *U. S.* Rhatany is without smell, but has a bitter, very astringent, slightly sweetish taste, which is connected with its medical virtues, and is much stronger in the cortical than in the ligneous part. The smallest pieces are therefore preferable, as they contain the largest proportion of the bark. The powder is of a reddish color. The virtues of the root are extracted by water and alcohol, to which it imparts a deep reddish brown color. From the researches of Vogel, Gmelin, Peschier, and Trommsdorff, it appears to contain tannic acid, lignin, and minute quantities of gum, starch, saccharine matter, and an acid which Peschier considered as peculiar, and named *krameric acid.* The tannic acid is in three states: 1st, that of purity, in which it is without color; 2d, that of apotheme, in which it has lost its astringency, and been rendered insoluble by the action of the air; and, 3d, that of extractive, which is a soluble combination of tannin and its apotheme, and is the substance which imparts to the infusion and tincture their characteristic reddish brown color. (Soubeiran, *Journ. de Pharm.*, xix. 596.) The tannic acid of rhatany (*krameria-tannic* or *rhatania-tannic acid*) is separated by treating the ethereal extract of the bark with alcohol, and evaporating the alcoholic solution. It gives a dark green precipitate with sesquichloride of iron, a flesh-colored one with gelatin, and none with tartar emetic. (*Gmelin.*) The tannin of rhatany, in the presence of melted potassa, is transformed into *protocatechuic acid* and *phloroglucin*, and with dilute acids gives glucose and a peculiar red coloring principle, called *ratanhia red*, $C_{26}H_{22}O_{11}$. (*Journ. de Pharm. et de Chim.*, Janv. 1868, p. 73.) The proportion of red astringent matter obtained by Vogel was 40 per cent. The mineral acids and most of the metallic salts throw down precipitates with the infusion, decoction, and tincture of rhatany, and are incompatible in prescription.

In examining a specimen of extract of rhatany from America, Wittstein discovered an alkaloid, apparently identical with tyrosine. A somewhat different result was obtained by M. Ruge, who, after an examination, showed that the new alkaloid was not identical with tyrosine, for it has the formula $C_{10}H_{13}NO_3$, whilst that of tyrosine is $C_9H_{11}NO_3$. It was called *ratanhine* by Ruge, and Gintl (*A. J. P.*, 1869, p. 300) obtained ratanhine from *resina d'angelim pedra*, a resin from Brazil. Dr. Kreitmair has also obtained this principle from a sample of extract of rhatany. (See *A. J. P.*, 1875, p. 266.)

Cold water, by means of displacement or percolation, extracts all the astringency of rhatany, forming a clear deep red infusion, which, upon careful evaporation, yields an almost perfectly soluble extract. The root yields its virtues also to boiling water by maceration; but the resulting infusion becomes turbid upon cooling, in consequence of the deposition of apotheme taken up by the water when heated. By boiling with water a still larger proportion of the apotheme is dissolved, and a considerable quantity of the pure tannin becomes insoluble in cold water, and medicinally inert, either by combining with the starch which is also dissolved, or by conversion into apotheme through the agency of the atmosphere. The decoction is, therefore, an ineligible preparation, and the extract resulting from its evaporation, though greater in weight than that from the cold infusion, contains much less soluble and active matter. Alcohol dissolves a larger proportion of the root than water; but

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been pronounced by Dr. Flückiger, after a careful examination, to be identical with the Para rhatany. (*Pharm. Journ.*, July, 1870, p. 84.)

this success is owing to the solution of apotheme, and the alcoholic extract contains little if any more of the astringent principle than that prepared by cold water, while it is encumbered with much inert matter. (See *Extractum Krameriæ.*)

Medical Properties and Uses. Rhatany is generally tonic and powerfully astringent, and may be advantageously given in chronic diarrhœa, passive hemorrhages, especially menorrhagia, some forms of leucorrhœa, and in all those cases in which kino and catechu are beneficial. It has long been used in Peru as a remedy in bowel complaints, as a corroborant in cases of enfeebled stomach, and as a local application to spongy gums. Ruiz, one of the authors of the Peruvian Flora, first made it known in Europe. It was not till after the year 1816 that it began to come into general use. It has the advantage over the astringent extracts imported, that, being brought in the state of the root, it is free from adulteration, and may be prescribed with confidence. The dose of the powder is from twenty to thirty grains (1·3–1·95 Gm.); but the decoction (an ounce to the pint) is preferable; the dose being one or two fluidounces (30 or 60 C.c.). The extract, tincture, and syrup are officinal, and may be given in the dose, the first of fifteen or twenty grains (1–1·3 Gm.), the second of two or three fluidrachms (7·5–11·25 C.c.), and the third of half a fluidounce (15 C.c.). In the form of infusion, tincture, and extract, rhatany has been highly recommended as a local remedy in fissure of the anus, prolapsus ani, and leucorrhœa.

Off. Prep. Extractum Krameriæ; Extractum Krameriæ Fluidum, *U. S.;* Infusum Krameriæ; Pulvis Catechu Compositus, *Br.;* Syrupus Krameriæ, *U. S.;* Tinctura Krameriæ.

LAC. *Br.* *Milk.*

(LĂC.)

"The fresh milk of the Cow, Bos Taurus. Linn." *Br.*

Lac Vaccinum; Lait, *Fr.;* Milch, *G.*

As it is the cow's milk which the British Pharmacopœia exclusively designates by the name of milk, we shall, in the observations that follow, exclude all other varieties of this product from consideration. The natural history, mode of obtaining, and ordinary sensible properties of milk are so well known, that the insertion of them here would be quite superfluous; and we pass on directly to a description of the chemical and physical characters of milk; more especially as a knowledge of these is necessary to a proper understanding of several of the more important properties of milk, as its coagulability, the formation of cream, and the production of butter.

Properties. When examined with the aid of the microscope, milk is seen to contain a vast number of extremely small opaque corpuscles floating in a transparent liquid. These corpuscles have been found to consist of fatty matter surrounded by a very delicate coating of an albuminoid substance. To them the milk owes its opacity and whiteness; and, as they are slightly lighter than the liquid portion, they rise when the milk is allowed to stand, and form a layer on the surface, which is cream. The interior fatty matter, when caused to separate from its envelopes, aggregates in small masses, and forms butter. Thus it is that, in preparing butter, the milk is agitated, by churning or otherwise, so as to break the corpuscular coating. But in the formation of both cream and butter, the residuary liquid still contains a number of unbroken corpuscles, which give it more or less whiteness; and in skimmed milk, notwithstanding the quantity of corpuscles lost, enough remain to give it almost the whiteness and opacity of the milk just from the cow. It has been denied that the corpuscles are really enveloped by a distinct membrane; but the effect of mechanical agency in the preparation of butter seems to afford indisputable proof of the existence of a coating which is broken in the process; and there is chemical proof, which would appear to be not less decisive. Ether dissolves the fatty matter constituting butter; and if a liquid, having oil globules floating in it free, be agitated with ether, the oily matter is dissolved, and the liquid quite deprived of it. Now, if milk be agitated with ether, and the mixture be allowed to stand, the two liquids separate, and the ether rises in consequence of its levity, and floats unaltered on the surface. But if, before the addition of ether, acetic acid, which dissolves the envelopes of the fatty matter, be made to act on the milk, the interior fatty matter of the corpuscles is set free; and then ether added to it takes up the butter thus liberated. (Dumas, *Chem. News*, July 12, 1872, p. 15.)

The composition of normal milk, as given by Fownes, is as follows: in 1000 parts 873 of water, 30 of butter, 48·20 of casein, 43·90 of sugar of milk, 2·31 of phosphate of calcium, 0·42 of phosphate of magnesium, 0·07 of phosphate of iron, 1·44 of chloride of potassium, 0·24 of sodium, and 0·42 of a compound of sodium and casein. (*Chem. News*, Jan. 7, 1870, p. 5.) As milk often constitutes the exclusive diet of infants for months, it must contain all the materials necessary for the support of the body; the butter yielding the fatty matters; the casein, the albuminoid ingredients; the sugar, the saccharine principle with the lactic acid, etc.; the phosphate of calcium, the chief material of the bones; the phosphate of iron, an essential constituent of the blood; both phosphates, phosphorus to the brain; and the various salts mentioned, the saline, alkaline, and acid ingredients.

The following method of estimating the quantity of the different ingredients in milk is given by Dr. C. F. Chandler, of New York. 1. The water may be determined by evaporating a weighed quantity of milk, drying the residue carefully at 100° C. (212° F.), and weighing what remains. The loss represents the water. 2. The salts are estimated by burning all that is combustible in the solid residue, and weighing the ash. 3. To ascertain the proportion of butter and casein, a portion of milk, having been coagulated by a few drops of acetic acid, is boiled; the precipitate is washed with water, and finally the butter is separated by ether, leaving the casein behind. The ethereal solution yields the butter on evaporation. 4. The sugar is generally estimated by deducting the weight of the other ingredients from 100.

The fatty matter of milk, or butter, consists of stearin, palmitin, and olein, with small proportions of butyrin, caproin, and caprin, to which it owes its smell. Butyrin is a compound ether of butyric acid and glyceryl, and is inodorous. On exposure of butter for some time to air, the butyrate of glyceryl is decomposed, and the butyric acid, being set free, causes the disagreeable odor characteristic of rancid butter. The proportion of fatty matter in milk is estimated by Mr. John Horsley by means of the joint solvent powers of alcohol and ether; the mixed menstrua being allowed to stand, and the oil as it rises to the surface removed. For minute particulars, see the *Chemical News* (May 2, 1874, p. 224).[*]

The casein of milk is a peculiar and most important ingredient, bearing a close resemblance to animal albumen, but differing from it slightly in composition, and also in some of its chemical relations with other substances. A little phosphorus is contained in albumen, which has not been found in casein. (*Chem. News*, Jan. 7, 1870, p. 6.) Nevertheless, there is reason for believing that it is the source of all the albuminoid substances in the body, when supported by milk alone.

The sugar of milk is peculiar. (See *Saccharum Lactis.*)

Preservation of Milk. Milk is so important as an article of diet both in health and disease, that ships bound on long voyages have often been supplied with cows in order that this essential article may be supplied. But a much more convenient method is to treat fresh milk in such a manner that it will keep unaltered at least during the time of the voyage. The readiest mode, probably, of effecting this, is to introduce milk into a bottle so that it shall be quite filled, then place the bottle thus filled in a vessel of boiling water for some time, so as to destroy any organic germs, which might cause fermentation, and to expel atmospheric air; next to close the bottle tightly, and make it quite secure against the access of air. To obviate any danger of rupture of the vessel, in consequence of the shrinking of the milk on cooling, it might be well to adopt the plan of the fruit-canners, of using a tin vessel for the purpose of holding the milk, having a closed cover, with an opening capable of being closed by soldering, filling it, exposing it as before to heat; then, when the vapor or gas ceases to escape, soldering and allowing it to cool, and finally unsealing the aperture, filling the vacant space with fresh milk, again heating, and soldering while hot. Milk which had been preserved by Appert's method, and kept thirteen years, was examined by Prof. Bouchardat, and found in three layers, the lowest consisting of a thin white deposit (probably the pellicles of the corpuscles); the middle, which was largest, an aqueous liquid, not perfectly transparent, and of a yellowish color; the third and uppermost a fatty matter, partly liquid at 15 C., which was the butter. When the flask was opened there was a faint odor of boiled milk; and, though the taste of the butter was not agreeable, there was no evidence of putrefaction. (*A. J. P.*, 1871, p. 544.)

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[*] The following method of estimating the quantity of fatty matter in milk, by Mr. F. N. Macnamara (*Chem. News*, May 16, 1873), may be found useful. Take a glass tube of 50 C.c., and, drawing out one end, introduce 10 C.c. of milk, and as much of alcohol and ether. Seal the tube, and keep it for two hours in a water-bath at 180° F. Allow it to cool, break off one end, and permit the fluid portion of its contents to drain into a small flask. Exhaust the residue in the tube by boiling ether, and add the washings to the liquid in the flask. Evaporate the contents of the flask to about 10 C.c.; then, when the flask is cool, add ether, and by means of a separating tube, draw off the ethereal solution of fat from the watery fluid. Let the ethereal solution evaporate to dryness, in a very small weighed beaker; heat to 100° C. (212° F.) in a water oven for two hours, and when cool weigh. Finally test the residue as to its solubility before calculating the result.

Another method of preservation recommended is to add to every litre (2 pints 4 oz.) of unskimmed milk, in a well-annealed glass bottle, 40 centigrammes (about 6 grs.) of bicarbonate of sodium. The bottle containing the milk, being well corked, is placed, for about four hours, in a water-bath heated to 194° F. On being taken out, the bottle is varnished over with tar; and in that state, it is said, the milk it contains will keep sound and sweet for several weeks. (*Chem. News*, 1870, p. 131.) Salicylic acid in minute proportion has also been used successfully as a preservative.

CONDENSED MILK. Various processes have been employed for preparing condensed milk, in a form capable of being preserved for an indefinite time, and of being diluted, at any time when wanted, so as to have the ordinary condition of fresh milk. The following process of M. Martin de Lignac is among the most satisfactory yet made public. Milk immediately from the cow is put in shallow boilers with a flat bottom, to the depth of about two inches, and heated by a water-bath. For every pint of milk an ounce of white sugar is added; and, so long as the heat is continued, the contents of the boilers are constantly stirred, so as to favor evaporation. When the volume is reduced four-fifths, the concentrated liquid is poured into cylindrical cans, the opening of which is hermetically closed by tin solder. The cans are arranged in a boiler constructed like a steam-boiler, so as to support a pressure within, and vapor is introduced at the temperature of 103·5° to 104° C. (218° to 219° F.). As soon as the boxes have thus been exposed to heat, the preparation is completed. When the can is opened, it will be found to be filled with a pasty substance, somewhat translucent, and yellowish white. Diluted with five times its weight of water, this substance has all the exterior and nutritive characters of ordinary milk. When thus exposed, the milk will keep readily ten days or more, especially if a little is taken every day from the can, so as to change the surface in contact with the air. The sugar used contributes to the preservation of the milk. The high temperature employed for a short time contributes greatly to the same end, by destroying the ferments which may be in the milk. M. Payen recommends, when the taste of boiled milk is objectionable, that the evaporation be carried on in vacuo by means of vapor, aided by agitation with mechanical stirrers. (*Journ. de Pharm.*, Mars, 1868, p. 195.) Condensed milk is now consumed in our country on an enormous scale. Unfortunately, a great deal of it is adulterated with white cane sugar, which, from being first used moderately as a preservative, is now largely employed as a make-weight.

Injury from Exposure. Milk is liable to various changes which more or less diminish its value as food or medicine, and, therefore, require to be guarded against. One of these is spontaneous, occurring on the exposure of milk to the air, and at an earlier or later period after being drawn from the cow, according to the weather; the greater the heat, the surer and greater will be the amount of change. The milk becomes sour to the taste and smell, imperfect coagulation takes place, the envelope opens and the oil escapes; and altogether the milk becomes unfit for any delicate use. Against such alterations the milk may be protected if kept in closed glass jars, so as to exclude the air; and it is desirable to keep the jars, to some extent, in as cold a place as convenient.

Microscopic Alteration. There is another injurious change to which milk is often exposed, sooner or later after being taken from the cow; that is, the presence in it of various organic germs or growths, derived generally from the atmosphere. In a paper by M. V. Essling giving the result of his microscopic observations on milk, it is stated that, in less than a day in summer, and in two or three days in winter, after milking, milk, if examined, will be found to contain, among its proper corpuscles, a number of minute spherical or oblong bodies, that rapidly increase, and ultimately become developed into a kind of mushroom growth, which no doubt proves very deleterious to children who live on the milk as food, and may cause some of their infantile diseases. Mr. J. B. Dancer, however, examined milk microscopically with somewhat different results. Of several portions which had been exposed to the air, some time after they had become sour, only one out of three was affected by these organic bodies from the air, and that not till after the third day, when a cup of milk placed in a closet which was known to be favorable to the growth of fungi, was seen to have become affected; patches of mould being visible on its surface, which the microscope proved to be *Mucor Mucedo.* The inference from this latter observation is that little apprehension need be entertained of fresh milk, if not exposed to a bad atmosphere, and even then not till after some days. (*Chem. News*, Jan. 7, 1870. p. 6.)

There can be no doubt that, by being exposed to putrescent effluvia and otherwise bad air, or derived from a diseased cow, milk may become infected with noxious matter, whether chemical or organic, and may thus, when used as food, be the cause of serious disease. In a prevalence of enteric fever in London or its neighborhood, the disease was traced, in the opinion of some, to the use of infected milk.

Adulteration. Milk is liable to adulteration. The most common, and perhaps the most important, is dilution with water. This, within certain limits, is very easily effected, is very difficult to discover, and, moreover, very profitable in a pecuniary point of view. The temptations to its practice are so great and universal, that constant watchfulness is necessary to one who would guard himself against it. Very copious addition of water is recognized at once by the thinness, blueness, and in some degree the translucency of the milk. But much adulteration may take place short of this; and to detect the fraud, it is necessary to prove a decided excess of water; for, even in perfectly normal milk, there is often some disproportion of this ingredient above or below the mean, owing to the mode of living and health of the cow. This deviation, however, is small. Observations made in Sweden by Alexander Muller and Eisenstuck, on a herd of fifteen cows, with daily analysis in every case throughout the year, resulted in the statement that in no instance did the solids of the milk fall short of 11·5 per cent., and only in four instances below 12; while the highest was 14·05; the average being 12·8 per cent. In England, of ten cows, from different parts of the country, the milk of which was examined by Mr. J. Alfred Wanklyn, that of only one contained so little as 11·80 per cent., while the highest was 14·34, and the mean was 12·7. With the aid of these figures it will be easy to detect any considerable amount of adulteration by water; for all besides the amount of solids may be considered as consisting of this fluid. All that is necessary, therefore, is to weigh very carefully a given quantity of milk, say 1000 grains, in thin platinum or silver dishes, and maintain it by means of a water-bath, at the temperature of 212°, for three hours, or until evaporated to dryness. The residue when weighed will give the amount of the solids; and the difference between it and the 1000 grains will be the weight of the water. If the solids fall short of 11·8, the proportion of the deficiency to the whole weight of the milk may be considered as representing the quantity of water added. Other methods of estimating the proportion of water in excess have been based on the specific gravity of the milk, which it was supposed would be lighter than the normal. Upon this principle it was that lactometers were formed. But it has been found that this method is not entirely reliable; as the specific gravity of the milk varies with other causes besides an excess of water; for the removal of the cream increases the density of the milk, the former being the lighter of the two. Starch or farinaceous substances have been used apparently for giving substance to milk rendered too fluid by dilution. This may be detected by the usual reagent for starch; but it must be recollected that, when iodine is added to milk containing starch, it acts on the latter only after the milk has been completely saturated with the iodine, after which the blue color is produced by a further addition of the reagent. Chalk has, we believe, been used in the adulteration of milk, in like manner with the starch, for giving it whiteness and increasing its opacity; but this and all similar mineral bodies may be detected by their subsidence, if insoluble, and by remaining behind, when the milk is incinerated, if more or less soluble. Many methods have been proposed for testing milk. Want of space prevents our making an abstract; the reader is referred to the following accessible sources for further information: *A. J. P.*, 1872, p. 211; 1873, p. 176; 1874, p. 477; 1878, p. 382; 1879, pp. 23, 250, 553; and *N. R.*, April, 1875; 1876, p. 172; 1877, pp. 72, 172, 357; 1880, p. 98; 1881, p. 117.

Medical Properties and Uses. Few remedies are more important than milk for the sick, considered in its relations whether as an article of food or of medicine. In the former capacity, its easy digestibility, nutritious character, and entire want of stimulant or irritant properties, render it peculiarly useful, as an exclusive article of diet, in many cases of chronic irritation or inflammation of the alimentary mucous membrane. In obstinate chronic diarrhœa, chronic dysentery, and chronic gastritis, it will sometimes effect cures, as an exclusive diet, with but little aid from medicine. As a remedy in nausea and vomiting, either alone or attendant on other diseases, milk associated with lime-water in the dose of a tablespoonful of each every half-hour, one, or two hours, according to the severity of the case, has long been esteemed one of our most efficient remedies. In the form of wine-whey it has from time immemorial been used as a gentle stimulant, applicable to febrile diseases beginning to assume a low form; and still later, in conditions of great debility, it is, with brandy, the remedy upon which reliance is placed beyond all others. For the mode of preparing and using wine-whey, see the article on *Vinum*.

Externally milk is much used in making one of the most convenient and effectual emollient applications, that of the bread and milk poultice, prepared by mixing bread thoroughly with boiling hot milk over the fire; a little perfectly fresh lard may often be advantageously applied upon the surface of the poultice when spread, in order to prevent it from becoming dry and sticking to the skin at the edges.

Off. Prep. Mistura Scammonii, *Br.*

LACTUCA. *Br.* *Lettuce.*

(LĂC-TŪ′CẠ.)

"The flowering herb of Lactuca virosa. Linn." *Br.*

Herba Lactucæ, *P.G.;* Herba Lactucæ Virosæ; Laitue vireuse, *Fr.;* Giftlattich, *G.*

LACTUCARIUM. *U. S.* *Lactucarium.*

(LĂC-TU̇-CĀ′RỊ-ŬM.)

"The concrete milk-juice of Lactuca virosa. Linné. (*Nat. Ord.* Compositæ.)" *U. S.*

Lactucarium, *Fr.;* Giftlattichsaft, *G.*

Gen. Ch. Receptacle naked. *Calyx* imbricated, cylindrical, with a membranous margin. *Pappus* simple, stipitate. *Seed* smooth. *Willd.*

The plants of this genus yield when wounded a milky juice, to which, indeed, they owe their generic name. In some of them this juice possesses valuable narcotic properties. This is the case, among others, with *L. sativa*, *L. virosa*, and *L. altissima*. It was supposed that our native *L. elongata*, or *wild lettuce*, might have similar virtues; and Dr. Bigelow was informed by physicians who had employed it, that it acts as an anodyne, and promotes the secretion from the skin and kidneys. But, according to M. Aubergier, the milky juice of this plant is of a flat and sweetish taste without bitterness, contains much mannite, but no bitter principle, and is destitute of narcotic properties. (*Ann. de Thérap.*, 1843, p. 18.) The probability is that it is nearly or quite inert.* Therefore, though formerly holding a place in our national Pharmacopœia, it has been discarded. In Europe *Lactuca scariola* is said to be substituted for the officinal plant.

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* An investigation of our native *Lactuca elongata* by Prof. Maisch has led to conclusions differing essentially from those of M. Aubergier. The milky juice collected by Prof. Maisch himself from plants in his neighborhood, was converted quickly into a gelatinous mass, that shrunk much in drying, and, so far from a flat taste, had a persistent bitterness, and a heavy, nauseous, narcotic odor. Having prepared a syrup from this concrete juice, he gave it for trial to Drs. Da Costa and

Lactuca sativa. Willd. *Sp. Plant.* ii. 1523; *B. & T.* 161. The garden lettuce is an annual plant. The stem, which rises above two feet, is erect, round, simple below, and branching in its upper part. The lower leaves are obovate, rounded at the end, and undulating; the upper are smaller, sessile, cordate, and toothed; both are shining, and of a yellowish green color. The flowers are pale yellow, small, and disposed in an irregular terminal corymb. Before the flower-stem begins to shoot, the plant contains a bland pellucid juice, has little taste or smell, and is much used as a salad for the table; but during the period of inflorescence it abounds in a milky juice, which readily escapes from incisions in the stem, and has been found to possess decided medicinal as well as sensible properties. The juice is more abundant in the wild than in the cultivated plants. The original native country of the garden lettuce is unknown. The plant has been cultivated from time immemorial, and flourishes equally in hot and temperate latitudes. Some botanists suppose that *L. virosa* of the old continent is the parent of all the varieties of the cultivated plant.

Lactuca virosa. Willd. *Sp. Plant.* iii. 1526; Woodv. *Med. Bot.* p. 75, t. 31; *B. & T.* 160. The *acrid* or *strong-scented lettuce* is biennial, with a stem from two to four feet high, erect, prickly near the base, above smooth and divided into branches. The lower leaves are large, oblong-ovate, undivided, toothed, commonly prickly on the under side of the midrib, sessile, and horizontal; the upper are smaller, clasping, and often lobed; the bracts are cordate and pointed. The flowers are numerous, of a sulphur-yellow color, and disposed in a panicle. The plant is a native of Europe.

L. virosa is lactescent, and has a strong disagreeable smell like that of opium, and a bitterish, acrid taste. It was admitted by the late Edinburgh and Dublin Pharmacopœias as one of the sources of lactucarium, which it is said to yield in greater quantity, and of better quality, than the garden lettuce. Mr. Schutz, of Germany, obtained only 17 grains, on the average, from a single plant of the garden lettuce, while a plant of *L. virosa* yielded 56 grains. The British Pharmacopœia recognizes it, but not for the sake of its inspissated juice, which it has discarded.

Lactucarium is chiefly produced in Scotland, in Rhenish Prussia, and in France. According to Mr. Fairgrieve, in Scotland* the plant cultivated is *L. virosa*, var. *montana*. Late in July or early in August the collectors proceed over the field, cutting the head of each stalk and scraping the flow into their vessels. This is repeated several times daily until the plants are exhausted. (*P. J. Tr.*, iii. 972.) M. Aubergier is said to be the only French producer. He cultivates the *L. altissima*, a gigantic Caucasian plant, which reaches the height of 9 feet. In collecting, transverse incisions are made daily, beginning at the top. In Germany the plan is the same as that practised in Scotland.†

Lactucarium,‡ as brought from England, is in small, irregular lumps, about the size of a pea or larger, of a reddish brown color externally, and of a narcotic odor and bitter taste. As prepared near Edinburgh, it is commonly in roundish, compact, and rather hard masses, weighing several ounces. (*Christison.*) A variety, known in our market as *German lactucarium*, is in pieces about an inch and a half by an inch in thickness, four-sided, with one side convex and the three others flat, or slightly concave from shrinking, as if quarter sections of a saucer-shaped cake which had been divided before it was quite dry. The color on the outer or convex surface is darkish brown, that of the cut surfaces light yellowish brown. From experiments by Messrs. Parrish and Bakes, the German appears to be inferior to the English; as

August Muller, who found it decidedly useful, and by the latter physician it was pronounced quite equal to the imported German lactucarium. Nevertheless Prof. Maisch is not prepared to substitute the concrete juice of the American species growing wild, for the German lactucarium from cultivated plants. (*A. J. P.*, 1869, p. 145.)

* For the mode of cultivating and preparing lactucarium in England, see a communication by Mr. Thos. Fairgrieve to *P. J. Tr.*, June, 1873, p. 972.

† For various plans which have been suggested of collecting the drug, see 14th ed. U. S. D.

‡ The *thridace* of Dr. François, at one time supposed to be identical with lactucarium, is in all probability nothing more than the inspissated expressed juice of lettuce, and, indeed, was directed as such in the French Codex of 1837; the leaves being rejected, and the stalks alone, near the flowering period, being subjected to pressure.

44 per cent. of spirituous extract was obtained from the latter, and only 36 per cent. from the former, while the two extracts were about equal in their sensible properties. (*A. J. P.*, 1860, p. 226.) French lactucarium resembles the German, except in being in circular cakes about an inch and a half in diameter. The officinal description is as follows. "In sections of plano-convex, circular cakes, or in irregular, angular pieces, externally gray-brown or dull reddish brown, internally whitish or yellowish, of a waxy lustre." *U. S.* In color, taste, and smell lactucarium bears considerable resemblance to opium, and has sometimes been called *lettuce opium.* It does not attract moisture from the air. It yields nearly half its weight to water, with which it forms a deep brown infusion. It is partly soluble in ether and alcohol. From its resemblance in sensible properties and therapeutical effects to opium, it was conjectured to contain morphine, or some analogous principle; but this conjecture has not yet been verified. Buchner, Aubergier, and Walz claim severally to have discovered the active principle, which has been named *lactucin;* but the substances obtained by these different chemists are not exactly identical in properties; and the lactucin of Walz and Aubergier is considered by M. Lenoir as owing its bitterness to impurities, separated from which it is without taste and inert. It is at least doubtful whether the constituent upon which the medical virtues of lactucarium depend has yet been isolated. For want of space we give in a note the results of various analyses of the lactucarium obtained from *Lactuca virosa.**

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* Buchner published experiments on lactucarium in 1832. His results are not essentially different from those subsequently obtained. The principle, named by him *lactucin*, was bitter, soluble in water, more soluble in alcohol, less so in ether, without alkaline reaction though precipitated by tannic acid, destitute of nitrogen, capable of forming with acids very soluble bitter combinations, and not easily obtained perfectly white and crystallized. (See *P. J. Tr.*, vii. 74.)

Dr. Walz, in 1839, gave the following constituents of lactucarium from *L. virosa;* viz., a peculiar principle denominated *lactucin*, volatile oil, a fatty matter easily dissolved by ether, and another of difficult solubility in that fluid, a reddish yellow tasteless resin, a greenish yellow acrid resin, common sugar, uncrystallizable sugar, gum, pectic acid, a brown humus-like acid. a brown basic substance, albumen, oxalic, citric, malic, and nitric acids, potassa, lime, and magnesia. Lactucin, as obtained by Walz, is in yellow crystalline needles, inodorous, of a strong and durable bitter taste, easily fusible, soluble in from 60 to 80 parts of cold water, freely soluble in alcohol, less so in ether, soluble in very dilute acids, and without alkaline or acid reaction. (*Annal. der Pharm.*, xxxii. 97.) It was obtained by treating lactucarium with alcohol acidulated with one-fifteenth of concentrated vinegar, adding an equal volume of water, precipitating by subacetate of lead, separating the excess of lead by sulphuretted hydrogen, filtering, evaporating by a gentle heat, treating the residuum by ether, and allowing the solution to evaporate.

M. Aubergier, in his memoir presented to the French Academy in 1842, gives the following as the result of his analysis:—1, a bitter crystallizable substance (*lactucin*), soluble in alcohol and boiling water, scarcely soluble in cold water, insoluble in ether, without alkaline reaction, and supposed to be the active principle; 2, mannite; 3, asparamide; 4, a crystallizable substance having the property of coloring green ferric salts; 5, an electro-negative resin, combined with potassa; 6, a neutral resin; 7, ulmate of potassium; 8, cerin, myricin, pectin, and albumen; 9, oxalate, malate, nitrate, and sulphate of potassium, chloride of potassium, phosphate of calcium and magnesium, oxides of iron and manganese, and silica. The bitter principle above referred to separates from its solution in boiling water, upon cooling, in pearly scales. By the action of alkalies it loses its bitterness, which is not restored by acids. The lactescence of the fresh juice of lettuce is owing to a mixture of wax and resin, and not to caoutchouc. The bitter principle of Aubergier differs from that of Dr. Walz in being less soluble in cold water, and insoluble in ether.

M. Lenoir considers the lactucin of these two chemists as impure, and denies that it is the active principle, which, he thinks, is probably an alkaloid. He obtained the lactucin pure by treating the lactucarium of *L. virosa* with boiling alcohol, and filtering while hot. It was deposited on the cooling of the liquid, and afterwards purified by frequent crystallization from alcohol, and treatment with animal charcoal. Thus obtained, it was without taste or smell, and without effect upon the system. It was nearly insoluble in water, but readily dissolved by alcohol, ether, and the volatile and fixed oils. He proposed to name it *lactucone*, leaving the former name for the active principle when isolated. (*Ann. de Chim. et de Phys.*, Feb. 1847.) According to Walz, the lactucone of Lenoir is only the fatty matter discovered by himself. Thieme could not divide this into the two kinds noticed by Walz as differing in their solubility in ether, and, considering it as peculiar, proposed for it the name of *lactucerin.*

A later analysis of lactucarium is by Ludwig. This chemist found, in 100 parts, 48·63 of substances insoluble in water, and 51·37 of those soluble in water. Of the insoluble matter 42·64 parts were of *lactucerin* or *lactucone*, which he obtained by first exhausting lactucarium with water, then treating the insoluble residue several times with hot alcohol of 0·833, allowing the alcoholic solution to evaporate slowly, washing the yellowish substance thus procured with water, and purifying it by re-solution in alcohol, and crystallization. Thus obtained, it is in snow-white aggregated granules, dissolves in strong hot alcohol which deposits it on cooling, is readily soluble in ether but insoluble in water, becomes transparent and tenacious when moderately heated in a platinum dish, melts completely at a higher heat with the escape of white odorous vapors, is incapable of saponification by caustic potassa, and is therefore not properly a fat, and in alcoholic solution

Medical Properties and Uses. That lettuce possesses soporific properties is a fact which was known to the ancients; but the credit belongs to the late Dr. J. R. Coxe, of Philadelphia, of having first proposed the employment of its inspissated milky juice as a medicine. Dr. Duncan, senior, of Edinburgh, afterwards paid particular attention to the subject, and, in his treatise on pulmonary consumption, recommended lactucarium as a substitute for opium, the anodyne properties of which it possesses, without being followed by the same injurious effects. From this recommendation, the medicine came into extensive use, and was adopted as officinal in several of the Pharmacopœias. The general inference which may be drawn from the recorded experience in relation to lactucarium is, that it has, in a very much inferior degree, the anodyne and calming properties of opium, without its disposition to excite the circulation, to produce headache and obstinate constipation, and to derange the digestive organs. In this country the medicine is occasionally employed to allay cough, and quiet nervous irritation. It may be given in all cases in which, while opium is indicated in reference to its anodyne or soothing influence, it cannot be administered from idiosyncrasy of the patient. It is, however, very uncertain. The dose is from five to fifteen or twenty grains (0·33 to 1 or 1·3 Gm.). An alcoholic extract would be a good preparation. The officinal fluid extract and syrup are useful preparations.

Water distilled from lettuce (*eau de laitue*) is used in France as a mild sedative, in the quantity of from two to four ounces. The fresh leaves boiled in water are sometimes employed in the shape of cataplasm. It is said that in Egypt a mild oil is derived from the seeds, fit for culinary use.

Off. Prep. of Lactuca, *Br.* Extractum Lactucæ, *Br.*

Off. Prep. of Lactucarium, *U. S.* Extractum Lactucarii Fluidum, *U. S.;* Syrupus Lactucarii, *U. S.*

LAPPA. *U. S.* *Lappa.* [*Burdock.*]

(LĂP′PẠ.)

Radix Bardanæ, *P. G.;* Bardane, *Fr.;* Klettenwurzel, *G.*

"The root of Lappa officinalis. Allioni. (*Nat. Ord.* Compositæ.)" *U. S.*

This drug seems to us of such trivial importance that the reader is referred to Part II. for its consideration. There is no officinal preparation of it. It is officinally described as

"About twelve inches (30 cm.) or more long, and about one inch (25 mm.) thick; nearly simple, fusiform, fleshy, longitudinally wrinkled, crowned with a tuft of whitish, soft, hairy leaf-stalks; gray-brown, internally paler; bark rather thick, the inner part and the soft wood radially striate, the parenchyma often with cavities lined with snow-white remains of tissue; odor feeble and unpleasant; taste mucilaginous, sweetish and somewhat bitter." *U. S.*

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faintly reddens litmus paper. Besides this principle there were 3·99 parts of *wax*, and 2·00 of *lignin* and of a substance which swelled in ammonia, and was insoluble in water, alcohol, and ether. Of the 51·37 parts soluble in water, 6·98 were *albumen*, 1·75 *lactucerin* held in solution by other substances, 27·68 *bitter extract soluble in water and in alcohol*, and 14·96 *watery extract* insoluble in alcohol of 0·830. The former of these extracts was found to contain a peculiar acid substance called *lactucic acid*, and the lactucin of Aubergier. To obtain these principles, 80 parts of lactucarium, in fine powder, were triturated with 80 of pure cold diluted sulphuric acid, and then mixed with 400 parts of alcohol of 0·851; the liquor was filtered, shaken with hydrate of lime till it yielded no precipitate with baryta-water or oxalate of potassium, then decolorized with pure animal charcoal, and evaporated; the brown tenacious mass thus obtained (alcoholic extract) was treated with boiling water, which left behind a viscid substance; the aqueous solution was treated with animal charcoal, and on being evaporated yielded a mixture of lactucic acid and lactucin; these were separated by dissolving the mixture in boiling water, which on cooling deposited the latter in white crystalline scales, and gave up the former on subsequent evaporation. *Lactucic acid* is of difficult crystallization, light yellow, strongly bitter, without sour taste, of an acid reaction, and readily soluble in alcohol and water. It has as much claim as any other discovered substance to be considered the active principle of lactucarium. *Lactucin*, purified by animal charcoal, is in white pearly scales, the solution of which exhibits no reaction with subacetate of lead, or solution of iodine. It is dissolved without change of color by concentrated sulphuric acid. Besides the above ingredients, Ludwig found also in lactucarium *a substance resembling mannite, oxalic acid, another organic acid* not well determined, *a soft resin, potassa, magnesia*, and *oxide of iron*. Distilled with diluted sulphuric acid, it gave an acid product smelling like lactucarium, which, saturated with carbonate of calcium, and again distilled with bisulphate of potassium, yielded an acid fluid having the odor of valerian. (*A. J. P.*, xx. 57.)

LARICIS CORTEX. *Br.* *Larch Bark.*

(LA̤-RĪ′CĬS CŎR′TĔX.)

"The bark, deprived of its outer layer, of Larix Europæa, D. C.; Abies Larix, Rich.; the common Larch." *Br.*

Écorce de Mélèze, *Fr.;* Lärchenrinde, *G.*

For the botanical history of the *Larix Europæa*, see *Terebinthina.*

Examined by Prof. Aldridge, Larch Bark was found to contain gum, starch, resin, and tannic acid of the kind which precipitates the salts of iron olive-green. Dr. John Stenhouse has obtained from it a peculiar volatile principle, which he has not found in other trees of the Pine family, and which, as it has acid properties, though extremely feeble, he proposes to name *larixinic acid* (*larixine*). It is obtained by evaporating an infusion of the bark to the consistence of syrup, and submitting the residue to distillation in a glass retort or silver alembic, by means of a sand-bath cautiously heated. A portion of the larixinic acid comes over and condenses in crystals, but the greater part is dissolved in the liquid distillate. This on careful distillation deposits the impure acid, which may be purified by pressing it in bibulous paper, again crystallizing from a strong watery solution, and lastly subliming once or twice. Larixinic acid is most abundant in the young bark. It is in beautiful white, lustrous crystals, often more than an inch long, of a peculiar somewhat empyreumatic smell, and a slightly bitter and astringent taste, inflammable, volatilizing at 93° C. (199·4° F.) and melting at 153° C. (307·4° F.), soluble in 87·88 parts of water at 56° F., very soluble in boiling water, soluble in cold but much more so in hot alcohol, and sparingly soluble in ether. It readily crystallizes from its solutions. A very singular and characteristic property is that of forming, when added, in strong solution, in excess, to baryta-water, a bulky, transparent, gelatinous precipitate, occupying the whole measure of the liquids if concentrated. The probable formula of the acid is $C_{10}H_{10}O_5$.

Medical Properties and Uses. The inner larch bark possesses astringent and gently stimulant properties, and is supposed to have a special tendency to the mucous membranes. It has been found particularly efficacious in purpura and other hemorrhagic affections, especially hæmoptysis, and has been given in bronchitis with copious expectoration, and in diseases of the urinary passages. It has been used also, mixed with soap and glycerin, as a local remedy in psoriasis, chronic eczema, and other cutaneous affections. The usual forms of exhibition are those of extract * and tincture, the former in the dose of from three to five grains (0·20 to 0·33 Gm.), the latter from thirty minims to a fluidrachm (1·9 to 3·75 C.c.) or more, every three or four hours.†

Off. Prep. Tinctura Laricis, *Br.*

LAURO-CERASI FOLIA. *Br.* *Cherry-laurel Leaves.*

(LÂU′RŌ–CĔR′A̤-SĪ FŌ′LI̤-A̤.)

"The fresh leaves of Prunus Lauro-cerasus, Linn.; the Common or Cherry Laurel." *Br.* (*Nat. Ord.* Amygdalaceæ.)

Laurier cerise, *Fr.;* Kirschlorbeer, *G.;* Lauro-ceraso, *It.*

Gen. Ch. Differing from Prunus only in its fruit being destitute of bloom, with the stone round instead of acute, and the leaves when in bud folded flat, not rolled up. (Lindley, *Flor. Med.*, 232.)

Cerasus Lauro-cerasus. De Cand. *Prodrom.* ii. 540.—*Prunus Lauro-cerasus.* Willd. *Sp. Plant.* ii. 988; *B. & T.* 98. This is a small evergreen tree, rising 15 or 20 feet, with long spreading branches, which, as well as the trunk, are covered with a smooth, blackish bark. The leaves, standing alternately on short strong footstalks, are oval-oblong, from five to seven inches in length, acute, finely toothed, firm, coriaceous, smooth, beautifully green and shining, with oblique nerves, and yellowish glands at the base. The flowers are small, white, strongly odorous, and disposed in simple axillary racemes. The fruit is an oval drupe, very similar in shape and structure to a small black cherry.

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* The extract may be made according to the U. S. formula for extract of rhubarb.

† From *Dub. Hosp. Gaz.*, April 15, 1858, and Jan. 15, 1859; *Med. Times and Gaz.*, Nov. 1859, p. 476; and *A. J. P.*, Nov. 1862, p. 556, etc.

The cherry-laurel is a native of Asia Minor, but is cultivated in Europe, both for medical use and for the beauty of its shining evergreen foliage. Almost all parts of it are more or less impregnated with the odor of hydrocyanic acid.

In their recent and entire state cherry-laurel leaves have scarcely any smell; but, when bruised, they emit the characteristic odor of the plant in a high degree. Their taste is somewhat astringent and strongly bitter, with the flavor of the peach kernel. By drying they lose their odor, but retain their bitterness. They yield a peculiar oil and hydrocyanic acid by distillation with water, which they strongly impregnate with their flavor. One pound, avoirdupois, of the fresh leaves yields 40·5 grains of the oil. (*Centralb.*, 1855, p. 205.) The oil resembles that of bitter almonds, for which it is said to be sometimes sold in Europe, where it is employed to flavor liquors and various culinary preparations; but, as it is highly poisonous, danger may result from its careless use. It has not been determined how far the mode of production of this oil resembles that of bitter almonds. (See *Amygdala Amara.*) Chemists have failed in obtaining amygdalin from the leaves. That the oil exists already formed, to a certain extent, in the fresh leaves, is rendered probable by the fact, stated by Winckler, that they yield it in considerable quantity when distilled without water. (*Journ. de Pharm.*, xxv. 195.) The fresh leaves are used to flavor milk, cream, etc., and more safely than the oil; though they also are poisonous, when too largely employed. (See *Aqua Lauro-Cerasi.*)

Medical Properties and Uses. The leaves of the cherry-laurel possess properties similar to those of hydrocyanic acid; and the water distilled from them is much employed in various parts of Europe for the same purposes as that active medicine. But it is deteriorated by age, and therefore, as kept by pharmacists, must be of variable strength. Mr. J. Bröker, a Dutch pharmacologist, has satisfied himself, by numerous experiments, that the proportion of hydrocyanic acid in the leaves varies with the season, the age of the plant, the character of the soil and of the weather, and thinks that, in consequence of this variability, they are inferior for medical use to bitter almonds, which in this respect have a more uniform composition. He found the proportion of the acid in the leaves greatest in July, and least in February. (*B. and F. Med.-Chir. Rev.*, Oct. 1868, p. 517.) It is not, therefore, to be regretted that the want of the plant in this country has prevented the general introduction of so variable a remedy as the distilled water.

Off. Prep. Aqua Lauro-cerasi, *Br.*

LAVANDULA. *U. S.* *Lavender.*

(LA-VĂN′DŪ-LA.)

"The flowers of Lavandula vera. De Candolle. (*Nat. Ord.* Labiatæ.") *U. S.*

Flores Lavandulæ, *P. G.;* Lavender Flowers; Lavande, Fleurs de Lavande, *Fr.;* Lavandelblumen, Lavandelblüthen, *G.;* Lavandola, *It.;* Espliego, Alhucema, *Sp.*

Gen. Ch. Calyx ovate, somewhat toothed, supported by a bract. *Corolla* resupine. *Stamens* within the tube. *Willd.*

Lavandula vera. De Cand. *Flor. Fr. Sup.* p. 398.—*L. Spica.* Willd. *Sp. Plant.* iii. 60; Woodv. *Med. Bot.* p. 321, t. 114; *B. & T.* 199. The *Lavandula Spica* of Linnæus includes two distinct species, which were considered by him merely as varieties of the same plant, but have been separated by subsequent botanists. Of these, the officinal plant, the narrow-leaved variety of Linnæus, has been denominated by De Candolle *L. vera*, while the broad-leaved variety still retains the title of *L. Spica.* The latter is scarcely cultivated in the United States.

Common lavender is a small shrub, usually not more than two or three feet high, but sometimes as much as six feet. The stem is woody below, and covered with a brown bark; above, is divided into numerous, slender, straight, herbaceous, pubescent, quadrangular branches, furnished with opposite, sessile, narrow, nearly linear, entire, and green or glaucous leaves. The flowers are small, blue, and disposed in interrupted whorls around the young shoots, forming terminal cylindrical spikes. Each whorl is accompanied with two bracts. The corolla is hairy, glandular on the outside, tubular, and labiate, with the lower lip divided into three segments, the upper larger and bifid. The four stamens are within the tube. The calyx is tubular, blue-gray, hairy, five-toothed, the upper tooth largest and roundish rhomboid.

The plant is a native of Southern Europe, and covers vast tracts of dry and barren land in Spain, Italy, and the south of France. In England it is very largely cultivated for commercial purposes, often covering many acres. For method of culture, see *Bost. Med. and Surg. Journ.*, Aug. 1873, p. 165. It is cultivated in our gardens, and in this country flowers in August. It is said that in fields, when too thickly planted, it is apt to suffer from a disease consequent on the noxious influence of its own aroma, which is relieved by thinning the plants. (*P. J. Tr.*, x. 119.) All parts of it are aromatic. The spikes should be cut when they begin to bloom. Lavender flowers have a strong fragrant odor, and an aromatic, warm, bitterish taste. They retain their fragrance long after drying. Alcohol extracts their virtues; and a volatile oil upon which their odor depends rises with that liquid in distillation. The oil may be procured separate by distilling the flowers with water. (See *Oleum Lavandulæ.*) Hager obtained from a pound of the fresh flowers from half a drachm to two drachms of the oil.

Medical Properties and Uses. Lavender is an aromatic stimulant and tonic, esteemed useful in certain conditions of nervous debility, but seldom given in its crude state. The products obtained by its distillation are much used in perfumery, and as adjuvants to other medicines, which they render at the same time more acceptable to the palate, and cordial to the stomach.

Off. Prep. Oleum Lavandulæ; Vinum Aromaticum, *U. S.*

LEPTANDRA. *U. S.* *Leptandra.* [*Culver's Root.*]

(LẸP-TĂN′DRẠ.)

"The rhizome and rootlets of Leptandra virginica. Nuttall. (Veronica virginica, Linné. *Nat. Ord.* Scrophulariaceæ.)" *U. S.*

Culver's Physic, Black Root; Racine de Leptandra, s. de Véronique de Virginie, *Fr.;* Leptandra-Wurzel, *G.*

Gen. Ch. Calyx five-parted, segments acuminate. *Corolla* tubular-campanulate, border four-lobed, a little ringent, unequal, the lower lamina narrower. *Stamens* and at length the *pistils* much exserted; filaments below, and tube of the corolla pubescent. *Capsule* ovate, acuminate, two-celled, many-seeded, opening at the summit. *Nuttall.*

The genus Leptandra was separated by Nuttall from the Veronica of Linnæus; and, though the new genus is not generally admitted and is probably not distinct, it is retained here, following the U. S. Pharmacopœia.

Leptandra Virginica. Nuttall, *Genera of N. Am. Plants,* i. 7; Rafinesque, *Med. Flora*, vol. ii.—*Veronica Virginica*, Linn.; Gray, *Man. of Bot. etc.* p. 290. This plant, commonly called *Culver's root*, or *Culver's physic*, is an herbaceous perennial, with a simple, erect stem, three or four feet high, smooth or downy, furnished with leaves in whorls, and terminating in a long spike of white flowers. The leaves, of which there are from four to seven in each whorl, are lanceolate, pointed, and minutely serrate, and stand on short footstalks. A variety was seen by Pursh with purple flowers, which was described and figured as a distinct species by Rafinesque, under the name of *L. purpurea.* The plant flowers in July and August. It grows throughout the United States east of the Mississippi, affecting mountain meadows in the South, and rich woods in the North, and is not unfrequently cultivated.

Properties. The root consists of a rhizome or root-stalk several inches in length, sometimes branched, with numerous long slender radicles. As found in commerce, the rhizome is usually broken into pieces an inch or more long, from two to four lines in thickness, either beset with the rootlets or very rough from their remains when broken, very hard and firm, and of difficult fracture, dark brown externally, light colored and ligneous within. The rootlets are round, smooth, slender, generally broken, but, when not so, six inches or more in length, and almost black, being much darker colored than the caudex. The officinal description is as follows. "Horizontal, from four to six inches (10 to 15 cm.) long, and about a quarter of an inch (6 mm.) thick, somewhat flattened, bent and branched, deep blackish brown, with cup-shaped scars on the upper side, hard, of a woody fracture, with a thin, blackish bark, a hard, yellowish wood, and a large, purplish brown, about six-rayed pith; rootlets thin, wrinkled, very fragile; inodorous; taste bitter and feebly acrid." *U. S.* The odor is feeble and not disagreeable, the taste bitterish, somewhat nauseous, and feebly acrid. Water and alcohol extract the virtues of the root. According to Prof. E. S. Wayne, of Cincinnati, it contains volatile oil, extractive, tannin, gum, resin, and a peculiar crystalline principle, to which the virtues of the medicine may be ascribed. To this principle the name of *leptandrin* properly belongs. Prof. F. F. Mayer confirmed the presence of the crystalline principle, and proved it to be a glucoside. Prof. Wayne obtained it by treating an infusion of the root with subacetate of lead, filtering, precipitating the excess of lead by carbonate of sodium, filtering to separate the carbonate of lead, passing the filtered liquid through animal charcoal which absorbed all the active matter, washing the charcoal with water till the washings began to be bitter, then treating it with boiling alcohol, and allowing the alcoholic solution to evaporate spontaneously. By dissolving the powder thus obtained in water, treating this with ether, and allowing the ether to evaporate, needle-shaped crystals were obtained, which had the bitter taste of the root. The resinous matter obtained by making a tincture of the root and precipitating this with water, has been improperly called leptandrin, and considered the active principle. The pure resin is probably inert; and the preparation referred to owes what activity it may possess to some of the true leptandrin associated with it. Leptandrin is soluble in water, alcohol, and ether. It has not been isolated for use. (*Proc. A. P. A.*, 1856, p. 34.) Subsequently Mr. Wayne obtained from the root a saccharine principle, having the properties of *mannite.* (*A. J. P.*, 1859, p. 557.) The chemistry of leptandra needs further investigation.

Medical Properties. The recent root is said to act violently as a cathartic, and sometimes as an emetic. In the dried state it is much milder, but less certain. The practitioners calling themselves Eclectics consider it an excellent cholagogue, and use both the impure resin, which they call leptandrin, and the root itself as a substitute for mercurials.* Dr. A. P. Dutcher, of Cleveland, Ohio, has not found it to act decidedly on the liver, but believes that it has a special influence on the muciparous follicles of the intestines, and acts very advantageously in cases of duodenal indigestion and chronic constipation. (*Med. and Surg. Rep.*, March 28, 1868.) Prof. Rutherford, in his experiments upon dogs, found leptandrin to act rather feebly upon the liver. The full cathartic dose of the powder is from twenty grains to a drachm (1·3–3·9 Gm.); that of the impure resin referred to, from two to four grains (0·13–0·26 Gm.). Dr. J. Adolphus says that, in the dose of one or two grains (0·065–0·13 Gm.), the powder acts like rhubarb. On the same authority, from five to ten drops (0·3–0·6 C.c.) of a strong tincture, given every two hours, produce a mild aperient effect. (*Ibid.*, Jan. 11, 1868, p. 23.)

Off. Prep. Extractum Leptandræ, *U. S.;* Extractum Leptandræ Fluidum, *U. S.*

LIMONES. *Lemons.*

(LỊ-MŌ′NĒṢ.)

"The fruit of Citrus Limonum."

Limons, Citrons, *Fr.;* Limonen, Citronen, *G.;* Limoni, *It.;* Limones, *Sp.*

LIMONIS CORTEX. *U. S., Br.* *Lemon Peel.*

(LỊ-MŌ′NĬS CŎR′TĔX.)

"The rind of the recent fruit of Citrus Limonum. Risso. (*Nat. Ord.* Aurantiaceæ.)" *U. S.* "The outer part of the rind of the fresh fruit of Citrus Limonum. D. C. Lemons are imported from Southern Europe." *Br.*

Cortex Fructus Citri, *P.G.;* Écorce (Zeste) de Citron, de Limon, *Fr.;* Citronenschale, Limonenschale, *G.*

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* Prof. J. U. Lloyd communicated a process for resin of leptandra (or leptandrin) to the Amer. Pharm. Association in 1880. (See *A. J. P.*, 1880, p. 491.)

LIMONIS SUCCUS. *U.S., Br.* *Lemon Juice.*

(LĪ-MŌ'NĬS SŬC'CŲS.)

"The freshly expressed juice of the ripe fruit of Citrus Limonum. Risso. (*Nat. Ord.* Aurantiaceæ.)" *U. S.* "The freshly expressed juice of the ripe fruit of Citrus Limonum. D. C." *Br.*

Succus Citri; Lime Juice; Suc de Citron (de Limon), *Fr.;* Citronensaft, Limonensaft, *G.*

For some general remarks on the genus CITRUS, see *Aurantii Cortex.*

Citrus medica. Willd. *Sp. Plant.* iii. 1426; Woodv. *Med. Bot.* p. 582, t. 189. This tree closely resembles *Citrus Aurantium,* before described. The leaves, however, are larger, slightly indented at the edges, and stand upon footstalks which are destitute of the winged appendages that characterize the other species. The flowers, moreover, have a purplish tinge on their outer surface, and the fruit is entirely different in appearance from the orange. There are several varieties of *Citrus medica,* which some botanists consider as distinct species, but which scarcely differ except in the character of their fruit. Those particularly deserving of notice are the citron, lemon, and lime. 1. In the *citron, C. medica* of Risso (*Bentley & Trimen,* p. 53), the fruit is very large, sometimes six inches in length, ovoidal, with a double rind, of which the outer layer is yellowish, thin, unequal, rugged, with innumerable vesicles filled with essential oil; the inner is white, very thick, and spongy. It is divided in the interior into nine or ten cells, filled with oblong vesicles, which contain an acid juice precisely like that of the lemon, and used for the same purposes. The rind is applied to the preparation of conserves, to which it is adapted by its thickness. The fruit is called *cédrat* by the French. 2. The *lemon* (*C. medica,* var. *limon* of Linn., *Citrus Limonium* of Risso) (*Bentley & Trimen,* p. 54) is smaller than the preceding, with a smoother and thinner rind, a pointed nipple-shaped summit, and a very juicy, acid pulp. In other respects it closely resembles the citron, to which, however, it is usually preferred in consequence of the greater abundance of its juice. 3. The *lime* is still smaller than the lemon, with a smoother and thinner rind, oval, rounded at the extremities, of a pale yellow or greenish yellow color, and abounding in a very acid juice, which renders it highly useful for the purposes to which the lemon is applied. It is the product of the variety *C. acris* of Miller.

The *Citrus medica,* like the orange-tree, is a native of Asia. It is now known to grow wild in Northern India, and was introduced into Europe from Persia or Media. It was first cultivated in Greece, afterwards in Italy, so early as the second century, and has now spread over the whole civilized world, being raised by artificial heat where the climate is too cold to admit of its exposure during winter to the open air.

We are supplied with lemons and limes chiefly from the West Indies and the Mediterranean. Though the former of these fruits only is directed by the United States Pharmacopœia, both kinds are employed indiscriminately for most medicinal purposes; and the lime affords a juice at least equal, in proportional quantity and acidity, to that obtained from the lemon.

As lemons rapidly deteriorate on keeping, if exposed to the air, the suggestion of protecting them by a varnish of shellac dissolved in alcohol, made by Mr. George Mee, of London, is not without value. Mr. Mee found that lemons thus covered with varnish continued sound for many months. (See *A. J. P.*, 1866, p. 474.)

Properties. The exterior rind of the lemon has a fragrant odor, and a warm, aromatic, bitter taste, somewhat similar to that of the orange, though less agreeable. It is usually found in narrow, thin bands, with very little of the spongy, white, inner layer adhering to it. It contains a bitter principle, and yields, by expression or distillation, an essential oil, which is much used for its flavor. Both this and the rind itself are recognized in the Pharmacopœias. (See *Oleum Limonis.*) When the white spongy portion of the rind is boiled in water, and the decoction evaporated, crystals are deposited, of a substance called *hesperidin.* This is a glucoside, and has the formula $C_{22}H_{26}O_{12}$, and is decomposed by dilute acids into hesperetin, $C_{16}H_{14}O_6$, and glucose, $C_6H_{12}O_6$. It turns dingy black when gently warmed with alcoholic solution of ferric chloride. It is bitter, but, as it is found most largely in the spongy and comparatively tasteless part of the rind, it may be doubted whether it is entitled to be considered as the active bitter principle. (See *A. J. P.*, xxvi. 553.) Lemon peel yields its virtues to water, wine, and alcohol.

The juice is the part for which the fruit is most esteemed. It is sharply acid, with a peculiar grateful flavor, and consists chiefly of citric acid (some 10 per cent.), gum and sugar (3 to 4 per cent.), and inorganic salts (2·28 per cent.). It sometimes has in it a little volatile oil, derived by pressure from the rind. The U. S. P. gives the following standard tests. "Sp. gr. not less than 1·030. On evaporating a portion of the juice to dryness and igniting the residue, not more than 0·5 per cent. of ash should remain. Fresh Lemon Juice contains about 7 per cent. of citric acid." *U. S.* As lemons cannot always be obtained, the juice is often kept in a separate state; but, from its liability to spontaneous decomposition, it speedily becomes unfit for medical use; and, though various means have been resorted to for its preservation, it can never be made to retain for any length of time its original flavor unaltered. The best substitute for lemon juice is a solution of crystallized citric acid in water, in the proportion of about an ounce to the pint, with the addition of a little oil of lemon, but even this solution is nearly useless as an antiscorbutic. One of the most effectual methods of preserving the juice is to allow it to stand for a short time after expression, till a coagulable matter separates, then to filter, and introduce it into glass bottles, with a stratum of almond oil or other sweet oil upon its surface. It will keep still better, if the bottles containing the filtered juice be suffered, before being closed, to stand for fifteen minutes in a vessel of boiling water. Another mode is to add one-tenth of alcohol, and to filter. The juice may also be preserved by concentrating it either by evaporation with a gentle heat, or by exposure to a freezing temperature, which congeals the watery portion, and leaves the juice much stronger than before. When used, it may be diluted to the former strength; but, though the acid properties are retained, the flavor of the juice is found to have been deteriorated. Lemon syrup is another form in which the juice is preserved.

The British Pharmacopœia gives the average sp. gr. of lemon juice at 1·039, and the average quantity of citric acid in a fluidounce of it, 32·5 grains. According to Mr. W. W. Stoddart, these quantities do not correspond, the sp. gr. being too great for the weight of the acid. Mr. Stoddart himself found, in lemons from six different sources, an average of 42·53 grains in an ounce of the juice, and a mean sp. gr. of 1·044. By other authorities the proportions are given very differently. Thus Mr. Watts gives 20·5 grains to the ounce, or 4·7 per cent. of the juice. But the fact is that the quantity of acid varies very greatly. Mr. Stoddart found it to diminish rapidly with the advance of summer, with little change in the sp. gr. (*P. J. Tr.*, Oct. 1868, p. 203.)

A solution of tartaric acid in water, with the addition of a little sulphuric acid, and flavored with the oil of lemons, has been fraudulently substituted for lemon juice, particularly as an antiscorbutic on long voyages, for which purpose it is quite useless. An application of the tests for tartaric and sulphuric acid will at once detect the fraud.

Medical Properties and Uses. The rind of the lemon is sometimes used to qualify the taste and increase the power of stomachic infusions and tinctures. The juice is refrigerant, and, properly diluted, forms a refreshing and agreeable beverage in febrile and inflammatory affections. It may be given with sweetened water in the shape of lemonade, or may be added to the mildly nutritive drinks, such as gum-water, barley-water, etc., usually administered in fevers. It is also much employed in the formation of those diaphoretic preparations known by the names of *neutral mixture* and *effervescing draught.* (See *Mistura Potassii Citratis.*) One of the most beneficial applications of lemon juice is to the prevention and cure of scurvy, for which it may be considered almost a specific. For this purpose, ships destined for long voyages should always be provided with a supply of the concentrated juice. In England every foreign-going ship is required by law to take such a supply of lemon juice that every seaman should have a daily allowance of an ounce, after having been ten days at sea. It has been employed with advantage in acute rheumatism in doses of from one to four fluidounces (30–120 C.c.) four to six times a day. It has been used with benefit as a local application in pruritus of the scrotum, and in uterine hemorrhage after delivery; in sunburn,* and as a gargle in diphtheritic sore throat.

Off. Prep. of the Peel. Infusum Aurantii Compositum, *Br.;* Infusum Gentianæ Comp., *Br.;* Oleum Limonis, *Br.;* Spiritus Limonis, Tinctura Limonis, *Br.*

Off. Prep. of the Juice. Acidum Citricum, *Br.;* Mistura Potassii Citratis, *U. S.;* Syrupus Limonis.

LINUM. *U. S.* *Flaxseed.*

(LĪ′NŬM.)

"The seed of Linum usitatissimum. Linné. (*Nat. Ord.* Linaceæ.)" *U. S.* "The seeds of Linum usitatissimum, Linn.; cultivated in Britain." *Br.*

Lini Semina, *Br.;* Linseed; Semen Lini, *P.G.;* Grains de Lin, Semence de Lin, *Fr.;* Leinsame, Flachssamen, *G.;* Semi di Lino, *It.;* Linaza, *Sp.*

LINI FARINA. *Br.* *Flaxseed Meal.* *Linseed Meal.*

(LĪ′NĪ FẠ-RĪ′NẠ.)

"The cake of linseed from which the oil has been pressed, reduced to powder." *Br.*

Gen. Ch. Calyx five-leaved. *Petals* five. *Capsule* five-valved, ten-celled. *Seeds* solitary. *Willd.*

Linum usitatissimum. Willd. *Sp. Plant.* i. 1533; *B. & T.* 39. Common flax is an annual plant, with an erect, slender, round stem, about two feet in height, branching at top, and, like all other parts of the plant, entirely smooth. The leaves are small, lanceolate, acute, entire, of a pale green color, sessile, and scattered alternately over the stem and branches. The flowers are terminal, and of a delicate blue color. The calyx is persistent, and composed of five ovate, sharp-pointed, three-nerved leaflets, which are membranous on their border. The petals are five, obovate, striated, minutely scalloped at their extremities, and spread into funnel-shaped blossoms. The filaments are also five, united at the base; and the germ, which is ovate, supports five slender styles, terminating in obtuse stigmas. The fruit is a globular capsule, about the size of a small pea, having the persistent calyx at the base, crowned with a sharp spine, and containing ten seeds in distinct cells.

This highly valuable plant, now almost everywhere cultivated, is said by some to have been originally derived from Egypt, by others from the great elevated plain of Central Asia. It flowers in June and July, and ripens its seeds in August.†

The seeds are oval, oblong, flattened on both sides with acute edges, somewhat pointed at one end, one to two lines in length, smooth, glossy, brown externally, and yellowish white within. They are inodorous, and have an oily mucilaginous taste. Meyer found in them fixed oil, wax, resin, extractive, tannin, gum, nitrogenous mucilage, starch, albumen, gluten, and various salts. M. Meurein could find no starch, but detected phosphates, which had escaped the notice of Meyer. (*Journ. de Pharm.*, 3e sér., xx. 97.) Their investing coat abounds in a peculiar gummy matter or mucilage, which is readily imparted to hot water, forming a thick viscid fluid, that lets fall white flakes upon the addition of alcohol, and affords a copious dense precipitate with subacetate of lead. The viscid mucilage of linseed cannot be filtered until it has been boiled. It contains in the dry state more than 10 per cent. of mineral substances; when freed from these and dried at 110° C., it corresponds, like althæa-mucilage, to the formula $C_{12}H_{20}O_{10}$. The seeds by exhaustion with cold or warm water afford of it about 15 per cent. By boiling with nitric acid, it yields crystals of mucic acid; by dilute mineral acids, it is broken up into dextrogyre gum, sugar, and cellulose. (Kirchner and Tollens, *Ann. der Chem.*, 175, p. 215.)

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* An excellent formula for this purpose is: Glycerin and lemon juice, each, a fluidounce, subnitrate of bismuth one drachm; to be applied freely to the affected part.

† The linseeds in commerce have been divided by Mr. E. M. Holmes into two groups. The first group, characterized by the seeds being of sufficient size for six or seven to weigh a grain, contains Bombay, Bold Calcutta, Sicilian, and Ionian seed; in the group of small seeds (10 to 12 to the grain) are English, Dutch, Russian, and ordinary Calcutta varieties. An important practical point noticed by Mr. Holmes is that many of these seeds are apparently purposely adulterated with weed seeds, which are nearly always smaller than the linseed, and can therefore be separated by the sieve. When linseed meal is to be made for medical use, this separation should always be insisted upon, as many of the weed seeds are from Crucifera and are irritating. For detailed information as to varieties of linseed, weed seeds, etc., the reader is referred to Mr. Holmes's paper. (Reprinted from *P. J. Tr.*, July, 1881, in *N. R.*, 1881, p. 294.)

Linseed contains about 4 per cent. of nitrogen, corresponding to about 25 per cent. of protein substances. After expression of the oil these substances remain in the cake, so that the latter contains 5 per cent. of nitrogen, and constitutes a very important article for feeding cattle.

In the ripe state linseed is altogether destitute of starch, though this substance is found in the immature seed in the very cells which subsequently yield the mucilage. The mucilage may be considered, as in analogous cases, to be a product of the transformation of starch. (Flückiger, *Pharmacographia*, 2d ed., p. 99.) The interior of the seed, or nucleus, is rich in a peculiar oil, which is separated by expression, and extensively employed in the arts. (See *Oleum Lini.*)

The ground seeds are kept in the shops under the name of *flaxseed meal.* This is of a dark gray color, highly oleaginous, and when mixed with hot water forms a soft adhesive mass, much employed for luting by practical chemists. The cake remaining after the expression of oil, usually called *oil-cake*, or, when ground, *cake-meal*, still retains the mucilaginous matter of the envelope, and affords a nutritious food for cattle. This is the *Farina Lini* of the British Pharmacopœia. The U. S. Pharmacopœia, very properly, does not recognize this cake-meal, but directs that "*Ground Flaxseed*, for medicinal purposes, should be recently prepared, free from unpleasant or rancid odor, and, when extracted with disulphide of carbon, should yield not less than 25 per cent. of fixed oil."

Medical Properties and Uses. Flaxseed is demulcent and emollient. The mucilage obtained by infusing the entire seeds in boiling water, in the proportion of half an ounce to the pint, is much and very advantageously employed in catarrh, dysentery, nephritic and calculous complaints, strangury, and other inflammatory affections of the mucous membrane of the lungs, intestines, and urinary passages. By decoction water extracts also a portion of the oleaginous matter, which renders the mucilage less fit for administration by the mouth, but superior as a laxative enema. The meal mixed with hot water forms an excellent emollient poultice.

Off. Prep. of the Seeds. Farina Lini, *Br.;* Infusum Lini, *Br.*

Off. Prep. of the Meal. Cataplasma Carbonis, *Br.;* Cataplasma Conii, *Br.;* Cataplasma Lini, *Br.;* Cataplasma Sinapis, *Br.;* Cataplasma Sodæ Chloratæ, *Br*

LINIMENTA. *Liniments.*

(LĬN-Ị-MĔN'TẠ.)

Embrocations, *E., Fr.;* Linimente, Einreibungen, *G.*

These are preparations intended for external use, of such a consistence as to render them conveniently applicable to the skin by gentle friction with the hand. The former officinal preparations, belonging to this class, which have been omitted in the present editions of the U. S. and Br. Pharmacopœias, are the *Liniments of Aconite*, U. S.; *Verdigris*, Lond., and *Sesquicarbonate of Ammonium*, Lond.; the *Compound Liniment of Ammonia*, Ed.; the *Camphorated Soap Liniment*, or *Opodeldoc*, U. S.; and the *Simple Liniment*, Ed.

LINIMENTUM ACONITI. *Br.* *Liniment of Aconite.*

(LĬN-Ị-MĔN'TỤM ĂC-Ọ-NĪ'TĪ.)

Liniment d'Aconite, *Fr.;* Akonitliniment, *G.*

"Take of Aconite Root, in coarse powder, *twenty ounces* [avoirdupois]; Camphor *one ounce* [avoird.]; Rectified Spirit *a sufficiency.* Moisten the Aconite Root with some of the Spirit, and macerate in a close vessel for three days; then transfer to a percolator, and adding more Spirit percolate slowly into a receiver containing the Camphor, until the product measures one pint [Imperial measure]." *Br.*

The British preparation is simply a very strong tincture of aconite root and camphor; that of the U. S. P. 1870* is almost equivalent to a fluid extract of aconite.

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* "Take of Aconite Root, in fine powder, *eight troyounces;* Glycerin *a fluidounce;* Alcohol *a sufficient quantity.* Moisten the powder with four fluidounces of Alcohol, and let it macerate for

Either may be applied alone by means of a camel's-hair pencil, or in connection with two parts or more of soap liniment or chloroform liniment, by rubbing it on the part affected. Experiments made by Mr. W. Donovan with a tincture prepared by macerating the fresh root, sliced, in rectified spirit for only twenty-four hours, proved that the preparation thus made, though acting in the same way, was much more powerful than the officinal (*Br.*). (*P. J. Tr.*, 2d ser., vi. 57.) The inference is that the fresh root should be used in preparing this liniment, and that a simple maceration is all that is required. There is a great waste both of aconite and of spirit in the process; as no provision is made, either by displacement with water, or by expression, to separate from the mass in the percolator the strongly impregnated spirit retained in it. According to Mr. J. T. Porter, it requires twenty-eight parts, by measure, for every sixteen parts, by weight, of the dry root. On expressing the marc the loss of spirit was reduced to from six to twelve per cent. (*Ibid.*, xi. 66.)

LINIMENTUM AMMONIÆ. *U.S., Br.* *Ammonia Liniment. Volatile Liniment.*

(LĬN-Ị-MĔN′TỤM ẠM-MŌ′NỊ-Æ.)

Linimentum Ammoniatum, *P.G.;* Linimentum volatile, Linimentum ammoniacale; Liniment ammoniacal (volatil), Savon ammoniacal, *Fr.;* Flüchtiges Liniment, Flüchtige Salbe, G.

" Water of Ammonia, *thirty parts* [or four and a half ounces av.]; Cotton Seed Oil, *seventy parts* [or ten and a half ounces av.], To make *one hundred parts* [or fifteen ounces av.]. Mix them." *U. S.*

"Take of Solution of Ammonia *one fluidounce;* Olive Oil *three fluidounces.* Mix together with agitation." *Br.*

The process of the U. S. Pharmacopœia differs from that of U. S. P. 1870 not only in the proportion of water of ammonia, which has been slightly reduced, but in the substitution of cotton seed oil for olive oil, an important practical improvement. A liniment is now furnished which is liquid at ordinary temperatures. The ammonia liniment of the U. S. P. 1870 was usually solid and unmanageable. Complete saponification is not a desideratum in this liniment. It is more convenient here to weigh these liquids than to measure them.

The U. S. and British Pharmacopœias agree at present very nearly in the strength of this liniment; the U. S. preparation being somewhat the stronger. In the process, the ammonia reacts with the oil to form a soap, which is partly dissolved, partly suspended in the water, producing a white, opaque emulsion. The liniment is an excellent rubefacient, frequently employed in inflammatory affections of the throat, in catarrhal and other pectoral complaints of children, and in rheumatic pains. It is applied by rubbing it, or placing a piece of flannel saturated with it, over the affected part. Should it occasion too much inflammation, it must be diluted with oil.

LINIMENTUM BELĹADONNÆ. *U.S., Br.* *Liniment of Belladonna.*

(LĬN-Ị-MĔN′TỤM BĔL-LẠ-DŎN′NÆ.)

Liniment de Belladone, *Fr.;* Belladonna-Liniment, *G.*

" Fluid Extract of Belladonna, *ninety-five parts* [or nineteen fluidounces]; Camphor, *five parts* [or one ounce av.], To make *one hundred parts* [or about twenty fluidounces]. Dissolve the Camphor in the Fluid Extract." *U. S.*

This is a new officinal liniment. It is identical with the liniment of belladonna of the British Pharmacopœia, which is prepared from Belladonna Root precisely as the Liniment of Aconite is prepared from Aconite Root; and the same remarks are applicable as to its strength and use; especially in relation to the waste incurred in the process. According to Mr. C. Umney, not more than 40 per cent. of the active matter of the belladonna root is extracted. (*P. J. Tr.*, v. 281.) (See *Linimentum Aconiti.*)

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twenty-four hours; then pack it in a conical percolator, and gradually pour Alcohol upon it until two pints of tincture have been obtained. Distil off a pint and a half of alcohol, and evaporate the remainder until it measures seven fluidounces; to this add the Glycerin, and mix them thoroughly."

LINIMENTUM CALCIS. *U. S., Br.* *Lime Liniment.*

(LĬN-Ị-MĔN'TỤM CĂL'CỊS.)

Liniment of Lime; Liniment calcaire, Savon calcaire, *Fr.;* Kalkliniment, *G.*

"Solution of Lime, Cotton Seed Oil, each *fifty parts* [or eight ounces av.], To make *one hundred parts* [or about one pint]. Mix them." *U. S.*

"Take of Solution of Lime, Olive Oil, of each, *two fluidounces.* Mix together with agitation." *Br.*

The lime forms a soap with the oil, of which there is a great excess, that separates upon standing. Olive oil, as directed by the British Pharmacopœia, is often substituted for that of flaxseed, which was originally used, but possesses no other advantage than that of having a less unpleasant odor. The use of cotton seed oil in the U. S. Pharm. is probably an improvement. This is a very useful liniment in recent burns and scalds. It is sometimes called *Carron oil,* from having been much employed at the Carron iron works in Scotland. It is recommended to be applied upon carded cotton.

LINIMENTUM CAMPHORÆ. *U. S., Br.* *Camphor Liniment.*

(LĬN-Ị-MĔN'TỤM CĂM'PHỌ-RÆ.)

Linimentum Camphoratum, Oleum Camphoratum; Camphorated Oil; Liniment camphré, Huile camphrée, *Fr.;* Kampferliniment, *G.*

"Camphor, *twenty parts* [or three ounces av.]; Cotton-Seed Oil, *eighty parts* [or twelve ounces av.], To make *one hundred parts* [or fifteen ounces av.]. Dissolve the Camphor in the Oil." *U. S.*

"Take of Camphor *one ounce* [avoirdupois]; Olive Oil *four fluidounces.* Dissolve the Camphor in the Oil." *Br.*

This is employed as an anodyne embrocation in sprains, bruises, rheumatic or gouty affections of the joints, and other local pains. It is also supposed to have a discutient effect when rubbed upon glandular swellings.

Mr. Wm. B. Price, of Burlington, N. J., proposes a modification of this liniment, founded on the solvent power of chloroform over camphor, whereby the preparation is made stronger with camphor, and acquires also additional anodyne influence from the chloroform. The proposed liniment consists of an ounce and a half of camphor, two fluidrachms of chloroform, and two fluidounces of olive oil. It is useful in rheumatic and neuralgic pains. (*N. J. Med. Reporter*, ii. 217.) J. Weichselbaum has found camphor liniment to be a specific for the itching produced by cowhage. (*A. J. P.*, xlii. 519.)

Off. Prep. Linimentum Chloroformi, *Br.;* Linimentum Hydrargyri, *Br.;* Linimentum Terebinthinæ Aceticum, *Br.*

LINIMENTUM CAMPHORÆ COMPOSITUM. *Br.* *Compound Liniment of Camphor.*

(LĬN-Ị-MĔN'TỤM CĂM'PHỌ-RÆ CỌM-PŎṢ'Ị-TŬM.)

Liniment camphré ammoniacal, *Fr.;* Ammoniak- und Kampfer-Liniment, *G.*

"Take of Camphor *two ounces and a half* [avoirdupois]; Oil of Lavender *one fluidrachm;* Strong Solution of Ammonia *five fluidounces;* Rectified Spirit, *fifteen fluidounces.* Dissolve the Camphor and Oil of Lavender in the Spirit; then add the Solution of Ammonia gradually, shaking them together until a clear solution is formed." *Br.*

This is used as a rubefacient and at the same time anodyne embrocation in local pains, particularly of a rheumatic character.

LINIMENTUM CANTHARIDIS. *U. S., Br.* 1864. *Cantharides Liniment.*

(LĬN-Ị-MĔN'TỤM CẠN-THĂR'Ị-DĬS.)

Liquor Epispasticus, *Br.;* Blistering Liquid; Huile de Cantharides térébinthinée, *Fr.;* Spanischfliegen-Liniment, *G.*

"Cantharides, in No. 60 powder, *fifteen parts* [or one ounce av.]; Oil of Turpentine, *a sufficient quantity*, To make *one hundred parts* [or half a pint]. Digest the Cantharides with *one hundred parts* [or half a pint] of Oil of Turpentine, in a closed vessel, by means of a water-bath, for three hours; then strain and add enough Oil of Turpentine through the strainer to make the Liniment weigh *one hundred parts* [or half a pint]." *U. S.*

"Take of Cantharides, in powder, *eight ounces* [avoirdupois]; Acetic Acid *four fluidounces;* Ether *a sufficiency.* Mix the Cantharides and Acetic Acid; pack them in a percolator, and at the expiration of twenty-four hours pour ether over the contents of the percolator, and allow it to pass slowly through till twenty fluidounces are obtained. Keep it in a stoppered bottle." *Br.*

Oil of turpentine dissolves, especially with the aid of heat, the active principle of cantharides, and, when impregnated with it, acquires in addition to its own rubefacient properties those of a powerful epispastic. Caution, however, is necessary in its use, lest it may produce troublesome, if not dangerous, vesication. If too powerful, it may be diluted with olive or linseed oil. The British preparation is a solution of the active matter of the flies in acetic acid and ether, and, as the ether must quickly evaporate, conjoins the influence of the cantharides and the acid. From the name conferred upon it at the revision of the Pharmacopœia in 1870, it would appear to be intended rather as a vesicating than as a rubefacient agent.

LINIMENTUM CHLOROFORMI. *U. S., Br.* *Liniment of Chloroform.*

(LĬN-Ị-MĔN′TỤM ȻHLŌ-RỌ-FÖR′MĪ.)

Liniment au Chloroforme, *Fr.;* Chloroform-Liniment, *G.*

"Commercial Chloroform, *forty parts* [or four fluidounces]; Soap Liniment, *sixty parts* [or eleven fluidounces], To make *one hundred parts* [or fifteen fluidounces]. Mix them." *U. S.*

"Take of Chloroform, Liniment of Camphor, of each, *two fluidounces.* Mix." *Br.*

A very great improvement has been made in this preparation by the Committee of Revision, in the substitution of soap liniment for the olive oil. This change was proposed in the previous edition of this Dispensatory, and it was desirable on account of the greasy residue which was left on the skin by the old preparation.

This is an excellent local application in painful affections. As the chloroform rapidly evaporates, it is desirable, in order to obtain its full anodyne effect, to guard against this by using waxed paper, or some other impermeable covering.

LINIMENTUM CROTONIS. *Br.* *Liniment of Croton Oil.*

(LĬN-Ị-MĔN′TỤM CRỌ-TŌ′NĬS.)

Liniment crotoné, *Fr.;* Krotonöl-Liniment, *G.*

"Take of Croton Oil *one fluidounce;* Oil of Cajuput, Rectified Spirit, of each, *three fluidounces and a half.* Mix." *Br.*

This is a pustulating preparation, the irritant influence of which has been increased by the substitution of the oil of cajuput and the spirit, for the olive oil of the original formula. From ten to thirty minims (0·6 to 1·9 C.c.) or more may be rubbed upon a limited surface, and repeated twice a day or oftener till an eruption is produced.

LINIMENTUM HYDRARGYRI. *Br.* *Liniment of Mercury.*

(LĬN-Ị-MĔN′TỤM HȲ-DRÄR′ĢỴ-RĪ.)

Linimentum Mercuriale; Liniment mercuriel, *Fr.;* Quecksilber-Liniment, *G.*

"Take of Ointment of Mercury *one ounce* [avoirdupois]; Solution of Ammonia, Liniment of Camphor, of each, *one fluidounce.* Liquefy the Ointment of Mercury in the Liniment of Camphor, with a gentle heat, then add the Solution of Ammonia gradually and mix with agitation." *Br.*

This is a stimulating liniment, employed for the discussion of chronic glandular enlargements, swellings of the joints, and venereal tumors, and to promote the absorption of fluid. It is said to be more apt to salivate than mercurial ointment. One drachm (3·75 C.c.) may be rubbed upon the affected part night and morning.

LINIMENTUM IODI. *Br.* *Liniment of Iodine.*

(LĬN-Ị-MĔN'TỤM Ī-Ō'DĪ.)

Liniment iodurê, *Fr.;* Jodliniment, *G.*

"Take of Iodine *one ounce and a quarter* [avoirdupois]; Iodide of Potassium *half an ounce* [avoir.]; Camphor *one-fourth of an ounce;* Rectified Spirit *ten fluidounces.* Dissolve the Iodine, Iodide of Potassium, and Camphor in the Spirit." *Br.*

This is an alcoholic solution of iodine, in which the iodide of potassium acts by increasing the solubility of the active ingredient. The strength of the solution has been reduced one-half in the present liniment. See *Iodum*, p. 803.

LINIMENTUM OPII. *Br.* *Liniment of Opium. Anodyne Liniment.*

(LĬN-Ị-MĔN'TỤM Ō'PỊ-Ī.)

Liniment opiacé, *Fr.;* Opiumliniment, *G.*

"Take of Tincture of Opium, Liniment of Soap, of each, *two fluidounces.* Mix." *Br.*

This is commonly called *anodyne liniment*, and is employed as an anodyne and gently rubefacient embrocation in sprains, bruises, and rheumatic and gouty pains. We are informed that the preparation which has commonly been used, under the name of *anodyne liniment*, in this city, is that of the late London Pharmacopœia, as given in former editions of the U. S. Dispensatory, consisting of one part by measure of tincture of opium and three of soap liniment, and consequently having only half the opiate strength of the present British liniment.

LINIMENTUM PLUMBI SUBACETATIS. *U. S.* *Liniment of Subacetate of Lead.*

(LĬN-Ị-MĔN'TỤM PLŬM'BĪ SŬB-ĂÇ-Ẹ-TĀ'TĬS.)

Liniment saturné, Beurre de Saturne, Baume universelle, *Fr.;* Bleiliniment, *G.*

"Solution of Subacetate of Lead, *forty parts* [or two ounces av.]; Cotton Seed Oil, *sixty parts* [or three ounces av.], To make *one hundred parts* [or five ounces av.]. Mix them." *U. S.*

This preparation, which was introduced in the U. S. P. 1870, is retained in the revision of 1880, with the substitution of cotton seed oil for the olive oil.

This liniment may be used as a sedative application in superficial inflammations.

LINIMENTUM POTASSII IODIDI CUM SAPONE. *Br.* *Liniment of Iodide of Potassium and Soap.*

(LĬN-Ị-MĔN'TỤM PỌ-TĂS'SỊ-Ī Ī-ŎD'Ị-DĪ CŬM SẠ-PŌ'NĒ.)

Liniment savonneux iodurê, *Fr.;* Jodkalium-Seifenliniment, *G.*

"Take of Hard Soap, cut small, Iodide of Potassium, of each, *one ounce and a half* [avoirdupois]; Glycerine *one fluidounce;* Oil of Lemon *one fluidrachm;* Distilled Water *ten fluidounces.* Dissolve the Soap in seven fluidounces of the Water by the heat of a water-bath. Dissolve the Iodide of Potassium and Glycerine in the remainder of the Water, and mix the two solutions together. When the mixture is cold add the Oil of Lemon and mix the whole thoroughly." *Br.*

This preparation is apparently intended, by application to the surface, which may be attended with a gentle friction, to produce the absorption of the iodide, and thus to obtain its alterative and deobstruent effects through the circulation. The soap and glycerin act as demulcents, and thus obviate in some measure the local irritation of the salt.*

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* It seems to have been clearly established by the discussion carried on in *P. J. Tr.*, 2d ser., xi., that Castile soap, and even individual brands of Castile soap, vary so much that it is impossible to get uniform results from the officinal process; the preparation sometimes being beautifully transparent and jelly-like, at other times opaque and ointment-like. Various remedies were proposed, but finally Mr. N. Smith called attention to the fact that the formula adopted by the reviewers of the Pharmacopœia differs from the original one of Dr. Rumsey. This Mr. Smith states to be as follows: "Take of White Curd Soap (made from Russian tallow) two ounces; Iodide of Potassium one ounce and a half; Glycerin one ounce; Distilled Water ten ounces; Essential Oil of Lemons one drachm. Reduce the Soap into fine shreds, and melt in a water-bath, with

LINIMENTUM SAPONIS. *U.S., Br.* *Soap Liniment.*

(LĬN-Ị-MĔN′TỤM SẠ-PŌ′NĬS.)

Tinctura Saponis Camphorata, *U. S.* 1850; Camphorated Tincture of Soap; Linimentum Saponato-Camphoratum Liquidum, *P.G.;* Liquid Opodeldoc; Liniment savonneux camphré, *Fr.;* Flüssiger Opodeldok, *G.*

"Soap, in shavings, *ten parts* [or five ounces av.]; Camphor, *five parts* [or two and a half ounces av.]; Oil of Rosemary, *one part* [or four and a half fluidrachms]; Alcohol, *seventy parts* [or forty-one fluidounces]; Water, *a sufficient quantity,* To make *one hundred parts* [or three and a half pints]. Digest the Soap in *fourteen parts* [or seven fluidounces] of Water, until it is dissolved; dissolve the Camphor and Oil in the Alcohol; mix the solutions, and filter through paper, adding enough Water, through the filter, to make the Liniment weigh *one hundred parts* [or measure three and a half pints]." *U. S.*

"Take of Hard Soap, cut small, *two ounces and a half* [avoirdupois]; Camphor *one ounce and a quarter* [avoird.]; Oil of Rosemary *three fluidrachms;* Rectified Spirit *eighteen fluidounces;* Distilled Water *two fluidounces.* Mix the Water with the Spirit, and add the Oil of Rosemary, the Soap, and the Camphor. Macerate for seven days at a temperature not exceeding 70°, with occasional agitation, and filter." *Br.*

This process is intended to furnish a saturated solution of Castile soap. It is to be regretted that the Committee of Revision of U. S. P. 1880 did not direct the soap in coarse powder and dried at 100° C. (212° F.), so that it should contain a definite amount of water. By retaining the indefinite term "soap in shavings" the difficulties of the formula of 1870 have been perpetuated, for soap loses in drying from 10 to 25 per cent. of water, and a pharmacist using dry shavings will be sure to have the excess of soap precipitate out, when the soap liniment is exposed to a cooler temperature. Under the circumstances it will be wisest to use shavings from a soft fresh Castile soap, and not those which have been dried, or obtained from old hard soap. The British process is in accord with that formerly officinal in the U. S. Pharmacopæia but in disagreement with the present U. S. formula, in directing the maceration of the soap in alcohol, and not its solution in water. In 1859, Mr. Deane showed that oleate of sodium is freely soluble in alcohol, while the palmitate is nearly insoluble, consequently the latter salt is left behind in the British process. Although olive oil contains a large per cent. of oleic acid, yet it has been proposed to substitute almond oil,[*] for it is still richer. The economy of this is, however, very doubtful. Castor oil has also been suggested. (*A. J. P.*, xliv. 529.) G. H. Barckhausen states that the potassa soaps are perfectly soluble in alcohol, and suggests rape-seed oil as a good base. (*A. J. P.*, 1873, p. 17.)

In former editions of the U. S. Pharmacopœia, this preparation, though commonly called *Soap Liniment*, received the name of *Tinctura Saponis Camphorata*, to distinguish it from a similar preparation called *Opodeldoc*, which, having a soft semi-solid consistence, was introduced with the title of *Linimentum Saponis Camphoratum.* This having been discarded in 1860, the Tincture reverted to its place among the liniments, and is now called simply Linimentum Saponis. But, as the old Camphorated Soap Liniment or *Opodeldoc* is an excellent preparation, and still somewhat in use, we give here the process of the Pharmacopœia of 1850 for its preparation, with some remarks on the subject.

"Take of Common Soap, sliced, *three ounces;* Camphor *an ounce;* Oil of Rosemary, Oil of Origanum, each, *a fluidrachm;* Alcohol *a pint.* Digest the Soap with the Alcohol, by means of a sand-bath, till dissolved; then add the Camphor and Oils, and, when they are dissolved, pour the liquid into broad-mouthed bottles. This liniment has, when cold, the consistence of a soft ointment."

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the whole of the Water and the Glycerin; when the Soap is perfectly dissolved, pour it into a No. 9 Wedgwood mortar in which the iodide of potassium has been previously reduced to fine powder; mix briskly, and continue the trituration until the mortar has become cool and the liniment assumes the character of ice cream. Set aside for an hour, after which gently rub in the Oil of Lemons."

[*] A formula for making almond oil soap on the small scale may be found in *P. J. Tr.*, 2d ser., xi. 417.

This preparation differs from the officinal Linimentum Saponis chiefly in being prepared with common white soap, made with animal fat, instead of Castile soap, which is made of olive oil. The former is peculiarly adapted to the purposes of this formula, in consequence of assuming, when its alcoholic solution cools, the consistence characteristic of the liniment. It is customary, after the solution of the soap has been effected, to pour the liquid into small wide-mouthed glass bottles, containing about four fluidounces, in which it concretes into a soft, translucent, uniform, yellowish white mass. This liniment melts with the heat of the body, and therefore becomes liquid when rubbed on the skin.

It is much used, as an anodyne and gently rubefacient embrocation, in sprains, bruises, and rheumatic or gouty pains.

Off. Prep. Linimentum Opii, *Br.*

LINIMENTUM SINAPIS COMPOSITUM. *U.S., Br.* *Compound Liniment of Mustard.*

(LĬN-Ị-MĔN'TỤM SỊ-NĀ'PĬS CỌM-PŎȘ'Ị-TŬM.)

Liniment sinapisé composé, *Fr.;* Zusammengesetztes Senfliniment, *G.*

"Volatile Oil of Mustard, *three parts* [or one fluidrachm]; Extract of Mezereum, *two parts* [or forty grains]; Camphor, *six parts* [or one hundred and twenty grains]; Castor Oil, *fifteen parts* [or six fluidrachms]; Alcohol, *a sufficient quantity,* To make *one hundred parts* [or five and a half fluidounces]. Dissolve the Extract of Mezereum and the Camphor in *seventy parts* [or four fluidounces] of Alcohol; then add the Oil of Mustard and the Castor Oil and, finally, enough Alcohol to make the product weigh *one hundred parts* [or measure five and a quarter fluidounces]." *U. S.*

"Take of Oil of Mustard *one fluidrachm;* Ethereal Extract of Mezereon *forty grains;* Camphor *one hundred and twenty grains;* Castor Oil *five fluidrachms;* Rectified Spirit *four fluidounces.* Dissolve the Extract of Mezereon and Camphor in the Spirit, and add the Oil of Mustard and Castor Oil." *Br.*

This newly officinal U. S. preparation is slightly weaker than the British. It affords a convenient method of applying the volatile oil of mustard, and may often be appropriately used as a substitute for sinapisms. The extract of mezereon is also a very energetic irritant. The castor oil seems to be added in order to somewhat increase the consistence of the liniment, and was probably chosen from among oleaginous substances in consequence of its solubility in alcohol. The camphor may have some effect in moderating the pain without diminishing the rubefacient action. The effect is increased if the liniment be applied on flannel, and volatilization guarded against by covering it with oiled silk. For the circumstances calling for the use of this liniment, see *Sinapis.*

LINIMENTUM TEREBINTHINÆ. *U.S., Br.* *Turpentine Liniment.*

(LĬN-Ị-MĔN'TỤM TĔR-Ẹ-BĬN'THỊ-NÆ.)

Liniment térébenthiné, *Fr.;* Terpentinliniment, *G.*

"Resin Cerate, *sixty-five parts* [or thirteen ounces av.]; Oil of Turpentine *thirty-five parts* [or half a pint], To make *one hundred parts* [or twenty ounces av.]. Add the Oil to the Cerate previously melted, and mix them thoroughly." *U. S.*

"Take of Soft Soap *two ounces* [avoirdupois]; Camphor *one ounce* [avoird.]; Oil of Turpentine *sixteen fluidounces.* Dissolve the Camphor in the Oil of Turpentine, then add the Soap, rubbing them together until they are thoroughly mixed." *Br.*

The U. S. preparation is the liniment originally proposed by Dr. Kentish, and subsequently so highly lauded as a remedy in burns and scalds. It should be applied as soon after the occurrence of the accident as possible, and should be discontinued when the peculiar inflammation excited by the fire is removed. The best mode of application is to cover the burnt or scalded surface with pledgets of patent lint saturated with the liniment. It should not be allowed to come in contact with the sound parts. This liniment may also be successfully applied in other cases of cutaneous inflammation requiring stimulation, as in certain conditions of erysipelas. The present British preparation, so far as regards its rubefacient operation, may be looked upon as almost undiluted oil of turpentine; the soft soap having little other effect than to give consistence to the liniment, and the camphor acting as an anodyne; and both being too small in bulk to materially dilute the oil.

LINIMENTUM TEREBINTHINÆ ACETICUM. *Br.* *Liniment of Turpentine and Acetic Acid.*

(LĬN-Ị-MĔN′TỤM TĔR-Ẹ-BĬN′THỊ-NÆ Ạ-CĔT′Ị-CŬM.)

Liniment térébenthiné acétique, *Fr.;* Terpentin- und Essig-Liniment, *G.*

"Take of Oil of Turpentine, Acetic Acid, Liniment of Camphor, of each, *one fluidounce.* Mix." *Br.*

This is a powerful rubefacient liniment, combining the irritant properties of the oil of turpentine and acetic acid, though somewhat diluted by the camphor liniment.*

LIQUORES. *Solutions.*

(LỊ-QUŌ′RĔṢ—lẹ-kwō′rēz.)

Solutés, *Fr.;* Lösungen, *G.*

The U. S. Pharmacopœia includes, in this class of preparations, all *aqueous* solutions without sugar in which the substance acted on is wholly soluble in water, excluding those in which the dissolved matter is gaseous or very volatile, as in the Aquæ or Waters. The *Solution of Gutta-percha* is the only one in which water is not used as the menstruum; and it has been placed in the present category only because no better position could be found for it.

Although several changes have been made in the strength of preparations of this class in the U. S. Pharmacopœia of 1880 for the sake of round numbers and to adjust the relative quantity of solid to the solvent, so as to avoid fractions in the percentages, yet it is a question whether these are advantages sufficient to overbalance the *disadvantage* of changing the doses of important preparations.

In the British Pharmacopœia it has been deemed expedient, in almost all instances in which the substance to be dissolved is an isolated solid body, to make the solutions of uniform strength, without regard to the physiological powers of the medicine, or its ordinary dose. The solutions of this kind contain four grains of the medicine to an Imperial fluidounce of the menstruum, or half a grain in a fluidrachm. There is a convenience in this plan to the prescriber, in relation to all medicines which habitually present themselves to his mind in the solid state; but to alter the strength of a solution which has been long known, and the dose of which is familiar, in order to make it conform with others, is to endanger frequent serious errors for the sake of an idea. In such medicines the dose is fixed in the mind of the practitioner in reference to the solution, and not to the solid medicinal substance it may contain.

LIQUOR ACIDI ARSENIOSI. *U. S.* *Solution of Arsenious Acid.*

(LĪ′QUỌR ĂÇ′Ị-DĪ ÄR-SĒ-NỊ-Ō′SĪ.)

Liquor Arsenici Hydrochloricus, *Br.;* **Liquor Arsenici Chloridi,** *U. S. Pharm.* 1870; Hydrochloric Solution of Arsenic, *E.;* Liqueur arsénicale hydrochlorique, *Fr.;* Chlorarsenik-Lösung, *G.*

"Arsenious Acid, in small pieces, *one part* [or thirty-seven grains]; Hydrochloric Acid, *two parts* [or sixty-seven minims]; Distilled Water, *a sufficient quantity,* To make *one hundred parts* [or half a pint]. Boil the Arsenious Acid with the Hydrochloric Acid and with *twenty-five parts* [or two fluidounces] of Distilled Water, until it is dissolved. Filter the liquid and pass enough Distilled Water through the filter to make the solution weigh *one hundred parts* [or measure half a pint]." *U. S.*

"Take of Arsenious Acid, in powder, *eighty grains;* Hydrochloric Acid, *two fluidrachms;* Distilled Water, *a sufficiency.* Boil the Arsenious Acid with the Hydrochloric Acid, and four [fluid]ounces of the Water until it is dissolved, then add Distilled Water to make the bulk up to one pint [Imperial measure]." *Br.*

This solution is stronger than the Liquor Arsenici Chloridi of U. S. P. 1870. It contains 4·6 grains of arsenious acid in a fluidounce; the U. S. P. 1870 preparation corresponded in strength with the British solution, *i.e.* 4 grains in a fluidounce. The increase in strength was made in order to make the relation one that would be easy to recollect, namely, 1 per cent. by weight. The name has also been changed, as the former title was a misnomer. The hydrochloric acid does not enter into combination with the arsenious acid: it merely aids in its solution. The British title is, in our opinion, to be preferred, because the U. S. name does not indicate the presence of the hydrochloric acid.

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* *St. John Long's Liniment.* Under this name a liniment is often used which is made as follows: "Take the yolk of one egg, 5 fluidrachms of Acetic Acid, 3 fluidounces of Oil of Turpentine, 2½ fluidounces of Rose Water, and ½ fluidrachm of Oil of Lemon. Make an emulsion."

Properties. The hydrochloric solution of arsenious acid was first recognized by the U. S. Pharmacopœia at the revision of 1870. According to the British Pharmacopœia, it is a colorless liquid, of the sp. gr. 1·009 (*Br.*), and an acid reaction. With sulphuretted hydrogen it gives a bright yellow precipitate of arsenious sulphide. "One fluidounce of it (441·5 grains), boiled for five minutes with twenty grains of bicarbonate of sodium, and then diluted with six fluidounces of distilled water to which a little mucilage of starch has been added, does not give with the *volumetric solution of iodine* a permanent blue color until 808 grain-measures have been added, corresponding to four grains of arsenious acid in one fluidounce." The following test is given in the U. S. P. 1880. "If 24·7 Gm. of Solution of Arsenious Acid be boiled for a few minutes with 0·5 Gm. of bicarbonate of sodium, the resulting liquid should not decolorize less than 48·5 C.c. of the volumetric solution of iodine (corresponding to 1 per cent. of arsenious acid of the required purity)." *U. S.*

Medical Properties. The medical properties of this solution are the same as those of Fowler's solution, with which it corresponds in strength, being nearly three times as strong as the former London solution of chloride of arsenic. The dose is from two to eight minims (0·12 to 0·5 C.c.).

LIQUOR AMMONII ACETATIS. *U. S.* *Solution of Acetate of Ammonium.* [*Spirit of Mindererus.*]

(LĬ'QUỌR ẠM-MŌ'NỊ-Ī ĂÇ-Ẹ-TĀ'TĬS.)

Liquor Ammoniæ Acetatis, *Br.;* Liquor Ammonii Acetici, *P. G.;* Acétate d'Ammoniaque liquide, *Fr.;* Essigsaure Ammonium-Flüssigkeit, *G.*

"Diluted Acetic Acid, *one hundred parts* [or one pint]; Carbonate of Ammonium, *a sufficient quantity.* Add a sufficient quantity of Carbonate of Ammonium gradually to the Diluted Acetic Acid, until it is neutralized.* This preparation should be freshly made, when required for use.

"*Solution of Acetate of Ammonium* may also be prepared in the following manner: Carbonate of Ammonium, *ten parts* [or two ounces av.]; Acetic Acid, *twenty-eight parts* [or four and three-quarter fluidounces]; Distilled Water, *one hundred and forty-two parts* [or about twenty-seven fluidounces]. Dissolve the Carbonate of Ammonium in *eighty parts* [or one pint] of Distilled Water, and filter the solution. To the Acetic Acid add *sixty-two parts* [or sufficient to make one pint] of Distilled Water. Keep the solutions in separate, well-stopped bottles, and, when Solution of Acetate of Ammonium is to be dispensed, weigh (or if the alternative formula is used, measure) equal quantities of each solution and mix them." *U. S.*

"Take of Acetic Acid *ten fluidounces* [Imperial measure]; Carbonate of Ammonia *three ounces and a quarter* [avoirdupois], or *a sufficiency;* Distilled Water *two and a half pints* [Imp. meas.]. Reduce the Carbonate of Ammonia to powder, and add it gradually to the Acetic Acid, until a neutral solution is formed, then add the Water." *Br.*

This preparation is an aqueous solution of acetate of ammonium.† The U. S. process by which it is formed, involves the decomposition of ammonium carbonate by dilute acetic acid. The formula of commercial ammonium carbonate is complex, but if we consider the salt as neutral carbonate, the reaction is expressed by the following equation: $(NH_4)_2CO_3 + (C_2H_3O_2.H)_2 = (C_2H_3O_2.NH_4)_2 + H_2O + CO_2$.

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* For curious observations on behaviors of *super-saturated saline solutions* on exposure to the air, see *Chem. News*, 1871, xxiv. 64.

† For method of making dry acetate of ammonium, see *A. J. P.*, 1875, p. 25.

Distilled vinegar was formerly used, but it has been abandoned for diluted acetic acid, which is much to be preferred; because, besides furnishing a solution of the acetate of uniform strength, a result which cannot be attained by the employment of distilled vinegar, it avoids the production of a brownish solution, which uniformly follows the use of the latter, especially when it has been condensed in a metallic worm. The quantity of carbonate of ammonium, necessary to saturate a given weight of the acid of average strength, cannot be laid down with precision, on account of the variable quality of the salt. The preparation, when made with the diluted acetic acid of the U. S. Pharmacopœia, contains about 7·6 per cent. of acetate of ammonium. It is more convenient to add the salt to the acid than the acid to the salt; as the point of saturation is thus more easily attained. In ascertaining this point by test-paper, the alkaline reaction will begin, though a portion of free acetic acid may still remain; a little of it being insufficient to overcome the natural alkaline reaction of the salt. A complication is caused by the presence of free carbonic acid, which may be expelled from the liquid towards the end of the saturation by warming it. Supposing it to be free from carbonic acid, the best rule is to cease adding the carbonate of ammonium, upon the occurrence of the least sign of alkalinity.

The formula of the U. S. P. 1880 differs from that formerly officinal, in containing about 1·6 per cent. more acetate of ammonium. It is to be regretted that the old process of saturating the diluted acetic acid with the carbonate of ammonia was not entirely abandoned in the last revision and the second process alone directed. The separate solutions keep well, and the rapidity and ease with which this preparation can be made by the pharmacist, by simply mixing equal measures of the solutions, are advantages which at once recommend its exclusive use, whilst the physician is more apt to secure a fresh preparation, and one which usually retains a quantity of carbonic acid gas to render the preparation grateful to the patient.

The present British process corresponds essentially with ours; but in that of the Br. Pharmacopœia of 1864, the strong solution of ammonia was used instead of the carbonate, and the ammonia combined directly with the acetic acid, without other reaction. The solution was much stronger than that of the U. S. Pharmacopœia, or of the former Pharmacopœias of Great Britain, being made with undiluted ingredients, probably because it keeps better when thus made. To reduce it to the strength of the U. S. preparation, it required to be diluted with about four measures of distilled water. There was an advantage in this process in the use of ammonia instead of its carbonate; as the difficulty of ascertaining the precise point of saturation arising from carbonic acid was avoided; but in this solution, as in the neutral mixture, a great benefit remedially is gained by the presence of that acid, which reconciles the stomach to the medicine, and sometimes even allays vomiting in febrile diseases. With this view of the subject, it is better to use the carbonate of ammonium; and the change has been made in the present Br. Pharmacopœia.

Properties. Solution of acetate of ammonium, when made of pure materials, is "a clear, colorless liquid, free from empyreuma, of a mild saline taste, and a neutral or slightly acid reaction. Sp. gr. 1·022. It is wholly volatilized by heat. When heated with potassa, it evolves vapors of ammonia, and when heated with sulphuric acid, it gives out vapor of acetic acid. It should not be darkened by hydrosulphuric acid or sulphide of ammonium (abs. of metals). It contains about 7·6 per cent. of acetate of ammonium." *U. S.* Its taste resembles that of a mixture of nitre and sugar. When it contains an excess of alkali, its taste is bitterish. It should be freshly prepared at short intervals; as its acid becomes decomposed, and a portion of carbonate of ammonium is generated. As formerly prepared, under the name of *spiritus Mindereri*, it was made from the impure carbonate of ammonium containing animal oil, which modified the preparation by giving rise to a portion of ammoniacal soap. When pure it is not precipitated by chloride of barium. Nitrate of silver precipitates crystals of acetate of silver, soluble in water, and especially in nitric acid. An insoluble precipitate with this test is chloride of silver, and shows the presence of hydrochloric acid. Potassa disengages ammonia; sulphuric acid, acetous vapors. When evaporated to dryness, the residue is wholly dissipated by heat with the smell of ammonia. It is incompatible with acids, the fixed alkalies and their carbonates, lime-water, magnesia, sulphate of magnesium, corrosive sublimate, the sulphates of iron, copper, and zinc, and nitrate of silver. When it contains free carbonic acid, it produces with the acetate or subacetate of lead a precipitate of carbonate of lead, which, being mistaken for the sulphate, has sometimes led to the erroneous conclusion that sulphuric acid was present in the distilled vinegar, when this has been employed. *Acetate of ammonium* is a salt of difficult crystallization, and very deliquescent. When perfect it probably has an alkaline reaction, like the acetates of potassium and sodium. It may be obtained by sublimation from a mixture of equal parts of dry acetate of potassium or of calcium, and chloride of ammonium; or, according to Berthelot, by dissolving glacial acetic acid in ammonia, keeping the retort cool, and adding enough water to prevent the crystallization of the salt during the neutralization; the solution is then evaporated in a current of dry, gaseous ammonia until the liquid solidifies on cooling. It is then introduced into a large capsule, and this placed upon caustic lime, under a large bell glass, in which a considerable quantity of ammonia gas is injected. After a few days the crystalline mass is broken, and the capsule replaced as before upon lime in an ammoniacal atmosphere, under the bell glass. When this operation has been repeated several times, a perfectly pure acetate of ammonium is obtained, which crystallizes in large needles, like nitrate of potassium, and resembling formiate of ammonium; it is extremely soluble in water, and does not possess an acid reaction. (*A. J. P.*, 1875, p. 25.) It is formed by the union of one molecule of acetic acid, $H.C_2H_3O_2$, with one group, NH_4, from $NH_4.OH$, the hydrate, or $(NH_4)_2CO_3$. the carbonate. When evaporated to dryness, however, it readily yields an acid salt, $C_2H_3O_2.NH_4 + C_2H_4O_2$. The molecular weight of the normal salt is 77.

Medical Properties and Uses. Solution of acetate of ammonium is a valuable diaphoretic, much employed in febrile diseases. If, instead of promoting its determination to the skin by external warmth, the patient walk about in a cool air, its action will be directed to the kidneys. In large doses, it is said to relieve painful menstruation. It is sometimes used externally as a discutient. Mr. Brande speaks of it as very useful in mumps, applied hot upon a piece of flannel. Mixed in the quantity of a fluidounce with seven fluidounces of rose-water, and two fluidrachms of laudanum, it forms a useful collyrium in chronic ophthalmia. The late Dr. A. T. Thomson used it as a lotion with good effect in porrigo affecting the scalp. The dose of the U. S. preparation is from half a fluidounce to a fluidounce and a half (15–45 C.c.), every three or four hours, mixed with water and sweetened with sugar. It proves sometimes very grateful to febrile patients, when prescribed with an equal measure of carbonic acid water. In the present Br. Pharmacopœia the dose is stated at from two to six fluidrachms (7·5–22·5 C.c.).

Off. Prep. Mistura Ferri et Ammonii Acetatis, *U. S.*

LIQUOR AMMONIÆ CITRATIS. *Br.* *Solution of Citrate of Ammonia.*

(LĬ′QUỌR ẠM-MŌ′NỊ-Æ CĪ-TRĀ′TĬS.)

Citrate d'Ammoniaque liquide, *Fr.;* Citronensaure Ammoniak-Flüssigkeit, *G.*

"Take of Citric Acid *three ounces* [avoirdupois]; Strong Solution of Ammonia *two fluidounces and three-quarters* [Imperial measure], or *a sufficiency;* Distilled Water *one pint* [Imp. meas.]. Dissolve the Citric Acid in the Water and add the Solution of Ammonia until the solution is neutral to test-paper." *Br.*

This may be used for the same purposes as the preceding in the dose of from two to six fluidrachms (7·5 to 22·5 C.c.).

LIQUOR ANTIMONII CHLORIDI. *Br.* *Solution of Chloride of Antimony.*

(LĬ′QUỌR ĂN-TỊ-MŌ′NỊ-Ī CHLŌ′RỊ-DĪ.)

Liquor Antimonii Terchloridi, *Br.* 1864; Solution of Terchloride of Antimony; Liquor Stibii Chlorati, *P.G.:* Liquid Butter of Antimony; Chlorure (Beurre) d'Antimoine liquide, Huile d'Antimoine, *Fr.;* Speissglanzbutter, *G.*

"Take of Black Antimony *one pound* [avoirdupois]; Hydrochloric Acid *four* *pints* [Imperial measure]. Place the Black Antimony in a porcelain vessel; pour upon it the Hydrochloric Acid, and, constantly stirring, apply to the mixture, beneath a flue with a good draught, a gentle heat, which must be gradually augmented as the evolution of gas begins to slacken, until the liquid boils. Maintain it at this temperature for fifteen minutes; then remove the vessel from the fire, and filter the liquid through calico into another vessel, returning what passes through first, that a perfectly clear solution may be obtained. Boil this down to the bulk of two pints [Imp. meas.], and preserve it in a stoppered bottle." *Br.*

When tersulphide of antimony is dissolved with the aid of heat in hydrochloric acid, a double decomposition takes place, resulting in the formation of terchloride of antimony and hydrosulphuric acid (sulphuretted hydrogen), which gives rise to effervescence. As this gas is exceedingly offensive and deleterious, the materials, during the reaction, are directed to be placed under a flue with a good draught. When the reaction is over, the resulting aqueous solution of terchoride, after having been strained, is boiled down to a determinate volume.

Properties. Solution of chloride of antimony is a transparent, pale yellow, dense liquid, possessing caustic properties. When of a deep red color, it is impure from the presence of iron. Its sp. gr., concentrated to the extent directed in the Br. Pharmacopœia, is 1·470. "A little of it dropped into water gives a white precipitate, and the filtered solution lets fall a copious deposit on the addition of nitrate of silver. If the white precipitate formed by water be treated with sulphuretted hydrogen it becomes orange-colored." (*Br.*) These reactions show that it contains antimony and chlorine. A fluidrachm of it, mixed with four fluidounces of water in which is dissolved a quarter of an ounce (avoirdupois) of tartaric acid, forms a clear solution, from which sulphuretted hydrogen throws down an orange precipitate (tersulphide of antimony), weighing, when washed and dried at 212°, at least 22 grains. (*Br.*) When it is distilled, water, the excess of hydrochloric acid, and any tersulphide of arsenic that may happen to be present, are first expelled, and afterwards the terchloride volatilizes. The pure terchloride may be obtained by changing the receiver, as soon as the distilled product concretes on cooling. Pure terchloride of antimony, called by the earlier chemists *butter of antimony*, is a white, readily fusible solid, of the consistence of butter, deliquescent and powerfully caustic, and volatilizable under an obscure red heat. It was formerly used in medicine as a caustic. It usually acts without causing much pain or inflammation; and, after the separation of the eschar, a clean, healthy ulcer is left.

Solution of terchloride of antimony was a new officinal of the Dublin Pharmacopœia of 1850, and is probably retained in the British not as a therapeutic agent, but simply as a source of the officinal oxide of antimony.

Off. Prep. Antimonii Oxidum, *Br.*

LIQUOR ARSENII ET HYDRARGYRI IODIDI. *U. S.* *Solution of Iodide of Arsenic and Mercury.* [*Donovan's Solution.*]

(LĪ'QUỌR ÄR-SĒ'NỊ-Ī ĔT HȲ-DRÄR'ÇỴ-RĪ Ī-ŎD'Ị-DĪ.)

Liquor Arsenici et Hydrargyri Iodidi, *Br.;* also *U.S.* 1870; Solution of Hydriodate of Arsenic and Mercury; Solutio Donovani; Soluté d'Iodo-arsénite de Mercur, Liqueur de Donovan, *Fr.;* Jodquecksilber-Arsenik-Lösung, Donovan'sche Tropfen, *G.*

"Iodide of Arsenic, *one part* [or thirty-five grains]; Red Iodide of Mercury, *one part* [or thirty-five grains]; Distilled Water, *a sufficient quantity*, To make *one hundred parts* [or half a pint]. Triturate the Iodides with *fifteen parts* [or a fluidounce] of Distilled Water, until they are dissolved. Filter the liquid and pass enough Distilled Water through the filter to make the solution weigh *one hundred parts* [or measure half a pint]." *U. S.*

This solution was introduced to the notice of the medical profession in 1839, by Mr. Donovan, of Dublin, as a therapeutic agent combining the medical virtues of its three ingredients, and was adopted as an officinal preparation in the U. S. and Dublin Pharmacopœias of 1850. The former has retained it; but on the absorption of the latter in the British Pharmacopœia it was discarded. The formula of the U. S. Pharmacopœia is the simplified one of Prof. Procter, which consists essentially in dissolving equal weights of the teriodide of arsenic and mercuric iodide (red iodide) in a measured quantity of distilled water. The change in the quantities of the two salts from the process of the U. S. P. 1870 is very trifling. The proportion of equal weights corresponds nearly to single molecules of the component iodides. The Dublin formula was more complicated. In it the proper quantities of arsenic, mercury, and iodine were caused to unite by first rubbing them together with alcohol, and then boiling the product with distilled water, which was afterwards added, so as to give the whole a determinate bulk. The iodides of arsenic and mercury, formed by the trituration, were assumed by Mr. Donovan to become, by solution, hydriodates severally of arsenious acid (white oxide of arsenic), and of mercuric oxide (red precipitate).

Properties. This solution has a pale yellow color, and a slightly styptic taste. Sometimes, however, the color is orange-yellow, owing to the presence of free iodine. This may be neutralized by rubbing the solution with a little metallic mercury or arsenic, in fine powder, and the proper hue be thus restored. The solution is incompatible with laudanum and the soluble salts of morphine. On the supposition that it is an aqueous solution of iodides, it will contain them in the proportion of one mol. of teriodide of arsenic 456, to one of mercuric iodide 454, which are nearly equal weights.

Medical Properties. This preparation has been found decidedly useful as an alterative in various diseases of the skin, such as the different forms of psoriasis, impetigo, porrigo, lepra, pityriasis, lupus, and venereal eruptions, both papular and scaly. In support of its efficacy in these affections, Mr. Donovan has adduced the testimony of a number of respectable practitioners, who have communicated to him the results of their experience. The disease in some of the cases cured had existed for several years. Many American physicians also have used it advantageously in cutaneous diseases, and found more prompt effects from it than from the remedies usually resorted to. In chronic rheumatism and in advanced specific diseases, especially "night pains," it is often useful. The dose is from five to ten drops (0·3 to 0·6 C.c.) three times a day, given preferably in distilled water.

LIQUOR ATROPIÆ. *Br.* *Solution of Atropia.*

(LĬ′QUỌR Ạ-TRŌ′PỊ-Æ.)

Soluté d'Atropine, *Fr.;* Atropin-Lösung, *G.*

"Take of Atropia *four grains;* Rectified Spirit *one fluidrachm;* Distilled Water *seven fluidrachms.* Dissolve the Atropia in the Spirit, and add this gradually to the Water, shaking them together." *Br.*

For the effects of this solution, see *Atropina.* If given internally, the dose to begin with should not exceed two minims (0·12 C.c.).

LIQUOR ATROPIÆ SULPHATIS. *Br.* *Solution of Sulphate of Atropia.*

(LĬ′QUỌR Ạ-TRŌ′PỊ-Æ SŬL-PHĀ′TĬS.)

Soluté de Sulfate d'Atropine, *Fr.;* Schwefelsaure Atropinlösung, *G.*

"Take of Sulphate of Atropia *four grains;* Distilled Water *one fluidounce* [Imperial measure]. Dissolve." *Br.*

This solution is of the same strength as the preceding.

LIQUOR BISMUTHI ET AMMONIÆ CITRATIS. *Br.* *Solution of Citrate of Bismuth and Ammonia.*

(LĬ′QUỌR BĬS-MŪ′THĪ ĔT ẠM-MŌ′NỊ-Ī CĪ-TRĀ′TĬS.)

Liquor Bismuthi; Soluté de Citrate de Bismuth ammoniacal, *Fr.;* Citronensaure Wismuth-Ammoniak-Lösung, *G.*

"Take of Purified Bismuth *four hundred and thirty grains;* Nitric Acid *two fluidounces* [Imperial measure]; Citric Acid *two ounces* [avoirdupois]; Solution of Ammonia, Distilled Water, of each, *a sufficiency.* Mix the Nitric Acid with a [fluid]ounce of Distilled Water, and add the Bismuth in successive portions. When effervescence has ceased apply for ten minutes a heat approaching that of ebullition, and decant the solution from any insoluble matter that may be present. Evaporate the solution until it is reduced to two fluidounces; then add the Citric Acid previously dissolved in four [fluid]ounces of Distilled Water, and afterwards the Solution of Ammonia in small quantities at a time until the precipitate formed is redissolved, and the solution is neutral or slightly alkaline to test-paper. Dilute with Distilled Water to the volume of one pint [Imp. meas.]." *Br.*

This is not the formula that we would recommend for the preparation of the "*Solution of Citrate of Bismuth and Ammonia*" (see *Bismuthi et Ammonii Citras*, p. 289). Indeed, the product of the formula is not the substance it purports to be; but probably nitrate of bismuth held in solution by means of citrate of ammonium. The first step is to make a very concentrated solution of nitrate of bismuth, to which is then added a solution of citric acid, containing water enough to cause a partial precipitate of subnitrate of bismuth, which is dissolved again by the addition of ammonia. This neutralizes the citric acid, and the resulting citrate of ammonium holds the re-formed nitrate of bismuth in solution; or the two acids may divide the two bases between them, forming a mixture of nitrate and citrate of ammonium and bismuth. At all events, the nitric acid is retained in the preparation; and, as all its salts are much more irritating than the corresponding salts of citric acid, we have a preparation likely to irritate the stomach, instead of the mild insoluble salts of bismuth which it is intended to represent, or the mild citrate of bismuth and ammonia which it purports to be. In all other processes we have seen, pains are taken to get rid of the nitric acid.

Some years since, a secret preparation was made and sold by Mr. Schacht, of Clifton, England, under the name of *Liquor Bismuthi*. Mr. Ch. R. C. Tichborne, having analyzed the liquid, and found it to contain oxide of bismuth, ammonia, and citric acid, announced the discovery at a meeting of the Pharmaceutical Society, when Mr. Schacht, being present, acknowledged the correctness of the analysis, stating, at the same time, that he had never made a secret of the composition of his solution to medical practitioners, and that a fluidrachm of his liquid contained one grain of the teroxide. (*P. J. Tr.*, 1864, p. 301.) A formula for the preparation was given by Mr. Tichborne, which, however, on repeated trial by Mr. N. Gray Bartlett, of Chicago, proved to be impracticable. After numerous experiments, Mr. Bartlett succeeded in making a solution which had all the desired qualities. (See *A. J. P.*, Jan. 1865.) He first prepares a *citrate of bismuth* by dissolving a *troy-ounce* of the subcarbonate of bismuth in 720 *grains* of nitric acid, diluting the solution after effervescence has ceased with *a fluidounce and a half* of distilled water gradually introduced, and then adding this solution, slowly and with constant stirring, to another solution made by dissolving 600 *grains* of citrate of potassium in *two pints* of distilled water. By an interchange of principles, nitrate of potassium and citrate of bismuth are formed, the latter of which, being insoluble, is precipitated, and is obtained by throwing the whole upon a filter, thoroughly washing the salt with distilled water, and then drying it on bibulous paper with a gentle heat. The next step is to prepare the *citrate of bismuth and ammonium*. This is done by rubbing the citrate of bismuth with sufficient distilled water to make a paste, and adding to this gradually, and with constant trituration, stronger water of ammonia until the citrate is dissolved, care being taken to avoid an excess of ammonia. The solution is now filtered, and spread on glass to dry.

Various modifications of Mr. Bartlett's process have been suggested, though it may be doubted whether any one, on the whole, is preferable to the original. Besides the processes offered by Mr. T. P. Blunt and Mr. Tichborne, in England, Mr. A. E. Ebert and Prof. Markoe have each proposed a modification of Mr. Bartlett's process. (See *A. J. P.*, 1866, p. 1, and 1869, p. 151.) In Ebert's formula the solution of nitrate of bismuth is decomposed by caustic potassa in the presence of citric acid, instead of the citrate of potassium already formed; in Markoe's, crystallized carbonate of sodium is substituted for the caustic alkali, to which various objections exist. After precipitating the solution of nitrate of bismuth to which citric acid has been added, with carbonate of sodium, washing the precipitate to get rid of the nitrate of sodium, and dissolving the residue of the precipitate in water of ammonia, Markoe completes the process by determining the proportion of teroxide of bismuth contained in the solution, and then diluting the liquid so that each fluidrachm shall contain one grain of teroxide.*

Citrate of bismuth and ammonium, obtained by Mr. Bartlett's process, is in fine, glossy, translucent, colorless scales, of a slightly acidulous, somewhat metallic, not disagreeable taste, very soluble in water, but not deliquescent, and of an acid reaction. (See page 289.) From an analysis by Mr. Bartlett, it appears to possess the formula $Bi,C_6H_5O_7,NH_3 + 3H_2O$. (See page 289.)

There is no occasion for a permanent solution of this salt, as it may at any time be dissolved when wanted for use. But, as it is in the liquid form that it has obtained its present reputation, we give a formula for a permanent solution prepared by Mr. Bartlett. Dissolve 260 *grains* of citrate of bismuth and ammonium in *fourteen fluidounces* of distilled water, neutralize the solution with water of ammonia, and add *two fluidounces* of alcohol. The solution of the salt without addition is liable to spontaneous decomposition; but, in the opinion of Mr. Bartlett, it is completely protected by the ammonia and alcohol, so that in this state it will keep indefinitely.

Medical Properties and Uses. This preparation is much more astringent than are the insoluble salts of bismuth, and is at the same time irritant, and not possessed of the peculiar medical properties which grow out of the insolubility of the subnitrate or subcarbonate. It is, therefore, not a substitute for these, and is adapted to the treatment of diarrhœas rather of relaxation than of irritation. The dose of the solution is a half to one fluidrachm (1·9–3·75 C.c.).

LIQUOR CALCIS. *U. S.*, *Br.* *Solution of Lime.* [*Lime-water.*]

(LĪ'QUỌR CĂL'CĬS.)

"An aqueous solution containing about 0·15 per cent. of Hydrate of Calcium [$\mathbf{Ca(HO)_2}$; 74. — CaO,HO ; 37]." *U. S.*

Aqua Calcis; Aqua Calcariæ, *P.G.;* Eau Liqueur de Chaux, *Fr.;* Kalkwasser, *G.*

"Lime, *one part* [or half an ounce av.]; Water, Distilled Water, each, *a sufficient quantity.* Slake the Lime by the gradual addition of *six parts* [or three fluidounces] of Water, then add *thirty parts* [or one pint] of Water and stir occasionally during half an hour. Allow the mixture to settle, decant the liquid and throw it away. Then add to the residue *three hundred parts* [or eight pints] of Distilled Water, stir well, wait a short time for the coarser particles to subside, and pour the liquid, holding the undissolved Lime in suspension, into a glass-stoppered bottle. Pour off the clear liquid when wanted for use." *U. S.*

"Take of Slaked Lime *two ounces* [avoirdupois]; Distilled Water *one gallon* [Imperial measure]. Put the Lime into a stoppered bottle containing the Water; and shake well for two or three minutes. After twelve hours the excess of lime will have subsided, and the clear solution may be drawn off with a siphon as it is required for use, or transferred to a green-glass bottle furnished with a well-ground stopper." *Br.*

A solution of calcium hydrate, $Ca(OH)_2$, in water is the result of these processes. By the slaking of the lime it is reduced to powder, and rendered more easily diffusible through the water. According to both Pharmacopœias, the solution is to be kept in bottles with a portion of undissolved hydrate, which causes it always to be saturated whatever may be the temperature, and to whatever extent it may be exposed to the air. If care be taken to have a considerable quantity of the solution in the bottle, and to avoid unnecessary agitation, the upper portion will always remain sufficiently clear for use. The employment of distilled water as the solvent may seem a useless refinement; and it certainly is unnecessary when pure spring or river water is attainable; but in many places the common water is very impure, and wholly unfit for a preparation, one of the most frequent uses of which is to allay irritation of stomach. Water dissolves but a minute proportion of lime, and, contrary to the general law, less when hot than cold. Hence the propriety of employing cold water in the process. According to Mr. Phillips, a pint of water (the wine pint of the U. S. Pharm.) at 212° dissolves 5·6 grains of lime, at 60°, 9·7 grains, and at 32°, 11·0 grains. When the officinal solution is heated, a deposition of lime takes place, but is redissolved on cooling.

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* Mr. C. H. Wood proposes the following formula as exceedingly simple and satisfactory. Its result has the same strength as the officinal liquor. Take of Oxide of Bismuth nine ounces; Citric Acid sixteen ounces; Strong Solution of Ammonia twelve fluidounces or q. s. Dissolve eight ounces of citric acid in four ounces of hot water, and carefully neutralize it with some of the solution of ammonia (about seven fluidounces), mixed with half its volume of water. Then add the other eight ounces of citric acid, and when it has dissolved introduce the oxide of bismuth. Heat the mixture to near its boiling point for fifteen minutes with frequent stirring, then add about a pint of water, and introduce sufficient ammonia to dissolve the insoluble portion and render the liquid slightly alkaline. Augment the solution to the volume of one gallon, and filter through paper. Mr. C. Meher (*A. J. P.*, 1873, p. 541) states that in this process an excess of citric acid is employed, and offers the following substitute. Dissolve pure bismuth in three times its weight of nitric acid; set aside to crystallize; evaporate the mother-liquid until all acid is driven off; unite the crystals and pour upon them a hot concentrated solution of citric acid, in such amount that there shall be one equivalent of citric acid for each of bismuth (about equal weights); to half of this solution add ammonia in sufficient quantity to redissolve the precipitate first formed and then add the other half; wash the white precipitate of citrate of bismuth until the water no longer becomes acid. This citrate dissolves readily in ammonia.

Properties. Lime-water is "a clear, colorless liquid, without odor, having a saline and feebly caustic taste, and an alkaline reaction. Sp. gr. 1·0015 at 15° C. (59° F.). When heated to boiling, it becomes cloudy. Test-solution of oxalic acid added to it produces a white precipitate soluble in hydrochloric, but insoluble in acetic acid. The alkaline reaction of the liquid entirely disappears after it has been saturated with carbonic acid gas, and the excess of the latter has been expelled by boiling (abs. of alkalies or their carbonates)." *U. S.* Exposed to the air it attracts carbonic acid, and becomes covered with a pellicle of insoluble carbonate of calcium, which, subsiding after a time, is replaced by another, and so on successively till the whole of the lime is exhausted. Hence the necessity of keeping lime-water, either in closely corked bottles which should be full, or, what is more convenient, in bottles with an excess of lime. "Ten fluidounces of it require for neutralization at least 200 grain-measures of the *volumetric solution of oxalic acid*, which corresponds to 5·6 grains of lime, CaO." *Br.*

Medical Properties and Uses. Lime-water is antacid, tonic, and astringent, and is very usefully employed in dyspepsia with acidity of stomach, diarrhœa, diabetes, and gravel attended with superabundant secretion of uric acid. Mixed with an equal measure of milk, which completely covers its offensive taste, it is one of the best remedies in our possession for nausea and vomiting dependent on irritability of stomach. We have found a diet exclusively of lime-water and milk to be more effectual than almost any other plan of treatment in dyspepsia accompanied with vomiting of food. In this case one part of the solution to two or three parts of milk is usually sufficient. Externally it is employed as a wash in tinea capitis and scabies, as an application to foul and gangrenous ulcers, as an injection in leucorrhœa and ulceration of the bladder or urethra, and, mixed with linseed or olive oil, as a liniment in burns and scalds. Having been found to possess the property of dissolving false-membrane, it was naturally employed as a local remedy in pseudomembranous croup. Dr. B. W. Wilson reported (*Med. Surg. Reporter*, Aug. 27, 1867, p. 355) several cases in which the remedy was used successfully; and other similar instances have been since recorded. There are two methods of applying the remedy; one by directing lime-water spray, produced by the atomizer, so that it shall be inhaled by the patient; the other, which is recommended by Dr. Wilson, by causing the patient to inhale freely the vapors arising from lime undergoing the process of slaking with water. The dose of lime-water is from two to four fluidounces (60 to 118 C.c.) several times a day. When employed to allay nausea, it is usually given in the dose of a tablespoonful mixed with the same quantity of milk, and repeated at intervals of half an hour, an hour, or two hours. If too long continued it debilitates the stomach.

Pharm. Uses. In preparing Argenti Oxidum, *Br.;* Lotio Hydrargyri Flava, *Br.;* Lotio Hydrargyri Nigra, *Br.*

Off. Prep. Linimentum Calcis.

LIQUOR CALCIS CHLORATÆ. *Br.* *Solution of Chlorinated Lime.*

(LĪ'QUỌR CĂL'CĬS ÇHLỌ-RĀ'TÆ.)

Chlorure de Chaux liquide, *Fr.;* Chlorkalk-Flüssigkeit, *G.*

"Take of Chlorinated Lime *one pound* [avoirdupois]; Distilled Water *one gallon* [Imperial measure]. Mix well the Water and the Chlorinated Lime by trituration in a large mortar, and, having transferred the mixture to a stoppered bottle, let it be well shaken several times for the space of three hours. Pour out now the contents of the bottle on a calico filter, and let the solution which passes through be preserved in a stoppered bottle. The sp. gr. of this liquid is 1·035." *Br.*

For the properties and uses of this preparation, see *Calx Chlorinata.* The British Pharmacopœia gives the following test of its strength. "Sixty grains mixed with twenty grains of iodide of potassium dissolved in four fluidounces of water, when acidulated with two fluidrachms of hydrochloric acid, gives a red solution, which requires for the discharge of its color 500 grain-measures of the *volumetric solution of hyposulphite of soda*, corresponding to 13 grains of available chlorine in a fluidounce." This determines its strength in chlorine, by determining the quantity of iodine which the chlorine contained in it is capable of separating from iodide of potassium. Notwithstanding, however, that a test of its character is thus given by the Pharmacopœia, its strength must vary according to the quality of the chlorinated lime employed. It is one of the best antidotes for hydrosulphuric acid, ammonium sulphydrate, sulphide of potassium, and hydrocyanic acid. The dose for internal use is from twenty minims to a fluidrachm (1·25 to 3·75 C.c.). For external application the solution may be diluted with twice its bulk of water, or may be used of the full strength in some cutaneous affections.

LIQUOR FERRI ACETATIS. *U. S.* *Solution of Acetate of Iron.* [*Solution of Ferric Acetate.*]

(LĪ'QUỌR FĔR'RĪ ĂÇ-Ẹ-TĀ'TĬS.)

"An aqueous solution of Ferric Acetate [$\mathbf{Fe_2(C_2H_3O_2)_6}$; **465·8.**—$Fe_2O_3.3C_4H_3O_3$ 232·9], containing 33 per cent. of the anhydrous salt." *U. S.*

Liquor Ferri Acetici, *P.G.;* Liqueur d'Acétate de Fer, *Fr.;* Essigsaure Eisen-Flüssigkeit, *G.*

"Solution of Tersulphate of Iron, *one hundred parts* [or fourteen and a half fluidounces]; Glacial Acetic Acid, *twenty-six parts* [or four and three-quarter fluidounces]; Water of Ammonia, *eighty parts* [or one pint]; Water, Distilled Water, each, *a sufficient quantity*, To make *one hundred parts* [or one pint]. To the Water of Ammonia diluted with *two hundred parts* [two and a half pints] of cold Water add, constantly stirring, the solution of Tersulphate of Iron, previously diluted with *three hundred and fifty parts* [or four pints] of cold Water. Pour the whole on a wet muslin strainer, allow the precipitate to drain, then return it to the vessel and mix it intimately with *six hundred parts* [or seven pints] of cold Water, again drain it on the strainer, and repeat the operation, until the washings cause but a slight cloudiness with test-solution of chloride of barium. Then allow the excess of Water to drain off and press the precipitate, folded in the strainer, until its weight is reduced to *seventy parts* [or fourteen ounces av.] or less. Add the precipitate to the Glacial Acetic Acid contained in a capacious porcelain capsule, and stir occasionally, until the oxide is entirely dissolved. Finally, add enough cold, Distilled Water to make the solution weigh *one hundred parts* [or measure one pint], and filter, if necessary. Solution of Acetate of Iron should be kept in well-stopped bottles, protected from light." *U. S.*

The formula of this new officinal preparation is almost identical with that of the solution of acetate of iron of the German Pharmacopœia. The U. S. process consists in first forming ferric hydrate, by precipitating a solution of tersulphate of iron with water of ammonia, washing and draining the precipitate, and finally dissolving it in glacial acetic acid. The solution is readily effected in the cold, and no heat whatever should be used, to avoid decomposition. The German Pharmacopœia directs diluted acetic acid; and its Liquor Ferri Acetici is not so strong as our officinal solution, having only the sp. gr. 1·134 to 1·138, corresponding to 8 per cent. of iron.

Properties. The officinal solution is described as "a dark red-brown, transparent liquid, of an acetous odor, a sweetish, faintly styptic taste, and a slightly acid reaction. Sp. gr. 1·160. The diluted solution affords a brown-red precipitate with water of ammonia, and a blue precipitate with test-solution of ferrocyanide of potassium. When heated with sulphuric acid, the solution evolves acetous vapors. If the iron be completely precipitated from the solution by an excess of ammonia, a portion of the filtrate should not yield a white or a dark-colored precipitate with hydrosulphuric acid (zinc, copper). Another portion of the filtrate should leave no fixed residue on evaporation and gentle ignition (fixed alkalies). A few drops added to freshly-prepared test-solution of ferricyanide of potassium should impart to it a pure greenish brown color without a trace of blue (abs. of ferrous salt). 10 Gm. of the Solution mixed with a few drops of nitric acid, carefully evaporated and ignited, should yield a residue weighing 1·13 Gm." *U. S.*

Medical Properties. Acetate of Iron is an excellent chalybeate; this strong solution is not, however, quite so well adapted for internal administration as is the Tincture of Acetate of Iron, or the Mixture of Acetate of Iron and Ammonium, which are now officinal. Although it was introduced for the purpose of making the former preparation, it may be serviceable when mixed with an equal bulk of water, with the addition of an aromatic syrup. The dose is from two to ten minims (0·12 to 0·6 C.c.).

Off. Prep. Tinctura Ferri Acetatis, *U. S.*

LIQUOR FERRI CHLORIDI. *U. S., Br.* *Solution of Chloride of Iron.* [*Solution of Ferric Chloride.*]

(LĪ'QUỌR FĔR'RĪ ȻHLŌ'RỊ-DĪ.)

"An aqueous solution (with some free Hydrochloric Acid) of Ferric Chloride [Fe_2Cl_6; **324·2**.—Fe_2Cl_3; 162·1], containing 37·8 per cent. of the anhydrous salt." *U. S.*

Liquor Ferri Perchloridi Fortior, *Br.;* Liquor Ferri Sesquichlorati, *P.G.;* Strong Solution of Perchloride of Iron; Soluté de Perchlorure de Fer, Chlorure ferrique liquide, *Fr.;* Flüssiges Eisenchlorid, *G.*

"Iron, in the form of fine wire and cut into small pieces, *fifteen parts* [or three and a half ounces av.]; Hydrochloric Acid, *eighty-six parts* [or sixteen and three-quarter fluidounces]; Nitric Acid, Distilled Water, each, *a sufficient quantity,* To make *one hundred parts* [or one pint]. Put the Iron Wire into a flask capable of holding double the volume of the intended product. Pour upon it *fifty-four parts* [or ten and a half fluidounces] of Hydrochloric Acid previously diluted with *twenty-five parts* [or five and a half fluidounces] of Distilled Water, and let the mixture stand until effervescence ceases; then heat it to the boiling point, filter through paper, and, having rinsed the flask and Iron Wire with a little boiling Distilled Water, pass the washings through the filter. To the filtered liquid add *twenty-seven parts* [or five and a quarter fluidounces] of Hydrochloric Acid, and pour the mixture, slowly and gradually, in a stream, into *eight parts* [or one fluidounce and three fluidrachms] of Nitric Acid contained in a capacious porcelain vessel. After effervescence ceases, apply heat, by means of a sand-bath, until the liquid is free from nitrous odor. Then test a small portion with freshly prepared test-solution of ferricyanide of potassium. Should this reagent produce a blue color, add a little more Nitric Acid and evaporate off the excess. Finally, add the remaining *five parts* [or one fluidounce] of Hydrochloric Acid, and enough Distilled Water to make the solution weigh *one hundred parts* [or measure one pint]." *U. S.*

"Take of Iron Wire *two ounces* [avoirdupois]; Hydrochloric Acid *twelve fluidounces;* Nitric Acid *nine fluidrachms;* Distilled Water *eight fluidounces.* Mix eight fluidounces of the Hydrochloric Acid with the Distilled Water, and in this dissolve the Iron at a gentle heat. Filter the solution, add to it the remainder of the Hydrochloric Acid and the Nitric Acid, heat the mixture briskly until, on the sudden evolution of red fumes, the liquid becomes of an orange-brown color, then evaporate by the heat of a water-bath until it is reduced to ten fluidounces." *Br.*

By the reaction between the hydrochloric acid and iron, ferrous chloride is produced, which by the subsequent agency of the hydrochloric and nitric acids is converted into ferric chloride, or, as denominated in the Br. Pharmacopœia, the perchloride, which is held in solution by the water.

This preparation was included in the original British Pharmacopœia, but was not officinal with us until 1870. The original British formula (1864) was defective in several respects. For an account of these see 13th edition of this book.

When iron is treated with hydrochloric acid there is a copious evolution of hydrogen, and an emerald-green solution of ferrous chloride ($FeCl_2$) results. Green crystals having the composition $FeCl_2,4H_2O$ separate if the solution is permitted to rest. In the officinal process, water is added to the hydrochloric acid in order to retain the crystals in solution, and the mixture is heated whilst still in contact with the excess of iron, in order to hasten the complete conversion of all of the hydrochloric acid into ferrous chloride. The action slackens very materially as the quantity of hydrochloric acid is gradually lessened in the mixture, but when it is brought, as officinally directed, to the boiling point, a saturated solution is produced. After filtering from the excess of iron, half the original quantity of hydrochloric acid is added; this for the purpose of supplying the requisite amount necessary to form the solution of ferric chloride; and the mixture is then gradually poured into nitric acid, which at once converts the solution of green ferrous chloride into the solution of red ferric chloride. Formerly the nitric acid was added to the solution; now the order is reversed, in accordance with the recommendation of Prof. C. L. Diehl, to prevent frothing. (See *A. J. P.*, 1867, p. 140.) The reaction may be thus expressed:

$$\underset{\text{Ferrous chloride.}}{6FeCl_2} + \underset{\text{Nitric acid.}}{2HNO_3} + \underset{\text{Hydrochloric acid.}}{6HCl} = \underset{\text{Ferric chloride.}}{3Fe_2Cl_6} + \underset{\text{Nitrogen dioxide.}}{N_2O_2} + \underset{\text{Water.}}{4H_2O}.$$

If the solution should have a blackish color, and not a clear ruby-red, it is due to the presence of a nitro-compound composed of a portion of ferrous chloride and nitrogen dioxide, $FeCl_2 + N_2O_2$. As this compound is easily decomposed, all that is necessary is to heat the liquid and add a few drops of nitric acid, when the blackish color soon disappears, nitrogen dioxide is liberated, and a ruby-red solution remains. Any excess of nitric acid is to be evaporated off. The final addition of hydrochloric acid is to compensate for any loss which may have been suffered by heating the solution.

The solution of chloride of iron, properly made, is "a reddish brown liquid, having a faint odor of hydrochloric acid, an acid, strongly styptic taste, and an acid reaction. Sp. gr. 1·405. The diluted solution affords a brown-red precipitate with water of ammonia; a blue one with test-solution of ferrocyanide of potassium, and a white one, insoluble in nitric acid, with test-solution of nitrate of silver. If the iron be completely precipitated from a portion of the solution by excess of water of ammonia, the filtrate should not yield either a white or a dark-colored precipitate with hydrosulphuric acid (zinc, copper). Another portion of the filtrate should leave no fixed residue on evaporation and gentle ignition (fixed alkalies). On adding a clear crystal of ferrous sulphate to a cooled mixture of equal volumes of concentrated sulphuric acid and a moderately dilute portion of the solution, the crystal should not be colored brown, nor should there be a brownish black zone developed around it (abs. of nitric acid). A few drops added to freshly-prepared test-solution of ferricyanide of potassium should impart to the latter a pure greenish brown color without a trace of blue (abs. of ferrous salt). On diluting 3 parts of the solution with Distilled Water to 100 parts, and boiling in a test-tube, the liquid should remain clear (abs. of oxychloride). 10 Gm. of the solution, when completely precipitated by excess of water of ammonia, yield a precipitate, which, when washed, dried, and ignited, should weigh 1·86 Gm." *U. S.* Water and alcohol unite with it in all proportions. The British preparation is weaker than the U. S. officinal, the sp. gr. of the former being 1·338, of the latter, 1·405. Whilst the present officinal solution is a little stronger than that of the U. S. P. 1870. we believe that the sp. gr., 1·405, of the present U. S. solution is too high. A fluidrachm of the British liquor diluted with two fluidounces of water gives, upon the addition of an excess of solution of ammonia, a reddish brown precipitate, which, when well washed and incinerated, weighs 15·62 grains. When this test is answered, the solution is about four times as strong in iron as the U. S. Tincture of the Chloride.*

From the experiments of M. Adrian it appears that sugar has the property, when mixed in certain proportions with solution of ferric chloride, of converting it partly into ferrous chloride. The alteration commences immediately on the addition of sugar, as shown by the deeper color of the liquid; after some hours ferricyanide of potassium will indicate the presence of a ferrous salt; and, after 24 hours, the greater proportion of the ferric salt has undergone the change. (*Bost. Med. and Surg. Journ.*, March 12, 1868, p. 85; from *Revue Méd.*, Dec. 31, 1867.)

Medical Uses. This preparation was brought prominently into notice by M. Pravaz, a surgeon of Lyons, who found that a few drops of a strong solution, injected into a blood-vessel, produced coagulation of all the blood in the vessel for the extent of an inch or more. Its use as a styptic was the natural result of this observation. In this capacity it has been used in the cure of varices, and has even been recommended as an injection in ordinary aneurisms. In arresting hemorrhages from cut surfaces or wounded vessels it has proved remarkably successful. It has also been found advantageous as an application to nasal polypi, erectile tumors or *nævi materni* in infants, in ulcers about the nails, and in various cutaneous affections. (See *Chloride of Iron.*) Attempts have been made to cure nævi materni by the injection of the solution into the erectile tumor; but this proceeding is hazardous; and a fatal result is recorded as having occurred in an infant a month old. Five drops of the solution, introduced into the centre of the tumor, were followed instantly by a sharp cry, a brief convulsion, and death. (*Ann. de Thérap.*, 1867, p. 117.) Several other similar cases have occurred. Injection of it in cystic goitre has been strongly recommended by Dr. Morell Mackenzie (*London Lancet*, May 11, 1872), and has also been practised with advantage by some other surgeons. It has been used externally with asserted success in varicose veins. (*Med. and Surg. Reporter*, April, 1874, p. 1342; *New York Med. Journ.*, April, 1870, p. 202; *Amer. Journ. Med. Sci.*, April, 1874, p. 553.) It may be used internally, properly diluted, for the general purposes of the chalybeates, and especially as a substitute for the tincture of the chloride of iron, when the alcohol of that preparation is objectionable. For ordinary purposes the dose is from two to ten minims (0·12 to 0·6 C.c.). In post-partum hemorrhage it has been largely employed by various English obstetricians, a solution of it, varying in strength from a drachm to the half-ounce to the pint, being thrown directly into the relaxed and bleeding uterus. It is used in the preparation of the tincture of the chloride.

Off. Prep. Liquor Ferri Perchloridi, *Br.;* Tinctura Ferri Chloridi, *U. S.;* Tinctura Ferri Perchloridi, *Br.*

LIQUOR FERRI CITRATIS. *U. S.* *Solution of Citrate of Iron.* [*Solution of Ferric Citrate.*]

(LĪ′QUỌR FĔR′RĪ CĪ-TRĀ′TĬS.)

"An aqueous solution of Ferric Citrate [$\mathbf{Fe_2(C_6H_5O_7)_2}$; **489·8.**—$Fe_2O_3,C_{12}H_5O_{11}$; 244·9], containing about 35·5 per cent. of the anhydrous salt." *U. S.*

Liquor Ferri Citrici; Citrate de Fer liquide, *Fr.;* Flüssiges Eisencitrat, *G.*

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* The solution of ferric chloride, when kept, has a disposition to deposit the insoluble oxychloride of iron, and the resulting excess of hydrochloric acid is injuriously irritating. To obviate this disadvantage, M. Burin du Buisson recommends the following mode of preparation. "Saturate as quickly as possible pure and colorless hydrochloric acid with [gelatinous] hydrated peroxide of iron; evaporate the solution to somewhat less than one-half over a gentle fire; and then continue the evaporation by means of the salt-bath, taking care to remove the aqueous vapors, which would cause the formation of hydrochloric acid, and a deposition of insoluble oxychloride. When the solution has attained the consistence of thick syrup (in which state it curdles on cooling, without, however, becoming a solid mass), cease evaporating, add an excess of the gelatinous hydrate diluted with a little water, agitate for a quarter of an hour, and afterwards allow the liquor to rest for several hours. Next add distilled water sufficient to bring the solution to the density of 30° Baumé, and allow it to stand for eight days in contact with an excess of the hydrate; after which filter, and again allow it to stand for two weeks." This strength of the solution is required for the cure of varices. For injection into aneurismal tumors, it is sufficient to employ a solution of 20° or even 15°. These degrees of Baumé are equivalent, 30° to 29·70 per cent. of the dry salt, 20° to 17·05 per cent., and 15° to 12·10 per cent. (See *Ferri Chloridum*, U. S., page 660.)

"Solution of Tersulphate of Iron, *one hundred and five parts* [or ten and a half ounces av.]; Citric Acid, *thirty parts* [or three ounces av.]; Water of Ammonia, *eighty-four parts* [or eight and a half fluidounces]; Water, *a sufficient quantity*, To make *one hundred parts* [or ten ounces av.]. To the Water of Ammonia previously diluted with *two hundred parts* [or twenty fluidounces] of cold Water, add, constantly stirring, the Solution of Tersulphate of Iron previously diluted with *one thousand parts* [or six pints] of cold Water. Pour the whole on a wet muslin strainer, allow the precipitate to drain, then return it to the vessel and mix it intimately with *twelve hundred parts* [or seven and a half pints] of cold Water. Again drain it on a strainer, and repeat the operation until the washings cause but a very slight cloudiness with test-solution of chloride of barium; then allow the excess of Water to drain off. Transfer the moist precipitate to a porcelain dish, add the Citric Acid, and heat the mixture, on a water-bath, to 60° C. (140° F.), stirring constantly, until the precipitate is dissolved. Lastly, filter the liquid and evaporate it, at the above-mentioned temperature, until it weighs *one hundred parts* [or ten ounces av.]." *U. S.*

In this process, the ferric hydrate is first obtained by treating solution of the tersulphate with ammonia, and is then combined, with the aid of heat, with the citric acid, thus forming a solution of ferric citrate. It might appear, from the phraseology of the process, that, in the direction to add the citric acid to the precipitated hydrate, the addition of water to hold the resulting citrate in solution had been omitted; but the fact is, that the precipitate, even after draining, retains mechanically quite sufficient water for the purpose, so much, indeed, that evaporation is necessary at the end of the process to reduce the bulk to the required standard. The temperature is limited to 60° C. (140° F.), because, though a moderate heat promotes the solution, a high degree of it diminishes the solubility of the oxide, and thus interferes with the process.

The solution is "a dark brown liquid, odorless, having a slightly ferruginous taste, and an acid reaction. Sp. gr. 1·260. When allowed to evaporate spontaneously, or at a moderate heat, and spread on plates of glass, it forms transparent, garnet-red scales, which are easily detached from the glass. 100 parts of the solution thus treated yield 43 to 44 parts of scales, which, when completely incinerated, leave about 11 parts of residue. The solution is not precipitated but only rendered darker by water of ammonia. If heated with solution of potassa, it affords a brown-red precipitate without evolving any vapor of ammonia. If a portion of the solution be deprived of its iron by boiling with an excess of solution of potassa, the concentrated and cooled filtrate precipitated by test-solution of chloride of calcium, and the new filtrate heated to boiling, a white, granular precipitate will be produced. On adding test-solution of ferrocyanide of potassium to the diluted solution, a bluish green color or precipitate is produced, which is increased and rendered dark blue by the subsequent addition of hydrochloric acid." *U. S.* It keeps for a long time without change, and answers admirably well for preparing solid citrate of iron, and the chalybeate salts containing it, and for introducing it into extemporaneous mixtures. Each fluidounce of it contains about half a troyounce of citrate of iron. It may be given, for the general purposes of the ferruginous preparations, in the dose of ten minims (0·6 C.c.), equivalent to five grains (0·33 Gm.) of the salt, several times a day.

Off. Prep. Ferri Citras, *U. S.;* Ferri et Ammonii Citras, *U. S.*

LIQUOR FERRI ET QUININÆ CITRATIS. *U. S.* *Solution of Citrate of Iron and Quinine.*

(LĪ′QUỌR FĔR′RĪ ĔT QUỊ-NĪ′NÆ CĪ-TRĀ′TĬS.)

Citrate de Fer et de Quinine liquide, *Fr.;* Citronensaures Eisen- und Chinin-Lösung, *G.*

"Citrate of Iron and Ammonium, *sixty-five parts* [or five hundred and sixty-eight grains]; Quinine, dried at 100° C. (212° F.), until it ceases to lose weight, *twelve parts* [or one hundred and five grains]; Citric Acid, *twenty-eight parts* [or two hundred and forty-five grains]; Alcohol, *thirty parts* [or six fluidrachms]; Distilled Water, *a sufficient quantity*, To make *two hundred parts* [or four ounces av.]. Dissolve the Citrate of Iron and Ammonium in *two hundred parts* [or four fluidounces] of Distilled Water, contained in a tared porcelain capsule, heat the solution to 60° C. (140° F.), on a water-bath, add the Citric Acid, and, when it is dissolved, add the Quinine, stirring the mixture until a perfect solution has been obtained. Evaporate this to *one hundred and sixty parts* [or three ounces av.], allow it to cool, add the Alcohol, and finally enough Distilled Water to make the solution weigh *two hundred parts* [or four ounces av.]." *U. S.*

This is a new officinal solution. Its introduction grew out of the necessity for a soluble form of citrate of iron and quinine. That comparatively insoluble salt, the officinal citrate of iron and quinine, has been but little used; whilst the readily soluble preparation of the manufacturers, which contains ammonia, is in extensive demand. It is believed that the above solution will be even more satisfactory, as it bears a definite and easily remembered relation towards the officinal salt (see *Ferri et Quininæ Citras*), being *exactly half its strength.* Its principal use will undoubtedly be by the pharmacist, who will use it in manufacturing and in prescriptions, as it will save him the time and labor of dissolving the salt, whilst the process of assay, which is identical with that given under the salt, will serve as an efficient means of testing the solution should he be compelled to purchase it.

Properties. "A dark greenish yellow to yellowish brown liquid, transparent in thin layers, odorless, having a bitter and mildly ferruginous taste, and a slightly acid reaction. On supersaturating the diluted solution with a slight excess of ammonia, the color of the liquid is deepened and a white, curdy precipitate is thrown down, which is soluble in ether and answers to the reaction of quinine (see *Quinina*). A small portion of the filtrate, when mixed with test-solution of ferrocyanide of potassium, does not produce a blue color or precipitate, unless it is acidulated with hydrochloric acid. If another portion of the filtrate be deprived of its iron, by boiling with an excess of potassa, the concentrated and cooled filtrate precipitated by test-solution of chloride of calcium, and the new filtrate heated to boiling, a white granular precipitate is produced. On heating the solution with potassa, vapor of ammonia is evolved. The solution contains 6 per cent. of quinine. It may be assayed as follows: Dilute 8 Gm. of the solution with water to 30 C.c., introduce it, with any rinsings, into a glass separator, add an aqueous solution of 0·5 Gm. of tartaric acid, and then solution of soda in decided excess. Extract the alkaloid by agitating the mixture with four successive portions of chloroform, each of 15 C.c. Separate the chloroformic layers, mix them, evaporate them in a weighed capsule, on a water-bath, and dry the residue at a temperature of 100° C. (212° F.). It should weigh 0·48 Gm." *U. S.*

Medical Properties. The medical virtues of this solution are those of the citrate of iron and quinine. It may be given in dose of from 10 to 20 minims (0·6 to 1·25 C.c.).

Off. Prep. Vinum Ferri Amarum, *U. S.*

LIQUOR FERRI NITRATIS. *U. S.* *Solution of Nitrate of Iron.*
[*Solution of Ferric Nitrate.*]

(LĪ′QUỌR FĔR′RĪ NĪ-TRĀ′TĬS.)

"An aqueous solution of Ferric Nitrate [$\mathbf{Fe_2(NO_3)_6}$; **483·8.** — $Fe_2O_3.3NO_5$; 241·9], containing about 6 per cent. of the anhydrous salt." *U. S.*

Liquor Ferri Pernitratis, *Br.;* Solution of Pernitrate of Iron; Azotate (Pernitrate) de Fer liquide, *Fr.;* Salpetersaure Eisenoxyd-Lösung, *G.*

"Solution of Tersulphate of Iron, *eighteen parts* [or two fluidounces and five fluidrachms]; Water of Ammonia, *fifteen parts* [or three fluidounces]; Nitric Acid, *seven parts* [or seven and a half fluidrachms]; Distilled Water, Water, each, *a sufficient quantity*, To make *one hundred parts* [or twenty ounces av.]. To the Water of Ammonia previously diluted with *forty parts* [or half a pint] of cold Water, add, constantly stirring, the Solution of Tersulphate of Iron, previously diluted with *one hundred parts* [or twenty fluidounces] of cold Water. Pour the whole on a wet muslin strainer, allow the precipitate to drain, then return it to the vessel and mix it intimately with *one hundred parts* [or twenty fluidounces] of cold Water. Again drain it on a strainer and repeat the operation, until the washings cause but a very slight cloudiness with test-solution of chloride of barium. Then allow the excess of Water to drain off, transfer the precipitate to a capacious (tared) porcelain dish and add the Nitric Acid, stirring till a clear solution is obtained. Finally, add enough Distilled Water to make the solution weigh *one hundred parts* [or twenty ounces av.]." *U. S.*

"Take of fine Iron Wire, free from rust, *one ounce* [avoirdupois]; Nitric Acid, *four and a half fluidounces* [Imperial measure]; Distilled Water *a sufficiency.* Dilute the Nitric Acid with sixteen [fluid]ounces of the Water, introduce the Iron Wire into the mixture, and leave them in contact until the metal is dissolved, taking care to moderate the action, should it become too violent, by the addition of a little more Distilled Water. Filter the solution, and add to it as much Distilled Water as will make its bulk one pint and a half [Imp. meas.]. The specific gravity is 1·107." *Br.*

Solution of nitrate of iron was made in the U. S. P. 1870 by first forming ferrous nitrate by dissolving iron wire in diluted nitric acid, and then converting this into ferric nitrate by heating with an additional quantity of nitric acid; there was a slight excess of nitric acid left in the solution (about 1·4 per cent.). It was believed by the Committee of Revision that a solution of more definite composition would be made by adopting Mr. Louis Dohme's process. In this, ferric hydrate is dissolved in nitric acid in such proportion that the solution of nitrate of iron shall contain 2 per cent. of ferric hydrate when assayed by the officinal process, and 1 per cent. of free nitric acid.*

The U. S. solution is "a transparent, amber-colored, or reddish liquid, without odor, having an acid, strongly styptic taste, and an acid reaction. Sp. gr. 1·050. The solution affords a brown-red precipitate with water of ammonia, and a blue precipitate with test-solution of ferrocyanide of potassium. If a clear crystal of ferrous sulphate be added to a cooled mixture of equal volumes of concentrated sulphuric acid and of the solution, the crystal rapidly becomes brown and surrounded by a brownish-black zone. 10 Gm. of the solution, when precipitated by water of ammonia in excess, yield a precipitate, which, when washed, dried, and ignited, should weigh 0·2 Gm." *U. S.* It contains no ferrous nitrate, and does not give a blue precipitate with ferricyanide of potassium. The British preparation is of a reddish brown color, of the sp. gr. 1·107, and gives a blue precipitate with the yellow prussiate of potash [ferrocyanide of potassium]. The precipitate obtained from a fluidrachm of it by the addition of an excess of ammonia, when washed, dried, and incinerated, weighs 2·6 grains. (*Br.*) It is, therefore, about twice as strong as the U. S. solution.

Ferric nitrate is somewhat deliquescent, very soluble in water, and sparingly soluble in nitric acid. It consists of the double atom of iron, Fe_2, which is hexatomic, combined with 6 groups, NO_3, and crystallizes either with 12 molecules of water in colorless cubes, or with 18 molecules of water in colorless monoclinic crystals, yielding, therefore, either $Fe_2(NO_3)_6 + 12H_2O$ or $Fe_2(NO_3)_6 + 18H_2O$.

Medical Properties. This solution was introduced to the notice of the profession by Mr. William Kerr, in 1832. Its virtues are those of a tonic and astringent. Dr. R. J. Graves, of Dublin, praises it as a remedy in chronic diarrhœa, especially when occurring in delicate and nervous women, in which there is no thirst, redness of tongue, tenderness of the abdomen on pressure, or other indication of inflammation. Mr. Kerr attributed to it the property of diminishing the irritability of the intestinal mucous membrane. It is considered particularly applicable to the treatment of mucous diarrhœa, attended with pain, but not to cases in which ulcerations of the intestines exist; but in our experience it has seemed to be irritating, and has generally failed to accomplish good. Dr. T. C. Adams, of Michigan, also reports favorably of this remedy in chronic diarrhœa, considering it, like Mr. Kerr, to act as a sedative as well as astringent. He employed it, likewise with good effect, in menorrhagia, and both internally and by injection in leucorrhœa, when occurring in pale, exsanguine, and feeble subjects. The dose, according to Dr. Graves, is seven or eight drops (0·36–0·42 C.c.), gradually increased to fifteen (0·85 C.c.), sufficiently diluted, given in the course of the day. Dr. Adams gave it in doses of ten drops (0·6 C.c.), two, three, or four times a day, and sometimes increased it to twenty-five drops (1·5 C.c.). Dr. Garrod and Mr. Squire, the two most prominent expounders of the British Pharmacopœia, state the dose of the British preparation, though twice as strong in iron as our own, at from thirty minims to a fluidrachm (1·9–3·75 C.c.). Considering that a fluidrachm of the British solution contains 7·865 grains of the salt, this appears to us a very large dose; and the doses recommended by Drs. Graves and Adams would probably be safer. As an injection, Dr. Adams employed it sufficiently diluted to cause only a slight heat and smarting in the vagina.

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* Prof. Procter has proposed the following formula for a *syrup of ferrous nitrate,* a preparation used, in Philadelphia, as an astringent in chronic diarrhœa. Take of Iron Wire, in pieces (card teeth), *two ounces;* Nitric Acid (sp. gr. 1·42) *three fluidounces;* Water *thirteen fluidounces;* Sugar, in powder, *two pounds.* Put the iron in a wide-mouthed bottle, kept cool by standing in cold water, and pour upon it three fluidounces of water. Then mix the acid with ten fluidounces of water, and add the mixture in portions of half a fluidounce to the iron, agitating frequently until the acid is saturated, using litmus paper. When the saturation is complete, filter the solution into a bottle containing the sugar, and marked to contain thirty fluidounces. If the whole does not measure that bulk, pass water through the filter to make up the deficiency. When all the sugar is dissolved, strain if necessary, and introduce the syrup into suitable vials, and seal them. This syrup is thick, permanent, of a light greenish color, perfectly transparent, neutral, and yields a greenish precipitate with ammonia. (*A. J. P.*, 1851, p. 314.) Mr. W. W. D. Livermore has given a formula for a similar syrup. (*Ibid.*, p. 315.) A third formula has been proposed by Mr. Thomas Lancaster, of this city, in which the ferrous nitrate is obtained by double decomposition between nitrate of calcium and ferrous sulphate. (*Ibid.*, 1854, p. 400.) These syrups should not contain an excess of acid; for if they do, they are apt to deposit, after keeping, white granular masses of grape sugar, as observed by Mr. W. Tozier, of Kingstown, Ireland, in consequence of the action of the acid upon the cane sugar. According to Mr. Joseph Laidley, of Richmond, Va., the so-called syrup of ferric nitrate is an unscientific preparation, containing ferrous oxide if an excess of acid is avoided, and liable to let fall a precipitate of oxalate of iron when the acid is in excess. Hence Mr. Laidley believes that the only nitrate, proper to be formed into a syrup, is the ferrous nitrate, where alone the protective influence of sugar is required. (*Ibid.*, 1853, p. 97.)

LIQUOR FERRI PERCHLORIDI. *Br.* *Solution of Perchloride of Iron.*

(LĪ′QUỌR FĔR′RĪ PĔR-ȻHLŌ′RỊ-DĪ.)

"Take of Strong Solution of Perchloride of Iron *five fluidounces;* Distilled Water *fifteen fluidounces.* Mix." *Br.*

This is of one-fourth the strength of the *Liquor Ferri Perchloridi* of the Br. Pharmacopœia of 1864, which is the *Liquor Ferri Perchloridi Fortior* of the present edition. It is of the same ferruginous strength as the British tincture of Perchloride of Iron.

LIQUOR FERRI SUBSULPHATIS. *U. S.* *Solution of Subsulphate of Iron.* [*Solution of Basic Ferric Sulphate. Monsel's Solution.*]

(LĪ′QUỌR FĔR′RĪ SŬB-SŬL-PHĀ′TĬS.)

"An aqueous solution of Basic Ferric Sulphate [$\mathbf{Fe_4O(SO_4)_5}$; 719·6.—$2Fe_2O_3.5SO_3$; 359·8], containing 43·7 per cent. of the salt." *U. S.*

Solution of Persulphate of Iron; Liqueur hémostatique de Monsel, *Fr.;* Basisch-schwefelsaure Eisenoxydlösung, Monsel's Eisenlösung, *G.*

"Sulphate of Iron, *seventy-seven parts* [or thirteen ounces av.]; Sulphuric Acid, *seven parts* [or one ounce av. and seventy-two grains]; Nitric Acid, Distilled Water, each, *a sufficient quantity*, To make *one hundred and fourteen parts* [or nineteen ounces av.]. Mix the Sulphuric Acid with *eleven parts* [or one ounce av. and three hundred and sixty grains] of Nitric Acid and *fifty parts* [or half a pint] of Distilled Water in a capacious porcelain capsule, and, having heated the mixture to the boiling point, add the Sulphate of Iron (one-fourth of it at a time), stirring after each addition until effervescence ceases. Should the addition of a few drops of Nitric Acid cause a further evolution of red fumes, cautiously add Nitric Acid until red fumes cease to be evolved. Then keep the solution in brisk ebullition until nitrous vapors are no longer perceptible, and the liquid assumes a deep ruby-red tint. Lastly, add enough Distilled Water to make the solution weigh *one hundred and fourteen parts* [or nineteen ounces av.]. Solution of Subsulphate of Iron is to be dispensed when Solution of Persulphate of Iron is prescribed by the physician." *U. S.*

This process is essentially that of Dr. Squibb. The object is to obtain in solution *Monsel's Persulphate of Iron*, improperly so called, as it differs both in composition and in properties from the salt of iron properly named persulphate. The composition of the true persulphate is $Fe_2(SO_4)_3$, and it is a neutral salt, while Monsel's persulphate has the composition $Fe_4O(SO_4)_5$, and is properly a subsalt, as it is very appropriately designated in the U. S. Pharmacopœia. With this preliminary explanation, the process will be easily understood.

In its preparation the ferrous sulphate is converted into ferric sulphate at the expense of the nitric acid; but the sulphuric acid, mixed with the nitric, is in quantity insufficient to form the normal salt. The sesquioxide is therefore but partially saturated, and a subsalt results, having the constitution above mentioned.[*]

The solution of subsulphate of iron is "a dark reddish brown, almost syrupy liquid, odorless or nearly so, having an extremely astringent taste, free from causticity, and an acid reaction. Sp. gr. 1·555. It mixes with water and alcohol in all proportions, without decomposition. The diluted solution affords a brown-red precipitate with water of ammonia, a blue one with test-solution of ferrocyanide of potassium, and a white one, insoluble in hydrochloric acid, with test-solution of chloride of barium. On slowly mixing 2 volumes of the solution with 1 volume of concentrated sulphuric acid, in a beaker, the mixture separates a solid, white mass on standing (difference from tersulphate). On adding a clear crystal of ferrous sulphate to a cooled mixture of equal volumes of concentrated sulphuric acid and a diluted portion of the solution, the crystal should not become brown, nor should there be a brownish black zone developed around it (abs. of nitric acid). A few drops added to freshly-prepared test-solution of ferricyanide of potassium should impart to it a pure, greenish brown color, without a trace of blue (abs. of ferrous salt). 10 Gm. of the solution, when completely precipitated by excess of water of ammonia, yield a precipitate, which, when washed, dried, and ignited, should weigh 1·938 Gm." *U. S.* A little sulphuric acid decolorizes the liquid in a considerable degree, and an excess of the same acid converts it into a white, soft, pasty solid, resembling plaster of Paris which has begun to solidify after mixture with water. This test, according to Dr. Squibb, is quite characteristic. (*N. Y. Journ. of Med.*, 1860, p. 173.)

By evaporation, upon a glass surface, with a moderate heat, the solution yields the subsulphate of iron, or *Monsel's salt*, in the form of thin transparent scales, of a light reddish brown color, deliquescent, and readily soluble in water.

Attention was first called to the special styptic virtues of ferric sulphate by M. Monsel in 1852; but it was not until 1857 that he published the formula for the peculiar salt which now goes by his name, and the solution of which is the subject of the present article. (See *Journ. de Pharm.*, Sept. 1857, and Juillet, 1859.)

In consequence of its deficiency of sulphuric acid, this salt is less irritant than the tersulphate, while it has at least equal if not greater astringency. It is therefore very efficacious as a styptic, and peculiarly adapted, through its power of coagulating the blood, to cases of hemorrhage from incised wounds, or surfaces in which it is specially desirable to avoid irritation. It is said also to have been found peculiarly efficacious in chancre. The solution may be applied by means of a small sponge or pencil of spun glass to the bleeding surface or vessel. In cases of hæmoptysis, a dilution of it (five to ten minims to the fluidounce) has been used with advantage, by means of the atomizer. It is an excellent styptic in hemorrhage from the stomach and bowels, in dose of three to six minims (0·18 to 0·36 C.c.), properly diluted, and repeated as often as necessary.

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[*] Mr. J. Creuse offers the following formula for the preparation of the solutions of *ter.* and *subsulphate of iron*, claiming them to be superior to the officinal because they require no especial apparatus and generate no noxious vapors.

For the tersulphate, Take of Sulphate of Iron, in coarse powder, twelve troyounces; Sulphuric Acid two troyounces and sixty grains; Chlorate of Potassium three hundred and forty-eight grains; Boiling Water twelve fluidounces. Dissolve the sulphate of iron in the boiling water in a glass matrass, or any convenient bottle; add the sulphuric acid gradually, and, while the liquid is hot, add the chlorate of potassium by small portions. When all is dissolved, filter, and complete twenty-four fluidounces. The following formula explains the reaction. $6(FeSO_4) + 3H_2SO_4 + KClO_3 = 3(Fe_2(SO_4)_3) + 3H_2O + KCl$.

For the subsulphate, Take of the ingredients as above enumerated, respectively, twelve troyounces, one troyounce and thirty grains, three hundred and forty grains, ten fluidounces; proceed as before; evaporate to twelve fluidounces, and filter. (*A. J. P.*, xliii. 169.) The solutions thus obtained are contaminated with chloride of potassium.

LIQUOR FERRI TERSULPHATIS. *U.S., Br.* *Solution of Tersulphate of Iron.* [*Solution of Normal Ferric Sulphate.*]

(LĪ′QUO̤R FĔR′RĪ TĔR-SŬL-PHĀ′TĬS.)

"An aqueous solution of Normal Ferric Sulphate [$\mathbf{Fe_2(SO_4)_3}$; 399·8.—$Fe_2O_3.3SO_3$; 199·9], containing 28·7 per cent. of the salt." *U. S.*

Liquor Ferri Persulphatis, *Br.;* Liquor Ferri Sulfurici Oxydati, *P.G.;* Solution of Persulphate of Iron; Persulfate de Fer liquide, *Fr.;* Flüssiges Schwefelsaures Eisenoxyd, *G.*

"Sulphate of Iron, *eighty parts* [or eight ounces av.]; Sulphuric Acid, *fifteen parts* [or one and a half ounces av.]; Nitric Acid, Distilled Water, each, *a sufficient quantity*, To make *two hundred parts* [or twenty ounces av.]. Mix the Sulphuric Acid with *eleven parts* [one ounce av. and forty-five grains] of Nitric Acid and with *fifty parts* [or five fluidounces] of Distilled Water in a capacious porcelain capsule, and, having heated the mixture to the boiling point, add the Sulphate of Iron (one-fourth of it at a time), stirring, after each addition, until effervescence ceases. Should the addition of a few drops of Nitric Acid cause a further evolution of red fumes, cautiously add Nitric Acid until red fumes cease to be evolved. Then continue the heat until the solution acquires a reddish brown color and is free from nitrous odor. Lastly, add enough Distilled Water to make the whole weigh *two hundred parts* [or twenty ounces av.]." *U. S.*

"Take of Sulphate of Iron *eight ounces* [avoirdupois]; Sulphuric Acid, Nitric Acid, of each, *six fluidrachms;* Distilled Water *twelve fluidounces* or *a sufficiency.* Add the Sulphuric Acid to ten [fluid]ounces of the Water, and dissolve the Sulphate of Iron in the mixture, with the aid of heat. Mix the Nitric Acid with the remaining two [fluid]ounces of Water, and add the dilute acid to the solution of Sulphate of Iron. Concentrate the whole by boiling, until, upon the sudden disengagement of ruddy vapors, the liquid ceases to be black and acquires a red color. A drop of the solution is now to be tested with red prussiate of potash [ferricyanide of potassium], and if a blue precipitate forms, a few additional drops of Nitric Acid should be added, and the boiling renewed, in order that the whole of the sulphate may be converted into persulphate of iron. When the solution is cold, make the quantity eleven fluidounces by the addition, if necessary, of Distilled Water." *Br.*

The sulphate of iron used in these formulas is ferrous sulphate. The nitric acid in the process gives up enough of its oxygen to convert it entirely into ferric sulphate, and the effervescence is owing to the escape of nitrogen dioxide becoming red nitrogen tetroxide by contact with the air. The conversion of the ferrous salt into ferric salt is incomplete until the effervescence ceases, and the color, from black, as it was at first, has become reddish brown. Indeed, in order to convert the whole into ferric sulphate, it is necessary to continue the heat until nitrous odor ceases to be evolved; and thus, moreover, the entire absence of nitric or nitrous acid from the solution is insured. But in consequence of the higher oxidation of the iron the sulphuric acid of the sulphate is insufficient to saturate it. Enough sulphuric acid, therefore, is added to meet this demand. The process is completed by adding enough water to make a definite weight. The U. S. and British formulas are the same in principle; but in the latter, the additional precaution is taken, in order to insure the complete change of ferrous into ferric salt, of testing the liquid with ferricyanide of potassium, which will produce a blue precipitate so long as any of the ferrous sulphate remains.

This solution, prepared according to the U. S. formula, is "a dark, reddish brown liquid, almost odorless, having an acid, strongly styptic taste, and an acid reaction. Sp. gr. 1·320. It is miscible with water and alcohol in all proportions, without decomposition. The diluted solution affords a brown-red precipitate with water of ammonia, a blue one with test-solution of ferrocyanide of potassum, and a white one, insoluble in hydrochloric acid, with test-solution of chloride of barium. On slowly mixing 2 volumes of the solution with 1 volume of concentrated sulphuric acid, in a beaker, the mixture does not separate a solid, white mass on standing (difference from subsulphate). On adding a clear crystal of ferrous sulphate to a cooled mixture of equal volumes of concentrated sulphuric acid and a moderately diluted portion of the solution, the crystal should not become brown, nor should there be a brownish black zone developed around it (abs. of nitric acid). A few drops added to freshly-prepared test-solution of ferricyanide of potassium should impart to it a pure, greenish brown color without a trace of blue (abs. of ferrous salt). 10 Gm. of the solution, when completely precipitated by excess of water of ammonia, yield a precipitate, which, when washed, dried, and ignited, should weigh 1·147 Gm." *U. S.* The solution, diluted with water, gives a white precipitate with chloride of barium, showing that it contains a sulphate. It keeps well; and we have seen a specimen made by U. S. 1870 process, ten years old, which retained all its properties unchanged, and had deposited nothing. The British solution is considerably stronger than ours, having the sp. gr. 1·441, and yielding from a *fluidrachm*, on precipitation by ammonia, a precipitate, which, when washed and incinerated, weighs 11·44 grains. It is described in the Br. Pharmacopœia as a dense solution of a dark red color. Prof. Procter found that a preparation containing 120 grains of sesquioxide to the fluidounce is apt to deposit the anhydrous sulphate on standing.

This solution, though powerfully astringent, is too irritant for general use. The chief employment of it is in making other ferruginous preparations, in which the ferric hydrate is wanted; and it should always be kept on hand, if for nothing else, for the quick preparation of the antidote to arsenic.

Off. Prep. Ferri et Ammonii Citras, *U. S.;* Ferri et Ammoniæ Citras, *Br.;* Ferri et Ammonii Tartras, *U. S.;* Ferri et Potassii Tartras, *U. S.;* Ferri et Quiniæ Citras, *Br.;* Ferri Oxidum Hydratum, *U. S.;* Ferri Oxidum Hydratum cum Magnesia, *U. S.;* Ferri Oxidum Magneticum, *Br.;* Ferri Peroxidum Humidum, *Br.;* Ferrum Tartaratum, *Br;* Liquor Ferri Nitratis, *U. S.;* Liquor Ferri Citratis, *U. S.;* Tinctura Ferri Acetatis, *Br.*

LIQUOR GUTTA-PERCHÆ. *U. S., Br.* *Solution of Gutta-Percha.*

(LĪ'QUOR GŬT'TA-PĔR'CHÆ.)

Liqueur de Gutta-Percha, *Fr.;* Guttapercha-Lösung, *G.*

"Gutta-Percha, in thin slices, *nine parts* [or one ounce av.]; Commercial Chloroform, *ninety-one parts* [or six and a half fluidounces]; Carbonate of Lead, in fine powder, *ten parts* [or one ounce av.], To make *one hundred parts* [or about seven fluidounces]. Add the Gutta-Percha to *seventy parts* [or five fluidounces] of the Chloroform, contained in a bottle, cork it well, and shake it occasionally until the Gutta-Percha is dissolved. Then add the Carbonate of Lead previously mixed with the remainder of the Chloroform, and, having several times shaken the whole together, at intervals of half an hour, set the mixture aside until the insoluble matters have subsided and the solution has become perfectly clear. Lastly, decant the liquid and preserve it in small, cork-stoppered vials." *U. S.*

"Take of Gutta-Percha, in thin slices, *one ounce;* Chloroform *eight fluidounces;* Carbonate of Lead, in fine powder, *one ounce.* Add the Gutta-Percha to six fluidounces of the Chloroform in a stoppered bottle, and shake them together frequently until the solution has been effected. Then add the Carbonate of Lead previously mixed with the remainder of the Chloroform, and having several times shaken the whole together, set the mixture aside, and let it remain at rest until the insoluble matter has subsided. Lastly, decant the clear liquid and keep it in a well-stoppered bottle." *Br.*

Difficulty is often experienced in obtaining a clear solution of gutta-percha in chloroform of the proper consistence for use, in consequence of its viscidity, and the strong affinity with which it holds on to the coloring matter. It cannot be clarified by filtration; and the carbonate of lead is therefore resorted to, which unites with the coloring matter, and, in consequence of its weight, gradually subsides, carrying undissolved substances along with it, and leaving a clear and colorless or nearly colorless solution behind. The use of carbonate of lead for the purpose was first suggested by Mr. Wm. Hodgson, Jr., of Philadelphia. Everything in the success of the process depends on the quality of the gutta-percha used. Should the operator be unable to procure a clear solution by acting in precise accordance with the formula, he would be justifiable in adding more chloroform, filtering if necessary, and evaporating by a very moderate heat to the due consistence. It is better, however, to employ purified gutta-percha, which can now be had in commerce. When the preparation becomes too viscid in consequence of the spontaneous evaporation of the menstruum on exposure, we have always found that the addition of a little chloroform, with agitation, restores it without difficulty to the due condition. The ordinary commercial chloroform may be used in the process, as the preparation is exclusively for external use. It should be kept in small glass vials, with accurately fitting glass stoppers, and not containing more than may be wanted at once.

We have nothing, on the whole, so convenient and effective as this preparation, as a protective to the surface, in slight cases of superficial inflammation and abrasion. By the rapidity with which the chloroform evaporates, a thin elastic nearly colorless film is left after its application, sufficient to prevent injurious influence from the air, wholly without irritating properties, not shrinking inconveniently, and, in consequence of its softness, not mechanically disturbing the part, as sometimes happens with collodion. A little of it applied by the end of the finger, or by means of a small brush, or a glass rod, over eruptive affections, abrasions or slight excoriations, inflammation from friction, chaps on the lips or hand, and slight superficial wounds that have ceased bleeding, will often enable the parts beneath to heal almost immediately, while, if unprotected, they might go on for an indefinite period, giving annoyance, and often increasing. Surfaces yet sound, that are liable to irritation and abrasion from contact, pressure, friction, and the application of acrid substances, may often be protected by a coating of this material. The agreeable odor of chloroform is another recommendation over other preparations, of a similar character, made with ether or benzol.

Off. Prep. Charta Sinapis, *U. S.*

LIQUOR HYDRARGYRI NITRATIS. *U. S.* *Solution of Nitrate of Mercury.* [*Solution of Mercuric Nitrate.*]

(LĪ′QUỌR HȲ-DRÄR′G̣Ỵ-RĪ NĪ-TRĀ′TĬS.)

"A liquid containing in solution about 50 per cent. of Mercuric Nitrate **[$Hg(NO_3)_2$; 327·7.**—HgO,NO_5; 161·85], with some free Nitric Acid." *U. S.*

Liquor Hydrargyri Nitratis Acidus, *Br.;* Acid Solution of Nitrate of Mercury; Liquor Hydrargyri Nitrici Oxydati; Deutazotate (Pernitrate) de Mercuro liquide, *Fr.;* Flüssiges Salpetersaures Quecksilberoxyd, *G.*

"Red Oxide of Mercury *forty parts* [or four ounces av.]; Nitric Acid *forty-five parts* [or three fluidounces]; Distilled Water *fifteen parts* [or one fluidounce and three and a half fluidrachms], To make *one hundred parts* [or about four and a half fluidounces]. Mix the Nitric Acid with the Distilled Water and dissolve the Red Oxide of Mercury in the mixture. Keep the solution in glass-stoppered bottles." *U. S.*

"Take of Mercury *four ounces* [avoirdupois]; Nitric Acid *five fluidounces* [Imperial measure]; Distilled Water *one fluidounce and a half.* Mix the Nitric Acid with the Water in a flask; and dissolve the Mercury in the mixture without the application of heat. Boil gently for fifteen minutes, cool, and preserve the solution in a stoppered bottle." *Br.*

In the British process, mercury is dissolved, with the assistance of heat, in an excess of nitric acid, and there is formed an acid nitrate of mercury, which is brought to a determinate bulk by evaporation. The nitric acid taken weighs five ounces (avoir.). This proportion is sufficient not only to form mercuric nitrate, but to furnish a large excess of acid. The rather loose direction, at the close of the British process, to boil for fifteen minutes, cannot but lead to somewhat uncertain results, unless care be taken by the operator to bring the sp. gr. of the solution to the point indicated in the description of the solution given in the Pharmacopœia.

Properties. Solution of nitrate of mercury is a dense, transparent, nearly colorless liquid, of a strongly acid taste, of the sp. gr. 2·100 as prepared by the U. S. process, and 2·246 by the British. Its distinguishing properties, as given in the U. S. Pharmacopœia, are the following. "A clear, nearly colorless, heavy liquid, having a faint odor of nitric acid, and a strongly acid reaction. Sp. gr. 2·100. A few drops evaporated on platinum foil leave a white residue, which, on heating, becomes yellow, red, and brown, and is finally entirely volatilized. On a bright surface of copper, the solution deposits a coating of mercury. The diluted solution affords, with solution of potassa, a yellow precipitate, and with iodide of potassium, a bright red one, soluble in excess of the iodide. A crystal of ferrous sulphate, dropped into the solution, rapidly acquires a brown color and becomes surrounded by a brownish black zone. No precipitation or cloudiness should occur in the solution on the addition of distilled water or of diluted hydrochloric acid (abs. of mercurous salt)." *U. S.*

Mercuric nitrate, the salt present in this preparation, can be obtained in large crystals of the composition, $2(Hg(NO_3)_2) + H_2O$, when its solution is allowed to evaporate slowly over sulphuric acid. The same salt, which is very deliquescent, is obtained as a crystalline magma by adding strong nitric acid to the concentrated solution.

Medical Properties. This preparation is much used as a caustic application to malignant ulcerations and cancerous affections, lupus, ulcerations of the neck of the womb, chancres, etc. When a very free use is desired, it may be applied to the diseased surface by a camel's-hair brush, or preferably by a brush made of spun glass; usually, however, the application is made with a glass rod, or a match, or similar fragment of wood. In acne and boils, a drop proportioned in size to the pustule applied to the apex is sometimes of service. The parts touched immediately become white, the surrounding parts inflame, and in a few days a yellow scab is formed, which gradually falls off. Sometimes the application produces salivation. When it is desirable to avoid this result, the cauterized part should be washed with water immediately after the application of the caustic.

LIQUOR HYDRARGYRI PERCHLORIDI. *Br.* *Solution of Perchloride of Mercury.*

(LĪ′QUỌR HȲ-DRÄR′ÇỴ-RĪ PĔR-ÇHLŌ′RỊ-DĪ.)

Liquor Hydrargyri Bichloridi, *London;* Solution of the Bichloride of Mercury.

"Take of Perchloride of Mercury, Chloride of Ammonium, of each, *ten grains;* Distilled Water *one pint* [Imp. meas.]. Dissolve." *Br.*

This solution may be used as affording a convenient method of exhibiting corrosive sublimate. The dose is from half a fluidrachm to two fluidrachms (1·9–7·5 C.c.).

LIQUOR IODI COMPOSITUS. *U.S.* *Compound Solution of Iodine.* [*Lugol's Solution.*]

(LĪ′QUỌR Ī-Ō′DĪ CỌM-PŎŞ′Ị-TŬS.)

Liquor Iodinii Compositus, *U. S.* 1870; **Liquor Iodi**, *Br.;* Solution of Iodine; Soluté Ioduré de Lugol, *Fr.;* Lugol'sche Jodlösung, *G.*

"Iodine, *five parts* [or half an ounce av.]; Iodide of Potassium, *ten parts* [or one ounce av.]; Distilled Water, *eighty-five parts* [or eight fluidounces and three fluidrachms], To make *one hundred parts* [or about nine fluidounces]. Dissolve the Iodine and Iodide of Potassium in the Distilled Water. Keep the Solution in well-stopped bottles." *U. S.*

"Take of Iodine *twenty grains;* Iodide of Potassium *thirty grains;* Distilled Water *one fluidounce.* Dissolve." *Br.*

In this solution iodine is dissolved in water with the assistance of iodide of potassium. Iodine dissolves sparingly in water, but freely in a solution of that salt. In using iodide of potassium to render iodine more soluble in water, the iodide is generally taken in a quantity twice the weight of the iodine; and this is the proportion adopted in the U. S. formula. The preparation is a *concentrated* solution of iodine with iodide of potassium, and is intended to facilitate the administration of the combination in drops. The present formula differs in strength from that of 1870. The latter contained about 2·81 grains of iodine in a fluidrachm, whilst the present officinal solution has about 3·25 grains of iodine in the fluidrachm. In the Br. Pharmacopœia a solution is directed having less iodine than the U. S. solution, and very much weaker in iodide of potassium; the former having only twenty grains of iodine and thirty grains of iodide of potassium in the fluidounce, whilst the latter has nearly twenty-six grains of iodine and sixty-two and a half grains of iodide of potassium in the fluidounce; the difference in the fluidounce of the two Pharmacopœias being too small to enter into the calculation. "12·66 Gm. of the solution, mixed with a little gelatinized starch, should require for complete decoloration, 50 C.c. of the volumetric solution of hyposulphite of sodium." *U. S.* The medicinal properties of the solution depend mainly on the free iodine contained in it, by which the dose must be regulated, and not by the iodide of potassium. According to Mr. Lloyd, of St. Bartholomew's Hospital, London, it acts differently from iodide of potassium, which, when given alone, does not produce the same effects. In a case of constitutional syphilis under his care, the compound solution of iodine effected a rapid cure, after the iodide of potassium had been taken in large doses, for several months, without benefit. The dose is five minims (0·3 C.c.), containing about a quarter of a grain of iodine, three times a day, given in four tablespoonfuls of sweetened water, and gradually increased. The dilution should always be large, in order to favor the absorption of the medicine, and to avoid any irritation of the stomach. For children the dose to begin with is two minims (0·12 C.c.).

LIQUOR LITHIÆ EFFERVESCENS. *Br.* *Effervescing Solution of Lithia. Lithia Water.*

(LĪ′QUỌR LĬTH′Ị-Æ ĔF-FẸR-VĔS′CẸNṢ.)

Eau de Lithine, *Fr.;* Lithiumwasser, *G.*

"Take of Carbonate of Lithia *ten grains;* Water *one pint* [Imperial measure]. Mix in a suitable apparatus, and pass into it as much pure washed carbonic acid, obtained by the action of sulphuric acid on chalk, as can be introduced with a pressure of seven atmospheres. Keep the solution in bottles well closed, to prevent the escape of the compressed gas." *Br.*

This solution is clear and sparkling, has an agreeable acidulous taste, and, when evaporated, leaves a white solid residue of carbonate of lithium, in the proportion of five grains to half a pint (Imp. meas.), or about ten fluidounces. It is an appropriate method of administering carbonate of lithium; as this salt, compared with other alkaline carbonates, is sparingly soluble in pure water, and is readily dissolved by carbonic acid water. The quantity of carbonic acid is unnecessarily large; the pressure of five atmospheres, as directed in the U. S. formula 1870 for carbonic acid water, being sufficient for all practical purposes.

For the properties and uses of carbonate of lithium, see *Lithii Carbonas.* The dose of the solution is from five to ten fluidounces (148 to 296 C.c.).

LIQUOR MAGNESIÆ CARBONATIS. *Br.* *Solution of Carbonate of Magnesia. Fluid Magnesia.*

(LĪ′QUỌR MĂG-NĒ′ṢỊ-Æ CÄR-BỌ-NĀ′TĬS.)

Eau magnésienne, Magnésie liquide, *Fr.;* Kohlensaure Magnesialösung, *G.*

"Take of Sulphate of Magnesia *two ounces* [avoirdupois]; Carbonate of Soda *two ounces and a half* [avoird.]; Distilled Water *a sufficiency.* Dissolve the two salts separately, each, in half a pint [Imperial measure] of Water. Heat the Solution of Sulphate of Magnesia to the boiling point, then add to it the Solution of Carbonate of Soda, and boil them together till carbonic acid ceases to be evolved. Collect the precipitated carbonate of magnesia on a calico filter, and wash it with Distilled Water until what passes ceases to give a precipitate with chloride of barium. Mix the washed precipitate with a pint [Imp. meas.] of Distilled Water, and, putting them into a suitable apparatus, pass into it pure washed carbonic acid gas obtained by the action of sulphuric acid on chalk. Let the mixture remain in contact with excess of carbonic acid, retained there under pressure for about 24 hours, then filter the liquid to remove any undissolved carbonate of magnesia, and again pass carbonic acid gas into the filtered solution. Finally, keep the solution in a bottle securely closed, to prevent the escape of carbonic acid." *Br.*

The object of this process is to obtain a solution of carbonate of magnesium, by means of carbonic acid; the carbonate being insoluble in pure water. The first step is to prepare a freshly precipitated hydrated carbonate of magnesium, which is more readily dissolved than the carbonate which has been kept for some time. As the carbonate of magnesium of the Br. Pharmacopœia consists of three mols. of the neutral carbonate and one of hydrate of magnesia with four mols. of water, it follows that, in its preparation from the two salts used in the process, a portion of carbonic acid escapes; and the boiling is directed to be continued until the escape of the gas ceases, so that the normal composition is insured, and a longer heat, which might affect the constitution of the carbonate so as to diminish its solubility, avoided. The precipitate is thoroughly washed, so as to remove every trace of sulphate of sodium, which is indicated by the non-action of the test of chloride of barium. The next step is to dissolve the precipitated carbonate in water impregnated with carbonic acid gas; and, as the solution even thus favored is slowly effected, the carbonate is directed to remain exposed to the action of carbonic acid gas, under pressure, for 24 hours; and still the whole of the carbonate is not dissolved, and filtration is necessary. According to the Pharmacopœia, the "solution contains about 13 grains of carbonate of magnesia in a fluidounce." Were the results exactly in accordance with the proportion of sulphate of magnesium used, the quantity of carbonate dissolved would be 40 grains to the fluidounce. On exposure to the air, some of the carbonic acid escapes, and a portion of the salt is deposited. Prof. Redwood proposes to remedy this by reducing the strength of the solution. (*P. J. Tr.*, 2d ser., xi. 397.) Indeed, it has been shown by Mr. C. Muncy that the preparation as kept in the shops is usually much below the standard strength.

This solution is but slightly effervescent, is clear, and is stated in the Br. Pharmacopœia to be free from bitterness. Nevertheless its taste is disagreeable, much more so than that of the undissolved carbonate. "A fluidounce of it, evaporated to dryness, yields a white solid residue, which, after being calcined, weighs not less than five grains." This residue is insoluble in water, and answers to the tests for magnesia. The dose, as an antacid laxative, is one or two fluidounces (30 or 60 C.c.).

LIQUOR MAGNESII CITRATIS. *U.S.* *Solution of Citrate of Magnesium.*

(LĪ′QUO̩R MĂG-NĒ′ṢI̩-Ī CĪ-TRĀ′TĬS.)

Liquor Magnesiæ Citratis, *Br.;* Liquor Magnesii Citrici; Limonade au Citrate de Magnésie, *Fr.;* Flüssige Citronensaure Magnesia, *G.*

"Carbonate of Magnesium, *two hundred grains;* Citric Acid, *four hundred grains;* Syrup of Citric Acid, *twelve hundred grains* [or two fluidounces]; Bicarbonate of Potassium, in crystals, *thirty grains;* Water, *a sufficient quantity.* Dissolve the Citric Acid in *two thousand grains* [or four fluidounces] of Water, and, having added the Carbonate of Magnesium, stir until it is dissolved. Filter the solution into a strong bottle of the capacity of *twelve fluidounces*, containing the Syrup of Citric Acid. Then add enough Water, previously boiled and filtered, to nearly fill the bottle, drop in the Bicarbonate of Potassium, and immediately close the bottle with a cork, which must be secured with twine. Lastly, shake the mixture occasionally until the Bicarbonate of Potassium is dissolved." *U.S.*

"Take of Carbonate of Magnesia *one hundred grains;* Citric Acid *two hundred grains;* Syrup of Lemons *one-half fluidounce* [Imperial measure]; Bicarbonate of Potash, in crystals, *forty grains;* Water *a sufficiency.* Dissolve the Citric Acid in two ounces of the Water, and, having added the Carbonate of Magnesia, stir until it is dissolved. Filter the solution into a strong half-pint bottle, add the syrup and sufficient water to nearly fill the bottle, then introduce the Bicarbonate of Potash, and immediately close the bottle with a cork which should be secured with string or wire. Afterwards, shake the bottle until the Bicarbonate of Potash has dissolved." *Br.*

This formula first appeared in the second edition of the U. S. Pharmacopœia of 1850. The original formula was soon found to have defects. Four-fifths of the carbonate was dissolved in the citric acid, and the solution filtered into a bottle containing the syrup of citric acid; and then the reserved fifth, mixed with water, was added to the acid citrate, and the bottle tightly corked. The addition of the reserved carbonate was intended to impregnate the preparation with carbonic acid by its solution in the excess of citric acid. To effect the solution of this reserved carbonate required at least half an hour. But the chief objection to the formula, as originally framed, was that the citrate of magnesium, when the solution was kept for some days, crystallized out in the form of a white granular precipitate, which rendered the solution unfit for medical use. This precipitate was found by Prof. Procter to be $Mg_3(C_6H_5O_7)_2 + 14H_2O$. This still occurs to some extent, although more slowly, and probably cannot be avoided except by a very great reduction in the amount of magnesia.* The use of bicarbonate of potassium introduces citrate of potassium, but in too small a proportion to be of any consequence. It is somewhat more convenient to use calcined magnesia in place of the carbonate, and in one of the best processes that we have seen the two hundred grains of carbonate in the officinal formula are replaced by seventy-five grains of Jennings's light calcined magnesia. We prefer a modification in the manipulation of the officinal process; if instead of the solution being filtered into the bottles containing the syrup it is filtered into a separate vessel, and then the proper quantity poured very carefully down the inside of the bottle, so as not to disturb the heavy layer of syrup, and then the crystals of bicarbonate dropped in, very little loss of carbonic acid will ensue if the bottle is at once securely corked. When the bottle is dispensed, a vigorous shake at once liberates the carbonic acid, and the patient is sure to have the liquid in a highly effervescent condition.

Properties. This officinal solution is founded on a preparation proposed by M. Rogé Delabarre, and improved by M. Rabourdin, of Paris. It is an aqueous solution of citrate of magnesium, containing an excess of citric acid, impregnated with carbonic acid, and sweetened with syrup. When properly prepared, it is a clear liquid, having an agreeable taste like that of lemonade. Overlooking the excess of acid which it contains, the salt present is the tribasic citrate, in which the six atoms of hydrogen of two mols. of citric acid are replaced by three atoms of magnesium. Accordingly, it consists of two mols. of citric acid and three atoms of magnesium. It is advisable in preparing the solution to introduce the magnesia by small portions; as if too hastily added it disposes to the formation of the neutral citrate, which cannot afterwards be readily dissolved. (*A. J. P.*, 1867, p. 1.)

Dorvault makes a solid citrate of magnesium which is perfectly and readily soluble, by melting on a sand-bath 100 parts of crystallized citric acid in its water of crystallization, and thoroughly incorporating with it 29 parts of calcined magnesia. A pasty mixture is formed, which soon hardens, and may be pulverized for use. Citrate of magnesium, thus prepared, is soluble in twice its weight of water. When in saturated solution it soon precipitates as a nearly insoluble hydrate; but with eight or ten times its weight of water it forms a permanent solution. See the report on the solid citrate, made by E. Parrish and A. Smith, to the Philadelphia College of Pharmacy. (*A. J. P.*, 1852, p. 113.) See also M. E. Robiquet's paper on lemonades of citrate of magnesium (*Journ. de Pharm.*, Avril, 1852, p. 295), and his formula for preparing a soluble citrate of magnesium. (*A. J. P.*, July, 1855.) M. Simonin finds that an insoluble citrate of magnesium may be restored to solubility in boiling water by being thoroughly rubbed up with water so as to form a paste. The necessary trituration is abridged, if a little citric acid be added. (*Ann. de Thérap.*, 1857, p. 124.)†

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* *Extemporaneous Liquor Magnesii Citratis.* The following formula has been proposed by Mr. J. C. Wharton as a means of always giving a customer a fresh solution of the citrate, which is substantially the same as that of the U. S. Pharmacopœia. Syrup No. 1. "Take of simple Syrup two pints; Spirit of Lemon sixty-four minims; Bicarbonate of Potassium six hundred and forty grains. Mix, and make solution, and keep ready for use. Syrup No. 2. Take of Calcined Magnesia eighty-eight grains; Citric Acid four hundred and eight grains; Distilled Water a sufficient quantity. Mix the Magnesia and Citric Acid in a mortar and add one and a half fluidounces of Water. Stir with a pestle, and break up the lumps of acid if there be any. After solution is effected, add sufficient Water to make up the amount of one bottle nearly full, when mixed with two fluidounces of the Syrup No. 1. These two solutions are to be kept separately. When Syrup of Citrate of Magnesium is called for, pour into the bottle Syrup No. 1 first, without touching the mouth or sides of the bottle; then pour in along the sides of the bottle Syrup No. 2, so as to avoid as far as possible mixing them, cork and agitate."

† *Solid Citrate of Magnesium.* This salt as heretofore prepared, though soluble at first, is apt to become more or less insoluble, when kept, in consequence of molecular change. The following

Metatartrate of magnesium has been proposed, in the place of the citrate, by M. Léger, who, however, states that as a purgative it is more powerful than the citrate, resembling the sulphate. On account of its pleasant taste it might, perhaps, be substituted for Epsom salts. M. Léger prepares *metatartaric acid* in the following manner. Into a porcelain capsule put a small amount of tartaric acid, and heat it, with occasional agitation, on a slow fire until it fuses; then add successively small portions of the acid, so as not to cool the mass, lest it solidify and burn. When the capsule is two-thirds full, cease putting more in, but continue the heat until the mass, at first puffed up and doughy, is completely melted into an amber-colored liquid. Withdraw from the fire, and when sufficiently cooled form into pebbles, which must be kept in closely-stopped bottles on account of their being hygroscopic. This acid is very soluble in water, and in this state greedily attacks the carbonate of magnesium, forming with it a salt which is permanent even when in solution. (*Journ. de Pharm.*, xix. 226.)

Medical Properties. This solution is a cooling cathartic, and operates mildly. It has come into extensive use in the United States, on account of the facility with which it may be taken, and its acceptability to the stomach. The dose as a full purge is the whole quantity directed in the formula, or twelve fluidounces; as a laxative, half that quantity or less.

LIQUOR MORPHIÆ ACETATIS. *Br.* *Solution of Acetate of Morphia.*

(LĪ′QUỌR MŎR′PHỊ-Æ ĂÇ-Ẹ-TĀ′TĬS.)

Soluté d'Acétate de Morphine, *Fr.;* Essigsaure Morphinlösung, *G.*

"Take of Acetate of Morphia *four grains;* Diluted Acetic Acid *eight minims;* Rectified Spirit *two fluidrachms* [Imperial measure]; Distilled Water *six fluidrachms.* Mix the Acid, the Spirit, and the Water, and dissolve the Acetate of Morphia in the mixture." *Br.*

Acetate of morphine often contains a little uncombined morphine, in consequence of the escape of a portion of the acid during its evaporation, and especially when this is pushed to dryness. Hence the addition of the diluted acetic acid, which at the same time neutralizes the alkaloid in excess, and enables the solution to be completely effected. The spirit is added as a preservative. The dose is from 15 to 30 minims (0·9 to 1·9 C.c.), equivalent to from one-eighth to one-quarter of a grain of the acetate, and about as many drops of laudanum as minims of the solution.

LIQUOR MORPHIÆ HYDROCHLORATIS. *Br.* *Solution of Hydrochlorate of Morphia.*

(LĪ′QUỌR MŎR′PHỊ-Æ HȲ-DRỌ-ȻHLỌ-RĀ′TĬS.)

Liquor Morphiæ Muriatis, *Dub.;* Solution of Muriate of Morphia; Soluté de Hydrochlorate de Morphine, *Fr.;* Salzsaure Morphinlösung, *G.*

"Take of Hydrochlorate of Morphia *four grains;* Dilute Hydrochloric Acid *eight*

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process, by M. de Letter, of Brussels, yields a salt which is said to retain its solubility indefinitely. "Take of Citric Acid 20 parts, and of Carbonate of Magnesium 12 parts. Powder the acid finely, and mix it intimately with the carbonate, also in fine powder. Allow the mixture to stand, at the ordinary temperature, for four or five days, or until it ceases to manifest reaction when a little is thrown into water. During this time the powder slowly swells up, and gradually assumes the appearance of a spongy mass. Dry this at 30° C. (86° F.), pulverize it, and keep the powder in closely-stopped vials." According to M. de Letter, water, in a certain quantity, favors the formation of an insoluble hydrate; and hence the success of his process, in which no other water is present than that which is solidified in the dry materials. (*A. J. P.*, 1863, p. 312.) M. Hager has been unable to prepare a soluble salt by the process of M. de Letter. He considers citrate of magnesium as presenting itself in three forms: 1, *crystallizable,* soluble in from 80 to 90 parts of water, with the formula $Mg_3(C_6H_5O_7)_2 + 7H_2O$; 2, *amorphous,* soluble in two parts of water; and, 3, *metamorphous,* soluble in 8 or 10 parts of water, with a strong tendency to crystallize. It is the crystalline variety, presenting the form of microscopic needles, that occasions the difficulty; and its production should be avoided. M. Hager proceeds in the following manner. Rub 40 parts of citric acid and 25 of carbonate of magnesium, both in powder, with sufficient alcohol of ·833 to make a thick mixture; and, having allowed this to stand for several days, at a medium temperature, dry it at a heat of 45° C. (113° F.). The product is the amorphous salt, soluble in 2·5 parts of water, in half an hour at 15·5° C. (60° F.), immediately at 30° C. (86° F.). Its solution, whether made with hot or cold water, retains its clearness after long standing. The salt is neutral, and contains about 13 mols. of water. To succeed certainly it is necessary that the carbonate of magnesium be free from dust and impurities. (*Ibid.*, 1864, p. 19.)

minims; Rectified Spirit *two fluidrachms;* Distilled Water *six fluidrachms.* Mix the Hydrochloric Acid, the Spirit, and the Water, and dissolve the Hydrochlorate of Morphia in the Mixture." *Br.*

The use of the alcohol is to prevent spontaneous decomposition, that of the acid probably to assist in the solution of the salt. The strength of this solution is four times that of the *solution of sulphate of morphia*, U. S. 1870, one fluidounce of solution of hydrochlorate of morphine containing *four grains*, whilst one fluidounce of the former officinal solution of sulphate of morphine contained but *one grain*, of their respective salts. Besides these solutions, *Magendie's solution*, containing 16 *grains* of sulphate of morphine in a fluidounce, is still used. It has been shown that the solutions gradually lose strength on keeping, owing to the growth of a confervoid plant, which lives at the expense of the morphine in the solution. It was for these reasons that the Committee of Revision dropped the solution of sulphate of morphine from the Pharmacopœia of 1880; preferring to have the physician order the quantity of salt that he desires for his patient, as a solution may be quickly made extemporaneously. The full dose of the British solution for an adult is from fifteen to thirty minims (0·9 to 1·9 C.c.) or drops, containing from an eighth to a quarter of a grain of the hydrochlorate, and about equivalent to as many drops of laudanum.

LIQUOR PEPSINI. *U.S. Solution of Pepsin.* [*Liquid Pepsin.*]

(LĪ′QUỌR PĔP′SỊ-NĪ.)

Pepsine liquide, *Fr.;* Pepsin-Lösung, *G.*

"Saccharated Pepsin, *forty parts* [or four hundred grains]; Hydrochloric Acid, *twelve parts* [or one hundred minims]; Glycerin, *four hundred parts* [or seven fluidounces]; Water, *five hundred and forty-eight parts* [or twelve fluidounces], To make *one thousand parts* [or about twenty fluidounces]. Dissolve the Saccharated Pepsin in the Water, previously mixed with the Hydrochloric Acid, add the Glycerin, let the mixture stand twenty-four hours, and filter." *U. S.*

This preparation originated with Prof. Emil Scheffer, of Louisville, Ky., who suggested a process (see *A. J. P.*, 1870, p. 98), in which six pounds of the mucous membrane of hogs' stomachs were macerated with four pounds of glycerin and four pints of water containing six ounces of hydrochloric acid for thirty-six hours. The mass was then strained, and macerated with fresh water and again strained, and the operation repeated until ten pints were obtained. This process was simplified after the publication of his formula for Saccharated Pepsin, and the present officinal preparation is based upon this later process. The officinal solution contains 4 per cent. of Saccharated Pepsin, whilst Scheffer's original formula (*A. J. P.*, 1871, p. 5) was weaker, containing but 1·6 per cent.

Properties. This liquid is transparent, either colorless, or having a yellowish color, and a sweetish, agreeable taste, which is slightly acidulous. "It should not become mouldy, nor acquire a disagreeable, fetid odor, when kept for some time." *U. S.* It should be freshly made, as it gradually loses its powers of digestion when long kept.

Medical Properties. This preparation, if in good condition, undoubtedly has all the remedial virtues of pepsin, and should be used to the exclusion of all the elixirs. Wines and other non-officinal liquid preparations which flood the American market are in great part worthless. The dose is one-half to two fluidounces (15 to 60 C.c.).

LIQUOR PLUMBI SUBACETATIS. *U. S., Br. Solution of Subacetate of Lead.*

(LĪ′QUỌR PLŬM′BĪ SŬB-ĂÇ-Ẹ-TĀ′TĬS.)

"An aqueous liquid containing in solution about 25 per cent. of Subacetate of Lead." *U. S.*

Liquor Plumbi Subacetici, *P.G.;* Acetum Plumbicum, Acetum Saturni, Plumbum Hydrico-Aceticum Solutum; Goulard's Extract; Sous-acétate de Plomb liquide, Extrait de Goulard, Vinaigre de Plomb (de Saturne), *Fr.;* Bleiessig, *G.*

"Acetate of Lead, *one hundred and seventy parts* [or four ounces av. and one hundred and fifty grains]; Oxide of Lead, *one hundred and twenty parts* [or three ounces av. and thirty grains]; Distilled Water, *a sufficient quantity*, To make *one thousand parts* [or twenty fluidounces]. Dissolve the Acetate of Lead in *eight hundred parts* [or twenty fluidounces] of boiling, Distilled Water, in a glass or porcelain vessel. Then add the Oxide of Lead and boil for half an hour, occasionally adding enough hot, Distilled Water to make up the loss by evaporation. Remove the heat, allow the liquid to cool, and add enough Distilled Water, previously boiled and cooled, to make the product weigh *one thousand parts* [or measure twenty fluidounces]. Finally, filter the liquid in a well-covered funnel. Solution of Subacetate of Lead should be kept in well-stopped bottles." *U. S.*

"Take of Acetate of Lead *five ounces* [avoirdupois]; Oxide of Lead, in powder, *three ounces and a half* [avoird.]; Distilled Water *one pint* [Imperial measure], or *a sufficiency*. Boil the Acetate of Lead and the Oxide of Lead in the Water for half an hour, constantly stirring; then filter, and, when the liquid is cold, add to it more Distilled Water, until the product measures twenty fluidounces. Keep the clear solution in stoppered bottles." *Br.* The sp. gr. of the solution is 1·260.

The officinal process does not differ essentially from that formerly officinal. The present solution has the sp. gr. 1·228, and is slightly weaker than that of 1870, whose sp. gr. was 1·267. Crystallized acetate of lead consists of one atom of lead 206·5, two acetic acid groups 118, and three molecules of water 54 = 378·5. The formula is $Pb(C_2H_3O_2)_2 + 3H_2O$. Litharge, as usually found in the shops, is an impure oxide of lead. When the solution of the former is boiled with the latter, a large quantity of the oxide is dissolved, and a subacetate of lead is formed which remains in solution. The precise composition of the subacetate varies with the proportion of acetate of lead and of litharge employed. Thus, starting with 3 molecules of normal acetate, $Pb_3(C_2H_3O_2)_6$, we may have $Pb_3O(C_2H_3O_2)_4$ and $Pb_3O_2(C_2H_3O_2)_2$ formed successively. The latter of these oxyacetates is known as Goulard's, and a mixture of the two constitutes the basis of the officinal solution. In executing the process, the litharge should be employed in very fine powder, and, according to Thenard, should be previously calcined in order to decompose the carbonate of lead, which it always contains in greater or less proportion, and which is not dissolved by the solution of the acetate.

In former editions of the London and Dublin Pharmacopœias, a different process was directed, consisting in boiling litharge with distilled vinegar, the former being in much larger proportion than necessary to form the neutral acetate. A diacetate was thus produced; but, as the vinegar was of uncertain strength, there was necessarily more or less inequality of strength in the preparation. This process, therefore, has been abandoned. The solution prepared from litharge and distilled vinegar has a pale greenish straw color, owing to impurities in the vinegar. Made with common vinegar it is brown.

M. Nevning states that a solution of subacetate of lead more permanent than the officinal one may be prepared by simply allowing litharge to remain for twenty-four hours in a solution of acetate of lead, with occasional agitation. This preparation probably contains much less of the oxide of lead than does the officinal solution.

Properties. The solution of subacetate of lead of the Pharmacopœias is "a clear, colorless liquid, of a sweetish, astringent taste, and an alkaline reaction. Sp. gr. 1·228. When added to a solution of acacia, it produces a dense white precipitate. In other respects it possesses the reactions of an aqueous solution of acetate of lead. (See *Plumbi Acetas.*) 13·7 Gm. of the solution should require for complete precipitation 25 C.c. of the volumetric solution of oxalic acid." *U. S.* When concentrated by evaporation, it deposits on cooling crystalline plates, which, according to Dr. Barker, are flat, rhomboidal prisms, with dihedral summits.* It has an alkaline reaction, tinging the syrup of violets green, and reddening turmeric paper. One of its most striking properties is the extreme facility with which it is decomposed. Carbonic acid throws down a white precipitate of carbonate of lead; and this happens by mere exposure to the air, or by mixture even with distilled water, if this has had an opportunity of absorbing carbonic acid from the atmosphere. It affords precipitates also with the alkalies, alkaline earths, and their carbonates, with sulphuric and hydrochloric acids free or combined, with hydrosulphuric acid and the sulphydrates, with the soluble iodides and chlorides, and, according to Thenard, with solutions of all the neutral salts. Solutions of gum, tannin, most vegetable coloring principles, and many animal substances, particularly albumen, produce with it precipitates consisting of the substance added and oxide of lead. It should be kept in well-stopped bottles. It is known to contain a salt of acetic acid by emitting an acetous smell when treated with sulphuric acid; and a salt of lead, by yielding a white precipitate with an alkaline carbonate, a yellow one with iodide of potassium, and a black one with hydrosulphuric acid. It is distinguished from the solution of acetate of lead by being precipitated by gum arabic. Six fluidrachms (413·8 grains) of the Br. solution require for perfect precipitation 810 grain-measures of the *volumetric solution of oxalic acid. Br.*

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* *Crystallized Subacetate of Lead.* M. Jeannel prepares crystallized subacetate of lead in accordance with the following formula. Triturate six parts of neutral acetate of lead with two parts of pure litharge, and add one part of water. Heat in a porcelain capsule, stirring with a glass rod, until fusion, and finally ebullition, occur. After two or three minutes of boiling, filter through paper in a funnel heated by a sand-bath. Allow to cool and crystallize. (*Journ. de Pharm.*, 4e sér., xi. 54.)

Medical Properties and Uses. This solution is astringent and sedative, but is employed only as an external application. It is highly useful in inflammation arising from sprains, bruises, burns, blisters, etc., to which it is applied by means of linen cloths, which should be removed as fast as they become dry. It always, however, requires to be diluted. From four fluidrachms to a fluidounce (15 to 30 C.c.), added to a pint (472 C.c.) of distilled water, forms a solution sufficiently strong in ordinary cases of external inflammation. When applied to the skin denuded of the cuticle, the solution should be still weaker; as constitutional effects might result from the absorption of the lead. Paralysis is said to have been produced by its local action; and a case of poisoning by its injection into the urethra for gonorrhœa is reported in the *Dublin Journal of Med. Science*, 1874, p. 150. The solution has the common name of *Goulard's extract*, derived from a surgeon of Montpellier by whom it was introduced into general notice, though previously employed.

Off. Prep. Ceratum Plumbi Subacetatis, *U. S.;* Linimentum Plumbi Subacetatis, *U. S.;* Liquor Plumbi Subacetatis Dilutus; Unguentum Plumbi Subacetatis Compositum, *Br.*

LIQUOR PLUMBI SUBACETATIS DILUTUS. *U. S., Br. Diluted Solution of Subacetate of Lead.* [*Lead-water.*]

(LĪ'QUỌR PLŬM'BĪ SŬB-ĂÇ-Ẹ-TĀ'TĬS DỊ-LŪ'TŬS.)

Aqua Plumbi, *P.G.;* Eau de Saturne, Eau blanche, *Fr.;* Bleiwasser, Kühlwasser, *G.*

"Solution of Subacetate of Lead, *three parts* [or one fluidrachm]; Distilled Water, *ninety-seven parts* [or five fluidounces]; To make *one hundred parts* [or about five fluidounces]. Mix the Solution of Subacetate of Lead with the Distilled Water previously boiled and cooled. Keep the liquid in well-stopped bottles." *U. S.*

"Take of Solution of Subacetate of Lead, Rectified Spirit, of each, *two fluidrachms;* Distilled Water *nineteen fluidounces and a half.* Mix, and filter through paper. Keep the clear solution in a stoppered bottle." *Br.*

This preparation is convenient; as, in consequence of the subsidence of the carbonate of lead usually formed on the dilution of the strong solution, it enables the apothecary to furnish clear lead-water when it is called for. In our comments on the U. S. process of 1850, it was stated that the strength of our officinal preparation, though double what it formerly was, might be still further increased with propriety. In the edition of the U. S. Pharmacopœia of 1870 the proportion was increased from two to three fluidrachms to the pint; and this proportion has been practically retained in the preparation now officinal. The direction to dilute the strong solution with distilled water *previously boiled and cooled*, is an improvement, as even the small amount of carbonic acid dissolved in distilled water usually made the lead-water opalescent. The Br. preparation, though stronger than the old one of the London College, is still feeble. The old French Codex directed two drachms of the strong solution to a pound of distilled water, and an ounce of alcohol of 22° Baumé, and thus formed the *vegeto-mineral water* of Goulard. The minute proportion of proof spirit in the British solution can have little effect. The preparation should be as much as possible excluded from the air.

LIQUOR POTASSÆ. *U. S., Br.* *Solution of Potassa.*

(LĪ'QUOR PO-TĂS'SÆ.)

"An aqueous solution of Hydrate of Potassium [**KHO**; 56.—KO,HO; 56], containing about 5 per cent. of the hydrate." *U. S.*

Liquor Kali Caustici, *P.G.;* Kali Hydricum Solutum, Lixivium Causticum; Solution of Potash; Potassæ caustique liquide, Lessive caustique, *Fr.;* Aetzkalilauge, Kalilauge, *G.*

"Bicarbonate of Potassium, *ninety parts* [or two and a half ounces av.]; Lime, *forty parts* [or one ounce av.]; Distilled Water, *a sufficient quantity.* Dissolve the Bicarbonate of Potassium in *four hundred parts* [or ten fluidounces] of Distilled Water, heat the solution until effervescence ceases, and then raise it to boiling. Slake the Lime, make it into a smooth mixture with *four hundred parts* [or ten fluidounces] of Distilled Water, and heat it to boiling. Then gradually add the first liquid to the second and continue the boiling for ten minutes. Remove the heat, cover the vessel tightly, and, when the contents are cold, add enough Distilled Water to make the whole mixture weigh *one thousand parts* [or measure one and a half pints]. Lastly, strain it through linen, set the liquid aside until it is clear, and remove the clear solution by means of a siphon.

"*Solution of Potassa* may also be prepared in the following manner: Potassa, *fifty-six parts* [or one ounce av.]; Distilled Water, *nine hundred and forty-four parts* [or one pint], To make *one thousand parts* [or about one pint]. Dissolve the Potassa in the Distilled Water. The Potassa used in this process should be of the full strength directed by the Pharmacopœia (90 per cent.). Potassa of any other strength, however, may be used, if a proportionately larger or smaller quantity be taken, the proper amount for the above formula being ascertained, by dividing 5000 by the percentage of absolute Potassa (hydrate of potassium) contained therein. Solution of Potassa should be kept in well-stopped bottles." *U. S.*

"Take of Carbonate of Potash *one pound* [avoirdupois]; Slaked Lime *twelve ounces* [avoird.]; Distilled Water *one gallon* [Imperial measure]. Dissolve the Carbonate of Potash in the Water; and, having heated the solution to the boiling point, in a clean iron vessel, gradually mix with it the Slaked Lime; and continue the ebullition for ten minutes with constant stirring. Then remove the vessel from the fire; and, when by the subsidence of the insoluble matter the supernatant liquor has become perfectly clear, transfer it by means of a siphon to a green-glass bottle furnished with an air-tight stopper, and add distilled water, if necessary, to make it correspond with the tests of sp. gr. and neutralizing power. The sp. gr. is 1·058." *Br.*

The object of the first U. S. and of the British process is to separate carbonic acid from the carbonate or bicarbonate of potassium, so as to obtain the alkali in a caustic state. This separation of the carbonic acid is effected by hydrate of lime; and the chemical changes which take place are most intelligibly explained by supposing the occurrence of a double decomposition. The lime of the hydrate of lime, by its superior affinity, combines with the carbonic acid, and precipitates as carbonate of calcium; while the water of the hydrate of lime unites with the potassa and remains in solution as hydrate of potassa. $K_2CO_3 + Ca2(HO) = 2KHO + CaCO_3$. The proportion indicated by theory for this decomposition would be 69·2 of the dry carbonate to 28 of lime, or one molecule of each; but in practice it is found necessary to use an excess of lime. The bicarbonate is preferred in the U. S. process, as affording a purer product, being itself free from the contaminations usually found in the carbonate; and the application of heat to the solution of the bicarbonate is to drive off a portion of the carbonic acid and thus bring the salt to the state of a carbonate. The proportion of water employed has a decided influence on the result. If the water be deficient in quantity, the decomposing power of the lime, on account of its sparing solubility, will be lessened; and more of it will be required to complete the decomposition of the carbonate than if the solutions were more dilute. Straining should not be used; as it causes a prolonged contact with the air, and risk of the absorption of carbonic acid, and is apt, moreover, to introduce organic matter from the strainer into the solution; it is best to allow the precipitate to subside in a closed vessel and then siphon off the clear solution. The direction to keep the solution in green glass bottles is judicious; as white flint glass is slightly acted on, and sometimes contaminates the solution with lead.*

As the solution of potassa is made by the manufacturing chemist in considerable quantities, the following details, of the best mode of conducting the process, may not be without their use. Dissolve one part of carbonate of potassium in from seven to twelve parts of water in a bright iron vessel, and decant the solution after it has become clear by standing. Boil the solution in an iron vessel, and, while it is boiling, add at intervals small quantities of slaked lime, reduced to a thin paste with water; allowing the solution to boil a few minutes after each addition. One and a half parts of pure lime will be more than sufficient to decompose one part of the carbonate. When about half the hydrate of lime has been added, take out about a teaspoonful of the boiling solution, and, after dilution and filtration through paper, test it by adding it to some nitric acid, or by mixing it with an equal bulk of lime-water. If the solution has not been completely freed from carbonic acid, the first reagent will cause an effervescence, and the second a milky appearance; in either of which events the addition of the lime must be continued as before, until the above-mentioned tests give negative indications. In conducting the process, several advantages are gained by keeping the solution constantly boiling. One is that the carbonate of calcium formed is in this way rendered granular and heavy, and more disposed to subside; another, that it prevents the precipitated carbonate from coalescing into a mass at the bottom of the vessel, an occurrence which causes the ebullition, when subsequently renewed, to take place imperfectly and by jerks; and a third, that any silica present is precipitated in combination with lime and potassa. The process here described is essentially the same with those introduced into the last editions of the Edinburgh and Dublin Pharmacopœias.

According to Prof. Wöhler, solution of pure hydrate of potassa for analytical purposes may be conveniently obtained by exposing for half an hour to a moderate red heat, in a copper crucible, one part of pure nitre, and two or three parts of copper cut into small pieces. The resulting mass, consisting of hydrate of potassa and black oxide of copper, is treated with water, and the solution poured into a narrow cylindrical vessel, where it is left until it gets perfectly clear by the deposition of the oxide of copper. It is then drawn off, and kept in well-stopped bottles. (*Chem. Gaz.*, Nov. 15, 1853, p. 429.) Graf and Riegel assert that hydrate of potassa, thus obtained, contains nitrate and nitrite of potassium; but Dr. A. Geuther found it perfectly pure, when the process was properly conducted. (*Chem. Gaz.*, June 1, 1856.) A pure hydrate may also be obtained by the process of Dr. Mohr, of Coblentz, which consists in precipitating solution of sulphate of potassium with caustic baryta, obtained from the nitrate. Thus procured, the alkali is entirely free from chlorine, silica, and sulphuric acid. (*P. J. Tr.*, xvi. 310.)

Properties. Solution of potassa is a "clear, colorless liquid, odorless, having a very acrid and caustic taste, and a strongly alkaline reaction. Sp. gr. about 1·036. When dropped into a concentrated solution of tartaric acid, a white, crystalline precipitate, soluble in an excess of potassa, is produced (difference from solution of soda). A drop taken up by a platinum loop and held in a non-luminous flame, imparts to it a violet tint. When dropped into an acid, it should produce no effervescence, or, at most, only an escape of isolated bubbles (limit of carbonate). When neutralized by nitric acid, the solution should not yield more than a faint cloudiness with test-solution of carbonate of sodium (limit of alkaline earths), chloride of barium (sulphate), or nitrate of silver with a little nitric acid (chloride). The neutralized solution, when evaporated to dryness, should yield a residue which should dissolve in water without leaving more than a small quantity of insoluble matter. To neutralize 28 Gm. of Solution of Potassa should require 25 C.c. of the volumetric solution of oxalic acid." *U. S.* It acts rapidly on animal and vegetable substances, and, when rubbed between the fingers, produces a soapy feel, in consequence of a partial solution of the cuticle. It dissolves gum, resins, and extractive matter, and forms soap with oily and fatty bodies. The Br. solution is never pure, but contains either undecomposed carbonate, or free lime, in addition to minute portions of sulphate of potassium, chloride of potassium, silica, and alumina; impurities usually present in the carbonate of potassium used in their preparation. The U. S. solution, being obtained from the bicarbonate of potassium, is purer. Lead is detected by a black precipitate produced by ammonium sulphydrate. When solution of potassa is used as a test for diabetic urine, it should be free from lead, the presence of which renders the test ambiguous. With platinic chloride it produces a yellow precipitate, showing that the alkali present is potassa. It is incompatible with acids, acidulous salts, and all metallic and earthy preparations held in solution by an acid; also with all ammoniacal salts, and with calomel, and corrosive sublimate. The two officinal solutions of potassa vary in strength; the U. S. solution having the sp. gr. 1·036 and the Br. 1·058. These solutions are very dilute; that of the U. S. Pharmacopœia, which is the weakest, containing only 5·6 per cent. of hydrate of potassa; the percentage of the hydrate of potassa as stated in the Br. Pharmacopœia is 5·84, or somewhat greater than the American. One fluidounce of the British solution (462·9 grains) requires for neutralization 482 grain-measures of the *volumetric solution of oxalic acid. Br.* On account of its strong attraction for carbonic acid, solution of potassa should be carefully preserved from contact with the air. In consideration of the change to which it is liable by keeping, it may usually be advantageously prepared extemporaneously, according to the second U. S. process, by dissolving the hydrate in water.

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* For remarks by Prof. Redwood, of London, in relation to the preparation of this Solution, and, for a process for which various advantages are claimed, the reader is referred to *P. J. Tr.*, 1861, p. 450. The following are the outlines of the process. Into a stoppered bottle of green glass is introduced a mixture of ℥viiss of slaked lime and three Imperial pints of distilled water; and to this mixture is added, in small quantities at a time, a solution of ℥viiss of carbonate of potassium in one Imperial pint of distilled water, the bottle being shaken for some minutes after each addition. After the last addition, continue the shaking until a portion of the liquid filtered through calico no longer gives out carbonic acid, upon adding an excess of hydrochloric acid.

Medical Properties and Uses. Solution of potassa is antacid, diuretic, and antilithic. It has been much employed in calculous complaints, under the impression that it has the property of dissolving urinary concretions in the kidneys and bladder; but experience has proved that the stone once formed cannot be removed by remedies internally administered; and the most that the alkaline medicines can effect, is to correct that disposition to the superabundant secretion of uric acid, or the insoluble urates, upon which gravel and stone often depend. For this purpose, however, the carbonated alkalies are preferable to caustic potassa, as they are less apt to irritate the stomach, and to produce injurious effects when long continued. It has been proposed to dissolve calculi by injecting immediately into the bladder the solution of potassa in a tepid state, and so much diluted that it can be held in the mouth; but this mode of employing it has not been found to answer in practice. This solution has also been highly recommended in lepra, psoriasis, and other cutaneous affections, and is said to have proved peculiarly useful in scrofula; but in all these cases it probably acts simply by its antacid property, and is not superior to the carbonate of potassium or of sodium. Externally it has been used, in a diluted state, as a stimulant lotion in rachitis and arthritic swellings, and, concentrated, as an escharotic in the bite of rabid or venomous animals. The dose is from ten to thirty minims (0·6 to 1·9 C.c.), repeated two or three times a day, and gradually increased in cutaneous affections to one or two fluidrachms (3·75 to 7·5 C.c.); but the remedy should not be too long continued, as it is apt to debilitate the stomach. It may be given in sweetened water or some mucilaginous fluid. In dyspeptic cases it may be associated with the simple bitters. In excessive doses it irritates, inflames, or corrodes the stomach. The antidotes are oils and milder acids, such as vinegar and lemon-juice, which operate by neutralizing the alkali.

Off. Prep. Potassa Caustica, *Br.;* Potassii Bromidum, *Br.;* Potassii Iodidum, *Br.*

LIQUOR POTASSII ARSENITIS. *U. S.* *Solution of Arsenite of Potassium.* [*Fowler's Solution.*]

(LĬ′QUỌR PỌ-TĂS′SỊ-Ī ĂR-SẸ-NĪ′TĬS.)

Liquor Arsenicalis, *Br.;* Arsenical Solution; Liquor Kali Arsenicosi, *P.G.;* Solutio Arsenicalis Fowleri, Kali Arsenicosum Solutum; Liqueur arsénicale de Fowler, *Fr.;* Fowler'sche Tropfen, *G.*

"Arsenious Acid, in small pieces, *one part* [or thirty-seven grains]; Bicarbonate of Potassium, *one part* [or thirty-seven grains]; Compound Tincture of Lavender, *three parts* [or two fluidrachms]; Distilled Water, *a sufficient quantity*, To make *one hundred parts* [or half a pint]. Boil the Arsenious Acid and Bicarbonate of Potassium in a glass vessel with *ten parts* [or six fluidrachms] of Distilled Water, until the Acid is completely dissolved. Then add the Compound Tincture of Lavender, and enough Distilled Water to make the product weigh *one hundred parts* [or measure half a pint]. Lastly, set the mixture aside for eight days and then filter through paper." *U. S.*

"Take of Arsenious Acid, in powder, Carbonate of Potash, of each, *eighty grains;* Compound Tincture of Lavender *five fluidrachms* [Imperial measure]; Distilled Water *a sufficiency.* Place the Arsenious Acid and Carbonate of Potash in a flask with ten [fluid]ounces of the Water, and apply heat until a clear solution is obtained. Allow this to cool. Then add the Compound Tincture of Lavender, and as much Distilled Water as will make the bulk one pint [Imp. meas.]." *Br.* The sp. gr. of this solution is 1·009.

This preparation originated with the late Dr. Fowler, of Stafford, England, and was intended as a substitute for the celebrated remedy known under the name of "the *tasteless ague drop.*" The strength of the present officinal solution is somewhat greater than that of the Fowler's solution of U. S. P. 1870; it now contains 1 per cent. of arsenious acid in combination where the former solution contained but 0·87 per cent. It is an arsenite of potassium dissolved in water, and is formed by the combination of the arsenious acid with the potassium of the bicarbonate or carbonate, the carbonic acid being evolved. In the present U. S. process, the bicarbonate has been substituted for the carbonate, because more readily obtained pure. Its molecular weight corresponds so nearly with that of arsenious acid that, practically, the equal quantities directed will serve the purposes of the formula. According to M. H. Buignet, ebullition disengages the carbonic acid slowly; so that, after four hours' boiling, the solution still retains about one-sixth of this acid. (*Journ. de Pharm.*, 1856, p. 440.) The name by which the preparation is designated in the U. S. Pharmacopœia is the more correct. The contact of arsenious acid with bicarbonate of potassium in the presence of a small quantity of boiling water gives rise to effervescence with decomposition of bicarbonate. It has, however, been denied that carbonate of potassium is decomposed by arsenious acid, which is supposed to be merely held by it in solution; and, in this view of the nature of the preparation, the British name of Arsenical Solution would be appropriate. The spirit of lavender is added to give it taste, and prevent its being mistaken for water. The U. S. preparation is somewhat stronger than the British, the former requiring 4·63 grains of arsenious acid in a fluidounce, whilst the British has 4 grains in the imperial fluidounce.

In making this preparation, care should be taken that the arsenious acid is pure. This object is best secured by selecting the acid in small pieces instead of the commercial powder, and powdering the lumps in a mortar. Sulphate of calcium is a common impurity in the powdered acid, and if present will remain undissolved, and cause the solution to be weaker than it should be. Another insoluble impurity in the powdered acid is arsenite of calcium, which is sometimes present to the amount of 25 per cent. (*Buignet.*) Hence, if the arsenious acid does not entirely dissolve, the solution must be rejected.

Properties. Solution of arsenite of potassium is a transparent liquid, having the color, taste, and smell of the spirit of lavender. It has a strong alkaline reaction. It is decomposed by the usual reagents for arsenic, such as nitrate of silver, the salts of copper, lime-water, and sulphuretted hydrogen; and is incompatible with the infusions and decoctions of cinchona. Before sulphuretted hydrogen will act, the solution must be acidulated with some acid, as hydrochloric or acetic. "If 24·7 Gm. of the solution are boiled with 0·5 Gm. of bicarbonate of sodium, the liquid, when cold, diluted with 100 C.c. of water, and some gelatinized starch added, should require from 48·5 to 50 C.c. of the volumetric solution of iodine, before the blue color ceases to disappear on stirring (corresponding to 1 per cent. of arsenious acid of the required purity)." *U. S.* According to Dr. R. Fresenius, solutions of alkaline arsenites, by keeping, absorb oxygen from the air, and are in part converted into arseniates. Hence the propriety of keeping this solution in small bottles well filled. Mohr states that the alkaline reaction of the officinal solution delays the change.

Medical Properties and Uses. This solution has the general action of the arsenical preparations on the animal economy, already described under the head of *Arsenious Acid.* Its liquid form makes it convenient for exhibition and gradual increase; and it is the preparation generally resorted to when arsenic is given internally. It has been much employed in intermittent fever. In chorea it is almost a specific, and in nervous diseases of debility it is often very useful. In malarial affections and chorea, it should be administered in ascending doses until the puffiness about the eyes or disturbance of the bowels betrays the arsenical impression. Fowler's solution is a very valuable remedy in various skin diseases, and has the great advantage over the solid preparations that the dose may be readily increased from day to day. One hundred minims of the solution contain very nearly one grain of arsenious acid. The average dose for an adult is five drops two or three times a day. For the peculiar effects upon the human organism, see *Acidum Arseniosum.*

Duflos's antidote to the poisonous effects of Fowler's solution, and of the salts of the acids of arsenic generally, is ferric acetate with excess of base, made by dissolving freshly precipitated ferric hydrate in acetic acid to saturation, adding an equal quantity of the hydrate to the solution, and diluting the whole with water to the consistence of cream.

LIQUOR POTASSII CITRATIS. *U. S.* *Solution of Citrate of Potassium.*

(LĪ′QUỌR PỌ-TĂS′SỊ-Ī CĪ-TRĀ′TĬS.)

Liquor Kali Citrici; Citrate de Potasse liquide, *Fr.;* Flüssiges Citronensaures Kali, *G.*

"Citric Acid, *six parts* [or seven hundred and twenty grains]; Bicarbonate of Potassium, *eight parts* [or nine hundred and sixty grains]; Water, *a sufficient quantity.* Dissolve the Citric Acid and the Bicarbonate of Potassium, each, in *forty parts* [or eleven fluidounces] of Water. Filter the solutions separately, and wash the filters with enough Water to obtain, in each case, *fifty parts* [or twelve fluidounces] of solution. Finally, mix the two solutions, and, when effervescence has ceased, transfer the liquid to a bottle.* This preparation should be freshly made, when wanted for use." *U. S.*

Solution of Citrate of Potassium must not be confounded with *Mistura Potassii Citratis. U. S.* The *officinal solution* is stronger than the mixture, and is more definite in composition; lemon juice varies in strength, and consequently the amount of potassium citrate in the resulting mixture cannot be uniform. On the other hand, the mixture is much to be preferred, on account of its more agreeable taste. An improvement has been made in the present officinal solution in directing the acid and alkaline salt to be dissolved separately, and the direction to dispense the preparation in a fresh condition will undoubtedly lead to the keeping of the filtered solutions, by the pharmacist, in separate bottles, and mixing in equal measures or weights when prescribed. The solutions keep well for a considerable length of time, and the greater convenience and saving of time and labor, besides the satisfaction of dispensing an effervescent solution, will be strong inducements to adopt this course.

Properties. The U. S. Pharmacopœia describes the solution as "a clear, colorless liquid, odorless, having a mildly saline taste, and a slightly acid reaction. Sp.

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* It will be found more convenient for the pharmacist to use the alternative formula here, and to keep each solution in a separate bottle, and mix equal measures of them when the solution of Citrate of Potassium is wanted.

gr. 1·059. The solution contains about 9 per cent. of citrate of potassium, with some free citric acid and carbonic acid gas. It responds to the reactions and tests of Citrate of Potassium. (See *Potassii Citras.*)" *U. S.* The solution is officinally described as containing an indefinite amount of carbonic acid gas: hence the specific gravity cannot be regarded as an accurate test of its strength.

Medical Properties. See *Mistura Potassii Citratis.*

LIQUOR POTASSÆ EFFERVESCENS. *Br.* *Effervescing Solution of Potash.*

(LĪ′QUỌR PỌ-TĂS-SÆ ĔF-FẸR-VĔS′CẸNṢ.)

Aqua Potassæ Effervescens; Potash Water; Eau alcaline gazeuse, *Fr.;* Alkalisches Mineralwasser, *G.*

"Take of Bicarbonate of Potash *thirty grains;* Water *one pint* [Imperial measure]. Dissolve the Bicarbonate of Potash in the Water and filter the solution; then pass into it as much pure washed carbonic acid gas, obtained by the action of sulphuric acid on chalk, as can be introduced with a pressure of seven atmospheres. Keep the solution in bottles securely closed, to prevent the escape of the compressed gas." *Br.*

This is nothing more than a solution of bicarbonate of potassium in carbonic acid water, and, in the pharmacy of this country, is more conveniently prepared for extemporaneous use by introducing a solution of the bicarbonate, of a given strength, or even the salt itself, into a strong green-glass bottle, and filling the bottle with carbonic acid water at the fountain. The proportion of the salt is far too small to the water for medical use. Little effect can be expected from bicarbonate of potassium as an antacid or antilithic, or even with a view to the alkalizing of the blood, in a dose less than thirty grains (1·95 Gm.) twice or thrice daily; and 20 fluidounces of liquid is much too large to be taken at once, or even in two doses. We have frequently prescribed a solution containing a drachm (3·90 Gm.) of the bicarbonate in eight or ten fluidounces of carbonic acid water, to be given in two doses, with generally a little ginger syrup to improve the flavor. The advantages of carbonic acid as a vehicle are that it renders the medicine less disagreeable to the taste and more acceptable to the stomach, while by its stimulant impression it obviates the debility of the digestive organs often consequent on the use of alkaline medicines.

LIQUOR SODÆ. *U. S., Br.* *Solution of Soda.*

(LĪ′QUỌR SŌ′DÆ.)

"An aqueous solution of Hydrate of Sodium [**$NaHO$; 40.**—NaO,HO; 40], containing about 5 per cent. of the hydrate." *U. S.*

Liquor Natri Caustici, *P.G.;* Natrum Hydricum Solutum; Soude caustique liquide, *Fr.;* Aetznatronlauge, *G.*

"Carbonate of Sodium, *one hundred and eighty parts* [or five ounces av.]; Lime, *sixty parts* [or one and a half ounces av.]; Distilled Water, *a sufficient quantity.* Dissolve the Carbonate of Sodium in *four hundred parts* [or ten fluidounces] of boiling, Distilled Water. Slake the Lime and make it into a smooth mixture with *four hundred parts* [or ten fluidounces] of Distilled Water, and heat it to boiling. Then gradually add the first liquid to the second, and continue the boiling for ten minutes. Remove the heat, cover the vessel tightly, and, when the contents are cold, add enough Distilled Water to make the whole mixture weigh *one thousand parts* [or measure one and a half pints]. Lastly, strain it through linen, set the liquid aside until it is clear, and remove the clear solution, by means of a siphon.

Solution of Soda may also be prepared in the following manner: Soda, *fifty-six parts* [or one ounce av.]; Distilled Water, *nine hundred and forty-four parts* [or one pint], To make *one thousand parts* [or about one pint]. Dissolve the Soda in the Distilled Water. The Soda used in this process should be of the full strength directed by the Pharmacopœia (90 per cent.). Soda of any other strength, however, may be used, if a proportionately larger or smaller quantity be taken, the proper amount for the above formula being ascertained by dividing 5000 by the percentage of absolute

Soda (hydrate of sodium) contained therein. Solution of Soda should be kept in well-stopped bottles." *U. S.*

The British Pharmacopœia takes of Carbonate of Soda *twenty-eight ounces* [avoirdupois]; Slaked Lime *twelve ounces* [avoird.]; Distilled Water *one gallon* [Imperial measure], and prepares the solution in the manner directed for Liquor Potassæ. The sp. gr. of the British solution is 1·047; and the proportion of hydrated soda contained in it is 4·1 per cent.

Solution of soda is prepared in the same way as solution of potassa. The officinal solution is somewhat weaker than that officinal in 1870. By a double decomposition between carbonate of sodium and hydrate of lime, there are formed hydrate of soda in solution, and carbonate of calcium which precipitates, $Na_2CO_3 + Ca2(HO) = 2NaHO + CaCO_3$. In both the processes an excess of lime is used, which is necessary to insure a full decomposition of the carbonate. One fluidounce of the British solution (458 grains) requires for neutralization 470 grain-measures of the *volumetric solution of oxalic acid*, and contains 18·8 grains of the hydrated alkali. *Br.*

Properties. Solution of soda, sometimes called solution of *caustic* soda, is "a clear, colorless liquid, odorless, having a very acrid and caustic taste, and a strongly alkaline reaction. Sp. gr. about 1·059. When dropped into a concentrated solution of tartaric acid, no precipitate is produced (difference from solution of potassa). A drop taken up by a platinum loop and held in a non-luminous flame, imparts to it an intense yellow color. When dropped into an acid, it should produce no effervescence, or, at most, only a slight escape of isolated bubbles (limit of carbonate). When neutralized by nitric acid, the solution should not yield more than a faint cloudiness with test-solution of carbonate of sodium (limit of alkaline earths), chloride of barium (sulphate), or nitrate of silver with a little nitric acid (chloride). The neutralized solution, when evaporated to dryness, should yield a residue which is dissolved by water without leaving more than a small quantity of insoluble matter. To neutralize 20 Gm. of Solution of Soda should require 25 C.c. of the volumetric solution of oxalic acid." *U. S.* Its properties and tests are the same as those of solution of potassa, with the exception that no precipitate is produced by platinic chloride or tartaric acid. The alkali dissolved must be viewed as sodium hydrate (Na.OH), of which two molecules are formed by the union of the oxide with water, according to the reaction: $Na_2O + H_2O = (Na.OH)_2$.

Pharm. Uses. In preparing Antimonium Sulphuratum, *Br.;* Ferri Oxidum Magneticum, *Br.;* Ferri Peroxidum Humidum, *Br.;* Quiniæ Sulphas, *Br.*

Off. Prep. Soda Caustica, *Br.;* Sodæ Valerianas, *Br.*

LIQUOR SODÆ CHLORATÆ. *U. S., Br.* *Solution of Chlorinated Soda.* [*Labarraque's Solution.*]

(LĬ′QUO̤R SŌ′DÆ C̶HLO̤-RĀ′TÆ.)

Liquor Sodæ Chlorinatæ, *U. S.* 1870; Liquor Natri Chlorati, *P.G.;* Liquor Natri Hypochlorosi; Chlorure de Soude liquide, Liqueur de Labarraque, *Fr.;* Bleichflüssigkeit, *G.*

"Carbonate of Sodium, *one hundred parts* [or twenty-five ounces av.]; Chlorinated Lime, *eighty parts* [or twenty ounces av.]; Water, *a sufficient quantity*, To make *one thousand parts* [or fourteen pints]. Mix the Chlorinated Lime intimately with *four hundred parts* [or a pint and a half] of Water in a tared vessel provided with a tightly fitting cover. Dissolve the Carbonate of Sodium in *four hundred parts* [or a pint and a half] of boiling Water, and immediately pour the latter solution into the former. Cover the vessel tightly, and, when the contents are cold, add enough Water to make them weigh *one thousand parts* [or measure fourteen pints]. Lastly, strain the mixture through muslin, allow the precipitate to subside, and remove the clear solution by means of a siphon. Keep the product in well-stopped bottles." *U. S.*

"Take of Carbonate of Soda *twelve ounces* [avoirdupois]; Black Oxide of Manganese *four ounces* [avoird.]; Hydrochloric Acid *fifteen fluidounces* [Imperial measure]; Distilled Water *two pints* [Imp. meas.]. Dissolve the Carbonate of Soda in thirty-six [fluid]ounces of the Distilled Water and put the solution into a glass vessel. Mix the Oxide of Manganese and Hydrochloric Acid in a glass flask with a bent tube, attached, by means of a cork, to its mouth, apply a gentle heat, and with a suitable arrangement of apparatus cause the gas which is evolved to pass first through a wash-bottle containing four [fluid]ounces of Water, and then into the solution of carbonate of soda, regulating the heat so that the gas shall be slowly but constantly introduced. When the disengagement of chlorine has ceased, transfer the solution in which it has been absorbed to a stoppered bottle, and keep it in a cool and dark place." *Br.* The sp. gr. of this solution is 1·103.

This solution was first brought into notice as a disinfecting agent by Labarraque, an apothecary of Paris. It was afterwards found to possess valuable therapeutic properties. The U. S. process is that of Payen, adopted in the French Codex of 1837. It consists in decomposing a solution of carbonate of sodium by one of chlorinated lime. Carbonate of calcium is precipitated and the chlorinated soda remains in solution. The proportion employed gives an excess of carbonate of sodium, the presence of which renders the solution more permanent. The excess in the present officinal process is not so great as in that of the U. S. P. 1870, whilst the proportion of chlorinated lime is greater in the present formula. The British process is that of Labarraque. All the chlorine generated from the prescribed quantity of materials for forming that gas, is passed into the solution of carbonate of sodium; and, when the chlorine is limited to this quantity, no carbonic acid is disengaged. The chlorine is first passed through water to free it from hydrochloric acid, which, if suffered to come over, would convert the alkali into common salt.

The bicarbonate of sodium is recommended instead of the carbonate, on account of the state of crystalline powder in which the carbonate of calcium is precipitated, rendering its separation from the supernatant solution very easy, while the precipitate produced by the carbonate of sodium is a kind of magma from which the liquor is not readily decanted. It is stated also that a little excess of the bicarbonate is useful in various ways. (*Ann. de Thérap.*, 1866, p. 107.)

Properties. The U. S. solution is "a clear, pale greenish liquid, of a faint odor of chlorine, a disagreeable and alkaline taste, and an alkaline reaction. Sp. gr. 1·044. Addition of hydrochloric acid causes an effervescence of chlorine and carbonic acid gas. It rapidly decolorizes indigo, and produces a copious, light brown precipitate with solution of ferrous sulphate. 8·88 Gm. of the solution, when mixed with a solution of 2·6 Gm. of iodide of potassium in 200 C.c. of water, and afterward with 18 Gm. of hydrochloric acid and a little gelatinized starch, should require, for complete decoloration, not less than 50 C.c. of the volumetric solution of hyposulphite of sodium (corresponding to at least 2 per cent. of available chlorine)." *U. S.* The British solution is a colorless alkaline liquid, of an astringent taste, and a feeble smell of chlorine. With hydrochloric acid it effervesces, and evolves chlorine and carbonic acid, and forms a solution which is not precipitated by platinic chloride, thus showing the absence of potassa. It is not precipitated by oxalate of ammonium, showing that it contains no lime. "Seventy grains added to a solution of 20 grains of iodide of potassium in four fluidounces of water, and acidulated with two fluidrachms of hydrochloric acid, require for the discharge of the brown color which the mixture assumes, 500 grain-measures of the *volumetric solution of hyposulphite of soda.*" (*Br.*) This test, like that of our own Pharmacopœia, is intended to determine the chlorine strength of the solution. The hydrochloric acid liberates the chlorine, which then separates from the iodide of potassium an equivalent quantity of iodine, by which the solution is rendered brown; and, the iodine being converted into hydriodic acid by the hyposulphite of sodium, the solution again becomes colorless. The quantity of the solution of the latter salt required to bleach the liquid measures the proportion of iodine, and this that of the chlorine which separates it. The color of turmeric is first rendered brown, and afterwards destroyed. When it is boiled, chlorine is not given off, nor is its bleaching property sensibly impaired; and when carefully evaporated, a mass of damp crystals is obtained, which, when redissolved in water, possesses the properties of the original liquid. Both solutions, when exposed to the air, absorb carbonic acid and slowly evolve chlorine. It is on this property of gradually evolving chlorine that their disinfecting power depends.

Nature and Composition. The chemical nature of these solutions is different. Assuming the chlorinated lime to be essentially hypochlorite of calcium with chloride of calcium (see page 324), the U. S. solution, after decantation from the precipitated carbonate of calcium, will contain *hypochlorite of sodium* with *chloride of sodium;* $Ca(OCl)_2 + CaCl_2 + (Na_2CO_3)_2 = (CaCO_3)_2 + 2NaOCl + 2NaCl$. Besides these there will be present more or less *carbonate of sodium*, according as there happens to be in the chlorinated lime less or more chlorine to decompose it. In all cases, however, there will be an excess of carbonate of sodium; as the best chlorinated lime does not contain sufficient chlorine to effect its entire decomposition, in the proportion in which it is taken in the formula. The constitution of the British preparation is more complicated. As it is a peculiarity in its formation that no carbonic acid is evolved, it is necessary to assume the presence of all the carbonic acid of the carbonate of sodium; and hence it is considered to be a combination of *hypochlorite of sodium, chloride of sodium*, and *bicarbonate of sodium.* The British solution, though made on Labarraque's plan, is considerably stronger than his preparation; for in the British process the carbonate is dissolved in about three times its weight of water, before the chlorine is transmitted; whereas Labarraque dissolved it in four times its weight.

Medical Properties and Uses. Solution of chlorinated soda is stimulant, antiseptic, and resolvent. Internally it has been employed in diseases termed *putrid* or *malignant*, as typhus fever, scarlatina maligna, etc. The conditions which have been considered to indicate the propriety of its use are great prostration of strength, fetid evacuations, and dry and furred tongue. It has also been given in dysentery accompanied with peculiarly fetid stools, in dyspepsia attended with putrid eructations, and in glandular enlargements and chronic mucous discharges. Other complaints in which it has been recommended, are secondary syphilis, scrofula, bilious disorders, and chronic diseases of the skin. In asphyxia from sulphuretted hydrogen it forms, like chlorinated lime, an efficacious antidote. The dose is from thirty drops to a teaspoonful, given in a cupful of water or mild aqueous liquid, and repeated every two or three hours.

As a local remedy it is found useful in all affections attended with fetor, such as gangrenous, cancerous, scrofulous, and syphilitic ulcers, ulceration of the gums, carbuncle, ozæna, mortification, putrid sore throat, ptyalism, etc. In these cases it is applied as a gargle, wash, ingredient of poultices, or imbibed by lint. In fetid discharges from the vagina, uterus, and bladder, it has been employed with advantage as an injection, diluted with from fifteen to thirty parts of water for the vagina and uterus, and with sixty parts when the object is to wash out the bladder by means of a double canula. The solution of chlorinated soda has also been applied successfully to burns, and to cutaneous eruptions, particularly psoriasis, tinea capitis, scabies, and obstinate herpetic affections, and to allay itching and fetor in smallpox. In these cases it is diluted with from ten to thirty parts of water, the strength varying according to circumstances. For the cure of sore nipples, Dr. Chopin found nothing so successful as frequently repeated lotions with this solution. Glycerin is in many instances preferable as a diluent to water, as it tends to prevent irritation of the sound skin, and does not evaporate like water.

Solution of chlorinated soda is a powerful disinfectant, better suited for disinfecting operations on a small scale than is chlorinated lime. In the chambers of the sick it is highly useful, if put in the vessels intended to receive the excretions.

Off. Prep. Cataplasma Sodæ Chloratæ, *Br.*

LIQUOR SODÆ EFFERVESCENS. *Br.* *Effervescing Solution of Soda. Soda Water.*

(LĪ'QUỌR SŌ'DÆ ĔF-FẸR-VĔS'CẸNṢ.)

Aqua Sodæ Effervescens, Aqua Alkalina Effervescens; Eau alcaline gazeuse, *Fr.;* Sodawasser, *G.*

This is prepared by the British Pharmacopœia from Bicarbonate of Sodium and Water, in the same manner precisely and with the same quantities as the "*Effervescing Solution of Potash;*" and the remarks made upon that preparation are equally applicable to this.

LIQUOR SODII ARSENIATIS. *U. S., Br.* *Solution of Arseniate of Sodium.*

(LĪ′QUỌR SŌ′DỊ-Ī ÄR-SĒ-NỊ-Ā′TĬS.)

Liquor Sodæ Arseniatis, *Br.;* Liqueur (Soluté) d'Arséniate de Soude, *Fr.;* Arsensaure Natronlösung, *G.*

"Arseniate of Sodium, deprived of its water of crystallization by a heat not exceeding 149° C. (300° F.), *one part* [or twenty-three grains]; Distilled Water, *ninety-nine parts* [or five fluidounces], To make *one hundred parts* [or about five fluidounces]. Dissolve the Arseniate of Sodium in the Distilled Water." *U. S.*

"Take of Arseniate of Soda (rendered anhydrous by a heat not exceeding 300°) *four grains;* Distilled Water *one fluidounce.* Dissolve." *Br.*

This is simply an officinal form for the administration of arseniate of sodium. (See *Sodii Arsenias.*) The solution responds to the reactions and tests of Arseniate of Sodium. (See *Sodii Arsenias.*) The present officinal solution is somewhat stronger than that of the U. S. P. 1870. It now contains 1 per cent. of sodium arseniate, where formerly there was present but 0·87 per cent. The salt is directed to be dried, in order that the solution may be of a uniform strength; as, from the mode in which the arseniate of sodium is ordered to be prepared, it is scarcely possible that it should always contain precisely the same quantity of water of crystallization. It is important in drying it to limit the heat to 300° F., lest a portion of the arsenic should be volatilized. The commencing dose is from three to five minims or drops (0·18 to 0·3 C.c.), to be very cautiously increased if necessary. Its arsenical strength is about the same as that of the British solution of arsenite of potassa.

LIQUOR SODII SILICATIS. *U. S.* *Solution of Silicate of Sodium.*

(LĪ′QUỌR SŌ′DỊ-Ī SĬL-Ị-CĀ′TĬS.)

Silicate de Soude liquide, *Fr.;* Flüssiges Wasserglas, *G.*

This is a new officinal solution. As it is not a preparation which can be conveniently made by the pharmacist, no process is given. Under the head of *Silicate of Sodium* (Part II.) will be found the method of preparing and purifying it.

"Solution of Silicate of Sodium should be kept in well-closed vessels." *U. S.*

Properties. The Pharmacopœia describes the solution as "a semi-transparent, almost colorless, or yellowish, or pale greenish yellow, viscid liquid, odorless, having a sharp, saline and alkaline taste, and an alkaline reaction. The sp. gr. of the commercial Solution is between 1·300 and 1·400. A drop of the Solution, when held in a non-luminous flame, imparts to it an intense, yellow color. If a portion of the Solution, considerably diluted with water, be supersaturated with nitric acid, a gelatinous or pulverulent, white precipitate of silicic hydrate will be produced. A small quantity should not produce any caustic effect when applied to the skin (abs. of an excessive amount of alkali)." *U. S.*

Medical Properties. This solution is used solely by the surgeon in the preparation of mechanical dressings.

LIQUOR STRYCHNIÆ. *Br.* *Solution of Strychnia.*

(LĪ′QUỌR STRȲCH′NỊ-Æ.)

Soluté de Strychnine, *Fr.;* Strychninlösung, *G.*

"Take of Strychnia, in crystals, *four grains;* Dilute Hydrochloric Acid *six minims;* Rectified Spirit *two fluidrachms;* Distilled Water *six fluidrachms.* Mix the Hydrochloric Acid with four [fluid]drachms of the Water, and dissolve the Strychnia in the mixture by the aid of heat. Then add the Spirit and the remainder of the Water." *Br.*

This is in fact a solution of the hydrochlorate of strychnine. The spirit is added for its preservation. Two fluidrachms of it contain a grain of strychnine, and the commencing dose is from five to ten minims (0·3 to 0·6 C.c.), equal respectively to the twenty-fourth and the twelfth of a grain (0·0025 to 0·005 Gm.) of the alkaloid.

LIQUOR ZINCI CHLORIDI. *U. S., Br.* *Solution of Chloride of Zinc.*

(LĬ′QUỌR ZĬN′CĪ ÇHLŌ′RỊ-DĪ—zĭn′sī.)

"An aqueous solution of Chloride of Zinc [**$ZnCl_2$; 135·7.**—$ZnCl$; 67·85], containing about 50 per cent. of the salt." *U. S.*

Chlorure de Zinc liquide, Soluté de Burnett, *Fr.;* Flüssiges Chlorzink, *G.*

"Zinc, granulated, *two hundred and forty parts* [or six and a quarter ounces av.]; Nitric Acid, *twelve parts* [or one hundred minims]; Precipitated Carbonate of Zinc, *twelve parts* [or one hundred and thirty-six grains]; Hydrochloric Acid, Distilled Water, each, *a sufficient quantity*, To make *one thousand parts* [or one pint]. To the Zinc, contained in a glass or porcelain vessel, add, gradually, enough Hydrochloric Acid to dissolve it; then strain the solution, add the Nitric Acid, evaporate to dryness, and bring the dry mass to fusion. Let it cool, dissolve it in *one hundred and fifty parts* [or four and a half fluidounces] of Distilled Water, add the Precipitated Carbonate of Zinc, and agitate the mixture occasionally during twenty-four hours. Finally, filter through white filtering paper free from iron, and pass enough Distilled Water through the filter to make the solution weigh *one thousand parts* [or measure one pint]." *U. S.*

"Take of Granulated Zinc *one pound* [avoirdupois]; Hydrochloric Acid *forty-four fluidounces* [Imperial measure]; Solution of Chlorine *a sufficiency;* Carbonate of Zinc *half an ounce* [avoird.], or *a sufficiency;* Distilled Water *one pint* [Imp. meas.]. Mix the Hydrochloric Acid and Water in a porcelain dish, add the Zinc, and apply a gentle heat to promote the action until gas is no longer evolved. Boil for half an hour, supplying the water lost by evaporation, and allow the product to cool. Filter it into a bottle and add Solution of Chlorine by degrees, with frequent agitation, until the fluid acquires a permanent odor of chlorine. Add the Carbonate of Zinc in small quantities at a time, and with renewed agitation, until a brown sediment appears. Filter the liquid into a porcelain basin, and evaporate until it is reduced to the bulk of two pints [Imp. meas.]." *Br.*

The chloride of zinc is made, in the usual way, by dissolving zinc in hydrochloric acid. The solution of chlorine in the British process and the nitric acid in the U. S. process are added in order that any iron present may be converted into ferric chloride, from which it is afterwards precipitated by the carbonate of zinc. In the Dublin process the former object was accomplished by the use of solution of chlorinated lime, the latter by chalk. This is a decided improvement; as the use of the chalk as a precipitant introduced into the preparation some chloride of calcium; while the carbonate of zinc adds to the chloride of zinc in solution. The preparation is completed by bringing it to a certain bulk by the addition of distilled water, and by filtration to separate the precipitated iron and any excess of the carbonate.

As procured by the U. S. P. process, solution of chloride of zinc is "a clear, colorless liquid, odorless, having a very astringent, sweetish taste, and an acid reaction. Sp. gr. 1·555. It responds to the reactions and tests of an aqueous solution of Chloride of Zinc. (See *Zinci Chloridum.*)" *U. S.* The British solution contains about 175 grains of zinc in the *Imperial* fluidounce, and has the sp. gr. 1·593. The American solution does not differ much, containing about 170 grains to the fluidounce [wine measure]. This solution is equivalent to Burnett's disinfecting fluid noticed below. It is a powerful disinfectant, and, when applied, duly diluted with water, to cancerous and other offensive ulcers, destroys their fetor so long as the dressings are kept moist with it. The solution is recommended by M. Gaudriot in gonorrhœa in both sexes, as having remarkable remedial powers. For men he uses an injection, composed of from twenty-four to thirty-six drops in four fluidounces of water. A small quantity only is injected about an inch up the urethra, two or three times a day. For women he employs a vaginal suppository, formed of five drops of the solution, half a grain of sulphate of morphine, and three drachms of a paste consisting of a drachm and a half of starch, a drachm of mucilage of tragacanth, and half a drachm of sugar. The suppository is introduced every day, or every second day.

Burnett's disinfecting fluid, like the officinal solution, is an aqueous solution of chloride of zinc. It contains 200 grains of zinc in each Imperial fluidounce, and has the sp. gr. 2. It is, therefore, considerably stronger than the Dublin solution. It is so called after Sir William Burnett, who introduced it into use, in 1840, as a powerful deodorizing and disinfecting agent in neutralizing noxious effluvia, and in arresting animal and vegetable decomposition. Diluted with water it forms Sir William's patent preservative against the dry rot. The concurrent testimony of a number of observers shows that it acts as an excellent disinfectant for ships, hospitals, dissecting rooms, water-closets, privies, etc. Injected into the blood-vessels, it preserves bodies for dissection, without impairing their texture, and is said not to injure the knives employed; but the accuracy of the latter statement is doubtful. The advantage is claimed for it, that, while it destroys putrid odors, it has no smell of its own. For preserving anatomical subjects, one part of the disinfecting fluid to eighteen of water will form a solution of the proper strength. For disinfecting operations on a large scale, a pint may be mixed with four gallons of water.

LITHII BENZOAS. *U. S.* *Benzoate of Lithium.*

$Li\,C_7\,H_5\,O_2$; 128. (LĬTH'Ị-Ī BĔN'ZỌ-ĂS.) $LiO, C_{14}\,H_5\,O_3$; 128.

Benzoate de Lithium, *Fr.;* Benzoësaures Lithon, *G.*

This is a new officinal salt of lithium. It is made by decomposing lithium carbonate with benzoic acid. E. B. Shuttleworth (*A. J. P.*, 1875) deviates from the usual method of first making a hot solution of benzoic acid and then adding carbonate until effervescence ceases, by reversing the order. One ounce (av.) of lithium carbonate is put in a capsule with nine fluidounces of water, the mixture is heated, and three and a quarter ounces (av.) of benzoic acid in small portions added, until the carbonate is all decomposed and effervescence ceases, the solution is filtered and evaporated to dryness, or crystallized if desired. The yield is three and a half ounces. The advantage of this process is a saving in time and labor in evaporating, $Li_2CO_3 + 2HC_7H_5O_2 = 2LiC_7H_5O_2 + H_2O + CO_2$. No process is given in the Pharmacopœia. The officinal description is as follows.

Properties. "A white powder, or small, shining scales, permanent in the air, odorless, or having a faint benzoin-like odor; of a cooling and sweetish taste, and a faintly acid reaction. Soluble in 4 parts of water and in 12 parts of alcohol at 15° C. (59° F.); in 2·5 parts of boiling water, and in 10 parts of boiling alcohol. When heated, the salt fuses; at a higher temperature it chars, emits inflammable vapors having a benzoin-like odor, and finally leaves a black residue of an alkaline reaction, and imparting a crimson color to a non-luminous flame. On mixing the aqueous solution with a dilute solution of ferric sulphate, a flesh-colored precipitate is produced. If the benzoic acid be separated from the salt by precipitation with diluted nitric acid, and thoroughly washed, it should respond to the tests of purity mentioned under *Acidum Benzoicum.* On dissolving the residue, left on ignition, in diluted hydrochloric acid, and evaporating the filtered solution to dryness, 1 part of the residue should be completely soluble in 3 parts of absolute alcohol, which, when ignited, should burn with a crimson flame, and the addition of an equal volume of stronger ether to the alcoholic solution should produce no precipitate (salts of alkalies). On dissolving another portion of the residue in a small quantity of water, the solution should produce no precipitate with test-solution of oxalate of ammonium (salts of alkaline earths). The aqueous solution should remain unaffected by hydrosulphuric acid or sulphide of ammonium (abs. of metals)." *U. S.*

Medical Properties. The benzoate of lithium has been highly commended as a remedy against gout (*Edin. Med. Journ.*, Jan. 1875), and has been used to some extent; there is, however, no sufficient reason for supposing that it is superior to, or even as good as, the citrate or carbonate of the base. It may be given in doses of fifteen to thirty grains (1 to 1·95 Gm.) in aromatized water.

LITHII BROMIDUM. *U. S.* *Bromide of Lithium.*

$Li\,Br$; 86·8. (LĬTH'Ị-Ī BRỌ-MĪ'DŬM.) $Li\,Br$; 86·8.

Bromure de Lithium, *Fr.;* Bromlithium, *G.*

This salt is officinal for the first time. Yvon prepares bromide of lithium by mixing 37 parts of carbonate of lithium, 200 parts of distilled water, and 80 parts of bromine, and passing a current of sulphuretted hydrogen through the mixture until the color of bromine has disappeared. A slight heat is then applied to drive off excess of sulphuretted hydrogen and to agglutinate the sulphur. After filtration, the liquor is concentrated and finally crystallized by desiccating it under a bell glass, over sulphuric acid. It may also be obtained by double decomposition. Sulphate of lithium is first formed by treating 37 parts of carbonate of lithium with 49 parts of monohydrated sulphuric acid, diluted with its own volume of water. Then 119 parts of potassium bromide are dissolved in the smallest possible quantity of water. When the two solutions are mixed, an abundant precipitate of potassium sulphate is produced on the addition of a little alcohol. The whole is evaporated to dryness, the operation finished on a water-bath, and the residue is treated with alcohol which removes only bromide of lithium and deposits it again on evaporation. The bromide may then be crystallized from water or kept in solution of known strength.* (*P. J. Tr.*, Sept. 18, 1876.) No process is given in the Pharmacopœia. "Bromide of Lithium should be kept in well-stopped bottles." *U. S.*

Properties. "A white, granular salt, very deliquescent, odorless, having a very sharp, somewhat bitter taste, and a neutral reaction. Very soluble in water and alcohol. At a low red heat the salt fuses, and at a higher heat it is slowly volatilized. A fragment of the salt imparts a crimson color to a non-luminous flame. If disulphide of carbon be poured into a solution of the salt, then chlorine water added drop by drop, and the whole agitated, the disulphide will acquire a yellow or yellowish brown color without a violet tint. One part of the salt should be completely soluble in 3 parts of absolute alcohol, and the addition of an equal volume of stronger ether to the alcoholic solution should produce no precipitate (salts of alkalies). On dissolving a portion of the salt in a small quantity of water, the solution should produce no precipitate with test-solution of oxalate of ammonium (salts of alkaline earths). The aqueous solution should remain unaffected by hydrosulphuric acid or sulphide of ammonium (abs. of metals)." *U. S.*

Medical Properties. The bromide of lithium was first brought into notice as a remedy by Dr. S. Weir Mitchell, who asserts that its action differs from that of the other bromides only in being more hypnotic. It has been used to some extent clinically, but has not been sufficiently studied to enable us to form a decided opinion as to its exact influence upon the human organism. It should be given in dilute aromatized solution, in doses of fifteen to thirty grains (1 to 1·95 Gm.). Each drachm of it contains 55 grains of bromine, and it therefore exceeds in bromine strength the bromide of potassium.

LITHII CARBONAS. *U. S., Br.* *Carbonate of Lithium.*

Li_2CO_3; 74. (LĬTH′Ị-Ī CÄR-BŌ′NĂS.) LiO, CO_2; 37.

Lithiæ Carbonas, *Br.;* Lithium Carbonicum, *P.G.;* Carbonas Lithicus; Carbonate of Lithia, *E.;* Carbonate de Lithine, Carbonate lithique, *Fr.;* Kohlensaures Lithon, *G.*

This salt was for the first time made officinal in the U. S. Pharmacopœia of 1860, and was placed in the Materia Medica list, as an article to be obtained from the manufacturer. The alkali *lithia*, so far as has yet been ascertained, is rare in nature; for, though extensively diffused, it exists but in very small proportion, except in a few scarce minerals. It was discovered by Arfvedson in 1817, in certain minerals from the iron-mines of Utö, as *petalite, triphane,* and a variety of *tourmaline.* (*Berzelius.*) It has since been found in other minerals, as *lepidolite, spodumene, amblygonite,* etc., and in numerous mineral waters, as those of Carlsbad, Pyrmont, Kissingen, Kreuznach, Aix-la-Chapelle, Vichy, etc., in Europe, and the Gettysburg spring in the United States, in which it exists generally as a carbonate or bicarbonate. By spectrum analysis, it has been detected in the waters of the Atlantic and the Thames, the ashes of plants grown on a granite soil, and even in milk and human blood. In the mother-waters of tartaric acid, in the factories, it has been found in a proportion to justify extraction. It was at one time largely obtained from a *phosphatic triphyline*, found in Bavaria, in which it existed as a phosphate; but this source is said to have been exhausted.

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* *Iodide of Lithium* (LiI; 133·6) may be prepared by taking of iodine 127 parts, iron, in filings, 35 parts, lithium carbonate 38 parts, distilled water 300 parts. Prepare a solution of iodide of iron, using the whole of the distilled water, filter, add the carbonate of lithium to the still warm liquid, and heat gently to promote complete decomposition. The liquid must be slightly alkaline. Filter, wash the precipitated carbonate of iron, add the washings to the filtrate, evaporate the latter, pour it out to cool and harden, and immediately transfer it into well-dried, glass-stoppered vials. It forms a white salt very soluble in water and alcohol. One gramme of it is entirely precipitated by 1·27 Gm. of silver nitrate. (*N. R.*, July, 1877.)

There are several methods of extracting lithia from the minerals containing it, an account of which may be seen in *Roscoe and Schorlemmer*, vol. ii., Part I., p. 158. They contain the alkali in various proportions, from 3·6 per cent. in lepidolite to 11 per cent. in amblygonite. Carbonate of lithium is prepared from lepidolite in the following manner. 10 parts of finely powdered lepidolite, 10 parts of barium carbonate, 5 parts of barium sulphate, and 3 parts of potassium sulphate are fused at a very high temperature in a wind furnace. The heavy silicate and sulphate of barium sink to the bottom, and a layer of the sulphates of potassium and lithium is found at the top of the fused mass. These can be extracted by simple lixiviation, and then the carbonate prepared by double decomposition with ammonium carbonate.

Lithia, Li_2O, is the oxide of the metal lithium, and ranks in chemical properties with the fixed alkalies. In the form of hydrate, $LiOH$, it is white and translucent; does not deliquesce in the air, but absorbs carbonic acid, and becomes opaque; is fusible below ignition, but not volatilizable at a white heat; is soluble in water, but less so than potassa or soda; is sparingly soluble in alcohol; and in solution has an acrid alkaline taste, caustic properties, and a strong alkaline reaction. The salts of lithium are generally freely soluble, with the exception of the neutral carbonate and phosphate, the latter of which is nearly insoluble. *Lithium*, which was first obtained by Bunsen and Matthiessen, in 1855, is silver-white, brilliant, softer than lead, ductile, capable of welding, and the lightest known solid. Its sp. gr. is 0·594, melting point 180° C. (356° F.), atomic weight 7, and symbol Li.

Carbonate of lithium may be prepared directly from one of the lithia minerals, in the manner already described, or from sulphate or chloride of lithium in concentrated solution by adding carbonate of ammonium. The precipitated salt should be washed with alcohol and dried.

Properties. It is "a light, white powder, permanent in the air, odorless, having an alkaline taste, and an alkaline reaction. Soluble in 130 parts of water at 15° C. (59° F.), and in about the same proportion of boiling water; insoluble in alcohol. On heating a small quantity of the salt on a platinum loop in a non-luminous flame, it fuses to a clear, transparent bead, imparting a crimson color to the flame. The salt is soluble in acids with copious effervescence. If a solution of the salt in diluted hydrochloric acid be evaporated to dryness, the residue should respond to the tests of purity mentioned, for the corresponding residue, under *Lithii Benzoas*." *U. S.* Its aqueous solution has an alkaline reaction. In the British Pharmacopœia, the following test is given. "Ten grains, neutralized with sulphuric acid, and heated to redness, leave 14·86 grains of dry sulphate, which, when dissolved in distilled water, yields no precipitate with oxalate of ammonia or lime-water." *

Medical Properties and Uses. Carbonate of lithium has the ordinary remedial properties of the alkaline carbonates, over which, however, it possesses advantages, under certain circumstances, which render it a valuable addition to the Materia Medica. In the year 1843, Mr. Alexander Ure, of London, called attention to the extraordinary solvent power of a solution of lithia over uric acid, with which, unlike the other alkalies, it forms a very soluble salt, and suggested its injection into the bladder, for the solution or disintegration of uric acid calculi. In 1857, Dr. Garrod, of London, gave it internally in cases of gout and gouty diathesis in reference to the same property, as well as in consideration of its low combining number, and consequent extraordinary neutralizing power. From these properties, it is admirably adapted to cases in which it is desirable to eliminate uric acid from the system, and especially to cases of gout, in which there is a strong indication to prevent the formation of insoluble salts of uric acid, and their deposition in the bladder, kidneys, or joints, and to favor the solution of such salts when already formed, as in the chalky deposits in the joints and ligamentous tissues of gouty patients, consisting chiefly of urate of sodium. Dr. Garrod has, moreover, found the carbonate of lithium, in dilute solution, not only to exceed the other alkalies in rendering the urine neutral or alkaline, but also to act powerfully as a diuretic, probably more so than the corresponding salts of potassa and soda. (*Med. Times and Gaz.*, March, 1864, p. 303.) The dose of carbonate of lithium is from five to fifteen grains (0·52 to 1· Gm.), and is most advantageonsly given in carbonic acid water.

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* *Effervescing Carbonate of Lithium.* Take of Citric Acid 40 parts, Bicarbonate of Sodium 50 parts, and Carbonate of Lithium 10 parts. Powder and mix well, then introduce into a wide flat-bottomed dish, and heat to about 100° C. (212° F.), stirring constantly until the powder becomes granular. Separate the granules of uniform size by means of appropriate sieves, and preserve them in well-stopped bottles.

Off. Prep. Liquor Lithiæ Effervescens, *Br.;* Lithiæ Citras, *Br.*

LITHII CITRAS. *U. S., Br.* *Citrate of Lithium.*

$Li_3\,C_6\,H_5\,O_7$; 210. (LĬTH'Ị-Ī CĪ'TRĂS.) $3LiO,\ C_{12}\,H_5\,O_{11}$; 210.

Lithiæ Citras, *Br.;* Lithium Citricum; Citrate of Lithia, *E.;* Citrate de Lithine, *Fr.;* Citronensaures Lithium, *G.*

"Take of Carbonate of Lithia *fifty grains;* Citric Acid, in crystals, *ninety grains;* Warm Distilled Water *one fluidounce.* Dissolve the Citric Acid in the Water, and add the Carbonate of Lithia, in successive portions, applying heat until effervescence ceases, and a perfect solution is obtained. Evaporate by a steam or sand-bath till water ceases to escape, and the residue is converted into a viscid liquid. This should be dried in an oven or air-chamber at the temperature of about 240°, then rapidly pulverized, and enclosed in a stoppered bottle." *Br.* No process is given in the U. S. P. 1880 for this salt.

To saturate the 50 grains of carbonate of lithium directed by the British Pharmacopœia, 90·54 grains of the crystallized acid will be required; so that there is a slight deficiency on the part of the acid; whereas it should be in slight excess, and, according to Mr. Squire, 100 grains of the acid should be used instead of 90 grains. (See also *P. J. Tr.*, Sept. 11, 1875.) This proportion was employed in the U. S. Pharmacopœia process of 1870. See foot-note.* "Citrate of Lithium should be kept in well-stopped bottles." *U. S.*

Properties. Citrate of Lithium is in the form of a white powder, "deliquescent on exposure to air, odorless, having a slightly cooling, faintly alkaline taste, and a neutral reaction. Soluble in 5·5 parts of water at 15° C. (59° F.), and in 2·5 parts of boiling water; only slightly soluble in alcohol. When exposed to a red heat, the salt chars, emits inflammable vapors, and finally leaves a black residue having an alkaline reaction, which imparts a crimson color to a non-luminous flame. The aqueous solution of the salt, mixed with test-solution of chloride of calcium, deposits a white precipitate on boiling. On dissolving the residue, left on ignition, in diluted hydrochloric acid, and evaporating the filtered solution to dryness, the residue should respond to the tests of purity mentioned, for the corresponding residue, under *Lithii Benzoas.*" *U. S.* That the salt is a citrate will be shown by its solution becoming turbid when boiled with lime-water, but clear again on cooling. (*Brande and Taylor.*) "Twenty grains of it, burned at a low red heat, with free access of air, leave 10·6 grains of white residue." *Br.* In other words, 20 grains of the salt yield 10·6 grains of carbonate of lithium; for all the acid with its carbon must be consumed in the process.

Medical Properties and Uses. These are essentially the same as those of the carbonate, as the citric acid is burnt up in the system and a carbonate of lithium formed, which is finally eliminated by the kidneys. While thus acting like the carbonate, it has the advantages over that salt of having a less disagreeable taste, and of being less disposed to irritate the stomach; the same advantages that, in many instances, the citrate of potassium has over the carbonate of that alkali. The dose is from ten to thirty grains (0·65 to 1·95 Gm.).

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* "Take of Carbonate of Lithium *one hundred grains;* Citric Acid, in crystals, *two hundred grains;* Distilled Water *two fluidounces.* Dissolve the Citric Acid in the water gently heated, and to the solution, gradually add the Carbonate of Lithium until perfectly dissolved, heating the solution so long as effervescence is produced. Evaporate, by means of a steam or sand-bath, to a viscid consistence, dry the residue in an oven, at a temperature of about 240°, then rapidly pulverize it, and preserve the powder in a well-stopped bottle." *U. S.* 1870.

LITHII SALICYLAS. *U. S.* *Salicylate of Lithium.*

$2LiC_7H_5O_3.H_2O$; 306. (LĬTH'Ị-Ī SĂL-Ị-CȲ'LĂS.) LiO, HO, $C_{14}H_4O_4$. HO. 153.

No process is given in the Pharmacopœia for this new officinal. It may be prepared by adding to a mixture of eleven parts of salicylic acid and three parts of lithium carbonate twenty-five parts of water, and heating until effervescence ceases, filtering and evaporating. It may be obtained in crystals, and "should be kept in well-stopped bottles." *U. S.*

Properties. "A white powder, deliquescent on exposure to air, odorless, or nearly so, having a sweetish taste, and a faintly acid reaction. Very soluble in water and in alcohol. When strongly heated the salt chars, emits inflammable vapors, and finally leaves a black residue having an alkaline reaction, and imparting a crimson color to a non-luminous flame. On supersaturating the dilute aqueous solution with hydrochloric acid, a bulky, white precipitate is obtained, which is soluble in boiling water, from which it crystallizes on cooling; also soluble in ether; and producing an intense violet color with ferric salts. The aqueous solution should be colorless and should not effervesce on the addition of an acid (abs. of carbonate). When agitated with 15 parts of concentrated sulphuric acid, the salt should not impart any color to the acid within fifteen minutes (abs. of foreign organic matters). On dissolving the residue, left on ignition, in diluted hydrochloric acid, and evaporating the filtered solution to dryness, the residue should respond to the tests of purity mentioned, for the corresponding residue, under *Lithii Benzoas.*" *U. S.*

Medical Properties. This salt has probably been introduced into the Pharmacopœia as a remedy in gout and rheumatism, as uniting the virtues of salicylic acid and lithia. It will probably be found efficient, and has the great advantage over salicylic acid of being freely soluble in water and much less irritant to the stomach. Every drachm of it contains about 57·25 grains of salicylic acid and 2·75 grains of lithium. The dose is from twenty to forty grains (1·3 to 2·6 Gm.), to be given in an aromatized syrup.

LOBELIA. *U.S., Br.* *Lobelia.*

(LỌ-BĒ'LỊ-Ạ.)

"The leaves and tops of Lobelia inflata, Linné (*Nat. Ord.* Lobeliaceæ), collected after a portion of the capsules have become inflated." *U. S.* "The dried flowering herb." *Br.*

Herba Lobeliæ, *P.G.;* Indian Tobacco; Herbe de Lobélie enflée, *Fr.;* Lobelienkraut, *G.*

Gen. Ch. Calyx five-cleft. *Corolla* irregular, five-parted, cleft on the upper side nearly to the base. *Anthers* united into a tube. *Stigma* two lobed. *Capsule* inferior or semi-superior, two or three-celled, two-valved at the apex. *Torrey.*

Lobelia inflata. Willd. *Sp. Plant.* i. 946; Bigelow, *Am. Med. Bot.* i. 177; Barton, *Med. Bot.* i. 181; Carson, *Illust. of Med. Bot.* i. 60, pl. 51; *B. & T.* 162. This species of Lobelia, often called *Indian tobacco*, is an annual or biennial indigenous plant, usually a foot or more in height, with a fibrous root, and a solitary, erect, angular, very hairy stem, much branched about midway, but rising considerably above the summits of the highest branches. The leaves are scattered, or alternate, petiolate, the upper sessile, ovate, or oblong, about two inches (5 cm.) long, irregularly toothed, pubescent, pale green. The flowers are numerous, small, disposed in leafy terminal racemes, and upon short axillary footstalks. The calyx is five-toothed and much inflated in fruit. The corolla, which is of a delicate blue, has a labiate border, with the upper lip divided into two, the lower into three segments. The united anthers are curved, and enclose the stigma. The fruit is an oval, striated, inflated capsule, crowned with the persistent calyx, and containing, in two cells, numerous very small, brown seeds.*

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* In case of poisoning by lobelia, the seeds may be recognized by the following microscopic characters. (Fred. Curtis, *Lond. Med. Gaz.*, July, 1851.) They are almond-shaped, about 1-30th of an inch long by 1-75th broad, puce-colored, regularly marked with longitudinal ridges and fur-

Lobelia inflata is a very common weed, growing on the roadsides, and in neglected fields, throughout the United States. Its flowers begin to appear towards the end of July, and continue to expand in succession till the occurrence of frost. All parts of it are medicinal; but, according to Dr. Eberle, the root and inflated capsules are most powerful. The plant should be collected in August or September, when the capsules are numerous, and should be carefully dried. It may be kept whole, or in powder. As found in commerce, it is often in oblong compressed cakes, prepared by the Shakers or herb-dealers.

Dried lobelia has a slight irritating odor, and when chewed, though at first without much taste, soon produces a burning acrid impression upon the posterior parts of the tongue and palate, very closely resembling that occasioned by tobacco, and attended, in like manner, with a flow of saliva and a nauseating effect. The powder is greenish. The plant yields its virtues readily to water and alcohol. Water distilled from it has its odor without its acrimony. Prof. Procter found the plant to contain an odorous volatile principle, probably volatile oil; a peculiar alkaline principle named lobeline; a peculiar acid, first noticed as distinct by Pereira, called *lobelic acid;* besides gum, resin, chlorophyll, fixed oil, lignin, salts of lime and potassa, and oxide of iron. The seeds contain at least twice as much of lobeline, in proportion, as the whole plant, which yielded only one part in five hundred. They contain also 30 per cent. of a nearly colorless fixed oil, having the drying property in an extraordinary degree. *Lobeline* was obtained by Prof. Procter by the following process. The seeds were treated with alcohol acidulated with acetic acid, until deprived of acrimony, and the tincture was evaporated; the resulting extract was triturated with magnesia and water, and, after repeated agitation for several hours, the liquor, holding lobeline in solution, was filtered; this was then shaken repeatedly with ether until no longer acrid; and the ethereal solution, having been decanted, was allowed to evaporate spontaneously. The residue, which was reddish brown and of the consistence of honey, was deprived of coloring matter by dissolving it in water, adding a slight excess of sulphuric acid, boiling with animal charcoal, saturating with magnesia, filtering, agitating with ether until this fluid had deprived the water of acrimony, and finally decanting, and allowing the ether to evaporate. Thus obtained, *lobeline* is a yellowish liquid, lighter than water, of a somewhat aromatic odor, and a very acrid durable taste. It is soluble in water, but much more copiously in alcohol and ether; and the latter fluid readily removes it from its aqueous solution. It has an alkaline reaction, and forms soluble and crystallizable salts with sulphuric, nitric, and hydrochloric acids, and a very soluble but not crystallizable salt with acetic acid. It forms an insoluble compound with tannic acid, which instantly precipitates it from its solution. By a boiling heat it is entirely decomposed, losing all its acrimony; but, when combined with acids, it may be subjected to ebullition with water without change. Prof. Procter introduced a grain of it diluted with water into the stomach of a cat, which became immediately prostrate, remained for an hour nearly motionless, with dilated pupils, and had not wholly recovered at the end of fifteen hours. It did not occasion vomiting or purging. There can be little doubt that it is the narcotic principle of lobelia. (*A. J. P.*, ix. 105, and xiii. 1.)* Enders has also isolated the acrid substance of the drug, and gives to it the name *lobelacrin.* It is obtained in warty tufts of a brown color, soluble in ether and chloroform, but only slightly in water. It is decomposed by boiling with dilute acids or alkalies into sugar and lobelic acid. Lewis (*P. J. Tr.* [3], 10, p. 56) considers lobelacrin as only a mixture of lobeliate of lobeline with free lobelic acid. (*Pharmacographia*, 2d ed., p. 400.) The late Dr. S. Colhoun, of Philadelphia,

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rows, and cross ridges generally at right angles with the former; so that the surface presents the appearance of basket-work. No other seeds could be mistaken for them, except those of *Lobelia cardinalis*, which, however, are larger, coarser, of a lighter color, and with the superficial rectangular chequering less distinct.

* Mr. William Bastick, of London, published (*P. J. Tr.*, Dec. 1850) an article on lobeline, apparently in entire ignorance of the previous work of Prof. Procter. His process does not differ essentially from that above given. In one magnesia is used to decompose the native salt of lobeline, in the other lime; the caustic alkalies not being applicable to the purpose, as they decompose this alkaloid with great facility.

was the first to announce the existence of a peculiar principle in lobelia, capable of forming salts with the acids; but he did not obtain it in an isolated state. An important inference from the effects of heat upon lobeline is, that, in preparing lobelia for use, the plant should never be heated in connection with a salifiable base.

Medical Properties and Uses. Lobelia is said to have been used as a medicine by the aborigines of America, but was first brought into general professional notice by the Rev. Dr. Cutler, of Massachusetts. The leaves or capsules, chewed for a short time, occasion giddiness, headache, general tremors, and ultimately nausea and vomiting. When swallowed in the full dose, the medicine produces speedy and severe vomiting, attended with continued and distressing nausea, copious sweating, and great general relaxation. When toxic doses are taken, these symptoms are very severe, and have added to them burning pain in the fauces or œsophagus, progressive failure of voluntary motion, rapid, feeble pulse, fall of temperature, and finally collapse with stupor or coma; in some cases convulsions precede death. Death has often resulted from its empirical use. Its poisonous effects are most apt to occur, when, as sometimes happens, it is not rejected by vomiting. The experiments of Dr. I. Ott upon the lower animals show that the poison causes paralysis of the motor nerve trunks, the peripheral vagi, and probably also of the vaso-motor centres. Death seems to occur from failure of respiration, due, in part at least, to the condition of the motor nerves.

As an emetic, lobelia should never be used; at present it is rarely employed at all except in spasmodic asthma, the paroxysms of which it often greatly mitigates, and sometimes wholly relieves, even when not given in doses sufficiently large to vomit. It was from the relief obtained from an attack of this complaint in his own person, that Dr. Cutler was induced to recommend the medicine. It has been used also in catarrh, croup, pertussis, and other laryngeal and pectoral affections, but is chiefly valuable where there is bronchial spasm, and must always be employed with caution. It has been employed effectually, in small doses repeated so as to sustain a slight nausea, for producing relaxation of the os uteri. (*Am. Journ. of Med. Sci.*, xvii. 248); also successfully in tetanus. (*Char. Med. Jour. and Rev.*, xi. 58.) The tincture affords the most eligible mode of administration; in asthmatic cases it may be given in doses of fifteen minims (0·9 C.c.) every hour until an effect is produced. The fluid extract, tincture, and vinegar are officinal.

Two other species of Lobelia have attracted some attention from medical writers. *L. cardinalis* or *cardinal flower*, distinguished for its showy red flowers, is supposed to possess anthelmintic properties, but is seldom used. *L. syphilitica* is said to have been used by the Indians in the cure of syphilis, but has been found wholly inefficacious in that complaint. It is emetic and cathartic, and appears also to possess diuretic properties; whence it has been conjectured that it might have proved serviceable in gonorrhœa. Dr. Chapman states that it has been employed, as he has been informed, by some practitioners of the western country in dropsy, and not without success. The root is the part used. Both these species of Lobelia are indigenous. For a more detailed account of them, the reader is referred to Dr. W. P. C. Barton's Medical Botany.

Off. Prep. Acetum Lobeliæ, *U. S.;* Extractum Lobeliæ Fluidum, *U. S.;* Tinctura Lobeliæ; Tinct. Lobeliæ Ætherea, *Br.*

LOTIONES. *Lotions.*

(LŌ-TĮ-Ō′NĒŞ—lō-shẹ-ō′nēz.)

Washes; Lotions. *Fr.;* Waschungen, *G.*

This class has been introduced into the Br. Pharmacopœia, in order to give officinal recognition to two preparations, the *black wash*, or *lotio nigra*, and the *yellow wash*, or *lotio flava*, which have been long in use, and which will be found treated of under Calomel and Corrosive Sublimate at pages 752 and 747 of this work. Nothing more will be necessary here than to give the British formulas.

LOTIO HYDRARGYRI FLAVA. *Br.* *Yellow Mercurial Lotion.*

(LŌ′TI̤-Ō HȲ-DRÄR′ÇY̤-RĪ FLĀ′VA̤—lō′shẹ-ō.)

Aqua Phagedænica, *P. G.;* Yellow Wash; Eau phagédénique, Eau divine de Fernel, *Fr.;* Phagedänisches Wasser, Altschadenwasser, *G.*

"Take of Perchloride of Mercury [Corrosive Sublimate] *eighteen grains;* Solution of Lime *ten fluidounces.* Mix."

LOTIO HYDRARGYRI NIGRA. *Br.* *Black Mercurial Lotion.*

(LŌ′TI̤-Ō HȲ-DRÄR′ÇY̤-RĪ NĪ′GRA̤.)

Aqua Phagedænica Nigra, *P.G.;* Aqua Nigra, Aqua Mercurialis Nigra; Black Wash; Eau phagédénique noire, *Fr.;* Schwarzes Wasser, *G.*

"Take of Subchloride of Mercury [Calomel] *thirty grains;* Solution of Lime *ten fluidounces.* Mix."

LUPULINUM. *U.S.* *Lupulin.*

(LŪ-PŪ-LĪ′NŬM.)

"The glandular powder separated from the strobiles of Humulus Lupulus. Linné. (*Nat. Ord.* Urticaceæ, Cannabineæ.)" *U. S.*

Lupulina, *Pharm.* 1870; Glandulæ Lupuli, *P.G.;* Lupuline, Lupulite, *Fr.;* Hopfenmehl, Lupulin, *G.*

Lupulin is officinally described as "bright brownish yellow, becoming yellowish brown, resinous, consisting of minute granules which, as seen under the microscope, are subglobular, or rather hood-shaped, and reticulate; aromatic, and bitter. When agitated with water and allowed to stand, no considerable sediment (sand, etc.) should be deposited. When ignited, Lupulin should not leave more than 8 per cent. of ash." *U. S.* See *Humulus* (page 744).

Off. Prep. Extractum Lupulini Fluidum; Oleoresina Lupulini. *U. S.*

LYCOPODIUM. *U.S.* *Lycopodium.*

(LȲ-CO̤-PŌ′DI̤-ŬM.)

"The sporules of Lycopodium clavatum, Linné, and of other species of Lycopodium. (*Nat. Ord.* Lycopodiaceæ.)" *U. S.*

Semen Lycopodii, Pulvis Lycopodii, Sulphur Vegetabile: Lycopode, Soufre végétal, Pied de Loup, *Fr.:* Gemeiner Bärlapp, Kolbenmoos, Bärlappsamen, Streupulver, Hexenmehl, *G.;* Licopodio, *It., Sp.*

Gen. Ch. *Thecæ* unilocular, of one or two forms; that containing powder somewhat reniform and two-valved, the other roundish, three- or four-valved. *Lindley.*

Lycopodium clavatum. Linn. *Sp. Plant.* 1564; *B. & T.* 299. This plant, commonly called *club-moss*, has a trailing, branching stem, several feet long, and thickly beset with linear-lanceolate, flat, ribless, smooth, partly serrate leaves, with a capillary point, curved upward, and of a deep green color. The flowers are in terminal spikes, single or in pairs, with crowded ovate, entire, pointed scales, and yellow thecæ or capsules. The plant is a native of Europe and this country.

The capsules of this lycopod, and of others belonging to the same genus, contain a fine dust or powder, which is collected in Switzerland and Germany, and used in the shops of Europe under the name of *lycopodium*, or *vegetable sulphur.* It is this that constitutes the officinal part of the plant, of which it is the seeds or sporules. It is "a fine powder, pale yellowish, very mobile, inodorous, tasteless, floating upon water, and not wetted by it, burning quickly when thrown into a flame. Under the microscope the granules are seen to be four-sided, reticulated, with short projections on the edges. Lycopodium should be free from pollen, starch, sand, and other impurities, all of which are easily detected by means of the microscope." *U. S.* Bucholz in 1807 pointed out the existence of a fixed oil. Flückiger, however, by thoroughly comminuting the spores of lycopodium with sand, obtained 47 per cent. of a bland oil which does not congeal even at —15° C. (5° F.). Stenhouse found volatile bases to be present in very small amount. The ash amounts to 4 per cent. It contains alumina, 1 per cent. of phosphoric acid, and is not alkaline. (*Pharmacographia*, 2d ed., p. 732.) It is said to be often adulterated with the pollen of the pines and firs, and sometimes with talc and starch. In Nashville, Tenn., a specimen came into the possession of Mr. Benj. Lillard, which was found to contain one-half of its bulk of dextrin. (*Chicago Pharmacist*, Sept. 1873.) In medicine, it is used as an absorbent application to excoriated surfaces, especially those which occur in the folds of the skin in infants. In pharmacy it answers the purpose of facilitating the rolling of the pilular mass, and of preventing the adhesion of the pills when formed. The moss itself has been esteemed diuretic, antispasmodic, etc., and has been employed, in the form of decoction, in rheumatism, epilepsy, and complaints of the lungs and kidneys, and has been supposed to be of great service in the removal of plica Polonica. It has, however, fallen into discredit.

MACIS. *U. S.* *Mace.*

(MĀ'CĬS.)

"The arillus of the fruit of Myristica fragrans. Houttuyn. (*Nat. Ord.* Myristicaceæ.)" *U. S.*

Arillus Myristicæ; Macis, Fleur de Muscade, *Fr.;* Muskatblüthe (Macis), *G.;* Macis, *It.;* Macias, *Sp.*

Gen. Ch. MALE. *Calyx* none. *Corolla* bell-shaped, trifid. *Filament* columnar. *Anthers* six or ten united. FEMALE. *Calyx* none. *Corolla* bell-shaped, trifid, deciduous. *Style* none. *Stigmas* two. *Drupe* with a nut involved in an arillus with one seed. *Willd.*

Mace is in the shape of "narrow bands, one inch (25 mm.) or more long, somewhat branched and lobed above, united to broader bands below; brownish orange; fatty when scratched or pressed; odor fragrant; taste warm and aromatic." *U. S.* It contains from 7 to 9 per cent. of a volatile oil, the greater portion of which, according to Schacht, consists of *macene*, $C_{10}H_{16}$, boiling at 160° C., and considered by Koller as identical with myristicene, the terpene in nutmegs, though this is considered as doubtful by Flückiger; a fixed oil, odorous, yellow, soluble in ether, insoluble in boiling alcohol; another fixed oil, odorous, red, soluble in alcohol and ether in every proportion; a peculiar gummy matter, analogous to amidin and gum; and a small proportion of ligneous fibre. Flückiger finds that, instead of the fats just described, there is some 25 per cent. of resin. (*Pharmacographia*, p. 509.) Mace yields a volatile oil by distillation, and a fixed oil by pressure. Neumann found the former heavier than water. The latter is less consistent than the fixed oil of nutmeg. Mace is inferior when it is brittle, less than usually divided, whitish or pale yellow, or with little taste and smell. (See *Myristica.*)

MAGNESIA. *U. S.* *Magnesia.* [*Light Magnesia.*]

MgO ; 40. (MĂG-NĒ-ȘỊ-Ạ.) MgO; 20.

Magnesia Levis, *Br.;* Magnesia Usta, *P.G.;* Magnesia Calcinata; Calcined Magnesia; Magnésie, Magnésie calcinée, *Fr.;* Gebrannte Magnesia, *G.*

"Take of Light Carbonate of Magnesia *four ounces.* Put it into a Cornish or Hessian crucible closed loosely by a lid, and expose it to a low red heat until a small quantity, taken from the centre of the crucible, when it has been cooled, and dropped into diluted sulphuric acid, causes no effervescence." *Br.*

In the British Pharmacopœia directions are given for preparing two forms of magnesia, one called *Magnesia Levis*, or *Light Magnesia*, from the *Light Carbonate*, and the other simply *Magnesia*, from the heavy carbonate, which it designates as *Carbonate of Magnesia.* It is the former which corresponds with our ordinary magnesia.

By exposure to a red heat, the water and carbonic acid of the carbonate of magnesium are expelled, and the earth is obtained pure. According to Dr. Black, the carbonate loses seven-twelfths of its weight by calcination. Brande says that the loss varies from 50 to 60 per cent., of which from 15 to 20 per cent. is water, $(MgCO_3)_4 + Mg(OH)_2 + 5H_2O = 5MgO + 6H_2O + 4CO_2$. About the close of the process the earth exhibits a luminous or phosphorescent appearance, which is said to be a good criterion of its freedom from carbonic acid. (*Duncan.*) A more certain indication, however, is the absence of effervescence when hydrochloric acid is added to a little of the magnesia, previously mixed with water. It is an error to suppose that a very intense heat is requisite in the calcination. The temperature of ignition is sufficient for the expulsion of the water and carbonic acid, and any increase serves only to render the magnesia harder, denser, less readily soluble in acids, and consequently less useful as a medicine. In order to insure a pure product, care should be taken that the carbonate employed be free from lime. It should be rubbed to powder before being introduced into the pot or crucible; and, as in consequence of its levity it occupies a very large space, the plan has been proposed of moistening and compressing it in order to reduce its bulk; but the French pharmaceutical writers direct that the vessels employed should be sufficiently large to contain a considerable quantity of the carbonate, without the necessity of resorting to compression.* The officinal direction, to keep the magnesia, after it has been prepared, in well-closed vessels, is founded on the fact that it absorbs carbonic acid and water from the air; but, as the absorption of the acid goes on very slowly, and that of water does not injure the preparation, the caution is often neglected in the shops. The great bulk of the earth renders its introduction into small bottles inconvenient. A four-ounce bottle holds only about an ounce of the purest and finest magnesia. But its specific gravity is greatly increased by trituration; and four times the quantity may be thus got into the same space. The density of *Henry's Magnesia*, which is at least four times that of the earth prepared in the ordinary way, has been ascribed to this cause. It has also been attributed to the influence of intense heat employed in the calcination. The conjecture has even been advanced, that this magnesia, which has enjoyed so great a popularity in England and this country, is prepared by precipitating a solution of sulphate of magnesium by caustic potassa; as the earth afforded by this plan is comparatively dense. It is asserted that the magnesia, prepared from the carbonate procured by precipitating the sulphate of magnesium with carbonate of potassium, is softer to the touch and bears a closer resemblance to Henry's than that prepared from the ordinary carbonate. The fact is explained by the presence in such magnesia of a little sulphate of potassium, from which it is difficult entirely to free it in consequence of the sparing solubility of this salt, and of a portion of silica, which originally existed in the carbonate of potassium employed to decompose the sulphate of magnesium, and of which the carbonate of sodium is destitute. According to Mr. Richard Phillips, Jr., if equivalent quantities of crystallized sulphate of magnesium and crystallized carbonate of sodium be boiled together in water, the mixture evaporated to dryness, the residual salts calcined, and the sulphate of sodium dissolved out by water, the magnesia obtained will be dense. (See *A. J. P.*, xvi. 118.) By packing the carbonate closely in the crucible, or by moistening and then compressing it strongly in a cloth, before calcination, a heavy magnesia is obtained. The advantages of Henry's magnesia, independently of the convenience of its less bulk, are its greater softness, and more ready miscibility with water. A preparation similar to Henry's is made by T. J. Husband, of Philadelphia. In reference to the preparation of heavy magnesia, Mr. T. H. Barr, after trying various methods, obtained the best results either by precipitating a hot concentrated solution of sulphate of magnesium with a like solution of carbonate of sodium, or by decomposing chloride of magnesium by heat. (*A. J. P.*, xxvi. 193.) Dr. P. E. Alessandri proposes the following method, which is both simple and rapid, for preparing "heavy" calcined magnesia. Take ordinary calcined magnesia, free from carbonate, moisten it, in a mortar, with pure, absolute alcohol, and triturate it, at first gently, afterwards with some force, but not rapidly. During the agitation, the magnesia is to be moistened three or four times with fresh portions of the alcohol, and the operation is suspended when the bulk of the magnesia appears to remain stationary. Then remove the mass, dry it, rub it to powder, and pass it through a sieve. The product occupies only about one-fifteenth of the original bulk. (*N. R.*, March, 1882.)

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* In a paper by M. A. Vée (*Journ. de Pharm.*, Avril, 1860, p. 84), it is stated that the magnesia of commerce, in consequence of imperfect preparation, is often found dense, granular, harsh, and of difficult solubility in the acids. To remedy this inconvenience the only method heretofore known was to prepare it in small quantities, and to stir the magnesia during calcination with an iron spoon. The difficulty in preparing it properly on the large scale depends upon the unequal action of the heat on large masses, so that the outer part becomes heated in excess before the inner is sufficiently so. To remedy this inconvenience M. Vée uses a furnace and crucible of a peculiar shape, so arranged that the magnesia may not be in layers thicker than seven centimetres (2·7 inches), may be exposed equably to heat, and not longer exposed than may be necessary for its decomposition. For an account of the apparatus, and of the proper method of management, see *A. J. P.*, 1862, p. 522.

Dr. Pereira found *light magnesia*, under the microscope, to exhibit the same forms observed in the light carbonate; namely, one portion was amorphous and of a flocculent or granular consistence, and another was composed of fragments of prismatic crystals; while the *heavy magnesia* was homogeneous, exhibiting no traces of crystals, and consisting of minute granules more or less cohering into small soft balls or masses. (*P. J. Tr.*, viii. 235.)

Properties. Magnesia is a very light, white, inodorous powder, of a feeble alkaline taste. Its sp. gr. is commonly stated at 2·3. It was deemed infusible till melted by means of the compound blowpipe of Dr. Hare. Water sprinkled upon it is absorbed to the extent of about 18 per cent., but with scarcely any increase of temperature. It is almost insoluble, requiring, according to Dr. Fyfe, 5142 parts of water at 60°, and 36,000 parts of boiling water for solution. Water thus impregnated has no effect on vegetable colors; but magnesia itself produces a brown stain by contact with moistened turmeric paper. Magnesia is a metallic oxide, consisting of one atom of magnesium 24, and one of oxygen $16 = 40$. "It is almost insoluble in water and insoluble in alcohol, and is not altered or affected by heat. On stirring 1 part of magnesia with 15 parts of water, in a beaker, and allowing the mixture to stand for about half an hour, it will form a gelatinous mass of sufficient firmness to prevent it from falling out when the glass is inverted. A filtered solution of Magnesia in diluted sulphuric acid, mixed with chloride of ammonium and supersaturated with water of ammonia, yields, with test-solution of phosphate of sodium, a copious, white precipitate, soluble in acids. On dropping a small portion of Magnesia into hot water, waiting until all air-bubbles have escaped, and then pouring the mixture into an excess of diluted sulphuric acid, no effervescence should take place (abs. of carbonate), nor should an insoluble residue remain (abs. of more than traces of other alkaline earths). A solution of Magnesia in a slight excess of diluted nitric acid should yield, at most, only a faint cloudiness with test-solution of chloride of barium (limit of sulphate), or of nitrate of silver (chloride)." *U. S.* *Magnesium* is a white, very brilliant metal, resembling silver, malleable, fusible at a low temperature, and convertible into magnesia by the combined action of air and moisture. It burns with great facility, and yields by its combustion a light which is intensely white and very rich in chemical activity, so that it finds wide application in signal lights and for photography. There is a hydrate of magnesia possessing the formula $Mg(OH)_2$. Magnesia forms with nitric and hydrochloric acids, salts which are soluble in alcohol and very deliquescent. It is precipitated from its saline solutions by the pure alkalies in the state of a hydrate, and by the carbonates of potassium and sodium as a carbonate; but it is not precipitated by the alkaline bicarbonates, nor by common carbonate of ammonium.

Magnesia is liable to contain, as impurities, carbonate of magnesium, lime, alumina, silica, and small quantities of the soluble salts employed or produced in the preparation of the carbonate from which it is procured. Lime, which is a very frequent impurity, and imparts to the magnesia a more strongly alkaline and more disagreeable taste, is detected by oxalate of ammonium or bicarbonate of potassium. Neither of these salts disturbs a neutral solution of pure magnesia in a dilute acid; but, if lime is present, both produce a precipitate, the former of oxalate, the latter of carbonate of calcium. But, according to Wittstein, oxalate of calcium is soluble in the neutral salts of magnesia, requiring 50 parts of chloride of magnesium, and 90 of the sulphate of magnesium; and consequently there might be no precipitate, or one redissolved by the liquid, should the proportion of lime be very small. (*Journ. de Pharm.*, 4e sér., iii. 216.) As magnesia is completely dissolved by hydrochloric acid, silica and other impurities insoluble in that acid would be left behind. Alumina is indicated by the production of a precipitate when ammonia is added in excess to a solution of fifty grains of magnesia in a fluidounce of hydrochloric acid. If the magnesia contain a soluble sulphate or carbonate, chloride of barium will reveal it by producing a precipitate with water digested on the magnesia. Rochelle salt has been found as an impurity in magnesia, probably as the result of accident. (*A. J. P.*, Jan. 1873.)

Medical Properties and Uses. Magnesia is antacid and laxative, and is much used under the name of *calcined magnesia*, in dyspepsia, sick headache, gout, and other complaints attended with sour stomach and constipation. It is also a favorite remedy in the complaints of children, in which acidity of the primæ viæ is often a prominent symptom. Its antacid properties render it useful in gravel attended with an excessive secretion of uric acid. Its advantages over carbonate of magnesium are that it may be given in a smaller dose, and does not occasion flatulence. The dose as a laxative is from thirty grains to a drachm (1·95 to 3·9 Gm.); as an antacid merely, or antilithic, from ten to thirty grains (0·65 to 1·95 Gm.) twice a day. When it meets with no acid, it is apt to linger in the stomach or bowels, and may in that case be followed by lemonade. It should be administered in water or milk, and thoroughly triturated so as to render the mixture uniform. If mixed with less than 14 or 15 times its weight of water, and allowed to stand for a day or two, magnesia is apt to form a more or less concrete mass, owing to the production of a hydrate of the earth, and the solidification of a portion of the water. This change does not take place, or at least takes place much less readily, when magnesia already saturated with moisture is employed instead of that freshly calcined. It has been conjectured that anhydrous magnesia might prove injurious in the stomach by solidifying its liquid contents; and the earth which has become saturated with moisture by exposure to a damp air is preferably recommended. Freshly precipitated hydrate of magnesia will serve as an antidote to arsenious acid, though less efficient than hydrated sesquioxide of iron. The experiments of M. Carles have shown that the soluble *saccharate of magnesium* is not superior as an antidote for arsenic to simple magnesia. Dr. Ohleyer (*London Lancet*, July, 1873) employs magnesia as a dressing in ulcers and abrasions.

Off. Prep. Ferri Oxidum Hydratum cum Magnesia, *U. S.;* Massa Copaibæ, *U. S.;* Pulvis Rhei Compositus; Trochisci Magnesiæ, *U. S.*

MAGNESIA PONDEROSA. *U. S.* *Heavy Magnesia.*

MgO; 40. (MĂG-NĒ′ṢỊ-Ạ PŎN-DẸ-RŌ′SẠ.) MgO; 20.

Magnesia, *Br.*

"A white, dense, and very fine powder, corresponding in all other properties and reactions with Magnesia. (See *Magnesia.*)" *U. S.*

This is directed, in the British Pharmacopœia, to be prepared precisely in the same manner as light magnesia, using, however, the heavy carbonate, named by it Carbonate of Magnesia. The two varieties differ, according to the Br. Pharmacopœia, only in their weight in the same bulk; the volumes corresponding to the same weight being to each other in the ratio of three and one-half to one.

MAGNESII CARBONAS. *U.S.* *Carbonate of Magnesium.*

(MĂG-NĒ′ṢỊ-Ī CĂR-BŌ′NĂS.)

$(MgCO_3)_4 . Mg(HO)_2 . 5H_2O$; 484. $(MgO, CO_2)_4 . MgO, HO . 5HO$; 242.

Magnesiæ Carbonas, *Br.;* Carbonate of Magnesia; Magnesia Carbonica, *P.G.;* Magnesia Hydrico-carbonica, Carbonas Magnesicus, Magnesia Alba, *Lat.;* Carbonate de Magnésie, Magnésie blanche, *Fr.;* Kohlensaure Magnesia, Weisse Magnesia, *G.;* Carbonato di Magnesia, *It.;* Carbonato de Magnesia, *Sp.*

Carbonate of magnesium sometimes occurs as a native mineral known as *magnesite*, the best deposits of which are those of the Grecian Archipelago, though a common variety is found in Chester Co., Pa. That which is sold in commerce is prepared on a large scale by the manufacturer. In the British Pharmacopœia directions are given for preparing it in two forms: that of MAGNESIÆ CARBONAS, or *Carbonate of Magnesia;* and that of MAGNESIÆ CARBONAS LEVIS, or *Light Carbonate of Magnesia.* The following are the directions.

1. MAGNESIÆ CARBONAS. *Carbonate of Magnesia. Br.* "Take of Sulphate of Magnesia *ten ounces* [avoirdupois]; Carbonate of Soda *twelve ounces* [avoird.]; Boil-

ing Distilled Water *a sufficiency*. Dissolve the Sulphate of Magnesia and Carbonate of Soda, each, in a pint [Imp. Meas.] of the Water, mix the two solutions, and evaporate the whole to perfect dryness, by means of a sand-bath. Digest the residue for half an hour with two pints [Imp. Meas.] of the Water, and, having collected the insoluble matter on a calico filter, wash it repeatedly with Distilled Water, until the washings cease to give a precipitate with chloride of barium. Finally, dry the product at a temperature not exceeding 212°." *Br.*

This is essentially the old process of the Dublin College for MAGNESIÆ CARBONAS PONDEROSUM, or *Heavy Carbonate of Magnesia*, and yields a product which is characterized, in the British Pharmacopœia, as "a white granular powder, which dissolves with effervescence in the dilute mineral acids, yielding solutions which, when first treated with chloride of ammonium, are not disturbed by the addition of an excess of solution of ammonia, but yield a copious crystalline precipitate upon the addition of phosphate of soda. With excess of hydrochloric acid it forms a clear solution, in which chloride of barium causes no precipitate. Another portion of the solution, supersaturated with ammonia, gives no precipitate with oxalic acid or sulphuretted hydrogen. Fifty grains, calcined at a red heat, are reduced to twenty-two."

2. MAGNESIÆ CARBONAS LEVIS. *Light Carbonate of Magnesia. Br.* The same quantities of materials are taken as in the preceding formula, the Distilled Water being now cold instead of boiling. The two salts are dissolved separately, each in half a gallon [Imp. Meas.] of the Water, the solutions are mixed, and the mixture is boiled in a porcelain dish for fifteen minutes. The precipitate is then washed and dried as in the former process. The resulting carbonate is characterized, in the Br. Pharmacopœia, as "a very light powder, which, when examined under the microscope, is found to be partly amorphous with numerous slender prisms intermixed. The other characters and tests are the same as those of carbonate of magnesia."

Carbonate of potassium is less eligible than carbonate of sodium for the preparation of carbonate of magnesium. It is difficult to separate the last portions of sulphate of potassium from the precipitate, and carbonate of potassium usually contains silica, which is thrown down with the magnesia. The consequence is that, when prepared with that salt, carbonate of magnesium is liable to be gritty to the touch, and to have a saline taste. The following method is said to be pursued by some of the best manufacturers. To a saturated solution of 100 parts of sulphate of magnesium, a solution of 125 parts of crystallized carbonate of sodium is gradually added, the solutions being constantly stirred. The mixture is heated to ebullition, to complete the precipitation of the magnesia, which is then washed with tepid and finally with cold water, until the washings no longer give a precipitate with barium salts. When sufficiently washed, the carbonate is allowed to drain for one or two days on large linen filters, and is then placed in wooden moulds with a porous bottom of brick or gypsum, and subjected to pressure in order to give it a square and compact form. According to Otto and Gabler, very pure carbonate of magnesium is now made at Nauheim, Germany. Pattinson's process is used. It depends upon the fact that, on treating calcined dolomite, in the presence of water, with carbonic acid under pressure, the magnesia dissolves as bicarbonate before any of the accompanying lime enters in solution. The calcined and finely-powdered mineral is introduced, together with water, into a cylinder with a horizontal axis, and, while it is being kept in constant motion by a stirring apparatus, carbonic acid gas, under a pressure of five to six atmospheres, is pressed into it. The resulting solution of bicarbonate of magnesium, which is perfectly free from lime, if the process has been properly managed, is then transferred to a vertical cylinder, where it is heated with steam, whereby carbonate of magnesium is separated, which is collected, formed into prismatic pieces, and dried. The carbonic acid gas required issues from the earth immediately outside of the factory; and the dolomite is furnished by the quarries of May and Urban, near Dietz and Steelen on the Lahn. (*Arch. d. Pharm.*, Aug. 1880, p. 96; *N. R.*, Sept. 1881.)

The density of carbonate of magnesium is said to depend upon the strength of the solutions from which it is first precipitated, and its fineness and softness to the touch, upon the use of carbonate of sodium in its preparation. Much of the carbonate of magnesium used in this country is imported from England and Ireland, and is usually made by Pattinson's process, described above. It is also made (1882) in Philadelphia by Drueding Bros.

When made from the bittern of salt-works, carbonate of magnesium is contaminated with carbonate of calcium, salts of lime being contained in sea-water; and, when it is prepared from magnesite, or from magnesian schist, iron is almost always present. The only way in which these impurities can be avoided, is to prepare pure sulphate of magnesium by repeated crystallization, and to use a pure carbonate of sodium. It is also necessary that the water with which the precipitate is washed should be free from earthy salts, which would be decomposed and contaminate the magnesia.

Properties. Carbonate of magnesium is inodorous, nearly insipid, perfectly white, smooth to the touch, and nearly insoluble in water, requiring 2493 parts of cold, and 9000 parts of hot water for solution. It is decomposed by strong heat, by all the acids, by potassa, soda, lime, baryta, and strontia, and by acidulous and metallic salts. "Light, white, friable masses, or a light, white powder, odorless and tasteless. insoluble in alcohol, and almost insoluble in water, to which, however, it imparts a feebly alkaline reaction. When strongly heated, it loses water and carbonic acid gas, and is converted into magnesia. It is soluble in diluted hydrochloric acid, with copious effervescence. On supersaturating this solution with water of ammonia, and adding test-solution of phosphate of sodium, a white, crystalline precipitate, soluble in acids, is thrown down. Distilled water, boiled with the salt, and, after filtration, evaporated to dryness, should not leave more than a trace of residue. The salt should be soluble in diluted hydrochloric acid to a colorless liquid; on supersaturating the clear solution with test-solution of carbonate of ammonium, it should not be rendered more than faintly opalescent (abs. of aluminium or more than traces of calcium). A two per cent. solution of the salt, prepared with the aid of acetic acid, should not be affected by hydrochloric acid, nor, after addition of test-solution of carbonate of ammonium with an excess of water of ammonia, by solution of sulphide of ammonium (abs. of metals). Another portion of the 2 per cent. solution should not at once be rendered more than faintly opalescent by test-solution of nitrate of barium (limit of sulphate), or of nitrate of silver (chloride)." *U. S.*

Two kinds of carbonate of magnesium are in use, the light and the heavy. The British processes for both have been already given. The heavy may also, according to Dr. Pereira, be prepared as follows. "Add one volume of a cold saturated solution of carbonate of soda to a boiling mixture of one volume of a saturated solution of sulphate of magnesia, and three volumes of water. Boil until effervescence has ceased, constantly stirring with a spatula. Then dilute with boiling water, set aside, pour off the supernatant liquor, and wash the precipitate with hot water on a linen cloth, afterwards dry it by heat in an iron pot." Dr. Pereira states that the *light carbonate*, when examined with the microscope, is seen to consist of an amorphous powder, more or less intermingled with slender prismatic crystals, which appear as if they were eroded or efflorescent; the *heavy carbonate* consists of granules of various sizes, without any traces of the prismatic crystals observed in the former variety.

A solution in carbonic acid water, prepared by passing carbonic acid gas into a reservoir containing carbonate of magnesium suspended in water, has been introduced into use as a cathartic and antacid. *Dinneford's Magnesia* is a solution of this nature. According to Dr. Christison, it contains only nine grains of carbonate in the fluidounce, though alleged to contain twice that quantity. Its taste is more disagreeable than that of the undissolved carbonate. A formula for this preparation has been introduced into the British Pharmacopœia, with the name of Liquor Magnesiæ Carbonatis.

Adulterations and Tests. Carbonate of magnesium may contain an alkaline carbonate or sulphate, or both, from insufficient washing; also chloride of sodium, alumina, and carbonate of calcium. If water boiled on it changes turmeric, an alkaline carbonate is indicated. If chloride of barium produces a precipitate in the water, the presence of a sulphate or carbonate is shown; and if nitrate of silver produces precipitation, a chloride is indicated. When dissolved in an excess of hydrochloric acid, an excess of ammonia will throw down alumina, which is almost always present in minute quantity; and oxalate of ammonium, afterwards added to the filtered chloride solution, will throw down oxalate of calcium, if lime be present. If the same solution, nearly neutralized, be rendered blue by ferrocyanide of potassium, the presence of iron will be indicated.

Composition. According to Berzelius, carbonate of magnesium of commerce (*magnesia alba*) is a combination of three mols. of carbonate of magnesium with one of hydrate of magnesia. According to Phillips, whose analysis agrees with a subsequent one by Fownes, four mols. of the carbonate are combined with one of the hydrate, and four of water. (*P. J. Tr.*, iii. 480.) The formula given by the British Pharmacopœia is $3MgCO_3 + Mg(OH)_2 + 4H_2O$; in other words, a combination of three mols. of carbonate of magnesium, one of magnesium hydrate, and four of water, while the U. S. Pharmacopœia of 1880 makes it $4MgCo_3 + Mg (OH)_2 + 5H_2O$. The composition of this salt varies with the mode of preparation.

Medical Properties and Uses. Carbonate of magnesium is antacid, and, by combining with acid in the stomach, becomes generally cathartic. When it undergoes no change in the alimentary canal, it produces no purgative effect. Under these circumstances, it may usually be made to operate by following it with draughts of lemonade. It is useful in all cases which require a laxative antacid; and, though apt to produce flatulence in consequence of the extrication of its carbonic acid in the stomach and bowels, and therefore in ordinary cases inferior to calcined magnesia, it sometimes operates favorably, in consequence of this very property, in sick stomach attended with acidity. Carbonate of magnesium is also an excellent antilithic when uric acid is secreted in excess. The dose is from half a drachm to two drachms (1 to 7·8 Gm.), which may be given in water or milk. In order that it may be accurately diffused through water, it should be previously rubbed down with syrup or ginger syrup.

Carbonate of magnesium is a useful agent for diffusing camphor and the volatile oils through water, in preparing several of the medicated waters, and is also used with a similar purpose, as a diffusing agent in preparing syrups or elixirs.

Off. Prep. Liquor Magnesii Citratis, *U. S.;* Magnesia; Magnesia Levis, *Br.;* Trochisci Bismuthi, *Br.;* Misturæ Magnesiæ et Asafœtidæ, *U. S.*

MAGNESII CITRAS GRANULATUS. *U. S.* *Granulated Citrate of Magnesium.*

(MĂG-NĒ'ŞI-Ī CĪ'TRĂS GRĂN-Ū-LĀ'TŬS.)

"Carbonate of Magnesium, *eleven parts* [or three ounces av. and two hundred and ninety-two grains]; Citric Acid, *forty-eight parts* [or sixteen ounces av.]; Bicarbonate of Sodium, *thirty-seven parts* [or twelve ounces av. and one hundred and forty-six grains]; Sugar, in No. 60 powder, *eight parts* [or two ounces av. and two hundred and ninety-two grains]; Alcohol, Distilled Water, each, *a sufficient quantity*, To make *one hundred parts* [or about thirty-two ounces av.]. Mix the Carbonate of Magnesium intimately with *thirty-three parts* [or eleven ounces av.] of Citric Acid, and enough Distilled Water to make a thick paste; dry this at a temperature not exceeding 30° C. (86° F.), and reduce it to a fine powder. Then mix it intimately with the Sugar, the Bicarbonate of Sodium, and the remainder of the Citric Acid previously reduced to a very fine powder. Dampen the mass with a sufficient quantity of Alcohol, and rub it through a No. 20 tinned-iron sieve, to form a coarse, granular powder. Lastly, dry it in a moderately warm place. Granulated Citrate of Magnesium should be kept in well-closed bottles." *U. S.*

This is a new officinal salt, and the only one of the class introduced. It is intended to furnish an agreeable, effervescent drink. It is very important to obey the direction to keep it in well-closed bottles, for if permitted access of air the moisture would soon cause the acid to act upon the carbonates and liberate the carbonic acid gas gradually, and thus destroy the effervescent character of the preparation, its principal recommendation. Large quantities of so-called effervescent citrate of magnesia are sold in this country and in England which contain no citrate of magnesia at all.

Properties. "A white, coarsely granular salt, deliquescent on exposure to air, odorless, having a mildly acidulous, refreshing taste, and an acid reaction. Soluble, with copious effervescence, in 2 parts of water at 15° C. (59° F.), and very soluble in boiling water; almost insoluble in alcohol. On adding chloride of ammonium to the aqueous solution of the salt, a portion of the liquid, when mixed with excess of solution of phosphate of ammonium and water of ammonia, yields a white crystalline precipitate, soluble in acids. On mixing another portion with test-solution of chloride of calcium, supersaturating with water of ammonia and filtering, the filtrate deposits a white precipitate on boiling. The saturated aqueous solution of the salt, when mixed with a saturated solution of acetate of potassium and some acetic acid, should not yield a white, crystalline precipitate (abs. of tartrate)." *U. S.*

Medical Properties. The medical properties are those of its solution, excepting that, as it does not contain a large excess of acid, it is less pleasant to the palate, but may in some cases suit the stomach better. (See *Liquor Magnesii Citratis.*) It has also the advantage of portability. The dose is from one to three teaspoonfuls.

MAGNESII SULPHAS. *U. S.* *Sulphate of Magnesium.* [*Epsom Salt.*]

$MgSO_4 . 7H_2O$; 246. (MĂG-NĒ′ŞỊ-Ī SŬL′PHĂS.) $MgO, SO_3 . 7HO$; 123.

Magnesiæ Sulphas, *Br.:* Magnesia Sulfurica, *P.G.;* Sal Amarum, Sal Epsomense, Sal Anglicum, Sal Sedlicense, Sulfas Magnesicus; Sulfate de Magnésie, Sel d'Epsom, Sel de Sedlitz, Sel amer, *Fr.:* Schwefelsaure Magnesia, Bittersalz, *G.;* Solfato di Magnesia, *It.;* Sulfato de Magnesia, *Sp.*

Sulphate of magnesium is a constituent of sea-water, and of some saline springs. It also occurs native, either crystallized in slender, prismatic, adhering crystals, or as an efflorescence on certain rocks and soils, which contain magnesia and a sulphate or sulphide. In the United States it is found in the great caves so numerous to the west of the Alleghany Mountains. In one of these caves, near Corydon in Indiana, it formed a stratum on the bottom several inches deep, or appeared in masses sometimes weighing ten pounds, or disseminated in the earth of the cavern, one bushel of which yielded from four to twenty-five pounds of the sulphate. It also appeared on the walls of the cavern, and, if it was removed, acicular crystals again appeared in a few weeks. (*Cleveland.*)

Under the name of *kieserite*, a mineral is obtained from the saline deposits at Stassfurt, in Germany, which consists in part of impure sulphate of magnesium, of which it is said to contain 12 per cent. It is not used, so far as we have learned, for preparing medicinal sulphate of magnesium, but is exported from Germany into England, for manufacturing purposes. (*Journ. de Pharm.*, Mai, 1873, p. 403.)

Sulphate of magnesium was originally procured by evaporating the waters of saline springs at Epsom in England. Dr. Grew prepared it in this manner in 1675. It was afterwards discovered that the brine, remaining after the crystallization of common salt from sea-water, furnished by careful evaporation precisely the same salt; and, as this was a much cheaper product, it superseded the former. The residual brine or bittern consists of sulphate of magnesium, and the chlorides of magnesium and calcium. As the sulphate of magnesium crystallizes first, it may with proper care be obtained nearly pure, although most frequently the salt prepared in this way is deliquescent from the presence of chloride of magnesium. It may be freed from this impurity by washing the crystals with its own saturated solution. It was from this source that the greater part of the Epsom salt of commerce was long obtained in Europe. The salt works of New England supplied our own markets with an impure and deliquescent sulphate. With the improvements of chemistry, other and better processes have been adopted. In the neighborhood of Genoa and Nice, sulphate of magnesium is prepared in large quantities from a schistose rock, containing magnesia and sulphide of iron. The mineral is roasted, and exposed in heaps for some months to the action of air and water. It is then lixiviated, the sulphate of iron decomposed by lime-water, and the salt obtained pure by repeated solution and crystallization.

William Henry, of Manchester, whose calcined magnesia has become famous throughout the world, took out a patent for a mode of preparing magnesia and its salts from the double carbonate of magnesium and calcium,—the *dolomite* of mineralogists. His process was to drive off the carbonic acid by heat, and to convert the remaining earth into hydrates. He treated these with a sufficient quantity of hydrochloric acid to dissolve out the lime, and then converted the magnesia into a sulphate either by sulphuric acid or sulphate of iron.

The salt is extensively manufactured in Baltimore and Philadelphia from a silicious hydrate of magnesia. This mineral occurs in veins in the serpentine and other magnesian rocks which abound in the neighborhood of Baltimore and in the southern counties of Pennsylvania. The advantage which it possesses over the dolomite, in the preparation of this salt, is the almost entire absence of lime, owing to which there is little or no waste of acid, and the operation is much simplified. The mineral is reduced to a fine powder and saturated with sulphuric acid. The mass is then dried and calcined at a red heat, in order to convert any sulphate of iron, which may be present, into red oxide. It is then dissolved in water, and sulphide of lime added to separate any remaining portion of iron. The salt is crystallized and dissolved a third time, in order to purify it. The sulphate prepared by this process is generally very pure and clean, although it sometimes contains sulphate of iron.

Properties. Sulphate of magnesium is "in small colorless, right-rhombic prisms, or acicular needles, slowly efflorescent in dry air, odorless, having a cooling, saline, and bitter taste, and a neutral reaction. Soluble in 0·8 part of water at 15° C. (59° F.), and in 0·15 part of boiling water; insoluble in alcohol. When heated, the salt gradually loses nearly 44 per cent. of its weight (water of crystallization), and at a strong, red heat it fuses, congealing on cooling to a white mass, which amounts to 48·7 per cent. of the original weight. The aqueous solution, mixed with solution of chloride of ammonium, yields, with excess of test-solution of phosphate of sodium and water of ammonia, a white, crystalline precipitate, soluble in acids. With test-solution of chloride of barium it yields a white precipitate insoluble in hydrochloric acid. The aqueous solution should not be colored nor be precipitated by test-solution of ferrocyanide of potassium, hydrosulphuric acid, or sulphide of ammonium (abs. of metals). A five per cent. solution, after addition of chloride of ammonium, should not be precipitated nor rendered turbid by test-solution of carbonate of ammonium and water of ammonia (abs. of other alkaline earths). A one per cent. solution should not yield more than a slight opalescence with test-solution of nitrate of silver (limit of chloride). If an aqueous solution of 1 Gm. of the salt, mixed with chloride of ammonium, be completely precipitated by solution of phosphate of ammonium and water of ammonia, the filtrate evaporated to dryness, the residue gently ignited and then dissolved in 5 C.c. of water, this solution, acidulated with a few drops of hydrochloric acid, should not become more than faintly opalescent on mixing 1 volume of it with 2 volumes of alcohol, nor on adding test-solution of chloride of barium to another portion (abs. of more than about 1 per cent. of sulphates of alkalies)." *U. S.* It usually occurs in small acicular crystals, which are produced by agitating the solution while crystallizing. It slowly effloresces in the air. At 32° F. 100 parts of water dissolve 25·76 parts of the anhydrous salt, and, for every increased degree, 0·8597 part additional is taken up. The crystals contain 54·22 per cent. of water of crystallization, and dissolve in their own weight of water at 60°, and in three-fourths of their weight at 212°. They melt in their water of crystallization, and at a high temperature fuse into an enamel. (*Berzelius.*)

Sulphate of magnesium is completely decomposed by potassa, soda, and their carbonates; by lime, baryta, and strontia, and their soluble salts. Ammonia partially decomposes it, and forms with the remainder a double sulphate. The bicarbonates of potassium and sodium do not decompose it, except by the aid of heat.

An aqueous solution of 100 grains of the salt should yield, when completely decomposed by a boiling solution of carbonate of sodium, 34 grains of dry carbonate of magnesium, and, according to the British Pharmacopœia, 16·26 grains of the carbonate after having been well washed, dried, and heated to redness. If the dry precipitate is less, the specimen tested is not all sulphate of magnesium, and probably contains sulphate of sodium.

An economical use which has been recommended of sulphate of magnesium is the addition of a strong solution to ordinary whitewash, whereby a beautiful whiteness may be given to walls and ceilings. A little of it, moreover, added to starch considerably increases its stiffening properties, and at the same time in some degree resists the action of fire. (*Chem. News*, April 19, 1867, p. 196.)

Medical Properties and Uses. Sulphate of magnesium is an active but safe cathartic, operating with little pain or nausea, and producing watery stools. It is more acceptable to the stomach than most medicines of its class, and will often be retained when others are rejected. Like many of the other neutral salts, it is refrigerant, and may be made to act as a diuretic by keeping the skin cool and walking about after it has been taken. It is well adapted to the treatment of fevers and inflammatory affections. It is also useful in colic and obstinate constipation, and may be employed in most cases which require the use of a cathartic, without being attended with debility or relaxation of the stomach and bowels. The medium dose is an ounce (31·1 Gm.); but advantage often results from its administration in divided doses, frequently repeated. It is often given in combination with other medicines, especially with senna, the griping effect of which it tends to obviate. The most agreeable form for administering the salt, and that in which it usually agrees best with the stomach, is a solution in carbonic acid water with lemon syrup. By Dr. Henry, of Dublin, it is highly recommended in connection with sulphuric acid. To seven ounces of a saturated aqueous solution of the salt he adds an ounce of the diluted sulphuric acid of the Pharmacopœias, and gives a tablespoonful of the mixture for a dose, in a wineglassful of water.*

Off. Prep. Infusum Sennæ Compositum, *U. S.;* Enema Magnesiæ Sulphatis, *Br.;* Liquor Magnesiæ Carbonatis, *Br.;* Magnesiæ Carbonas, *Br.;* Magnesiæ Carbonas Levis, *Br.;* Mistura Sennæ Composita, *Br.*

MAGNESII SULPHIS. *U. S.* *Sulphite of Magnesium.*

$MgSO_3 . 6H_2O$; 212. (MĂG-NĒ'ṢỊ-Ī SŬL'PHĬS.) $MgO, SO_2 . 6HO$; 106.

"Sulphite of Magnesium should be kept in well-stopped bottles." *U. S.*

Sulfite de Magnésie, *Fr.;* Schweflichsaure Magnesia, *G.*

This new officinal salt may be prepared by double decomposition between magnesium sulphate and neutral sodium sulphite. Owing to the almost universal presence of sulphate in the sodium sulphite, Prof. Jos. P. Remington proposes to prepare it by suspending eight parts of pure magnesia in sixteen parts of water, and then adding gradually, with stirring, officinal aqueous sulphurous acid in excess. The crystals which form are washed with very cold water, drained, and dried. (*A. J. P.*, xl. 97.)

Properties. "A white, crystalline powder, gradually becoming oxidized on exposure to air, odorless, having a slightly bitter, somewhat sulphurous taste, and a neutral or slightly alkaline reaction. Soluble in 20 parts of water at 15° C. (59° F.), and in 19 parts of boiling water; insoluble in alcohol. When heated to 200° C. (392° F.), the salt loses its water of crystallization (50·9 per cent.), and is converted into magnesia and anhydrous sulphate of magnesium. The aqueous solution of the salt, mixed with chloride of ammonium, yields, with excess of test-solution of phosphate of sodium and water of ammonia, a white, crystalline precipitate soluble in acids. When treated with 4 times its weight of diluted hydrochloric acid, the salt dissolves completely and emits the odor of burning sulphur, without becoming cloudy (difference from hyposulphite). A one per cent. aqueous solution, strongly acidulated with hydrochloric acid, should not afford more than a slight cloudiness with test-solution of chloride of barium (limit of sulphate)." *U. S.*

Medical Properties. The sulphite of magnesium shares the general medical properties of the sulphites, but is better fitted for internal administration on account of its less solubility and less disagreeable taste, etc. See *Sodii Sulphis.* The dose is fifteen grains to half a drachm (1–2 Gm.).

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* It is said that a solution of an ounce of the salt in about a pint of the water, boiled for three minutes with a grain and a half of tannic acid, or with two or three drachms of roasted coffee, is entirely deprived of bitterness. The liquid prepared with coffee should be strained, and may be sweetened with sugar. (Combes, *Journ. de Pharm.*, 3e ser., xii. 110.)

MAGNOLIA. *U. S.* *Magnolia.*

(MĂG-NŌ′LI-A.)

"The bark of Magnolia glauca, Magnolia acuminata, and Magnolia tripetala. Linné. (*Nat. Ord.* Magnoliaceæ.)" *U. S.*

Magnolia Bark; Écorce de Magnolier, *Fr.;* Magnolienrinde, *G.*

Gen. Ch. Calyx three-leaved. *Petals* six or more. *Capsules* two-valved, one-seeded, imbricated in a cone. *Seeds* berried, pendulous. *Bigelow.*

1. *Magnolia glauca.* Willd. *Sp. Plant.* ii. 1266; Bigelow, *Am. Med. Bot.* ii. 67; Barton, *Med. Bot.* i. 77; Michaux, *N. Am. Sylv.* ii. 8. This species of Magnolia, which in the Northern States is often nothing more than a shrub, sometimes attains in the South the height of forty feet. The leaves are scattered, petiolate, oval, obtuse, entire, glabrous, thick, opaque, yellowish green on their upper surface, and of a beautiful pale glaucous color beneath. The flowers are large, terminal, solitary, cream-colored, strongly and gratefully odorous, often scenting the air to a considerable distance. The calyx is composed of three leaves; the petals, from eight to fourteen in number, are obovate, obtuse, concave, and contracted at the base; the stamens are very numerous, and inserted on a conical receptacle; the germs are collected into a cone, and each is surmounted by a linear recurved style. The fruit is conical, about an inch in length, consisting of numerous imbricated cells, each containing a single scarlet seed. This escapes through a longitudinal opening in the cell, but remains for some time suspended from the cone by a slender thread.

M. glauca extends along the seaboard of the United States, from Cape Ann, in Massachusetts, to the shores of the Gulf of Mexico. It is abundant in the Middle and Southern States, usually growing in swamps; but is seldom met with in the interior, west of the mountains. It begins to flower in May, June, or July, according to the latitude. It is usually known as *magnolia* in the North, and as *white bay* or *sweet bay* in the South, but is occasionally called *swamp sassafras, beaver tree,* etc.

2. *M. acuminata.* Willd. *Sp. Plant.* ii. 1257; Michaux, *N. Am. Sylv.* ii. 12. This species is much larger than the preceding, often growing to the height of seventy or eighty feet. The leaves are six or seven inches long, by three or four in breadth, oval, acuminate, and pubescent on their under surface. The flowers are five or six inches in diameter, bluish or cream-colored, slightly odorous, with obovate rather obtuse petals from six to nine in number. Mingled with the splendid foliage, they give a magnificent aspect to the tree when large and in full bloom. The tree grows in the interior mountainous regions of the United States, extending along the Alleghanies from New York to their termination in Georgia, and seldom existing in the low country far either to the east or west of that range. It is called *cucumber tree,* from the resemblance of its fruit to the common cucumber.

3. *M. tripetala.* Willd. *Sp. Plant.* ii. 1258; Michaux, *N. Am. Sylv.* ii. 18. This is a small tree, sometimes though rarely reaching an elevation of thirty feet, and almost always having an inclined trunk. It is remarkable for the size of its leaves and flowers. The former are eighteen or twenty inches long by seven or eight in breadth, thin, obovate, somewhat wedge-shaped, entire, acute at both extremities, pubescent when young, and often disposed in rays at the extremity of the shoots, displaying a surface thirty inches in diameter. Hence has arisen its name of *umbrella tree.* The flowers are terminal, seven or eight inches in diameter, white, with from five to twelve oval acute petals, of which the three outer are reflexed. This species extends from northern New York to the southern limits of the United States. It is found only in shady situations with a strong, deep, and fertile soil.

Mr. Wallace Procter found in the fruit of this species a crystalline principle. When pure, this is without smell, and has at first little taste, in consequence of its insolubility in the liquids of the mouth, but after a time produces an irritant effect on the fauces. It is nearly insoluble in cold, but slightly soluble in hot water, very soluble in alcohol, ether, chloroform, bisulphide of carbon, and benzin. It is neutral to test-paper. Mr. Procter considered it analogous to the liriodendrin obtained by Prof. Emmet, but quite distinct. He proposed for it the name of *magnolin*, which is the more appropriate, as the principle seems to be the same as that obtained by Dr. Stephen Procter from the bark of *M. grandiflora*, and by Mr. W. D. Harrison from that of the *M. glauca*. (*A. J. P.*, xxxiv. 29.) For a more detailed account of it, see *A. J. P.*, 1872, p. 145.

The bark and fruit of all of the species of Magnolia are possessed of similar medicinal properties: but the bark only is officinal, and that of the root is thought to be most efficient. It is officinally described as follows. "The bark from young wood is quilled or curved, thin, externally orange-brown and glossy, or light gray, with scattered warts and somewhat fissured, internally whitish or pale brownish and smooth; fracture short, in the inner layer somewhat fibrous; inodorous; taste somewhat astringent, pungent, and bitter. The bark of old wood, deprived of the cork, is whitish or brownish, fibrous, and less pungent." *U. S.* The aromatic property, which resides in a volatile principle, is diminished by desiccation, and entirely lost when the bark is long kept. The bitterness, however, remains. The bark is destitute of astringency. The bark of *Magnolia grandiflora*, examined by Dr. Stephen Procter, was found to contain volatile oil, resin, and a principle analogous to the liriodendrin of Professor Emmet. (*A. J. P.*, xiv. 95.)

Medical Properties and Uses. Magnolia is a gently stimulant aromatic tonic and diaphoretic, useful in chronic rheumatism, and capable, if freely given, of arresting the paroxysms of intermittent fever. It has been used advantageously in these complaints, and in remittents, especially of a typhoid character. The dose of the recently dried bark in powder is from half a drachm to a drachm (1·95 to 3·9 Gm.), frequently repeated. The infusion may also be used, but is less efficient. Diluted alcohol extracts all the virtues of the medicine; and a tincture, made by macerating the fresh bark or fruit in brandy, is a popular remedy in chronic rheumatism.

MALTUM. *U. S.* *Malt.*

(MÂL'TŬM.)

"The seed of Hordeum distichum, Linné (*Nat. Ord.* Graminaceæ), caused to enter the incipient stage of germination by artificial means, and dried." *U. S.*

Maltum Hordei, *Lat.;* Barley Malt; Malt d'Orge, Drêche, *Fr.;* Gerstenmalz, *G.*

The object of malting is to allow germination of the grain employed to go just far enough to develop the maximum amount of *diastase*, the ferment under whose influence the starch is converted into sugar. In order to achieve this, the barley is: first, *steeped*,—*i.e.*, allowed to remain one or two days in cold water, of which it absorbs from 10 to 50 per cent.; second, *couched*,—*i.e.*, thrown into heaps upon a floor and allowed to develop heat and germinate; third, when the *acrospire* or shoot is one-third the length of the grain the latter is *floored*,—*i.e.*, spread upon wide floors to dry; fourth, it is *kiln-dried*,—*i.e.*, exposed to such a temperature as thoroughly to dry it and to kill the young plant. If the temperature be raised high enough to scorch the grain, it becomes *Amber Malt*, or *Black Malt*, according to the extent of the charring.

The so-called malt liquors are prepared by making an infusion (*wort*) of the bruised malt, adding hops and various other substances, and fermenting. *Ale*, *brown stout*, and *porter* are made by rapid fermentation at a comparatively high temperature (75° F.), whilst *lager beer* is prepared by a very slow, prolonged fermentation at a low temperature. Differences of color in malt liquors depend chiefly upon the color of the malt which is employed.

Properties. Malt is composed of the germinated, dead barley grains with acrospires and radicles adherent. The U. S. Pharm. directs that it should be fresh, of a color not darker than pale amber, and should have an agreeable odor and a sweet taste. If it lack body and taste, it has probably been already exhausted. For a description of *diastase*, the peculiar ferment which converts the starch of the grain into dextrine and dextro-glucose, see *Hordeum Decorticatum*.

Medical Properties. See *Extractum Malti.*

Off. Prep. Extractum Malti.

MANGANI OXIDUM NIGRUM. *U. S.* *Black Oxide of Manganese.* [*Dioxide of Manganese.*]

(MĂN'GẠ-NĪ ŎX'Ị-DŬM NĪ'GRŬM.)

"Native, crude Binoxide of Manganese, containing at least 66 per cent. of the pure Oxide [**MnO_2; 86.**—MnO_2; 43]." *U. S.*

Manganesii Oxidum Nigrum, *Br.;* Manganum Hyperoxydatum, *P.G.;* Oxydum Manganicum; Manganese, Peroxide of Manganese, Deutoxide of Manganese, Black Oxide of Manganese, Pyrolusite; Oxide noir de Manganèse, *Fr.;* Braunstein, *G.;* Manganese, *It., Sp.*

The officinal oxide of manganese is the dioxide of the metal manganese. *Metallic manganese* was discovered by Scheele and Gahn in 1774, and is obtained from the native black oxide by intense ignition with charcoal. As obtained by C. Brunner, by decomposing the fluoride by sodium, manganese is brittle, grayish white, and very hard, being capable of cutting glass and scratching the best tempered steel. It is susceptible of the most perfect polish, and is not altered, even in moist air, at the ordinary temperature. Its sp. gr. is about 8·0. Deville suspects that Brunner's manganese contains a little carbon. This chemist obtained the metal by heating the black oxide in excess with charcoal, in a lime crucible. The metal, thus obtained, is more refractory than iron; while that procured by Brunner fused at the same heat as white cast iron. (*Chem. Gaz.*, June 1, 1857.) The atomic weight of manganese is 54. With oxygen it forms five and possibly seven compounds: MnO, Mn_2O_3, Mn_3O_4, MnO_2 and Mn_2O_7. The *monoxide* is of a light green color, and is the oxide present in or corresponding to manganous salts. The *sesquioxide* is black or dark brown, when in the hydrated state; the magnetic oxide, Mn_3O_4, is red; the dioxide is black; and the permanganic oxide, Mn_2O_7, is, when in the free state, a very unstable dark reddish brown liquid. The monoxide is a stable base, the sesquioxide feebly basic, and the dioxide when acted upon by acids yields manganous salts, while oxygen is evolved. The highest oxide is acid-forming, yielding permanganic acid, $HMnO_4$, the salts of which are known as permanganates. (See *Potassii Permanganas.*) There exists also an acid, H_2MnO_4 (manganic), of which the salts formed are called manganates. The oxide corresponding is not known, however. Metallic manganese is an occasional constituent of organic matter. It has been detected in minute quantity in bone, hair, brain, epidermis, gastric juice, bile, urine, and pus, and has been found by Millon and others in the blood. M. Glénard, of Lyons, denies that it is a normal constituent of the blood, although sometimes present; but the evidence of numerous experimenters shows that it generally exists in that fluid; and, when not detected, it may be because the quantity present is too minute for discovery. According to Mr. E. Davy, caustic potassa, dissolved in an equal weight of water, forms a delicate test for manganese, not obscured by the presence of other metals. The smallest portion of matter, suspected to contain the metal, being finely pulverized or in solution, is placed upon a slip of silver foil, and a drop of the test added. Upon evaporating to dryness with a spirit-lamp, and raising the heat, the characteristic green manganate of potassium will appear on the foil. (*Chem. Gaz.*, March 15, 1854.) Manganese is a constituent of all arable land, and is found in the ashes of most of the vegetables which form the food of man and the inferior animals. In the mineral kingdom, it occurs sometimes as silicate (rhodonite) or carbonate (diallogite), and very abundantly as the black or dioxide, called *pyrolusite.* It is the latter mineral which constitutes the officinal oxide.

Properties. Dioxide of manganese, as it occurs in nature, is very diversified in its appearance. Its sp. gr. varies from 4·7 to 4·9. It is found sometimes in brilliant needle-shaped crystals, often in compact masses having the metallic lustre, but far more frequently in the form of a dull earthy-looking substance, of a black or brown color. It is purest when crystallized. As it occurs in commerce, it is usually in the form of a black powder, insoluble in water, and containing more or less oxidized iron, carbonate of calcium, sulphate of barium, and earthy matter. Iron, which is rarely absent, is detected by the production of a greenish or blue tint on the addition of ferrocyanide of potassium to its chloride solution. When exposed to a red heat it yields a portion of its oxygen, and is reduced to the state of sesquioxide. Hence its use in obtaining that gas. Good samples, after being dried, lose, when heated to whiteness, 12 per cent. of oxygen. It is distinguished from sulphide of antimony by its infusibility, and by causing the evolution of chlorine on being heated with hydrochloric acid. When of a brown color, it is not of good quality.

The U. S. Pharmacopœia describes it as "a heavy, grayish black, more or less gritty powder, permanent in the air, odorless and tasteless, and insoluble in water or alcohol. At a red heat the Oxide gives off oxygen gas; and, if heated with hydrochloric acid, it causes the evolution of chlorine gas. On intimately mixing 1 part of the Oxide with 1 part of hydrate of potassium and 1 part of chlorate of potassium, introducing the mass into a crucible, moistening with water, drying and igniting, a dark, fused mass is obtained, which yields a green solution with water, changing to purplish red on being boiled or on the addition of diluted sulphuric acid. If 5 Gm. of the finely powdered Oxide be digested with 15 Gm. of water and 20 Gm. of hydrochloric acid, then 21 Gm. of ferrous sulphate be added, and the mixture heated to boiling, the cooled filtrate should not acquire a blue color on the addition of freshly-prepared test-solution of ferricyanide of potassium (presence of at least 66 per cent. of pure dioxide of manganese)." *U. S.*

But few mines of dioxide of manganese exist; though the metal itself is very generally diffused throughout the mineral kingdom. It occurs most abundantly in Bohemia, Saxony, the Hartz, France, and Great Britain. In the United States no mines have been opened, except in Vermont, from which State an inferior brown ferruginous manganese is supplied through Boston. Besides this source, the mineral is received from Nova Scotia, France, Germany, England, and occasionally Scotland. It comes packed in casks or barrels, generally in lumps and coarse powder, just as it is dug out of the mines; though occasionally it is received from England ready pulverized. It is a good rule to buy it unpowdered; as its quality can be better judged of in that state. A dark shining crystalline appearance may be taken as an indication of good quality. The Nova Scotia manganese is better than the Vermont; but that from Germany, England, and Scotland is the best, and commands the highest price.

Medical Properties and Uses. Black oxide of manganese is deemed tonic and alterative. When slowly introduced into the system, as happens to those engaged in grinding the mineral, it acts, according to Dr. Coupar, of Glasgow, as a cumulative poison, inducing a disease which begins with a staggering gait and ends in paraplegia. It has been used in syphilis, chlorosis, scurvy, and various skin diseases, especially itch and porrigo. It has lately been employed, in a purified state, with great advantage by Dr. Arthur Leared, in stomachic pains, of a purely nervous character, such as are apt to come on after eating. He has also found it useful in pyrosis, and other irritable states of the stomach which are purely functional. It has the advantage over the preparations of bismuth, in these cases, that it does not constipate. (*Glasgow Med. Journ.*, Jan. 1865, p. 79.) The dose is from three to twenty grains (0·20 to 1·3 Gm.), three times a day, given in the form of pill. Dr. Leared gave ten grains (0·65 Gm.) of the powder three times a day. For external use, an ointment may be made of one or two drachms of the oxide to an ounce of lard. The sulphate is officinal. For other compounds of manganese, see Part II.

This oxide is used in the arts for obtaining chlorine in the manufacture of bleaching powder, for giving a black glazing to pottery, and for freeing glass from the color which it derives from iron. In the laboratory, it is employed to obtain oxygen and chlorine, and to form the salts of manganese. In pharmacy it is used for liberating chlorine from hydrochloric acid and from common salt, and iodine from iodide of sodium, contained in kelp.

Pharm. Uses. In preparing Aqua Chlori, *U. S.;* Hydrargyri Perchloridum, *Br.;* Liquor Chlori, *Br.;* Liquor Sodæ Chloratæ, *Br.;* Potassæ Chloras, *Br.*

Off. Prep. Potassæ Permanganas, *Br.*

MANGANI SULPHAS. *U. S.* *Sulphate of Manganese.*

$MnSO_4.4H_2O$; 222. (MĂN'GA-NĪ SŬL'PHĂS.) $MnO, SO_3.4HO$; 111.

"Sulphate of Manganese should be kept in well-stopped bottles." *U. S.*

Manganesii Sulphas, *U. S.* 1870; Manganum Sulphuricum, Sulfas Manganosus; Manganous Sulphate; Sulfate de Manganèse, Sulfate manganeux, *Fr.;* Schwefelsaures Manganoxydul, *G.*

This salt may be prepared by heating the native black oxide with concentrated sulphuric acid. Oxygen is evolved, and the sulphate of the protoxide is formed. The product, when exhausted by water, furnishes a solution which must be heated to nearly the boiling point, and treated with carbonate of manganese, added by small portions at a time, which will precipitate any iron present, and change the color of the liquid from a dark red to a pale rose tint. The liquid is then filtered, evaporated to the consistence of a thin syrup, and set aside to crystallize. Prof. C. Lewis Diehl has obtained by means of the following process an abundant product of the pure salt. A mixture of 5 parts of black oxide of manganese and 0·75 of coarsely powdered charcoal is exposed to a red heat, in a covered crucible, until all the charcoal is consumed. The contents of the crucible, after cooling, are put into a porcelain dish, and treated with 6·5 parts of sulphuric acid. The whole is then evaporated to dryness, and the residue, being returned to the crucible, is again heated to redness. When cool, the mass is rubbed to powder if necessary, and treated twice with eight parts of boiling water; and the liquors, having been mixed, are filtered, evaporated till a pellicle appears, and set aside to crystallize. It is important that the liquid should be removed from the sand-bath as soon as the pellicle begins to form; as, if the heat be continued longer, an insoluble sulphate is deposited. If the black oxide of manganese employed is of good quality, a pure sulphate will be obtained; any salt of iron or copper present being rendered insoluble by the heat. (*A. J. P.*, 1867, p. 139.)

Laster's process is as follows. "Take of Black Oxide of Manganese 40 parts, Commercial Hydrochloric Acid 200 parts. Dissolve the black oxide in the acid beneath a chimney-flue, and, when solution is complete, and chlorine no longer evolved, mix very gradually 53 parts of sulphuric acid with the reddish liquid; continue the evaporation beneath the flue until acid vapor is no longer driven off, and the mass becomes dry. Dissolve this mass in 350 parts of water heated to the boiling point. Treat the solution with carbonate of manganese until it becomes rose-red, filter or decant, evaporate and crystallize." (*A. J. P.*, 1868, p. 175.)

Mr. F. Mahla, of Chicago, proposes to utilize chlorine residues. He takes the liquid remaining in the retort after the preparation of chlorine, adds to it carbonate of sodium sufficient to precipitate all the metallic oxides, or at least to cause a slight alkalinity, collects the precipitate thus produced on a muslin filter, and washes it with pure water, until the filtrate produces no longer an obvious reaction with nitrate of silver. Three-fourths of the moist mass are removed from the filter to an evaporating dish, and dilute sulphuric acid is added sufficient completely to dissolve it. The solution is heated to near the boiling point, and the remaining fourth of the mass from the filter is gradually added to it, until the liquid, after being filtered, is no longer blackened by tannic acid. The whole solution is then filtered, and the filtrate, with the waters, after washing, is evaporated to crystallization. The first crop of crystals is sometimes contaminated with sulphate of calcium, from the carbonate of calcium in the commercial black oxide employed in the process. To separate this impurity, evaporate to dryness, redissolve the residue in a little water, which leaves the sulphate of calcium undissolved; and the pure solution of sulphate of manganese is obtained by filtration. (*A. J. P.*, 1869, p. 351.)

Properties. Sulphate of manganese has the formula $MnSO_4$, in which the dyad metal manganese replaces the H_2 of H_2SO_4. From its aqueous solution it crystallizes in rhombic prisms, which contain variable proportions of water of crystallization according to the temperature of the solution and other circumstances. Obtained by evaporation at a gentle heat, they contain four mols. of water; between 45° and 68°, five mols.; under 42°, seven mols.; and a concentrated solution, mixed with sulphuric acid, and evaporated, yields granular crystals with one mol. Heated to 240°, the crystals lose three mols. of water, and at a red heat become anhydrous. (*Brande and Taylor.*) The crystals usually have a pale rose or pink color. The salt has an astringent and bitterish taste. It is very soluble in water; but its solubility varies with its water of crystallization. When anhydrous it is dissolved by two parts of water at 15·5 C. (60° F.), and in its own weight at 100° C. (212 F.). If carelessly prepared, it is apt to contain copper and arsenic, as well as iron. As it is the source of nearly all the preparations of manganese, it is of importance that it should be pure. Hence, the sulphate, as first obtained, should be calcined at a low red heat at least twice, to render the contaminating metals insoluble, and then tested in solution, to be sure of its purity. According to M. A. Gorgeu, copper and iron, as well as nickel and cobalt, are completely precipitated by sulphide of manganese. In applying this reagent, the impure solution is shaken for about a quarter of an hour with the sulphide, and then boiled for a few minutes. (*Chem. Gaz.*, July 1, 1853, p. 249.) The description of it in the U. S. Pharmacopœia is as follows: "colorless, or pale rose-colored, transparent, right-rhombic prisms, if crystallized at a temperature between 20° and 30° C. (68°–86° F.), slightly efflorescent in dry air, odorless, having a slightly bitter and astringent taste, and a faintly acid reaction. Soluble in 0·7 part of water at 15° C. (59° F.), and in 0·8 part of boiling water; insoluble in alcohol. The aqueous solution of the salt yields, with sulphide of ammonium, a flesh-colored precipitate completely soluble in moderately diluted acetic acid (abs. of zinc); with test-solution of ferrocyanide of potassium it affords a reddish white precipitate, and a brown one with test-solution of ferricyanide of potassium. Test-solution of chloride of barium produces a white precipitate insoluble in hydrochloric acid. The aqueous solution of the salt should not be affected by solution of tannic acid (abs. of iron). When slightly acidulated with hydrochloric acid, it should remain unaffected by hydrosulphuric acid (abs. of copper). If all the Manganese be precipitated from the aqueous solution by sulphide of ammonium, and the filtrate be evaporated, not more than a trace of fixed residue should remain on gentle ignition (limit of alkalies or magnesia)." *U. S.*

Medical Properties and Uses. C. G. Gmelin found sulphate of manganese to produce an extraordinary secretion of bile when given to the inferior animals, and its effects as a cholagogue have been observed in man. According to the late Dr. Thomas Thomson, of Glasgow, it resembles sulphate of sodium both in taste and in effect, operating as a purgative in the dose of one or two drachms (3·9 to 7·5 Gm.). From the circumstance that manganese had been found in small proportion in the blood, it was conjectured that this metal, like iron, might play an important part in the human economy; and trial was made of it in anæmia, with the hope that it might prove a useful adjuvant of the chalybeates as a reconstructive agent. When given with iron, its use was certainly in many instances followed by the most satisfactory results; but it may be questioned whether the beneficial effects were in any respect greater than those which the iron would have produced without such an auxiliary; and, where manganese has been used alone in anæmic cases, it has generally failed. Dr. Garrod, of London, after fair trial of it, pronounced against it. (*Med. Times and Gaz.*, Feb. 1863, p. 222.) The dose of sulphate of manganese as a tonic is from five to twenty grains (0·33 to 1·3 Gm.).

MANNA. *U. S., Br.* *Manna.*

(MĂN'NẠ.)

"The concrete, saccharine exudation of Fraxinus Ornus. Linné. (*Nat. Ord.* Oleaceæ.)" *U. S.* "A concrete, saccharine exudation from the stem of Fraxinus Ornus, Linn., and F. rotundifolia, D. C. Obtained by making incisions in the stems." *Br.*

Manne, *Fr.;* Manna, *G., It.;* Mana, *Sp.*

Manna is not the product of one plant exclusively. Besides the two species of Fraxinus indicated by the British Pharmacopœia, it is said to be obtained also from several other trees, belonging to the genera *Ornus* and *Fraxinus*, among which *F. excelsior* and *F. parviflora* have been particularly designated. Many saccharine substances, generally exudations from plants, have, from their resemblance to this substance, obtained the name of manna, and attracted more or less attention from writers. They are described in a note.*

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* *False Mannas.* The *tamarisk* of Northern Africa (*Tamarix Gallica*, Ehr.), which produces the small *Tamarisk Galls* of Mogador, containing 40 per cent. of tannic acid (*A. J. P.*, 1878, p. 27; also *N. R.*, 1877, p. 41), according to Burckhardt also gives origin to a species of manna that is used by the Bedouin Arabs near Mount Sinai with their food. This substance, however, according to

Gen. Ch. Flowers polygamous or diœcious. *Calyx* small and four-cleft, toothed or entire, or obsolete. *Petals* four, slightly cohering in pairs at the base, or only two, oblong or linear, or altogether wanting. *Stamens* two, three, or four. *Anthers* linear or oblong, large. *Style* single. *Stigma* two-cleft. *Fruit* a one- to two-celled samara. *Gray.*

This genus was separated by Persoon from the Fraxinus of Linnæus.

Fraxinus Ornus. Willd. *Sp. Plant.* iv. 1104. *B. & T.* 170.—*Ornus Europæa.* Persoon, *Synops.* i. 9; Lindley, *Flor. Med.* 547; Carson, *Illust. of Med. Bot.* ii. 8, pl. 61. The *flowering ash*[*] is a tree of moderate height, usually from twenty to twenty-five feet, very branching, with opposite, petiolate, pinnate leaves, composed of three or four pairs of leaflets, and an odd one at the end. The leaflets are oval, acuminate, obtusely serrate, about an inch and a half in length, smooth, of a bright green color, and supported on short footstalks. The flowers are white, and usually expand with the leaves. They grow in close panicles at the extremity of the young branches, and have a very short calyx with four teeth, and four linear lanceolate petals.

Both this species of *Ornus* and *O. rotundifolia* are natives of Sicily, Calabria, and Apulia; and both contribute to supply the manna of commerce. The former is cultivated in Sicily, yields manna after the eighth year, and continues to yield it for ten or twelve years, when it is usually cut down, and young sprouts allowed to grow up from the root. (Stettner, *Archiv der Pharm.*, liii. 194.) During the hot months the juice exudes spontaneously from the bark, and concretes upon its surface; but, as the exudation is slow, it is customary to facilitate the process by making deep longitudinal incisions on one side of the trunk. In the following season these are repeated on the other side, and thus alternately for the whole period during which the trees yield manna, extending sometimes, it is said, to thirty or

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Mitscherlich, contains no mannit, but consists wholly of mucilaginous sugar. M. Berthelot found a sample of manna from Sinai to consist of 55 per cent. of cane sugar, 25 of *levulose* and glucose, and 20 of dextrin and analogous substances. (*Annales de Chim. et Phys.*, lxvii. 82.) The same chemist obtained from so-called Turkish manna a new variety of sugar, which he named *trehalose.* (*Gaz. Méd. de Paris*, 1857, No. 49.) This has been shown to be a product from a species of larch (*Echinops Persica*), and is obtained by treating the cocoons of a coleopterous insect (*Larinus maculatus*) with hot water, filtering, and crystallizing the sugar. The manna used in India and Persia under the name of *Turaujbin* is said to be the product of *Hedysarum Alhagi* of Linn., *Alhagi Maurorum* of De Candolle, a leguminous thorny shrub abundant in the deserts of Persia and Arabia. According to A. Villiers, it is nearly pure melezitose. (*P. J. Tr.*, 3d ser., vii. 917.) A substance closely resembling manna is procured by exudation from *Eucalyptus mannifera*, growing in New South Wales. It contains a saccharine matter, called *melitose*, different from mannit and from all the varieties of sugar in properties, though isomeric with glucose. It is susceptible of the vinous fermentation. (See *A. J. P.*, xxviii. 157.) Another manna found in Australia is produced upon the leaves of *Eucalyptus dumosa*, when very small, and sometimes appears spread over large extents of country like a kind of snow. The natives use it for food. It is a complex body, containing sugar, gum, starch, inulin, and lignin. (*Journ. de Chim. et de Pharm.*, xvi. 240.) It is said to be a secretion from an insect, formed into minute cells, each of which is the abode of one of the insects. It is called *lerp* by the natives. (See *A. J. P.*, 1862, p. 547.) The substance known in France by the name of *Briançon manna* is an exudation from the common European larch (*Larix Europæa* or *Pinus Larix*), and differs chemically from ordinary manna in containing no mannit. Berthelot found in it a peculiar sugar, analogous to that of the cane, which he named *melezitose.* (See *A. J. P.*, 1859, p. 61.) *Larix Cedrus*, of Mount Lebanon, yields a similar product, which has some repute in Syria as a remedy in phthisis. (*P. J. Tr.*, xiii. 411.) A substance resembling manna, of a sweet, slightly bitter, and terebinthinate taste, and actively purgative, exudes from incisions in *Pinus Lambertiana*, of Southern Oregon, and is used by the natives. (*Nar. of U. S. Expl. Exped.*, v. 232.) M. Berthelot has extracted from this product a peculiar saccharine principle, which he calls *pinite.* It is very sweet, but does not undergo the vinous fermentation. (See *A. J. P.*, xxviii. 157.) In the neighborhood of Diarbekir, in Asiatic Turkey, a saccharine substance, known as *Diarbekir manna*, is found on the leaves of dwarf oaks, from which it appears to be exuded. (*Ibid.*, Nov. 1862, p. 546.) The manna of the oak of Kurdistan, spoken of by Flückiger, is probably the same as that of Diarbekir, which may be its entrepot. According to Flückiger, this consists chiefly (90 per cent.) of a crystallizable sugar. It deviates to the right the plane of polarized light, and reduces in the cold the solution of oxide of copper in soda and glycerin. This manna contains a mucilage, but no cane-sugar or dextrin. (*Journ. de Pharm.*, Avril, 1873, p. 335.) Certain sea-weeds, after their death, become covered, on exposure to the air, with an efflorescence of mannit, supposed not to pre-exist in the plants, but to be formed from their mucilaginous matter. (*Journ. de Pharm.*, Avril, 1859, p. 314.)

[*] A syrup prepared from the inner bark of this tree has been employed, in Europe, by Dr. Devergie, with supposed advantage, in chronic eczema and impetigo. The bark contains much tannin, and a mucilaginous principle, which renders diluted alcohol a better menstruum than boiling water. (*Journ. de Pharm.*, 3e sér., ix. 347.)

even forty years. Straw or chips are frequently placed so as to receive the juice, which concretes upon them. The manna varies in its character according to the mode of collection, nature of the season, and period of the year in which the exudation takes place. That procured in Sicily is said to be the best. Mr. Daniel Hanbury travelled through the old manna region, and satisfied himself that the collection of manna for commercial purposes is confined at present almost exclusively to Sicily. (*P. J. Tr.*, Nov. 1872, p. 421.) But a more recent writer (*Ibid.*, Nov. 1879) asserts that the manna trees are still cultivated in Calabria.

In commerce three varieties are distinguishable.

1. FLAKE MANNA, or *manna cannulata*, is the purest variety. It exudes spontaneously, or by incisions, during the hottest and dryest weather in July and August. According to Stettner, it is furnished by the upper incisions upon the trunk; while the lower incisions yield the inferior varieties. It is in irregular, unequal pieces, often several inches long, resembling stalactites, rough, light, porous, brittle, whitish or yellowish white, and frequently concave on the surface by which they were attached to the trunk, and which is often soiled by impurities, sometimes by adherent fragments of the bark. When broken, these pieces exhibit a crystalline or granular structure. This variety is sometimes in small fragments, generally less than an inch in length.

2. COMMON MANNA—*manne en sorte* of French pharmacy—is next in quality, and is collected in September and the beginning of October, when the heat of the weather has begun to moderate. The juice does not now concrete so readily, and a portion, falling on the ground at the root of the tree, becomes more or less mixed with impurities, and forms imperfectly solid masses, which require to be further dried in the sun. Common manna consists of whitish or yellowish fragments, similar to the pieces of flake manna, but much smaller, mixed with a soft, viscid, uncrystallized brownish matter, identical with fat manna.

3. FAT MANNA is collected in the latter part of October and November, when the weather is cooler and rains more common. The juice is now still less disposed to concrete, and flowing down the trunk is received in a small excavation at its base. As found in commerce, it is in the form of a soft, viscous mass, containing few crystalline fragments, of a brown or yellowish brown color, and full of impurities. The U. S. Pharmacopœia directs that such manna should be rejected.*

Properties. Manna is officinally described as "in flattish, three-edged pieces, occasionally eight inches (20 cm.) long, and two inches (5 cm.) broad, usually smaller; friable; externally yellowish white, internally white, porous, and crystalline; or in fragments of different sizes, brownish white and somewhat glutinous on the surface, internally white and crystalline." *U. S.* Manna has a slight, peculiar odor, and a sweet taste, which in the impure kinds is also very nauseous, but, in the finest flake manna, scarcely so much so as to be disagreeable. Its sp. gr. is 0·834. It melts with heat, and takes fire, burning with a blue flame. When pure it is soluble in three parts of cold, and in its own weight of boiling water. From a boiling saturated aqueous solution, it separates in partially crystalline masses on cooling. Alcohol also dissolves it. Boiling alcohol will dissolve 15 parts of it, and upon cooling deposit beautiful crystals of mannit. Fourcroy and Vauquelin found manna to consist of—1, a peculiar sweet principle, *mannit*, which constitutes 75 per cent.; 2, a variety of sugar; 3, a yellow nauseous matter, upon which the purgative property is thought chiefly to depend; and, 4, a little mucilage. Leuchtweiss obtained from 105 parts of manna 11·6 of water, 0·4 of insoluble matter, 9·1 of sugar, 42·6 of mannit, 40·0 of a mixture of mucilaginous matter containing mannit, resin, organic acid, and a nitrogenous substance, and 1·3 of ashes. M. Buignet discovered in manna a considerable proportion of dextrin. He appears to have been led to this discovery by observing a very energetic dextrogyrate power in flake manna, which could not be owing to the saccharine matter it contained, because the same power continued after all the sugar had been destroyed by fermentation. Dextrin forms about one-fifth part of flake manna, and a much larger part of the inferior kinds. It may be readily obtained separate by triturating 200 parts of flake manna with 400 of alcohol of 70° in successive portions, filtering the resulting mixture, by which the mannit is left behind, and then separating the sugar and dextrin contained in the clear liquor. This is done by concentrating the liquor to a syrupy consistence, and adding about 10 parts of alcohol at 90°. The mixture separates into two layers, the upper consisting of a strong alcoholic solution of sugar, the lower of a saturated solution of dextrin in weak alcohol. The latter is separated, washed repeatedly with alcohol at 90°, and then, after dilution with water, decolorization, and filtration, is evaporated gently by a water-bath till it ceases to lose weight. The substance remaining is dextrin. The saccharine matter of manna is a mixture of cane sugar and levulose, which are in such proportion as almost to neutralize their reciprocal optic properties. All the forms of commercial manna contain both sugar and dextrin, and, though the quantity of the two jointly varies considerably, yet their relative proportion is invariable, being 2 mols. of dextrin and 1 mol. of sugar. This is the same result which takes place in the saccharification of starch; and the inference is fair, that the dextrin and sugar in manna are the result of a transformation of starch in the plant. (*Journ. de Pharm. et de Chim.*, Juillet, 1868, pp. 5–16.) It is owing to the presence of glucose and dextrin that manna is capable of fermenting. Flückiger found in all samples of mannit examined a small amount of a dextrogyrate mucilage, which is precipitated by neutral acetate of lead, and yields mucic acid when boiled with strong nitric acid. The greenish color of certain pieces of manna is produced by *fraxin*, $C_{16}H_{18}O_{10}$, a glucoside closely resembling *æsculin*. Fraxin crystallizes in colorless prisms, easily soluble in hot water and in alcohol, and has a faintly astringent and bitter taste. By dilute acids, it is resolved into *fraxetin*, $C_{10}H_8O_5$, and *glucose*, $C_6H_{12}O_6$. Even its dilute solutions are fluorescent. (*Pharmacographia*, 2d ed., p. 413.)

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* Attempts have sometimes been made to counterfeit manna; but the facility of detection renders frauds of this kind unprofitable, and they are not often practised. Dr. R. P. Thomas described (*A. J. P.*, xxiv. 208) a sophisticated manna, which differed from the genuine drug both in sensible and in chemical properties, not even containing mannit. Baumé describes a method in which common manna is purified so as to resemble flake manna. It consists in dissolving common manna in a little water, allowing the liquid to settle, decanting it in order to separate the impurities, then inspissating it so that it will congeal on cooling, and immersing threads in the inspissated liquid, several times successively, in the manner practised by candle-makers. It may be still further purified by the use of animal charcoal. Thus prepared it contains less mannit than flake manna, and less of the nauseous principle, but is said not to operate less effectively as a laxative.

A fictitious manna is described by Mr. Edmond Histed (*P. J. Tr.*, April, 1870), as having been taken from Paris to London, which bears a close resemblance to flake manna, for which it might be mistaken upon a hasty notice. The resemblance is, moreover, increased by the fact that it contains mannit, of which Mr. Histed obtained 40 per cent., while fine natural flake manna yielded him 70 per cent. Closely examined, it is found to differ essentially from genuine flake manna, showing no crystals of mannit when broken, not having the taste and smell characteristic of good manna, and, besides, cleaner, lighter colored, more solid, and making a clearer solution in water. (See *A. J. P.*, 1870, p. 348.) May this not have been a specimen of artificial flake manna, prepared from the inferior or common manna?

Mannit is white, inodorous, crystallizable in semi-transparent needles, of a sweetish taste, soluble in five parts of cold water, scarcely soluble in cold alcohol, but readily dissolved by that liquid when hot, and deposited when it cools. Its composition is $C_6H_{14}O_6$, and it is considered as belonging to the class of *hexatomic alcohols*. If mixed with chalk and cream cheese, and kept for some weeks at the temperature of 40° C. (104° F.), it yields alcohol largely, with the disengagement of carbonic acid and hydrogen, and the production of lactic acid. No fungus is produced, as in the ordinary fermentation of sugar. (Berthelot, *Journ. de Pharm.*, xxx. 269.) With lime, baryta, and strontia, it forms definite compounds, soluble in water, and precipitable from their aqueous solutions by alcohol. (*Ibid.*, Jan. 1860, p. 56.) It does not reduce an alkaline solution of oxide of copper; and a test of its purity is thus presented. (*A. J. P.*, Jan. 1861, p. 26.) Though, when uncombined, it exercises no influence on polarized light, yet all of its derivatives deviate the plane of polarization. (*Journ. de Pharm.*, Mars, 1874, p. 219.) It may be obtained by boiling manna in alcohol, allowing the solution to cool, and redissolving the crystalline precipitate. Pure mannit is now deposited. Another method is to dissolve flake manna in water, precipitate by solution of subacetate of lead, filter, throw down the excess of lead by sulphuric acid, evaporate the solution, and mix with alcohol. On cooling, the mannit is deposited. (Bonsall, *Arch. der Pharm.*, cxxxiv. 70.) This principle has been found in numerous vegetables. It is said to be gently laxative in the dose of one or two ounces (31·1 or 62·2 Gm.).

Manna, when long kept, acquires a deeper color, softens, and ultimately deliquesces into a liquid, which, on the addition of yeast, undergoes the vinous fermentation. This is probably owing to its conversion into sugar by the absorption of enough oxygen to neutralize the slight excess of hydrogen, which constitutes the only essential difference in composition between it and glucose. That which is dryest resists this change the longest. It is said that manna, recently gathered, is less purgative than it afterwards becomes.

Medical Properties and Uses. Manna is a gentle laxative, usually operating mildly, but in some cases producing flatulence and pain. Though peculiarly adapted to children and pregnant women, it may be given with advantage in ordinary cases of piles from constipation, unattended with dyspeptic symptoms. It is usually, however, prescribed with other purgatives, particularly senna, rhubarb, magnesia, and the neutral salts, the taste of which it conceals, while it adds to the purgative effect. The dose for an adult is from one to two ounces (31·1 to 62·2 Gm.); for children, from one to four drachms (3·9 to 15·5 Gm.). It is usually given dissolved in water or some aromatic infusion; but the best flake manna may be administered in substance. Manna forms a combination with iron, which it preserves against change. (See *P. J. Tr.*, March, 1873.)

Off. Prep. Infusum Sennæ Compositum, *U. S.*

MARMOR ALBUM. *Br.* *White Marble.*

(MÄR'MỌR ĂL'BŬM.)

"Hard white crystalline native carbonate of lime, in masses." *Br.*

Marmor, *U. S.* 1870; Marbre, *Fr.;* Marmor, *G.;* Marmo, *It.;* Marmol, *Sp.*

Marble is used for obtaining carbonic acid, and for making several officinal preparations. For the former purpose common marble is sufficiently pure; for the latter, the purer varieties must be selected.

Officinal marble has a sp. gr. of from 2·7 to 2·8. It is brittle, pulverizable, and insoluble in water. It is wholly dissolved by dilute hydrochloric acid with effervescence. If magnesia be present, the neutral hydrochloric solution will be precipitated by ammonia; and if baryta or strontia be an impurity, a similar effect will be produced by a solution of sulphate of calcium. When marble is exposed to a full red heat, it loses about 44 per cent. of carbonic acid, and is converted into lime. (See *Calx.*) In composition it agrees with chalk.

The purest kind of marble is that of *Carrara*, sometimes called *statuary marble;* but it is not necessary that this kind should be obtained for pharmaceutic operations. Marble, sufficiently pure for these purposes, is abundant in the United States. It is necessary, however, to reject the *dolomitic* marbles, which contain magnesia.

Off. Prep. Potassæ Bicarbonas, *Br.;* Sodæ Bicarbonas, *Br.*

MARRUBIUM. *U. S.* *Marrubium.* [*Horehound.*]

(MẠR-RÛ'BỊ-ŬM.)

"The leaves and tops of Marrubium vulgare. Linné. (*Nat. Ord.* Labiatæ.)" *U. S.*

Herba Marrubii; Herbe de Marrube blanc, Marrube blanc, *Fr.;* Andornkraut, Weisser Andorn, *G.;* Marrubio, *It., Sp.*

Gen. Ch. Calyx salver-shaped, rigid, ten-streaked. *Corolla* with the upper lip bifid, linear, and straight.

Marrubium vulgare. Willd. *Sp. Plant.* iii. 111; *B. & T.* 210. *White Horehound* has a perennial fibrous root, and numerous annual stems, which are quadrangular, erect, very downy, and from twelve to eighteen inches high. The leaves are about an inch long, roundish-ovate, dentate or deeply serrate, obtuse, wrinkled, veined, downy above, hoary on the under surface, and supported in pairs on strong footstalks. The flowers are white, and in crowded axillary woolly whorls. The calyx is tubular, and divided at the margin into ten narrow segments, which are hooked at the end. The corolla is also tubular, whitish, with a labiate margin, of which the upper lip is bifid, the under reflected and three-cleft, with the middle segment broad and slightly scalloped: stamens four, included. The seeds are four, in the bottom of the calyx. The plant is a native of Europe, but has been naturalized in this country, where it grows on the roadsides, and flowers in July and August.

The herb has a strong, rather agreeable odor, which is diminished by drying, and lost by keeping. Its taste is bitter and durable. The bitterness is extracted by water and alcohol. It contains a volatile oil, resin, tannin, lignin, and a bitter principle called *marrubiïn* by Mein. This marrubiin is slightly soluble in cold water, crystallizes from alcohol in prismatic, and from ether in tabular crystals, is not precipated by tannin, and has a very bitter and somewhat acrid taste.

Medical Properties and Uses. Horehound is tonic, in large doses laxative, and may be so given as to increase the secretion from the skin, and occasionally from the kidneys. It was formerly considered a valuable deobstruent, and recommended in chronic hepatitis, jaundice, amenorrhœa, phthisis, and various cachectic affections. By its gently tonic powers it may have proved advantageous in some of these complaints; but it exerts no specific influence over any, and has passed mainly from the hands of physicians into domestic use. It is employed chiefly in catarrh, and other chronic affections of the lungs, attended with cough and copious expectoration. The infusion made in the proportion of an ounce of the herb to a pint of boiling water may be given in wineglassful doses. The dose of the powder is from thirty grains to a drachm (1·95 to 3·9 Gm.). The medicine is also much used in syrup and candy.

MASSA COPAIBÆ. *U. S.* *Mass of Copaiba.*

(MĂS'SA̤ CO̤-PĀ'I̤-BÆ.)

Pilulæ Copaibæ, *U. S.* 1870; Pilules de Copahu, *Fr.;* Copaiva-Pillen, *G.*

"Copaiba, *ninety-four parts* [or two ounces av.]; Magnesia, recently prepared, *six parts* [or fifty-six grains], To make *one hundred parts* [or about two ounces av.]. Mix them intimately, and set the mixture aside until it concretes into a pilular mass. Should the mixture not concrete in eight or ten hours, a deficiency of water in the Copaiba may be inferred; and this difficulty may be obviated, in subsequent operations, by shaking the Copaiba with one-twentieth of its weight of water, allowing it to stand until all the uncombined water has subsided, and then decanting and keeping it in closed bottles for use." *U. S.*

This preparation is identical with that formerly officinal. When copaiba is mixed with pure magnesia, it gradually loses its fluidity, forming at first a soft tenacious mass, and ultimately becoming dry, hard, and brittle. The quantity of magnesia, and the length of time requisite for this change, vary with the condition of the copaiba; being greater in proportion to the fluidity of this substance, or, in other words, to its amount of volatile oil. The quantity of magnesia directed by the Pharmacopœia, one-sixteenth of the weight of the copaiba, is sufficient to solidify the latter, as it is often found in commerce, in the course of six or eight hours; but, when the copaiba is fresh, or has been kept in closely-stopped bottles, and retains, therefore, nearly the whole of its oil, it is often necessary either to augment the proportion of magnesia, or to expose the mixture for a much longer time, or to diminish the volatile oil of the copaiba by evaporation. The magnesia combines chemically with the *copaivic acid* or hard resin, but, in relation to the volatile oil, acts merely as an absorbent; for, when the solidified mass is submitted to the action of boiling alcohol, a part is dissolved, abandoning the magnesia with which it was mixed, while the resin, combined with another portion of magnesia, remains undissolved. Varieties of copaiba, therefore, are solidifiable by magnesia, directly in proportion to the hard resin they contain, and inversely in proportion to the volatile oil; the soft resin being indifferent. According to Guibourt, copaiba, not solidifiable by magnesia, may be made so by adding one-sixth of Bordeaux or common European turpentine.

Hydrate of lime produces the same effect as magnesia, and, as stated by M. Thierry, in a shorter time, if employed according to his formula. He takes 15 parts of copaiba and 1 part of slaked lime, mixes them in a marble mortar, transfers the mixture to an open vessel, places this upon a sand-bath, and sustains the heat for four hours, occasionally stirring. The hydrate of lime must have been freshly prepared from recently-burnt lime. The mixture loses only a twenty-fourth of its weight, which is chiefly the water of the hydrate. (*Journ. de Pharm.*, 3e sér., i. 310.)

Notwithstanding the accuracy of the above statements, it sometimes happens that copaiba of undoubted genuineness, and with a due proportion of volatile oil, will not solidify with magnesia or with lime; and the cause of this uncertainty of action remained long undetermined. At length it was ascertained by M. Roussin, through a series of well-devised experiments, that the occasional want of solidifying power is owing to the absence of water, the presence of a certain quantity of which, whether in the copaiba or in the earth employed, is essential to the combination of the magnesia or lime with the copaivic acid. In instances of deficiency in the solidifying property, M. Roussin recommends that the copaiba be shaken for some time with about one-twentieth of its weight of water, and then allowed to stand for some days in a warm place so as to allow all the water in excess to subside. The copaiba may now be decanted and preserved. Thus prepared, it will solidify with one-sixteenth of calcined anhydrous magnesia, in the course of a few days, and often in twenty-four hours. (*Journ. de Pharm.*, 4e sér., i. 321–328.)

M Rabot proposes a process by which the copaiba can in a few minutes be solidified to a consistence fit for preparing pills. He mixes pure copaiba with one-sixteenth of its weight of magnesia, previously slightly hydrated by sprinkling on it some drops of water, equal to about one-tenth of its weight, then introduces the capsule containing the mixture into boiling water, and keeps it thus by means of a water-bath for several minutes. The immediate consolidation is explained by the fact that the magnesia combines most readily with the resin of copaiba at a temperature of about 50° C. (122° F.), a heat which in no degree impairs the virtue of the medicine. (*Ibid.*, ii. 445.)

Pills may also be made by incorporating vegetable powders with copaiba so as to bring it to the proper consistence; but this method has the inconvenience of greatly increasing the bulk. Spermaceti and wax have been proposed as excipients; and the latter, which was originally suggested by J. F. Simon, is recommended on account of its retaining all the volatile oil, and, with some vegetable powder, forming a mass that will retain its plasticity for years. One part, each, of wax, copaiba, and vegetable powder will answer the purpose, when the copaiba does not contain more than 50 per cent. of volatile oil; but if richer than this, it will require more of the excipient. To prepare the pills, melt the wax at the lowest possible heat, then gradually add the copaiba, and lastly incorporate some vegetable powder, as pulverized liquorice root, for example, with the other ingredients. (See *A. J. P.*, Jan. 1863.) In the preparation of the pills of copaiba, care should be taken to divide the mass before it has become too hard. The advantage of this preparation is, that the copaiba is brought to the state of pill with little increase of bulk. Each pill contains nearly five grains of copaiba (0·33 Gm.), and from two to six may be taken for a dose twice or three times a day.

MASSA FERRI CARBONATIS. *U. S.* *Mass of Carbonate of Iron.*

(MĂS′SẠ FĔR′RĪ CĂR-BỌ-NĀ′TĬS.)

Pilula Ferri Carbonatis, *Br.*, also *U. S.* 1870; Pill of Carbonate of Iron, Vallet's Ferruginous Pills; Pilulæ Ferri Carbonici, *P.G.;* Pilulæ Ferratæ Valleti; Vallet's Mass; Pilules de Carbonate ferreux, Pilules ferrugineuses, *Fr.:* Vallet'sche Pillen, *G.*

"Sulphate of Iron, *one hundred parts* [or eight ounces av.]; Carbonate of Sodium, *one hundred and ten parts* [or eight ounces av. and three hundred and fifty grains]; Clarified Honey, *thirty-eight parts* [or three ounces av.]; Sugar, in coarse powder, *twenty-five parts* [or two ounces av.]; Syrup, Distilled Water, each, *a sufficient quantity*, To make *one hundred parts* [or eight ounces av.]. Dissolve the Sulphate of Iron and the Carbonate of Sodium separately, each in *two hundred parts* (or one pint) of boiling Distilled Water, and, having added *twenty-five parts* (or one and a half fluidounces) of Syrup to the solution of the iron salt, filter both solutions. Mix them, when cold, in a bottle just large enough to hold them, or add enough Distilled Water to fill it; close the bottle accurately with a stopper, and set it aside so that the carbonate of iron may subside. Pour off the supernatant liquid, and, having mixed Syrup and Distilled Water in the proportion of *one part* (or six fluidrachms) of Syrup to *sixteen parts* (or one pint) of Water, wash the precipitate with the mixture until the washings no longer have a saline taste. Drain the precipitate on a flannel cloth, and express as much of the Water as possible. Lastly, mix the precipitate immediately with the Honey and Sugar, and, by means of a water-bath, evaporate the mixture, constantly stirring, until it is reduced to *one hundred parts* (or eight ounces av.)." *U. S.**

"Take of the Saccharated Carbonate of Iron *one ounce;* Confection of Roses *a quarter of an ounce.* Beat them into a uniform mass." *Br.*

The effect of saccharine matter in protecting iron from oxidation has been explained under the heads of *Ferri Carbonas Saccharatus* and *Syrupus Ferri Iodidi.* The U. S. mass of carbonate of iron is another example of a ferruginous preparation, in which the iron is protected from further oxidation by the same means. The salts employed are the same as those used for obtaining the formerly officinal subcarbonate of iron; but, in forming that preparation, the carbonate which is at first precipitated, absorbs oxygen, and loses nearly all its carbonic acid in the processes of washing and drying. When, however, as in the U. S. formula above given, the reacting salts are dissolved in weak syrup instead of water, and the washing is performed with weak syrup also, the absorption of oxygen and loss of carbonic acid, during the separation of the precipitate, are almost completely prevented. It only remains, therefore, to preserve it unaltered, and to bring it to the pilular consistence, and this is effected by admixture with honey and sugar, and evaporation by means of a water-bath. It is essential to the success of this process, that the sulphate of iron should be pure; otherwise some ferric oxide will be present in the product. The process is that of M. Vallet, of Paris, after whom the preparation is popularly called. The present U. S. process differs from that of 1870, in omitting to direct boiled water or recently distilled water for washing the precipitated ferrous carbonate. This is an important omission, because there is apt to be some oxidation of the salt due to the air. The British pill of carbonate of iron is made from the saccharine carbonate, which is brought to the pilular consistence by being mixed with conserve of roses. This mode of making it is inferior to that of Vallet; for, in the first place, the saccharine carbonate is admitted to contain sesquioxide of iron, and, secondly, conserve of roses, while it is a less efficient preservative of the pilular mass than honey and sugar, will, through its tannic acid, form an inky compound with the ferruginous oxide. (See *Ferri Carbonas Saccharatus.*)

Properties. The U. S. preparation is in the form of a soft pilular mass, of a dark greenish gray color, becoming black on exposure, and with a strong ferruginous taste. When carefully prepared, it is wholly and readily soluble in acids. It contains nearly half its weight of ferrous carbonate. The corresponding pill, obtained from the saccharine carbonate, may be supposed to contain one-third of ferruginous matter.

Medical Properties. The U. S. pill of carbonate of iron, or Vallet's ferruginous mass, is admirably adapted to cases in which pure chalybeate preparations are indicated. It is, therefore, extremely valuable in simple anæmia and chlorosis. Its chief merits are its unchangeableness, its freedom from astringency, and its ready solubility in acids. For further information respecting it, see the favorable report made on

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* Wm. Silver Thompson states that the mass is more stable when made by the following formula than when prepared in the officinal manner. Take of Sulphate of Iron eight ounces; Bicarbonate of Sodium six ounces; Sugar, in fine powder, four and a half ounces; Clarified Honey half an ounce; Syrup, Water, each, a sufficient quantity. Dissolve each salt separately in water, add the sodium solution to the iron solution gradually, constantly stirring until the effervescence ceases, then add about a fluidounce of syrup, and again stir. After the carbonate of iron has subsided, draw off the supernatant liquid, and repeat the washing with cold water slightly sweetened with syrup, until the washings are free from a saline taste; when, having again drawn off the supernatant liquid, transfer the precipitate to a muslin cloth, and express as much of the water as possible. To the precipitate, in a porcelain dish placed over a water-bath, add the honey and sugar, and with frequent stirring evaporate to the pilular consistence. (*A. J. P.*, 1870, p. 30.)

Vallet's pills to the French Royal Academy of Medicine, in 1837, by M. Soubeiran. (See *A. J. P.*, x. 244, 272.) The dose is three to five grains (0·20–0·33 Gm.), taken in pill-form, preferably after meals.

MASSA HYDRARGYRI. *U. S.* *Mass of Mercury.* [*Blue Mass. Blue Pill.*]

(MĂS'SẠ HȲ-DRÄR'ÇỴ-RĪ.)

Pilula Hydrargyri, *Br.;* **Pilulæ Hydrargyri,** *U. S.* 1870; Pills of Mercury, Mercurial Pill; Pilulæ Cœruleæ, Massa Cœrulea; Blue Pills; Pilule de Mercure, Pilules bleues, *Fr.;* Mercurial Pillen, *G.*

"Mercury, *thirty-three parts* [or five ounces av. and one hundred and twenty-two grains]; Glycyrrhiza, in No. 60 powder, *five parts* [or three hundred and fifty grains]; Althæa, in No. 60 powder, *twenty-five parts* [or four ounces av.]; Glycerin, *three parts* [or three fluidrachms]; Honey of Rose, *thirty-four parts* [or four and a half fluidounces], To make *one hundred parts* [or sixteen ounces av.]. Triturate the Mercury with the Honey of Rose and Glycerin until it is extinguished. Then gradually add the Glycyrrhiza and Althæa, and continue the trituration until globules of Mercury cease to be visible under a lens magnifying ten diameters." *U. S.*

"Take of Mercury two ounces [av.]; Confection of Roses three ounces [av.]; Liquorice Root, in fine powder, one ounce [av.]. Rub the Mercury with the Confection of Roses, until metallic globules are no longer visible, then add the liquorice, and mix the whole well together." *Br.*

The mercury constitutes one-third of the mass; and the pill of the Pharmacopœia of 1870, weighing three grains, contains one grain of the metal.

The precise condition of the mercury in this preparation is somewhat uncertain. By far the greater proportion is in a state of minute mechanical division, and not chemically altered. Some maintain that the whole of the metal is in this state, others, that a small portion is converted during the trituration into mercurous oxide, and that this is the ingredient upon which the activity of the pill depends. The supposed oxidation is attributed partly to the influence of the air upon the surface of the metal, greatly extended by the separation of its particles, partly to the action of the substance used in the trituration. If the mercury be not oxidized during the trituration, there can be little doubt that it becomes so, to a slight extent, by subsequent exposure. The obvious changes which the mass undergoes by time can be explained in no other way; and mercurous oxide is asserted to have been actually extracted from old mercurial pill. Mr. Harold Senier analyzed a number of samples of blue mass, with the view of determining the amount of metallic mercury and of mercurous and mercuric oxides. The results showed that the latter gradually increased in quantity with the age of the blue mass, which, 18 hours after preparation, was found to contain but a trace of mercurous oxide; after three months, 0·24 per cent. mercuric and 0·62 per cent. mercurous oxides were obtained, and in another sample, 0·44 and 1·60 per cent. respectively. After two years, 1·80 mercuric and 4·22 mercurous oxides were present. (*P. J. Tr.*, 1876.) Nevertheless, it scarcely admits of dispute that the metal, quite independently of oxidation out of the body, is capable of producing the peculiar mercurial effects when introduced into the stomach, probably undergoing chemical changes there. According to M. Mialhe, mercury is slowly converted into corrosive sublimate in the stomach, under the combined agency of air and chloride of sodium. All agree that the efficacy of the preparation is proportionate to the extinction of the mercury, in other words, to the degree in which the metallic globules disappear. This extinction may be effected by trituration with various substances; and manna, syrup, honey, liquorice, mucilage, soap, guaiac, and extract of dandelion have been recommended, among others, for this purpose; but the confection of roses has been adopted in all the Pharmacopœias, as less liable to objection than any other. The mercury is known to be completely extinguished, when, upon rubbing a small portion of the mass with the end of the finger upon a piece of paper or glass, no globules appear; or more accurately by the microscopic test of the U. S. Pharmacopœia. Powdered liquorice root and powdered marshmallow root are added in order to give due consistence to the mass. The process now officinal was proposed by Prof. C. Lewis Diehl, and is very satisfactory. It is possible for the apothecary to make moderate quantities extemporaneously with no other appliances but the mortar and pestle. As the trituration requires to be long continued, which renders the process very laborious, when conducted on the large scale, it is customary to prepare the mass by machinery. At Apothecaries' Hall, in London, the trituration is effected by the agency of steam. The machine there employed consists of "a circular iron trough for the reception of the materials, in which revolve four wooden cylinders, having also a motion on their axis." A machine for preparing blue mass, capable of being worked by the hand or by steam-power, has been invented by Mr. J. W. W. Gordon, of Baltimore, and, having been found to answer well, is in extensive use. (*A. J. P.*, xxi. 6.) We have already referred, under *Hydrargyrum cum Cretâ*, to another ingenious apparatus invented by Dr. Squibb, by which the extinguishment of mercury is very satisfactorily effected. Formerly much of the blue mass used in this country was imported; but at present the market is chiefly supplied by our own druggists. The preparation slowly changes color upon being kept, assuming an olive and sometimes even a reddish tint, in consequence, probably, of the further oxidation of the mercury.*

In consideration of the incomplete extinguishment of the mercury in many specimens of the blue pill, arising from the tedious process employed, Mr. F. B. Benger proposes to obtain the metal in a state of minute division. For this purpose he adds to a solution of an ounce of stannous chloride, in a mixture of two drachms of hydrochloric acid and two ounces of cold water, a boiling hot solution of 136 grains of corrosive sublimate in four ounces of distilled water, and stirs the mixture for a few seconds. The mercury of the corrosive chloride is thrown down in the form of a black powder, to which, after the liquid has been drawn off by means of a pipette, 30 grains of sugar, 100 grains of powdered liquorice, and about a drachm of glycerin are added. The mass being transferred to a porcelain slab, is allowed to become sufficiently dry, and then mixed with enough glycerin and liquorice to make it weigh 300 grains. (*P. J. Tr.*, ii. 165.) Theoretically, this appears to be a good process; but only a long experience of its practical advantages would justify its substitution for a plan which has been followed, for so many years, with results upon the whole so satisfactory. An obvious objection to the process is the possibility, with carelessness of manipulation, of having in the preparation a minute proportion of corrosive sublimate or bichloride of tin.

The blue pill is sometimes wanted in the state of powder; but, from its peculiar constitution, it is not eligible for reduction to this form, as the mercury is disposed to aggregate during pulverization, and, from the honey it contains, it is apt, when pulverized, to attract moisture from the air. Mr. Chas. Bullock, therefore, recommends the following method of preparing a powder which shall, as nearly as possible, represent the blue pill, in reference to its therapeutic effects. Take of finely powdered Elm-bark, finely powdered Sugar, and Mercury, equal parts, and of Alcohol a sufficiency. Rub the mercury with the powdered bark, adding from time to time enough alcohol to maintain a pasty consistence, till the mercury is completely extinguished; then spread the mass on paper to dry. When dry, powder it, add the sugar, and rub the mixture thoroughly until the powder will pass through a sieve of fine bolting-cloth. (*A. J. P.*, 1859, p. 271.)

Medical Properties and Uses. This mass is among the mildest of the mercurials, being less liable than most others to act upon the bowels, and exercising the peculiar influence of the remedy upon the system with less irritation. It is much employed for producing the sialagogue and alterative action of mercury. For the former purpose, three grains (0·20 Gm.) may be given two or three times a day; and in urgent cases the dose may be increased. Even this preparation sometimes disturbs the bowels. It should then be given combined with a little opium, or in very minute doses, as half a grain or a grain (0·03–0·065 Gm.) of the mass, repeated every hour or two through the day, so as to allow of its absorption before a sufficient quantity has been administered to act as an irritant. With a view to the alterative effect upon the digestive organs, three grains (0·20 Gm.) may be given every night, or every other night, at bedtime, and followed in the morning, if the bowels should not be opened, by a small dose of laxative medicine. From five to fifteen grains (0·33–1 Gm.) of the mass are occasionally given as a cathartic, in cases requiring a peculiar impression upon the liver; but, when used for this purpose, it should always either be combined with or speedily followed by a more certain purgative. The *blue mass* may often be administered with advantage, suspended in water by the intervention of thick mucilage; and it forms an excellent addition to the chalk mixture in diarrhœa, particularly that of children, when the biliary secretion is deficient or otherwise deranged.

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* The mercurial mass is very apt to contain less than the due proportion of the metal. This was frequently the case with the mass as formerly imported. The fraud may be detected by the following plan of estimating the proportion of mercury, suggested by Prof. Reid, of New York, and modified by a committee of the Philadelphia College of Pharmacy. A certain weight of the mercurial mass, say fifty grains, is mixed with about one-fourth of its weight of iron filings, and introduced into a small green glass bulb, at the end of a somewhat curved tube, the open extremity of which is inserted, through a cork, into alcohol, contained in a broad-mouthed glass vial; another tube, open at both ends, passing through the cork, in order to permit the escape of uncondensed gases. Heat is then applied to the bulb by means of a spirit-lamp, is gradually increased until the glass becomes red hot, and continued for an hour. The alcohol in the vial dissolves the empyreumatic products, and, by being allowed to rise in the tube, and then expelled, serves to wash out any mercury that may be condensed upon its sides. The alcohol is poured off from the condensed mercury, which is then washed with fresh alcohol, dried, and weighed. (See *A. J. P.*, xvii. 151 and 309.)

MASTICHE. *U. S., Br.* *Mastic.*

(MĂS'TI̤-ƇHĒ—măs'ti̤-kē.)

"A concrete resinous exudation from Pistacia Lentiscus. Linné. (*Nat. Ord.* Terebinthaceæ, Anacardieæ.)" *U. S.* "A resinous exudation obtained by incision from the stem of Pistacia Lentiscus. Linn. Produced in the island of Scio." *Br.*

Mastix, *P.G.;* Resina Mastiche; Mastich; Mastic, *Fr.;* Mastice, *It.;* Almastiga, *Sp.;* Sakes, *Turk.;* Arab, *Arab.*

Gen. Ch. MALE. *Calyx* five-cleft. *Corolla* none. FEMALE. *Calyx* three-cleft. *Corolla* none. *Styles* three. *Drupe* one-seeded. *Willd.*

Pistacia Lentiscus. Willd. *Sp. Plant.* iv. 753; *B. & T.* 68. The *lentisk* is a shrub or small tree, seldom more than twelve feet in height, much branched towards the top, and furnished with petiolate, abruptly pinnate leaves. The leaflets are from eight to twelve, and usually alternate, with the exception of the two upper, which are opposite. They are ovate-lanceolate, entire, obtuse, often mucronate, and sessile upon the common footstalk, which has a narrow foliaceous expansion on each side. The flowers are diœcious, and very small. The male are in an axillary ament; the female are arranged alternately upon a common peduncle, which is also axillary. The tree is a native of the countries bordering upon the Mediterranean. The fruit yields by expression a fixed oil, of a deep green color, and liquid at about 90° F., which the Arabs of North Africa use both as an article of diet and for light. A resinous exudation from the stem and branches is the officinal part, but it does not appear to be collected in all places where the tree flourishes.

Mastic is obtained chiefly from the island of Scio or Chios, in the Grecian Archipelago, where the tree is cultivated for this product. Incisions are made in the trunk and principal branches, from which the juice slowly exudes, and either hardens in tears upon the bark, or drops on the ground, where it is received upon cloths, or the bare earth, and concretes in irregular masses. The tears are most esteemed, and are the only form recognized by the U. S. P. They are of various sizes, oval or roundish, often compressed, smooth, semi-transparent, of a pale yellow color, of a shining fracture, friable, and usually covered with a whitish powder, occasioned by their friction against each other. They are brittle but become plastic when chewed. The masses consist of yellowish agglutinated tears, with others of a darker color and less translucent, and often fragments of wood, bark, or earthy matter intermingled.*

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* In a more recent account by M. J. Léon Soubeiran, it is stated that the juice is obtained not only by incision, but by spontaneous exudation from the branches, where it concretes in drops, which, after hardening, are gathered under the name of tears, which constitute the most valued part of the drug. But the greater part of the resin comes from longitudinal incisions in the stem, made with a knife, close together, and extending from the root to the branches. In fifteen or

Mastic is nearly inodorous, unless rubbed or heated, when it becomes fragrant. Its taste is weak, but agreeably terebinthinate, and, after long chewing, very slightly acrid. It is at first friable under the teeth, but soon becomes soft and ductile, and acquires a white opaque appearance. Its sp. gr. is 1·074. It is fusible and inflammable by heat. Alcohol dissolves about 90 per cent. of it, leaving a viscid substance which becomes brittle when dried, and for which the name of *masticin* or *beta-resin of mastiche* has been proposed. This substance, though not dissolved by alcohol, softens and swells up in it, as gluten does in water. According to Berzelius, it possesses the same general properties as copal, and should be considered as a variety of resin. That portion dissolved by the alcohol is called *alpha-resin of mastiche* or *mastichic acid* because of its acid properties, and has the formula $C_{20}H_{32}O_2$. Mastic is wholly soluble in ether, chloroform, and oil of turpentine, scarcely soluble in the fixed oils, and insoluble in water. It consists chiefly of resin, with *masticin*, and a minute proportion of volatile oil, which can scarcely be said to have been obtained in a separate state, though it imparts flavor to alcohol and water distilled from the mastic, especially when this has been previously triturated with an equal weight of carbonate of potassium. Mastic is occasionally adulterated with olibanum, sandarach, and other resinous bodies, and, in seasons of scarcity, with sea-salt.

Medical Properties and Uses. Mastic was formerly thought to possess properties analogous to those of the turpentines, and was used in debility of the stomach, hæmoptysis from ulceration, leucorrhœa, chronic diarrhœa, etc.; but its virtues were overrated, and it is at present scarcely ever given internally. In the East, however, an aqueous infusion is said to be still used in infantile cholera; and the Greeks employ cataplasms made by mixing it with bread and red wine, which they apply to the lower abdomen. (*Landerer.*) It is sometimes employed to fill the cavities of carious teeth, for which purpose it is well fitted by its softness. Great quantities of it are consumed in Turkey, where it is habitually chewed by the women, under the impression that it sweetens the breath and preserves the gums and teeth. The alcoholic solution has been employed as a styptic in bleeding from the nose, leech-bites, etc., being applied by means of a camel's-hair pencil directly to the bleeding vessel. Dissolved in alcohol or oil of turpentine, it forms a brilliant varnish. A solution made by macerating half an ounce of mastic and fifteen grains of caoutchouc in two fluidounces of a chloroform, and filtering in close vessels, forms a valuable *microscopic varnish.*

The following mode of applying it to carious teeth has been recommended. Dissolve four parts of mastic in one of ether, in a bottle well stopped. With the solution thus formed, which is yellow and of an oily consistence, saturate a small piece of cotton of the size of the carious cavity, and, having well cleansed and dried the cavity, introduce the cotton, without painful pressure, so as to fill it exactly. The resin attaches itself to the diseased surface of the tooth, which it protects from the air, and from the food taken into the mouth.

Off. Prep. Pilulæ Aloës et Mastiches, *U. S.*

MATICO. *U. S.* *Matico.*

(MẠ-TÎ′CŌ—mạ-tee′kō.)

"The leaves of Artanthe elongata. Miquel. (*Nat. Ord.* Piperaceæ.)" *U. S.*
"The dried leaves of Artanthe elongata. Miquel. Imported from Peru." *Br.*

Maticæ Folia, *Br.;* Matico Leaves; Feuilles de Matico, *Fr.;* Maticoblätter, *G.*

Gen. Ch. Spikes solitary, opposite the leaves. *Flowers* hermaphrodite. *Style* none. *Bracts* peltate or cucullate. *Miquel.*

This genus, separated by Miquel from Piper, is very extensive, embracing nearly a hundred species diffused through South and Central America. At least two of these have contributed to furnish their products to commerce; but it is to the *A.*

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twenty days, the resin has become concrete, and is collected in little paniers of white paper or cotton cloth. Great care is taken to prevent it from falling on the ground, and becoming soiled by the earth, and, if any is thus soiled, it is immediately cleansed at the time of collection. (*Journ. de Pharm.*, Nov.-Dec. 1870, p. 359.)

elongata exclusively that the medicine called matico has been officinally ascribed.*

Artanthe elongata. Miquel; Lindley, *Med. and Œconom. Bot.* p. 133, fig. 195. —*Piper angustifolium.* Ruiz and Pavon, *Flor. Peruv.*—*Piper elongatum.* Vahl. This is a shrub with a jointed stem about twelve feet in height. In a dried specimen received from Dr. Ruschenberger, of the U. S. Navy, the leaves are sessile or very shortly petiolate, oval-lanceolate, acuminate, from 2 to 6 inches long by about an inch in breadth, bright green on the upper surface, paler and downy beneath, finely crenate, tessellated above, reticulate beneath, the meshes small, and the veins densely brownish-hairy; of an agreeable aromatic odor, and a strong spicy taste. The spikes are solitary, opposite the leaves, and cylindrical. The bracts are peltate or cucullate; the flowers hermaphrodite. The plant is a native of Peru.

The leaves, spikes, and stalks are mixed together, and more or less compressed, in the packages of the imported drug, and are all possessed of activity, though the leaves only are recognized by the Pharmacopœias. Their shape and general aspect have been described above, as well as their smell and taste. They are readily pulverized, forming a light, greenish, absorbent powder. According to Dr. Hodges, they contain chlorophyll, a soft dark green resin, brown and yellow coloring matters, gum, salts, lignin, a light green, thickish volatile oil, and a peculiar bitter principle, soluble in water and in alcohol, but not in ether, which he calls *maticin.* (*Philos. Mag.*, Sept. 1844, p. 206.) According to Mr. Wiegand, the maticin of Dr. Hodges is a salt of potassa. Mr. John J. Stell, who examined the drug in the expectation of discovering a principle analogous to cubebin or piperine, failed in the attempt. Flückiger found it to contain 2·7 per cent. of the volatile oil, which was slightly dextrogyre and boiling in large part at 180° C.–200° C. In winter-time it deposited large crystals of a camphor, fusing at 103° C., and having the odor and taste of the oil. It also affords, according to Marcotte, a crystallizable acid named *artanthic acid*, with some tannin. (*Pharmacographia*, 2d ed., p. 590.)

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* *Ava, Kava.* The root of another species of the old genus Piper, *P. methysticum* (*Macropiper methysticum*, Miquel), is used in the Sandwich Islands to form an intoxicating drink, under the name of *ava, kava,* or *kawa.* (See articles, with figures, in *P. J. Tr.*, iii. 1844, p. 472.) The root is large and fibrous, but rather light and spongy in texture. When fresh it is said to weigh usually from two to four pounds, although it sometimes attains as much as twenty pounds in weight, or even more. In drying, however, it loses rather more than half its weight. Externally it is grayish brown, with very thin bark, which, when sliced off, shows a complete net-work of woody tissue, some of the interstices of which are filled with soft yellowish white cellular matter, while others are quite empty. Internally it is yellowish white. In a variety of the plant known as "*Marea,*" it is citron-yellow, and in another variety, known as "*Arini-Ute,*" it is pinkish. A transverse section shows a number of narrow lines (woody bundles) radiating from near the centre towards the circumference, the interstitial tissue being much wider than the lines themselves. The central portion of the root is soft and cellular, with a few woody bundles anastomosing with each other, and proceeding at right angles to the radiating bundles, so as to form a net-work in the centre of the transverse section. The root has a pleasant odor recalling that of the lilac (*Syringa vulgaris*, L.), or meadow-sweet (*Spiræa Ulmaria*, L.). It has a slightly pungent taste, and causes an increased flow of saliva, with a slightly astringent sensation in the mouth, and a scarcely perceptible bitterness. The root and extreme base of the stem are the parts generally used. The root contains also nearly half its weight of starch. M. Gobley has discovered in this root a crystalline principle analogous to piperin, which he calls *methysticin*, and which, possessing neither odor nor taste, is probably inert. He found also a greenish yellow resin, of a strong aromatic smell, and an acrid pungent taste, to which he ascribes the powers of the root. (*Journ. de Pharm.*, Janv. 1860, p. 20.) The priority of this discovery having been disputed by M. Cuzent, the question was referred by the Society of Pharmacy of Paris to a committee, who, after investigating the subject, ascertained that the priority of the discovery was in fact due to Mr. Morson, of London, who had announced it so early as 1844; though both the other chemists were ignorant of this fact. "The crystalline principle called *Kavahin*, or Methysticin, may be obtained in acicular crystals from a concentrated tincture. Kavahin differs from piperine and cubebin in being colored red by hydrochloric acid, the red color fading on exposure to air into a bright yellow, and in being colored by strong sulphuric acid a purplish violet, which passes into green." The name of *kawine* has been proposed for the acrid resin. There is also a volatile oil in the root. (*Ibid.*, Mars, 1862, p. 215.) It is stated to be in small doses tonic, and has been very highly recommended in gonorrhœa. In Oceanica, in this complaint, from a drachm to a drachm and a half of the powdered drug is macerated for five minutes in a pint of water, and the half of the filtrate is taken before a meal and the other after the meal. The action of Kava root appears to vary with the amount taken. In small doses it is generally stated to act as a stimulant and tonic, but when taken in large doses it produces an intoxication which differs from that caused by alcohol in being of a silent and drowsy nature, accompanied by incoherent dreams, the drinker not being quarrelsome or excited. A well-prepared fluid extract would probably be effective in doses of from half a drachm to a drachm (3·9 to 7·5 C.c.). In 1854 a tincture was commended in gout used internally and locally. (*Med. Times and Gaz.*, Dec. 1854, p. 591.)

Medical Properties and Uses. Matico is an agreeable aromatic tonic and stimulant, having a tendency, like cubebs, to act on the urinary passages. It has long been known as a medicine in Peru. Dr. Martius speaks of its use by the natives externally as a vulnerary, and internally as an aphrodisiac (*Pharm. Centralb.*, 1843, p. 12); and, according to Dr. Scrivener, who practised medicine at Lima, it is much employed in Peru locally for arresting hemorrhage, and in the treatment of ulcers. (*A. J. P.*, xviii. 175.) In 1839 it was taken to England, and was prescribed by Dr. Jeffreys, of Liverpool, with advantage, in diseases of the mucous membranes; as gonorrhœa, leucorrhœa, menorrhagia, catarrh of the bladder, hemorrhoids, and epistaxis. Others have employed it with benefit in similar cases and in diarrhœa; and it is said to have proved useful in hæmoptysis, hæmatemesis, dysentery, and hæmaturia. Dr. Ruschenberger gives strong testimony in its favor in several of the diseases mentioned. Its most useful internal application is probably as an alterative stimulant to the diseased mucous membranes. If efficient as a hæmostatic, it must be on principles similar to those upon which oil of turpentine acts; for it is not astringent. As a local styptic it probably acts mechanically in the same manner as agaric. The dose of the powder is from half a drachm to two drachms (1·95 to 7·8 Gm.) three times a day. The infusion and fluid extract are officinal.

Prof. Bentley, of London, describes a new variety of matico, brought from a port of Central America, consisting of broken leaves, spikes, and branches, which he referred to another species of the same genus, *Artanthe adunca*, growing in the West Indies and various parts of South America. The medicine is distinguishable from the genuine by the want of the reticulated upper surface and downy under surface which characterize the latter. Prof. Bentley found the sensible properties of the new variety identical with those of the old. (*P. J. Tr.*, Jan. 1864, p. 290.)

Off. Prep. Infusum Maticæ, *Br.;* Extractum Matico Fluidum, *U. S.*

MATRICARIA. *U. S.* *Matricariă.* [*German Chamomile.*]

(MĂT-RỊ-CĀ'RỊ-Ạ.)

"The flower-heads of Matricaria Chamomilla. Linné. (*Nat. Ord.* Compositæ.)" *U. S.*

Flores Chamomillæ Vulgaris, *P.G.;* Fleurs de Camomille commune (d'Allemagne), *Fr.;* Kamille, Kamillenblumen, *G.*

Gen. Ch. *Calyx* flat, imbricate, with scales having scarious margins. *Receptacle* naked, terete. *Pappus* none.

Matricaria Chamomilla. Linn. *Sp. Plant.* 1256. This is an annual plant, with a branching stem a foot or two in height, bearing alternate leaves about two inches long, the lower ones tripinnate, the upper bipinnate or simply pinnate, and all of them very green, and nearly or quite smooth. The leaflets are linear and very small. The flowers appear singly at the ends of the stem and branches. They are about three-quarters of an inch in diameter, with the ray spreading. The scales of the calyx are obtuse, green in the middle, and whitish, membranous, and translucent at the margin. The ray florets are white, at first spreading, and ultimately reflected. The disk is of a deep yellow color, at first flat, but in the end convex, and even somewhat conical.

The plant is a native of Europe, and is occasionally cultivated in our gardens. All parts of it are active; but the flowers only are officinal. These shrink in drying, so that they are scarcely half as large as in their recent state. Those found in our shops are imported from Germany. They are officinally described as "about three-fourths of an inch (18 mm.) broad, composed of a flattish, imbricate involucre, a conical, hollow, naked receptacle, about fifteen white, ligulate, reflexed ray-flowers, and numerous yellow, tubular, perfect flowers without pappus; strongly aromatic and bitter. The similar flower-heads of *Anthemis arvensis*, Linné, and *Maruta Cotula*, De Candolle, have a conical, solid, and chaffy receptacle." *U. S.*

The dried flowers of the Matricaria are considerably smaller than common chamomile, and exhibit a larger proportion of the disk florets compared with those of the ray. They have a strong, peculiar, rather unpleasant odor, and a disagreeable bitter taste. Their active constituents are volatile oil and bitter extractive, which are readily taken up by water and alcohol. The oil, which is obtained by distillation with water, is thick, somewhat tenacious, of a fine deep blue color becoming green and brown by age, and almost opaque in mass. Though supposed by Gerhardt to be identical with the oil of chamomile (*Anthemis nobilis*), it has been shown to be distinct. (*P. J. Tr.*, Feb. 1862, p. 429.) It congeals at —4° F., has the sp. gr. 0·93, and contains a terpene, $C_{10}H_{16}$, and a camphor, $C_{10}H_{18}O$. The blue color is due to a volatile principle called *azulene* by Piesse, and *cœrulein* by Gladstone.

Medical Properties and Uses. Matricaria is a mild tonic, very similar to chamomile in medical properties, and, like it, in very large doses, an emetic. It is esteemed also in Europe antispasmodic and anthelmintic. It is much employed in Germany; but in this country scarcely at all, unless by German practitioners. It may be given for the same purposes and in the same manner as chamomile.

MEL. *U.S.*, *Br.* *Honey.*

(MĔL.)

"A saccharine secretion deposited in the honey-comb by Apis mellifica. Linné. (*Class*, Insecta; *Order*, Hymenoptera.)" *U. S.*

"A saccharine secretion deposited in the honey-comb by Apis mellifica (Linn.), the hive bee." *Br.*

Miel, *Fr.;* Honig, *G.;* Miele, *It.;* Miel, *Sp.*

Naturalists have not yet determined whether honey is a secretion of the bee, *Apis mellifica*, or whether it exists already formed in plants. It is certain that the nectaries of flowers contain a saccharine matter, which is extracted by the insect; and the fact is well known that the flavor and character of honey are very much affected by the nature of the plants which predominate in the vicinity of the hive; so much so that, when these plants are poisonous, the fluid sometimes partakes of their noxious qualities. Several cases of poisoning from eating honey from a particular source are recorded in the *New Jersey Med. Reporter* for November, 1852, p. 46. Still, it probably undergoes change in the organs of the bee; as the saccharine matter of the nectaries, so far as it has been possible to examine it, wants some of the characteristic properties of honey.[*]

The finest honey is that which is allowed to drain from the comb. If obtained from hives that have never swarmed, it is called *virgin honey*. An inferior kind is procured by submitting the comb to pressure; and, if heat be employed previous to expression, the product is still more impure.

In the recent state honey is fluid; but, on being kept, it is apt to form a crystalline deposit, and to be ultimately converted into a soft granular mass. In commerce it is found of every consistence, from that of a viscid liquid like thin syrup or oil, to that of lard or soft suet. Its color is sometimes white, but usually yellowish, and occasionally of a brownish or reddish tinge. It has a peculiar agreeable odor, varying somewhat with the flowers from which it was collected, and a very sweet, feebly aromatic taste, which is followed by a slight prickling, or sense of acrimony in the fauces. Its sp. gr. is about 1·333. (*Duncan.*) Cold water dissolves it readily, alcohol with less facility. "When diluted with 2 parts of water, the resulting liquid is almost clear, not stringy, has the sp. gr. 1·101 to 1·115, a brownish or yellowish color, and a faintly acid reaction. If 1 part of Honey be dissolved in 4 parts of water, a clear solution should result, which should not be rendered more than faintly opalescent by a few drops of test-solution of nitrate of silver (chloride), or of nitrate of barium (sulphate). If a small portion of Honey be diluted with 1 volume of water and then gradually mixed with 5 volumes of absolute alcohol, it should not become more than faintly opalescent, and should neither become opaque, nor deposit a slimy substance at the bottom and along the sides of the test-tube. When incinerated in small portions at a time, in a platinum crucible, it should not leave more than 0·2 per cent. of ash (any larger percentage of ash and failure to respond to the preceding tests indicating the presence of glucose or other foreign admixtures). Water boiled with Honey, and allowed to cool, should not be rendered blue or green on the addition of test-solution of iodine (abs. of starch)." *U. S.* It is essentially a strong aqueous solution of mixed dextrose and levulose, the sum of which, known as "glucose," amounts generally to 70 to 80 per cent.

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[*] *Propolis.* This is a resinous substance, deposited by bees at the base of the hive, and in other parts which required protection from the outer air, of a nature entirely different from wax or honey, and supposed to be intended for the protection of the comb from injurious external agencies. Dr. H. O. Hitchcock (*Chicago Med. Journ.*, 1867) considers it as one of the best remedies in simple mucous diarrhœa, even when severe, and attended with pain and vomiting. In many cases only a single dose is required. It appears to possess anodyne and soporific properties. He has found it also efficacious in dysentery in the early stage; but it has proved useless in the disease when fully established. In chronic diarrhœa, even of the kind contracted in camp, and remarkable for its obstinacy, it has seemed to act like a charm. It is of a dark reddish or yellowish brown color, of a shining fracture, an aromatic taste and smell, quite insoluble in water, nearly so in ether, but readily dissolved by alcohol and solution of potassa. Dr. Hitchcock has used both a tincture and an alkaline solution; the former (two drachms of propolis and four fluidounces of alcohol), in doses of from thirty minims to a fluidrachm (1·9 to 3·75 C.c.); the latter (two drachms of the resin to a fluidrachm of liquor potassæ and four fluidounces of a menstruum consisting of equal parts of water and simple syrup), in the dose of half a fluidrachm (1·9 C.c.) after each stool.

Bee-bread is the name given to a material found in some of the cells of the comb, consisting mainly of the pollen of plants. (*Chicago Med. Examiner*, Sept. 1865.) Dr. Jas. S. Whitmire found that in the dose of a drachm (3·9 Gm.) three times a day, it caused great increase of the urinary secretion. No disagreeable effects followed its use, except a slight flatulency and looseness of the bowels. It is entirely palatable and inoffensive to the stomach. (See *A. J. P.*, 1866, p. 56.)

The following analyses of pure, unadulterated honey show the variations in its composition. They were made by Dr. J. Campbell Brown (*Analyst*, iii. 269).

Locality.	Levulose.	Dextrose.	Sucrose.	Wax, Pollen, and Insoluble Matter.	Ash.	Water expelled at 100° C.	Water expelled above 100° C. and Loss.
English	37·04	36·11	None.	Good trace.	·15	19·10	7·60
Welsh	37·66	39·24	None.	Trace.	·14	16·40	6·56
Normandy	37·36	42·02	None.	Slight trace.	·17	15·50	4·95
German	33·56	36·16	None.	Trace.	·17	19·11	11·00
Greek	40·43	31·77	None.	·05	·15	19·80	7·80
Lisbon	37·69	34·51	None.	Nearly 1·0	·14	18·80	6·86
Jamaica	33·60	34·80	2·2 (?)	2·1	·25	19·46	7·58
California	38·29	35·57	None.	Good trace.	·11	17·90	8·13
Mexican	36·39	35·04	None.	Trace.	·97	18·47	10·03

The glucose may be obtained by treating granular honey with a small quantity of alcohol, which, when expressed, takes along with it the other ingredients, leaving the crystals nearly untouched. The same end may be attained by melting the honey, saturating its acid with carbonate of calcium, filtering the liquid, then setting it aside to crystallize, and washing the crystals with alcohol. Inferior honey usually contains a large proportion of uncrystallizable sugar and vegetable acid. Diluted with water, honey undergoes the vinous fermentation.

In warm weather, honey, if not very pure, sometimes ferments, acquiring a pungent taste and deeper color. Starch is said to be occasionally added to the inferior kinds to give them a white appearance. The adulteration may be detected by dilution with water, which dissolves the honey and leaves the starch at the bottom of the vessel. The nature of the deposit may be tested by the tincture of iodine. The presence of added water may be suspected from the greater thinness of the liquid, and its want of disposition to crystallize.

Honey is largely adulterated with artificial glucose. This may be detected by the officinal tests, but the safest method is to determine the sugar by the use of Fehling's solution. The grape sugar may be determined directly in a weighed quantity of honey. An equal weight of the same honey is boiled with 2 per cent. sulphuric acid, and the sugar may be determined after inversion; finally the dextrin may be determined in a third portion by precipitation with alcohol. The difference in the quantity of sugar found before and after inversion is so great as to furnish a certain method for distinguishing natural and artificial honey.

Medical Properties and Uses. Honey possesses the same medical properties as sugar, but is more disposed to affect the bowels. Though largely consumed as an article of food, it is seldom employed medicinally, except as a vehicle. Its taste and demulcent qualities render it a useful addition to gargles; and it is sometimes employed as an application to foul ulcers.

Off. Prep. Mel Depuratum, *Br.;* Mel Despumatum, *U. S.*

MEL BORACIS. *Br.* *Honey of Borax.*

(MĔL BO̤-RĀ-CĬS.)

Mel Sodii Boratis, *U. S.* 1870; Honey of Borate of Sodium; Miel boraté, Mellite de Borax, *Fr.;* Boraxhonig, *G.*

"Take of Borax, in fine powder, *sixty-four grains;* Clarified Honey *an ounce* [avoirdupois]. Mix." *Br.*

This preparation was very properly dropped from the U. S. Pharmacopœia at the last revision, as it may well be left to extemporaneous prescription. The U. S. formula of 1870 was practically identical with the British process given above. It is used in the thrush of infants, and in aphthous ulcerations of the mouth.

MEL DESPUMATUM. *U. S.* *Clarified Honey.*

(MĔL DĔS-PŪ-MĀ'TŬM.)

Mel Depuratum, *Br.;* Miel despumé, Mellite simple, *Fr.;* Gereinigter Honig, *G.*

"Honey, *a convenient quantity.* Heat the Honey, by means of a water-bath, remove the scum, and strain." *U. S.*

"Take of Honey *five pounds.* Melt the honey in a water-bath, and strain, while hot, through flannel, previously moistened with warm water." *Br.*

Honey, by the heat of the water-bath, becomes so fluid that the wax and other lighter impurities which it contains rise to the surface, and may be skimmed off; while the heavier substances which may have been accidentally or fraudulently added, such as sand or other earth, sink to the bottom. A neat method of separating is described in *N. R.*, Feb. 1880. It is as follows. "Pour the honey into a perfectly clean cylindrical vessel, with straight sides, rather narrow, and having a small lip at the open margin, and heat the vessel on a water-bath. When the water is hot, pour enough honey into the vessel to fill it to within about 1 inch of the edge, and allow it to remain at rest in the water-bath, at a moderate heat, for about one hour. During this time, most of the impurities will rise to the top, while some others may sink to the bottom. Now remove the vessel very carefully from the water-bath. and pour on top of the hot honey, very gently, a sufficient amount of cold water to fill the vessel completely. This will cause all the impurities floating on the honey at once to rise to the top of the cold water, where they will often solidify to a tough skin or cake, which may be taken off without difficulty. Then pour off the water through the lip, remove the last remnants, if necessary, by means of blotting-paper, and filter the honey through a piece of well-washed, wetted, and dense white flannel. The resulting product—if the honey is pure—will be very brilliant." The French Codex simply directs six pounds of white honey to be heated with two pounds of water, skimmed, concentrated to 30° B. while boiling hot, and then strained through flannel.

The following method of clarifying honey is recommended by André von Hirschberg. Boil 25 lbs. of honey, to which half the quantity of water has been added, with a pulp obtained by stirring three sheets of white blotting-paper with water, over a slow fire, till the paper is reduced to minute fibres. When the mixture cools, put it into a woollen filtering bag, previously moistened, and allow the honey to pass. It comes away quite clear. The pulp may then be washed, and the dark liquid evaporated by a water-bath to the proper consistence. (*P. J. Tr.*, ix. 543.)

Another process, recommended by A. Hofmann, is to dissolve 28 lbs. of honey in twice its weight of water, heat the solution to the boiling point, and then add a solution of three drachms of gelatin in three times its weight of water, and afterwards an aqueous solution of one drachm of tannin, or an infusion of two drachms of galls. The mixture is to be well stirred, and kept hot for an hour. Lastly, seven-eighths of the honey may be drawn off clear, the remainder filtered through flannel, and the whole evaporated. (*Ibid.*, xv. 121.) The use of tannin is objectionable, however, on account of its solubility in honey, and the danger of honey so purified reacting when brought in contact with ferric salts. For other processes of purifying honey, see 14th edition of this work, p. 1321, and *A. J. P.*, 1877, p. 19; also 1879, pp. 193, 598, and 1880, p. 132. Heugel's method is to mix two pounds each of honey and water with a half ounce of carbonate of magnesium, frequently agitate for two or three hours, filter through doubled white filtering-paper, boil slowly, remove the scum carefully, and evaporate upon a steam-bath to a syrupy consistence.

Honey clarified with carbonate of calcium and animal charcoal, as in the first process described, is as clear and colorless as syrup made with sugar, but still retains a peculiar flavor. It is less disposed to ferment than crude honey, and is said not to be so liable to produce griping pain when swallowed.

Off. Prep. Confectio Piperis, *Br.;* Confectio Rosæ, *U. S.;* Confectio Scammonii, *Br.;* Confectio Terebinthinæ, *Br.;* Mel Boracis, *Br.;* Mel Rosæ, *U. S.;* Oxymel, *Br.;* Oxymel Scillæ, *Br.;* Massa Ferri Carbonatis, *U. S.*

MEL ROSÆ. *U. S.* *Honey of Rose.*

(MĔL RŌ'ŞÆ.)

Mel Rosatum, *P.G.;* Mellitum Rosatum; Mellite de Roses rouges, Miel Rosat, *Fr.;* Rosenhonig, *G.*

"Red Rose, in No. 40 powder, *eight parts* [or two ounces av.]; Clarified Honey, *ninety-two parts* [or twenty-three ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or about twenty-two fluidounces]. Moisten the powder with *two parts* [or half a fluidounce] of Diluted Alcohol, pack it firmly in a conical glass percolator, and gradually pour Diluted Alcohol upon it until *thirty-three parts* [or eight fluidounces] of percolate are obtained. Reserve the first *three parts* [or six fluidrachms] of the percolate, evaporate the remainder, by means of a water-bath, to *five parts* [or ten fluidrachms], add the reserved portion, and mix the whole with the Clarified Honey." *U. S.*

Though one of the officinals in the late London and Edinburgh Pharmacopœias, the Honey of Rose has been dropped in the British. The U. S. formula is based on that of Prof. Grahame. (See *A. J. P.*, 1859, p. 443.) The object in reserving a portion of the first tincture, in the process, is to avoid the evaporation of the volatile oil in the concentration of the liquid, and thus to preserve the flavor as well as the astringency of the roses. Honey of rose forms a pleasant addition to the gargles employed in inflammation and ulceration of the mouth and throat.

MELISSA. *Melissa. U. S.* [*Balm.*]

(MẸ-LĬS'SẠ.)

"The leaves and tops of Melissa officinalis. Linné. (*Nat. Ord.* Labiatæ.)" *U. S.*

Folia Melissæ, *P.G.;* Herba Melissæ; Lemon Balm; Herbe au Citron, Mélisse, *Fr.;* Melissenblätter, Citronenkraut, Garten-Melisse, *G.;* Melissa, *It.;* Torongil, *Sp.*

Gen. Ch. Calyx dry, nearly flat above; with the upper lip sub-fastigiate. *Corolla*, upper lip somewhat arched, bifid; lower lip with the middle lobe cordate. *Willd.*

Melissa officinalis. Willd. *Sp. Plant.* iii. 146; Woodv. *Med. Bot.* p. 334, t. 119. Balm has a perennial root, which sends up annually several erect quadrangular stems, usually branched towards the base, and a foot or two in height. The leaves are about two inches long, are opposite, ovate or cordate, obtuse, deeply serrate, glandular or pubescent; the lower on long footstalks, the uppermost nearly sessile. The flowers are white or yellowish, upon short peduncles, and in axillary whorls of four or five, surrounding only half the stem. The calyx is tubular, pentangular, and bilabiate, with the upper lip tridentate and flattened, the lower cut into two pointed teeth. The corolla is whitish or purplish, tubular and bilabiate, the upper lip less convex and notched, the lower three-cleft. The plant is a native of the south of Europe. It has been introduced into this country, where it is cultivated in gardens, and grows wild along the fences of our roads and lanes. For use the herb should be cut before the appearance of the flowers, which begin to expand in July.

In the fresh state, it has a fragrant, lemon-like odor, but is nearly inodorous when dried. The taste is somewhat austere, and slightly aromatic. The herb contains a minute proportion (one-eighth to one-fourth per cent.) of a yellowish or reddish yellow essential oil, which has its peculiar flavor in a very high degree. It contains also tannin, bitter extractive, and gum.

Medical Properties and Uses. Balm produces scarcely any remedial effects upon the system. The quantity of oil which it contains is not more than sufficient to communicate an agreeable flavor to the infusion, which forms an excellent drink in febrile complaints, and when taken warm tends to promote the operation of diaphoretic medicines.

MENISPERMUM. *U. S.* *Menispermum.* [*Canadian Moonseed.*]

(MĔN-Ị-SPĔR′MŬM.)

"The rhizome and rootlets of Menispermum canadense. Linné. (*Nat. Ord.* Menispermaceæ.)" *U. S.*

Gen. Ch. Sepals four to eight. *Petals* six to eight, short. *Stamens* twelve to twenty in the sterile flowers, as long as the sepals. *Anthers* four-celled. *Pistils* two to four in the fertile flowers, raised on a short, common receptacle. *Stigma* broad and flat. *Drupe* globular. *Gray's Manual.*

M. canadense. L. This is a woody, climbing plant, which grows throughout the eastern United States, as the only species of its genus there native. It is specifically characterized by its peltate three- to seven-lobed leaves, its small clusters of greenish yellow flowers, and its somewhat kidney-shaped glaucous fruit, which is ripened in the month of September. Its root was first brought into market as *Texas Sarsaparilla*, and identified by Prof. Robt. P. Thomas. (*A. J. P.*, xxvii. 7.)

Properties. Menispermum is officinally described as follows. "Rhizome several feet long, about a quarter of an inch (6 mm.) thick, yellowish brown or brown, finely wrinkled longitudinally and beset with numerous thin, rather brittle rootlets; fracture, tough, woody; internally yellowish, with a thickish bark, a circle of porous, short, nearly square, wood-wedges and a large central pith; nearly inodorous; taste bitter." *U. S.* Prof. J. M. Maisch proved the presence of a white alkaloid, and of a small quantity of berberine. The former reacts with the usual alkaloidal precipitants, is not very soluble in water, but soluble in alcohol and ether. Starch was also found in the root. (*A. J. P.*, 1863, p. 301.)

Medical Properties. In an unpublished inaugural dissertation by Dr. George F. Terrell (Feb. 1844), it is stated that the root of this plant is considerably employed in Virginia, both in domestic practice and by physicians, as a substitute for sarsaparilla, in scrofulous affections. It is also reputed to be tonic, but is very rarely used in regular practice, and is probably inert even in indefinite doses.

MENTHA PIPERITA. *U. S.* *Peppermint.*

(MĔN′THẠ PĪ-PẸ-RĪ′TẠ.)

"The leaves and tops of Mentha piperita. Linné. (*Nat. Ord.* Labiatæ.)" *U. S.*

Folia (Herba) Menthæ Piperitæ, *P.G.;* Menthe poivrée, *Fr.;* Pfefferminze, Pfeffermünze, *G.;* Menta piperita, *It.;* Pimenta piperita, *Sp.*

Gen. Ch. Corolla nearly equal, four-cleft; the broader segment emarginate. *Stamens* upright, distant. *Willd.*

Several species of Mentha possess medicinal properties. Besides the two here described, namely, *M. piperita* and *M. viridis*, the *Mentha Pulegium*, under the name of *pulegium* or *pennyroyal*, long held a place in the British Pharmacopœias, but is no longer recognized. The portions of this plant used, and their application to the treatment of disease, were similar to those of other mints. The plant is specifically characterized by its roundish prostrate stems, its ovate, obtuse, somewhat crenate leaves, and its verticillate flowers. It is a native of Europe, and neither cultivated nor employed in this country; our native pennyroyal belonging to a different genus. (See *Hedeoma Pulegioides.*)

Mentha piperita. Willd. *Sp. Plant.* iii. 79; *B. & T.* 203; Carson, *Illust. of Med. Bot.* ii. 16, pl. 63. Peppermint is a perennial herbaceous plant, with a creeping root, and quadrangular, channelled, purplish, somewhat hairy stems, branched towards the top, and about two feet in height. The leaves are about two inches long, opposite, petiolate, ovate, serrate, pointed, smoother on the upper than the under surface, and of a dark green color, which is paler beneath. The flowers are small, purple, and in terminal obtuse spikes, interrupted below. The calyx is tubular, furrowed, and five-toothed, often purplish; the corolla is purplish, tubular, with its border divided into four segments, of which the uppermost is broadest, and notched at its apex. The four short stamens are concealed within the tube of the corolla; the style projects beyond it, and terminates in a bifid stigma.

This species of mint is a native of Great Britain, whence it has been conveyed to the continent of Europe and to this country. In some parts of the United States, especially in New England and Michigan, the western part of New York, Ohio, and New Jersey, it is largely cultivated for the sake of its volatile oil, and is often found growing wild. The cultivators of this herb have observed that, in order to maintain its flavor in perfection, it is necessary to transplant the roots every three years. It should be cut for medical use in dry weather, about the period of the expansion of the flowers. These appear in August.

The herb, both in the recent and the dried state, has a peculiar, penetrating, grateful odor. The taste is aromatic, warm, pungent, glowing, camphorous, bitterish, and attended with a sensation of coolness when air is admitted into the mouth. These properties depend on a volatile oil, of which from 1 to 1·25 per cent. can be obtained from the herb. The leaves are said to contain a little tannic acid. The virtues of the herb are imparted to water, and more readily to alcohol.

Medical Properties and Uses. Peppermint is a grateful aromatic stimulant, much used for all the purposes to which medicines of this class are applied. To allay nausea, relieve spasmodic pains of the stomach and bowels, expel flatus, and cover the taste or qualify the nauseating or griping effects of other medicines are among the most common of these purposes. The fresh herb, bruised and applied to the epigastrium, often allays sick stomach, and is useful in the cholera of children. The medicine may be given in infusion; but the volatile oil, either alone, or in some state of preparation, is generally preferred.

Off. Prep. Oleum Menthæ Piperitæ, *U. S.;* Spiritus Menthæ Piperitæ, *U. S.;* Vinum Aromaticum, *U. S.*

MENTHA VIRIDIS. *U. S.* *Spearmint.*

(MĔN′THẠ VĬR′Ị-DĬS.)

"The leaves and tops of Mentha viridis. Linné. (*Nat. Ord.* Labiatæ.)" *U. S.*

Herba Menthæ Acutæ (vel Romanæ); Menthe verte, Menthe romaine, Baume vert, Menthe à épi, *Fr.;* Grüne Münze, Römische Minze, *G.;* Menta Romana, *It.;* Yerba buena puntiaguda, *Sp.*

Mentha viridis. Willd. *Sp. Plant.* iii. 76; *B. & T.* 202. Spearmint, sometimes called simply *mint*, differs from *M. piperita* chiefly in having sessile or nearly sessile, lanceolate, naked leaves; elongated, interrupted, panicled spikes; setaceous bracts; and stamens longer than the tube of the corolla. Like the preceding species, it is a native of Europe. In this country it is cultivated for domestic use and for the sake of its oil. It also grows wild in low grounds, in long-settled parts of the country. Its flowering season is August. According to Thomson, it should be cut in very dry weather, and, if intended for medical use, just as the flowers appear; if for obtaining the oil, after they have expanded.

The odor of spearmint is strong and aromatic, the taste warm and slightly bitter, less pungent than that of peppermint, but considered by some as more agreeable. These properties are retained for some time by the dried plant. They depend on a volatile oil, which is obtained by distillation, and is imparted to alcohol and water by maceration. (See *Oleum Menthæ Viridis.*)

Medical Properties. The virtues and applications of this plant are the same as those of peppermint.

Off. Prep. Oleum Menthæ Viridis, *U. S.;* Spiritus Menthæ Viridis, *U. S.*

MEZEREUM. *U. S.* *Mezereum.*

(MẸ-ZĒ′RẸ-ŬM.)

"The bark of Daphne Mezereum, Linné, and of other species of Daphne. (*Nat. Ord.* Thymelaceæ.)" *U. S.* "The dried bark of Daphne Mezereum (Linn.), *Mezereon*; or of Daphne Laureola (Linn.), *Spurge Laurel.*" *Br.*

Mezerei Cortex, *Br.;* Mezereon Bark; Cortex Mezerei, *P.G.;* Cortex Thymeleæ (vel Coccognidii); Écorce de Mézéréon, de Garou, de Lauréole, de Thymélée, Bois gentil, *Fr.;* Kellerhals, Seidelbastrinde, Kellerhalsrinde, *G.;* Mezereo, *It.;* Mecereon, *Sp.*

Gen. Ch. Calyx none. *Corolla* four-cleft, withering, enclosing the stamens. *Drupe* one-seeded. *Willd.*

All the species of Daphne are possessed of active properties; but three only are officinal—*D. Mezereum*, *D. Laureola*, and *D. Gnidium;* the first two of which are recognized in the British Pharmacopœia, the last in the French Codex.

1. *Daphne Mezereum.* Willd. *Sp. Plant.* ii. 415; *B. & T.* 225; Carson, *Illust. of Med. Bot.* ii. 26, pl. 72. This is a very hardy shrub, three or four feet high, with a branching stem, and a smooth, dark gray bark, very easily separable from the wood. The leaves spring from the ends of the branches, are deciduous, sessile, obovate-lanceolate, entire, smooth, of a pale green color, somewhat glaucous beneath, and about two inches long. They are preceded by the flowers, which appear very early in spring, and sometimes bloom even amidst the snow. These are of a pale rose color, highly fragrant, and disposed in clusters, each consisting of two or three flowers, forming together a kind of spike at the upper part of the stem and branches. At the base of each cluster are deciduous floral leaves. The fruit is oval, shining, fleshy, of a bright red color, and contains a single round seed. Another variety produces white flowers and yellow fruit.

This species of Daphne is a native of Great Britain and the neighboring continent, in the northern parts of which it is particularly abundant. It is cultivated in Europe both for medicinal purposes and as an ornamental plant, and is occasionally found in our own gardens. It flowers in February, March, or April, according to the greater or less mildness of the climate.

2. *Daphne Gnidium.* Willd. *Sp. Plant.* ii. 420; *B. & T.* 227. In this species, called *garou* or *sain-bois* by the French, the leaves are linear-lanceolate, acute, entire, smooth, and irregularly but closely set upon the branches. The flowers are white, downy, odoriferous, and disposed in terminal panicled racemes. The fruit is globular, dry, at first green, but ultimately black. *D. Gnidium* grows in dry uncultivated places in the south of Europe, and flowers in June. In France its bark is used indiscriminately with that of the former species.

Besides the species above described, *Daphne Laureola*, or *spurge laurel*, is said to furnish a portion of the mezereum of commerce, and is recognized by the Br. Pharmacopœia; but its product is inferior in acrimony, and consequently in medicinal activity.

The bark of the root was formerly directed; but the mezereum with which our markets are supplied is evidently the bark of the stem; and the Pharmacopœias at present very properly direct the bark, without designating the part from which it must be taken. British writers state that the bark of the root is the most active. The berries and leaves of the plant are also active; and the former have sometimes proved fatal to children who have eaten them. Pallas states that they are used as a purgative by the Russian peasants, and that thirty berries are required to act. French authors observe that fifteen are sufficient to kill a Frenchman. A tincture of them is used in Germany as a local application in neuralgia. (*Ann. de Thérap.*, 1854, p. 42.) Mezereum is brought to us chiefly from Germany.

Properties. Mezereum, as it comes to us, is usually in strips, from two to four feet long, and an inch or less in breadth, sometimes flat, sometimes partially rolled, and always folded in bundles, or wrapped in the shape of balls. It is covered externally with a grayish or reddish brown wrinkled epidermis, with transverse scars and minute black dots, very thin, and easily separable from the bark. Beneath the epidermis is a soft, greenish tissue. The inner bark is tough, pliable, fibrous, striated, and of a whitish color with a silky surface. When fresh it has a nauseous smell, but in the dry state is nearly inodorous. Its taste is at first sweetish, but afterwards highly acrid and even corrosive. It yields its virtues to water by decoction.

Vauquelin discovered a peculiar principle in the bark of *Daphne Alpina.* This has subsequently been found in other species, and has received the name of *daphnin.* Gmelin and Bär found it in the bark of *D. Mezereum*, associated with wax, an acrid resin, a yellow coloring matter, reddish brown extractive, an uncrystallizable and fermentable sugar, a gummy matter containing nitrogen, ligneous fibre, malic acid, and several malates. By J. B. Eng it has been discovered, together with a volatile oil, in the flowers of *Daphne Mezereum.* (*Wittstein's Viert.*, viii. 23.) *Daphnin* is in prismatic crystals grouped together, colorless, transparent, brilliant, slightly soluble in cold water, very soluble in boiling water and alcohol, without odor, and of a bitter, somewhat austere taste. By Zwenger it is said to be insoluble in ether. The same chemist states that it has an acid reaction; and acts like the glucosides, being resolvable by sulphuric or hydrochloric acid into sugar, and a peculiar crystallizable principle called *daphnetin*, $C_9H_6O_4+H_2O$. He gives for daphnin the formula $C_{15}H_{16}O_9+2H_2O$, the same as that of *æsculin.* (*Annal. der Chem. und Pharm.*, cxv. 1.) It is obtained by treating the alcoholic extract of the bark with water, decanting the solution, precipitating with subacetate of lead, filtering, decomposing the excess of the subacetate by sulphuretted hydrogen, again filtering, evaporating to dryness, submitting the residue to the action of anhydrous alcohol, and evaporating the alcoholic solution to the point of crystallization. Though daphnin is probably not inert, it is not the principle upon which the virtues of mezereum chiefly depend. Vauquelin thinks that in the recent plant they reside in an essential oil, which by time and exposure is changed into a resin, without losing its activity. The acrid resin, observed by Gmelin and Bär, is probably the characteristic principle to which the bark owes its vesicating properties. It is obtained separate by boiling mezereum in alcohol, allowing the liquor to cool in order that it may deposit some wax which it has taken up, then distilling off the alcohol, and treating the residue with water, which leaves the resin. This is of a dark green, almost black color, hard and brittle, and of an exceedingly acrid and permanent taste. In the isolated state, it is slightly soluble in water; and it is much more so, when combined with the other principles of the bark. It appears, however, not to be a pure proximate principle, but rather a resinoid combination of an acrid fixed oil with another substance. The acrid principle of mezereum is partially given off by decoction with water, as proved by the irritating character of the vapor; but none of it appears to escape when the bark is boiled with alcohol. (Squire, *P. J. Tr.*, i. 395.)

Coccognin, isolated in 1870 by Casselmann from the fruits of *D. Mezereum*, appears to be closely allied to, if not identical with daphnin. By the dry distillation of an alcoholic extract of mezereum bark, Zwenger obtained *umbelliferone*, $C_9H_6O_3$.

Medical Properties and Uses. The recent bark applied to the skin produces inflammation followed by vesication, and has been popularly used as an epispastic, from time immemorial, in some of the southern countries of Europe. The dried bark, though less active, is possessed of a similar property, and is occasionally employed in France by regular practitioners for the purpose of forming issues. A small square piece, moistened with vinegar, is applied to the skin, and renewed twice a day till a blister is formed, and occasionally afterwards to keep up the discharge. It is slow in its operation, generally requiring from twenty-four to forty-eight hours to vesicate. An irritant ointment is prepared from mezereum, which is used for maintaining the discharge from blistered surfaces, and may be applied advantageously to obstinate, ill-conditioned, indolent ulcers. An alcoholic extract has also been employed to communicate irritant properties to issue peas.

Internally administered, mezereum is a stimulant capable of being directed to the skin or kidneys, and in large doses apt to excite purging, nausea, and vomiting. In overdoses it produces the fatal effects of the acrid poisons; and a case of apparently severe narcotic effects has been recorded. (*Am. Journ. of Med. Sci.*, xxi. 518.) It had at one time much reputation as a remedy in the secondary stages of syphilis, and still enters as an ingredient into the officinal compound decoction of sarsaparilla. It has also been thought to act favorably as an alterative in scrofulous affections, chronic rheumatism, and obstinate diseases of the skin. For this purpose it is usually administered in decoction. (See *Decoctum Mezerei.*) The dose of the bark in substance is ten grains (0·60 Gm.); but it is seldom used.

Off. Prep. Decoctum Sarsæ Compositum, *Br.;* Decoct. Sarsaparillæ Compositum, *U. S.;* Extractum Mezerei, *U. S.;* Extractum Mezerii Æthereum, *Br.;* Extractum Mezerei Fluidum, *U. S.;* Extractum Sarsaparillæ Compositum Fluidum, *U. S.*

MICA PANIS. *Br.* *Crumb of Bread.*

(MĪ'CA PĀ'NĬS.)

"The soft part of bread made with wheat flour." *Br.*

Mie du Pain, *Fr.;* Brodkrumen, *G.*

Off. Prep. Cataplasma Carbonis, *Br.* See *Farina.*

MISTURÆ. *Mixtures.*

(MIS-TŪ'RÆ.)

Mixtures, *Fr.;* Mixturen, *G.*

This term should be restricted, in the language of pharmacy, to those preparations in which insoluble substances, whether solid or liquid, are suspended in watery fluids, by the intervention of gum arabic, sugar, the yolk of eggs, or other viscid matter. When the suspended substance is of an oleaginous nature, the mixture is properly called an *emulsion.* The object of these preparations is usually to facilitate the administration, to conceal the taste, or to obviate the nauseating effects of unpleasant medicines; and their perfection depends upon the intimacy with which the ingredients are blended. Some skill and care are requisite for the production of uniform and perfect mixtures. As a general rule, the body to be suspended should be thoroughly mixed by trituration with the substance intended to act as the intermedium, before the watery vehicle is added. In the case of the liquid balsams and oils, if gum arabic be employed as the intermedium, it should be previously brought to the state of mucilage of the consistence directed in the U. S. Pharmacopœia. When a fixed oil or balsam is to be made into an emulsion, the method most employed abroad is to add one part of gum, to two or three of the oil, in a mortar, triturate until the mixture is complete, and then add at once, twice as much water as gum used, and triturate rapidly until the oil is completely emulsified, then gradually add the remainder of the vehicle with constant trituration. Agitation in a bottle is sometimes substituted for trituration. The plan most largely used in this country is to make the emulsion with mucilage. Having a broad flat pestle and a mortar perfectly free from grease, put in a little mucilage, rub it around the mortar, add about half as much oil, triturate from the centre so as to emulsify this, then add more mucilage, then oil, and so on until the operation is completed. Care is required never to get the oil in excess of the mucilage. This plan seems to accord with the principle laid down by R. Rother (*Chicago Pharmacist*, 1872, p. 25), that the most perfect and rapid emulsifier is a perfect emulsion. The proportion of gum and water necessary to make a good emulsion with the fixed oils varies with the oil. Thus, while castor oil requires only two drachms of the gum and three drachms of water to the ounce, most other fixed oils require half their weight of gum, and a weight of water equal to half that of the oil and gum united. These quantities being well rubbed together, any desirable amount of water may afterwards be gradually added, and will readily incorporate with the other ingredients. The white of eggs has been frequently ordered by physicians as the suspending substance; but it is inferior for this purpose to the yolk, or to gum arabic. When the white is used it should be well beaten, and incorporated with the oleaginous or balsamic substances before the water is added. Mixtures are generally the objects of extemporaneous prescription; but a few have been deemed of sufficient importance to merit a place in the Pharmacopœias. They should be prepared only when wanted for use. The mixtures, now officinal, which were admitted at the last revision of the U. S. Pharmacopœia are Mistura Ferri et Ammonii Acetatis, Mistura Magnesiæ et Asafœtidæ, Mistura Rhei et Sodæ.

MISTURA AMMONIACI. *U.S., Br.* *Ammoniac Mixture.*

(MỊS-TŪ'RẠ ĂM-MỌ-NĪ'Ạ-CĪ.)

Emulsio Ammoniaci, Lac Ammoniaci; Ammoniacum Mixture, Milk of Ammoniac; Mixture de Gomme ammoniaque, Lait ammoniacal, *Fr.;* Ammoniak-Emulsion, *G.*

"Ammoniac, *four parts* [or one hundred and eighty grains]; Water, *one hundred parts* [or ten fluidounces]. Rub the Ammoniac with the Water, gradually added, until they are thoroughly mixed, and strain." *U. S.*

"Take of Ammoniacum, in coarse powder, *a quarter of an ounce* [avoirdupois]; Distilled Water *eight fluidounces.* Triturate the Ammoniacum with the Water, gradually added, until the mixture assumes a milky appearance, then strain through muslin." *Br.*

The present 4 per cent. officinal mixture is slightly stronger than that of U. S. P. 1870, which contained but 3 per cent. of ammoniac. In this mixture the resinous and oily constituents are suspended by means of the gum of the ammoniac, imparting a milky appearance to the preparation, which, from this circumstance, was formerly called *lac ammoniaci*, or *milk of ammoniac.* The greater portion of the resin subsides upon standing. The mixture is slightly curdled by acids. The dose is from one to two tablespoonfuls (15 to 30 C.c.).

MISTURA AMYGDALÆ. *U. S., Br.* *Almond Mixture.*

(MỊS-TŪ'RẠ Ạ-MỸG'DẠ-LÆ.)

Emulsio Amygdalæ, s. Amygdalarum, Emulsio Simplex; Milk of Almonds; Emulsion simple, Lait d'Amandes, *Fr.;* Mandelemulsion, Mandelmilch, *G.*

"Sweet Almond, *six parts* [or two hundred and forty grains]; Acacia, in fine powder, *one part* [or forty grains]; Sugar, *three parts* [or one hundred and twenty grains]; Distilled Water, *one hundred parts* [or nine fluidounces]. Having blanched the Almond, add the Acacia and Sugar, and beat them in a mortar, until they are thoroughly mixed; then rub the mixture with the Distilled Water, gradually added, and strain." *U. S.*

"Take of Compound Powder of Almonds *two ounces and a half* [avoirdupois]; Distilled Water *one pint* [Imperial measure]. Rub the powder with a little of the Water into a thin paste, then add the remainder of the Water, and strain through muslin." *Br.*

These preparations are essentially the same; the gum and sugar, which enter into the U. S. formula directly, being ingredients of the compound powder of almonds of the British. The gum arabic in these formulas is introduced, not so much for its demulcent properties, as to assist in the suspension of the insoluble ingredients of the almonds. The same formula will answer for the preparation of an *emulsion of bitter almonds.*

The oleaginous matter of the almonds is suspended in the water by means of their albumen, gum, and sugar, forming a milky emulsion. When the almonds themselves are employed, as in the U. S. process, care should be taken to reduce them to the consistence of a paste previously to the addition of the water; and with each successive portion of fluid a uniform mixture should be formed before another portion is added. Common water, when pure, may be properly substituted for the distilled. Great care should be taken to select the almonds perfectly free from rancidity. The mixture is not permanent.* Upon standing, the oil rises like thick cream to the surface, and the separation is effected more quickly by heat, alcohol, and the acids, which coagulate the albumen. The preparation is closely analogous to milk in chemical relations and appearance. In warm weather it soon becomes sour.

The almond mixture has a bland taste, and may be used as an agreeable, nutritive demulcent in catarrhal and dysenteric affections and irritation of the urinary passages. To be of service it must be freely employed. From two to eight fluidounces (60 to 236 C.c.) may be taken at once. It is occasionally employed as the vehicle of less agreeable medicines, but should not be used with any considerable quantity of tinctures, acidulous salts, or other acid substances.

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* *Concentrated Emulsion of Almonds.* H. P. Reynolds prepares a permanent preparation which, when mixed with three times its bulk of water, makes an emulsion which cannot be distinguished from the officinal, by using the following formula. Take of Sweet Almonds [blanched], Sugar, Glycerin ("C. P."), each, one ounce; Powdered Gum Arabic one drachm; Water two ounces. Rub to a uniform paste, strain through muslin, evaporate by a heat not exceeding 150° F. to the consistency of a fresh solid extract, flavor to suit.

MISTURA ASAFŒTIDÆ. *U.S.* *Asafetida Mixture.*

(MỊS-TŪ'RẠ ĂS-Ạ-FŒT'Ị-DÆ—ăs-ạ-fĕt'ị-dē.)

Mistura (Lac) Asafœtidæ; Mixture (Lait) d'Asafœtida, *Fr.;* Asafœtida-Emulsion, Stinkasantmilch, *G.*

"Asafetida, *four parts* [or one hundred and eighty grains]; Water, *one hundred parts* [or ten fluidounces]. Rub the Asafetida with the Water, gradually added, until they are thoroughly mixed, and strain." *U. S.*

The present 4 per cent. officinal mixture slightly exceeds in strength the mixture of U. S. P. 1870, which contained but 3 per cent. of asafetida.

This mixture is, as a general rule, the best form for the administration of asafetida, being less stimulant than the tincture, and more prompt in its action than the pill. Its excessively disagreeable smell and taste are, however, objections, which induce a frequent preference for the last-mentioned preparation. It is very often employed as an enema. The dose is from one to two tablespoonfuls (15 to 30 C.c.) frequently repeated. From two to four fluidounces (60 to 118 C.c.) may be given by the rectum. Mr. D. Ackerman prepares a concentrated emulsion of asafetida, which will keep if excluded from the light, by using a mixture of three-fourths pure water and one-fourth of dilute acetic acid as the menstruum. For cleaning mortars in which asafetida has been rubbed, he recommends liquor potassæ, followed by bitter almond water or paste, and soap and water. (*A. J. P.*, 1874, p. 268.*)

MISTURA CHLOROFORMI. *U.S.* *Chloroform Mixture.*

(MỊS-TŪ'RẠ ÇHLŌ-RỌ-FÖR'MĪ.)

Emulsio Chloroformi; Emulsion de Chloroforme, *Fr.;* Chloroform-Emulsion, *G.*

"Purified Chloroform, *eight parts* [or two fluidrachms]; Camphor, *two parts* [or forty-five grains]; Fresh Yolk of Egg, *ten parts* [or half a fluidounce]; Water, *eighty parts* [or four fluidounces], To make *one hundred parts* [or about five fluidounces]. Rub the Yolk of Egg in a mortar, first by itself, then with the Camphor, previously dissolved in the Chloroform, and lastly, with the Water, gradually added, so as to make a uniform mixture." *U. S.*

The formula for this mixture has not been changed to any extent in the recent revision. The yolk of one egg may generally be substituted for the half a fluidounce in the alternative formula, as this is the average measure.

In consequence of the great facility with which camphor dissolves in chloroform, and the ready miscibility of the solution, by the intervention of the yolk of eggs, with water, this mixture affords an easy and agreeable method of administering these medicines jointly. On account of the preservative influence of the chloroform, it will keep long unchanged. Dose, one or two tablespoonfuls (15 or 30 C.c.).

MISTURA CREASOTI. *Br.* *Creasote Mixture.*

(MỊS-TŪ'RẠ CRĒ-Ạ-SŌ'TĪ.)

Mixture de Créosote, *Fr.;* Kreosot-Mixtur, *G.*

"Take of Creasote, Glacial Acetic Acid, of each, *sixteen minims;* Spirit of Juniper *half a fluidrachm;* Syrup *one fluidounce;* Distilled Water *fifteen fluidounces.* Mix the Creasote with the Acetic Acid, gradually add the Water, and lastly the Syrup and Spirit of Juniper." *Br.*

The dose of this mixture is a fluidounce (30 C.c.), containing a minim of creasote.

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* *Syrup of Asafetida.* Mr. Richard Peltz has found the following formula to answer. Take of asafetida ℥j, boiling water Oj, sugar lbij. Rub the asafetida with a part of the water so as to make a uniform paste, then gradually add the remainder of the water, strain, and add the sugar, heating moderately till it is dissolved. This has a less disagreeable taste than the mixture, and keeps much better, remaining several months without change, while the latter is often altered in a short time. The dose is the same as that of the mixture. (*A. J. P.*, xxiv. 313.)

MISTURA CRETÆ. *U.S., Br.* *Chalk Mixture.*

(MỊS-TŪ′RẠ CRĒ′TÆ.)

Mixture avec la Craie, *Fr.;* Kreidemixtur, *G.*

"Compound Chalk Powder, *twenty parts* [or four hundred and eighty grains]; Cinnamon Water, *forty parts* [or two fluidounces]; Water, *forty parts* [or two fluidounces], To make *one hundred parts* [or about four fluidounces]. Rub the Powder with the Cinnamon Water and Water, gradually added, until they are thoroughly mixed. This preparation should be freshly made, when wanted for use." *U. S.*

"Take of Prepared Chalk *a quarter of an ounce* [avoirdupois]; Gum Acacia, in powder, *a quarter of an ounce* [avoird.]; Syrup *half a fluidounce;* Cinnamon Water *seven fluidounces and a half.* Triturate the Chalk and Gum Acacia with the Cinnamon Water, then add the Syrup and mix." *Br.*

The direction that this mixture be prepared extemporaneously is a decided improvement. Unsuccessful attempts have been repeatedly made to devise a formula which would yield a permanent product, and much injury has been done through the dispensing of chalk mixture in an incipient fermentative condition. The trifling amount of glycerin present in the chalk mixture officinal in 1870 was totally inadequate to preserve it during the warm summer months, when it is in greatest vogue. Compound Chalk Powder is now officinal (see *Pulvis Cretæ Compositus*); it will keep indefinitely, and, besides being itself a valuable addition to the materia medica, is quickly made into chalk mixture by rubbing it with the water and cinnamon water, so that there can be no excuse for not dispensing a fresh mixture.

This mixture is a convenient form for administering chalk, and is much employed in looseness of the bowels accompanied with acidity. Laudanum and kino or catechu are very often added to increase its astringency. The dose is a tablespoonful (15 C.c.) frequently repeated.

MISTURA FERRI AROMATICA. *Br.* *Aromatic Mixture of Iron.*

(MỊS-TŪ′RẠ FĔR′RĪ ĂR-Ọ-MĂT′Ị-CẠ.)

Mixture de Fer aromatique, *Fr.;* Aromatische Eisenmixtur, *G.*

"Take of Pale-Cinchona Bark, in powder, *one ounce;* Calumba Root, in coarse powder, *half an ounce;* Cloves, bruised, *a quarter of an ounce;* Fine Iron Wire, *half an ounce;* Compound Tincture of Cardamoms *three fluidounces;* Tincture of Orange Peel *half a fluidounce;* Peppermint Water *a sufficiency.* Macerate the Cinchona Bark, Calumba Root, Cloves, and Iron with twelve fluidounces of the Peppermint Water, in a closed vessel, for three days, agitating occasionally; then filter the liquid, adding as much Peppermint Water to the filter as will make the product measure twelve and a half fluidounces; to this add the tinctures, and preserve the mixture in a well-stopped bottle." *Br.* The weights used in this process are the avoirdupois, and the measures the Imperial.

This is an aromatic infusion of Peruvian bark and columbo, and has no claim to the title given it in the British Pharmacopœia, as it contains but a minute proportion of iron, insufficient for remedial effect. In consequence of the action of the vegetable principles on the wire, enough of the metal is taken up to impart a greenish black color to the liquor; but the quantity is scarcely appreciable, as the iron appears to be hardly diminished by the process. The mixture may be given as a tonic in the dose of one or two fluidounces (30 or 60 C.c.).

MISTURA FERRI COMPOSITA. *U. S., Br.* *Compound Iron Mixture.* [*Griffith's Mixture.*]

(MỊS-TŪ′RẠ FĔR′RĪ CỌM-PŎŞ′Ị-TẠ.)

Mixture de Griffith, *Fr.;* Griffith's Eisenmixtur, *G.*

"Sulphate of Iron, in coarse powder, *six parts* [or twenty-four grains]; Myrrh, in small pieces, *eighteen parts* [or seventy-two grains]; Sugar, *eighteen parts* [or seventy-two grains]; Carbonate of Potassium, *eight parts* [or thirty-two grains]; Spirit of Lavender, *fifty parts* [or half a fluidounce]; Rose Water, *nine hundred parts* [or eight fluidounces], To make *one thousand parts* [or about nine fluidounces].

Rub the Myrrh, Sugar, and Carbonate of Potassium with the Rose Water, gradually added; then with the Spirit of Lavender, and lastly, with the Sulphate of Iron. Pour the mixture immediately into a bottle, which should be well stopped. This preparation should be freshly made, when wanted for use." *U. S.*

"Take of Sulphate of Iron *twenty-five grains;* Carbonate of Potash *thirty grains;* Myrrh, Refined Sugar, of each, *sixty grains;* Spirit of Nutmeg *four fluidrachms;* Rose Water *nine and a half fluidounces.* Reduce the Myrrh to powder, add the Carbonate of Potash and Sugar, and triturate them with a small quantity of the Rose Water, so as to form a thin paste; then gradually add more Rose Water and the Spirit of Nutmeg, continuing the trituration and further addition of Rose Water until about eight fluidounces of a milky liquid is formed; then add the Sulphate of Iron dissolved in the remainder of the Rose Water, mix them together thoroughly, and preserve the mixture as much as possible from contact with the air." *Br.*

This is very nearly the same with the celebrated tonic or antihectic myrrh mixture of Dr. Griffith. The sulphate of iron is decomposed by the carbonate of potassium, with the production of sulphate of potassium and carbonate of iron; while the excess of the alkaline carbonate forms a saponaceous compound with the myrrh. The mixture is at first of a greenish color, which it loses upon exposure to the air, in consequence of the conversion of the ferrous carbonate into the ferric compound. Mr. C. A. Staples remedies this tendency by making a concentrated myrrh emulsion of such strength that one fluidrachm of it contains the amount of myrrh and carbonate of potassium found in a fluidounce of the officinal mixture, and also a concentrated syrup of sulphate of iron, fifteen minims of which equal one fluidounce of Mistura Ferri Composita. When the latter is called for, the emulsion, properly diluted, is put in a bottle and the requisite quantity of the iron syrup added. (*A. J. P.*, Nov. 1871.) The officinal solution may, however, be kept for some time without change, if the vessel in which it is contained be well closed; but the best plan is to prepare it extemporaneously. The sugar contained in it contributes somewhat to retard the further oxidation of the ferrous salt, and, if considerably increased in amount, would act still more efficiently. The finest pieces of myrrh in lump should be selected, and rubbed down for the occasion with a little of the rose-water; as the powdered myrrh of the shops is often impure, and otherwise does not make a good mixture, owing mainly to its loss of volatile oil.

This mixture is a good tonic in debility of the digestive organs, especially when attended with derangement of the menstrual function. Hence it is used with advantage in chlorosis and hysterical affections. It has been also much employed in the hectic fever of phthisis and chronic catarrh. It is contraindicated by the existence of inflammation of the gastric mucous membrane. The dose is one or two fluidounces (30 to 60 C.c.) two or three times a day.

MISTURA FERRI ET AMMONII ACETATIS. *U. S.* *Mixture of Acetate of Iron and Ammonium.* [*Basham's Mixture.*]

(MỊS-TŪ′RẠ FĔR′RĪ ĔT ẠM-MŌ′NỊ-Ī ĂÇ-Ẹ-TĀ′TĬS.)

"Tincture of Chloride of Iron, *two parts* [or one and a half fluidrachms]; Diluted Acetic Acid, *three parts* [or two fluidrachms]; Solution of Acetate of Ammonium, *twenty parts* [or fourteen fluidrachms]; Elixir of Orange, *ten parts* [or six fluidrachms]; Syrup, *fifteen parts* [or one fluidounce]; Water, *fifty parts* [or six fluidounces], To make *one hundred parts* [or about eight fluidounces]. To the Solution of Acetate of Ammonium, previously mixed with the Diluted Acetic Acid, add the Tincture of Chloride of Iron, and afterwards the Elixir of Orange, Syrup, and Water, and mix the whole thoroughly." *U. S.*

This is one of the new officinal solutions; we think the title unfortunate, however, as it is not a mixture from a pharmaceutical point of view. It is a transparent, bright red liquid; all of the ingredients are in perfect solution, and it is properly a *Liquor.* (See *Mistura.*) It is probably one of the most elegant combinations that has yet been introduced for administering iron in dilute solution. The iron is in the form of an acetate, whilst there is formed, as one of the products of decomposition, a small quantity of chloride of ammonium, the larger proportion of acetate of ammonium, however, remaining undecomposed. The dose is from one-half to one fluidounce (15 to 30 C.c.).

MISTURA GENTIANÆ. *Br.* *Gentian Mixture.*

(MỊS-TŪ′RẠ GĔN-TỊ-Ā′NÆ—jĕn-shẹ-ā′nē.)

Infusum Gentianæ Compositum, *Br.*, 1864; Mistura Gentianæ, *Br.;* Tisane de Gentiane composée, *Fr.;* Enzianaufguss, *G.*

"Take of Gentian Root, sliced, *a quarter of an ounce;* Bitter Orange Peel, cut small, Coriander Fruit, bruised, each, *thirty grains;* Proof Spirit *two fluidounces;* Distilled Water *eight fluidounces.* Macerate the Gentian, Orange Peel, and Coriander in the Proof Spirit, for two hours, then add the Water. Macerate again for two hours, and strain through calico." *Br.*

According to the strict pharmaceutical meaning of mixtures, this preparation does not belong to that class, being in fact a compound infusion, as it was named in the first edition of the British Pharmacopœia; but as it was thought proper, in the present edition, to introduce the old London Compound Infusion of Gentian, it became necessary to find another name for the preparation here given, and it was consequently placed among the mixtures. The British Gentian Mixture is almost identical with *Compound Infusion of Gentian*, formerly officinal in the U. S. Pharmacopœia (see page 795). The dose is a fluidounce (30 C.c.).

MISTURA GLYCYRRHIZÆ COMPOSITA. *U. S.* *Compound Mixture of Glycyrrhiza.* [*Brown Mixture.*]

(MỊS-TŪ′RẠ GLY̆Ç-ỴR-RHĪ′ZÆ CỌM-PŎŞ′Ị-TẠ.)

Mixture de Réglisse, *Fr.;* Lakritzen-Mixtur, *G.*

"Pure Extract of Glycyrrhiza, *three parts* [or half an ounce av.]; Sugar, *three parts* [or half an ounce av.]; Acacia, in fine powder, *three parts* [or half an ounce av.]; Camphorated Tincture of Opium, *twelve parts* [or two fluidounces]; Wine of Antimony, *six parts* [or one fluidounce]; Spirit of Nitrous Ether, *three parts* [or half a fluidounce]; Water, *seventy parts* [or twelve fluidounces], To make *one hundred parts* [or about one pint]. Rub the Extract of Glycyrrhiza, Sugar, and Acacia with the Water, gradually added; then add the other ingredients, and mix the whole thoroughly." *U. S.*

This is an exceedingly popular cough mixture, which was made officinal in the U. S. Pharmacopœia of 1850. The substitution in the present officinal process of pure Extract of Liquorice for the former impure powdered extract is undoubtedly an improvement; although by the change the mixture has lost somewhat its original appearance, and a large proportion of the precipitate which gave it a distinctive character. The spirit of nitrous ether is probably useful by somewhat retarding decomposition. The dose is a tablespoonful (15 C.c.) for an adult; a teaspoonful (3·75 C.c.) for a child two years old. It should be well shaken when administered.

MISTURA GUAIACI. *Br.* *Guaiac Mixture.*

(MỊS-TŪ′RẠ GUĀ′IẠ-CĪ—gwā′yạ-sī.)

Emulsio Resinæ Guaiaci, Emulsion de Resine de Gaïac, Lait de Gaïac, *Fr.;* Guajak-Emulsion, *G.*

"Take of Guaiacum Resin, in powder, Refined Sugar, of each, *half an ounce* [avoirdupois]; Gum Acacia, powdered, *a quarter of an ounce* [avoird.]; Cinnamon Water, *one pint* [Imperial measure]. Triturate the Guaiacum with the Sugar and the Gum, adding gradually the Cinnamon Water." *Br.*

For the changes of color which the Guaiac in this mixture undergoes, and which it produces in other substances, see *Guaiaci Resina*, page 729. From one to four tablespoonfuls (15–60 C.c.) may be given for a dose, repeated two or three times a day, or more frequently.

MISTURA MAGNESIÆ ET ASAFŒTIDÆ. *U. S.* *Mixture of Magnesia and Asafetida.* [*Dewees' Carminative.*]

(MỊS-TŪ'RẠ MĂG-NĒ'ṢỊ-Æ ĔT ĂS-Ạ-FŒT'Ị-DÆ.)

Mixture de Magnésie et d'Asafétide, *Fr.;* Magnesia und Stinkasant-Mixtur, *G.*

"Carbonate of Magnesium, *five parts* [or three hundred and sixty grains]; Tincture of Asafetida, *seven parts* [or ten fluidrachms]; Tincture of Opium, *one part* [or seventy-five minims]; Sugar, *ten parts* [or one and a half ounces av.]; Distilled Water, *a sufficient quantity,* To make *one hundred parts* [or one pint]. Rub the Carbonate of Magnesium and Sugar, in a mortar, with the Tincture of Asafetida and Tincture of Opium. Then gradually add enough Distilled Water to make the mixture weigh *one hundred parts* [or measure one pint]." *U. S.*

This preparation has been used for many years, yet there seems to be no good reason for making it officinal. The quantity of tincture of opium is considerably less than that usually employed in most of the formulas extant; there is but one per cent. in the officinal mixture, whilst the usual quantity is three per cent. This, however, is a gain in the right direction, considering the indiscriminate popular uses to which carminatives are generally put. The dose is twenty minims (1·25 C.c.).

MISTURA POTASSII CITRATIS. *U. S.* *Mixture of Citrate of Potassium.* [*Neutral Mixture.*]

(MỊS-TŪ'RẠ PỌ-TĂS'SỊ-Ī CĪ-TRĀ'TĬS.)

Mistura Neutralis; Potion gazeuse (effervescente), *Fr.*

"Fresh Lemon Juice, strained, *one hundred parts* [or four fluidounces]; Bicarbonate of Potassium, about *ten parts,* or, *a sufficient quantity.* Add the Bicarbonate of Potassium gradually to the Lemon Juice until it is neutralized. This preparation should be freshly made when wanted for use." *U. S.*

In this preparation the potassium of the bicarbonate unites with the citric acid of the lemon juice, and carbonic acid is liberated. The result, therefore, is a solution of citrate of potassium in water impregnated with carbonic acid, with the flavor from the lemon juice. The solution has a greenish yellow color, and it is not usually dispensed in a perfectly transparent condition, owing to the difficulty of filtering out the very fine albuminous precipitate found in lemon juice. In the U. S. Pharmacopœia of 1850, bicarbonate of potassium was substituted for the carbonate before used. About 48 grains of the crystals of the bicarbonate, 33 grains of the pure and perfectly dry carbonate, or 45 grains of the hydrated carbonate found in commerce, are sufficient to saturate a fluidounce of good lemon juice; but the strength of the juice is variable, and the carbonate is apt to absorb moisture from the air, so that precision as to quantities cannot be readily attained. Hence the propriety of the direction in the process for the neutral mixture, to add the alkaline carbonate to saturation. The point of saturation may be determined by the cessation of effervescence, by the absence of either an acid or an alkaline taste, and still more accurately by litmus paper, which should not be rendered bright red by the solution, or blue if previously reddened by an acid.

The inequality of strength in the lemon juice renders the neutral mixture prepared with it more or less uncertain; though, if the apothecary select ripe and sound fruit, and express the juice himself, the preparation will be found to approach sufficiently near a uniform standard for all practical purposes. Nevertheless, if the physician wish absolute precision, he may order the neutral mixture to be made with crystallized citric acid, as directed in Liquor Potassii Citratis; or he may pursue the following plan, suggested in former editions of this work. Dissolve two drachms of bicarbonate of potassium in two fluidounces of water; saturate the solution with good fresh lemon juice, and strain; and, lastly, add enough water to make the mixture measure six fluidounces. A fluidounce is the dose of this solution.

Another mode of preparing the neutral mixture, officinal in 1850, but omitted in the present edition of the Pharmacopœia, is simply to dissolve citrate of potassium in water, in the proportion of six drachms to half a pint. The preparation may be improved in flavor, and rendered more agreeable to the stomach, by rubbing a drop or two of oil of lemon with the six drachms of citrate before dissolving it, and substituting carbonic acid water for water as the menstruum; but this can be regarded only as a substitute, and is not equal to the officinal preparation.

EFFERVESCING DRAUGHT. Under this name, the citrate of potassium is often prepared extemporaneously, and given in the state of effervescence. The most convenient mode of exhibition is to add to a fluidounce of a mixture consisting of equal parts of lemon juice and water, half a fluidounce of a solution containing fifteen grains of carbonate of potassium, or twenty grains of the bicarbonate. Should effervescence not occur, as sometimes happens, when the carbonate is used, in consequence of the weakness of the lemon juice, more of the juice should be added; as, unless sufficient acid is present to neutralize the potassa, part of the carbonate passes into the state of bicarbonate, and the gas is thus prevented from escaping. A solution of citric acid of the strength of that directed in the officinal formula may be substituted for lemon juice, if the latter is not to be had. The fifteen grains of carbonate of potassium above mentioned are scarcely sufficient to saturate the lemon juice, if of ordinary strength; but a little excess of the acid renders the preparation more agreeable to the taste. Some prefer the bicarbonate in the preparation of the effervescing draught, because it will always effervesce with lemon juice, no matter what may be the strength of the latter. But this is an objection. The carbonate serves, by the absence of effervescence, to indicate when the lemon juice is very weak in acid; and the defect may then be easily remedied by the addition of more juice. When the bicarbonate is used, if there should be a deficiency of acid, it is not discovered; and the patient takes a considerable portion of undecomposed bicarbonate, instead of the full quantity of citrate intended.

Medical Properties and Uses. The solution of citrate of potassium has long been used under the name of *neutral mixture*, *saline mixture*, or *effervescing draught.* It is an excellent refrigerant diaphoretic, adapted to almost all cases of fever with a hot dry skin, and especially to the paroxysms of our remittent and intermittent fevers. The *effervescing draught* is peculiarly useful. The carbonic acid serves to cover the taste of the citrate of potassium, and adds to the diaphoretic powers of the salt its own cordial influence upon the stomach. No preparation with which we are acquainted is equally efficacious in allaying irritability of stomach and producing diaphoresis in our remittent fevers. It is usually also very grateful to the patient. In order to increase the sedative and diaphoretic properties of the neutral mixture, one-twenty-fourth to one-sixteenth of a grain of tartar emetic, or one-fourth to one drop of tincture of aconite, may be usefully added to each dose in sthenic cases; and a little sweet spirit of nitre will be found an excellent adjuvant in fevers with nervous disturbance. Should the solution irritate the bowels, it may be combined with an opium preparation. Sugar may be added if desired.

The dose of the officinal solution is half a fluidounce (15 C.c.), which should be somewhat diluted when taken. The whole of each effervescing draught, prepared as above stated, is to be taken at once. Each dose should be repeated every one, two, or three hours, according to the urgency of the symptoms.

MISTURA RHEI ET SODÆ. *U.S.* *Mixture of Rhubarb and Soda.*

(MỊS-TŪ′RẠ RHĒ′Ī ĔT SŌ′DÆ.)

"Bicarbonate of Sodium, *thirty parts* [or half an ounce av.]; Fluid Extract of Rhubarb, *thirty parts* [or three fluidrachms]; Spirit of Peppermint, *thirty parts* [or five fluidrachms]; Water, *a sufficient quantity*, To make *one thousand parts* [or one pint]. Dissolve the Bicarbonate of Sodium in *five hundred parts* [or half a pint] of Water. Add the Fluid Extract of Rhubarb and the Spirit of Peppermint, and lastly, enough Water to make the mixture weigh *one thousand parts* [or measure one pint]." *U. S.*

This is a new officinal mixture. A preparation closely resembling it has been used in Brooklyn, N. Y., the formula of which was published by Dr. E. R. Squibb. The ingredients in the original preparation were Fluid Extract of Ipecac 51 minims, Fluid Extract of Rhubarb 256 minims, Bicarbonate of Sodium 512 grains, Glycerin 12 f℥, Peppermint Water 2 pints. The officinal mixture may be given to children as a stomachic and carminative in the dose of from one half to one teaspoonful (1·9 to 3·75 C.c.) two or three times a day.

MISTURA SCAMMONII. *Br.* *Scammony Mixture.*

(MIS-TŪ'RA SCAM-MŌ'NI-Ī.)

Emulsio Purgans cum Scammonia, Lac Scammonii; Emulsion purgative avec la Scammonée, Mixture de Scammonée, *Fr.;* Scammonium-Emulsion, *G.*

"Take of Resin of Scammony *four grains;* Milk *two* [*fluid*]*ounces.* Triturate the Resin of Scammony with a little of the Milk, and continue the trituration, gradually adding the remainder of the Milk, until a uniform emulsion is obtained." *Br.*

This officinal is an imitation of a mixture recommended by Planche. The resin of scammony mixes admirably with the vehicle, and forms an emulsion scarcely distinguishable in appearance or taste from rich milk. Of course, it should be prepared only when wanted for immediate use. The whole is to be taken for a dose.

MISTURA SENNÆ COMPOSITA. *Br.* *Compound Mixture of Senna.*

(MIS-TŪ'RA SĔN'NÆ COM-PŎS'I-TA.)

Tisane de Séné composée, *Fr.;* Senna-Aufguss, *G.*

"Take of Sulphate of Magnesia *four ounces* [avoirdupois]; Extract of Liquorice *half an ounce* [avoird.]; Tincture of Senna *two and a half fluidounces* [Imperial measure]; Compound Tincture of Cardamoms *ten fluidrachms;* Infusion of Senna *a sufficiency.* Dissolve the Sulphate of Magnesia and Extract of Liquorice in fourteen fluidounces [Imp. meas.] of the Infusion of Senna, with the aid of a gentle heat, then add the Tinctures, and sufficient Infusion of Senna to make one pint [Imp. meas.]." *Br.*

This is a new form of compound infusion of senna, called commonly the *black draught.* We prefer the form given under *Infusum Sennæ,* as being more easily prepared, and quite as efficient. The dose of this mixture is given in the Br. Pharmacopœia as from one to one and a half fluidounces (30 to 45 C.c.).

MISTURA SPIRITUS VINI GALLICI. *Br.* *Mixture of Spirit of French Wine. Brandy Mixture.*

(MIS-TŪ'RA VĪ'NĪ GĂL'LI-CĪ.)

Mixture de Cognac, *Fr.;* Branntwein-Mixtur, *G.*

"Take of Spirit of French Wine [Brandy], Cinnamon Water, of each, *four fluidounces;* the Yolk of two eggs; Refined Sugar *half an ounce* [avoirdupois]. Rub the Yolk and Sugar together, then add the Cinnamon Water and Spirit." *Br.*

This is a nutritious and stimulant draught, applicable to the sinking stage of low forms of fever, but is scarcely entitled to a place in the Pharmacopœia. The dose of it is one or two fluidounces (30 to 60 C.c.).

MORI SUCCUS. *Br.* *Mulberry Juice.*

(MŌ'RĪ SŬC'CŬS.)

"The juice of the ripe fruit of Morus nigra (Linn.)." *Br.* (*Nat. Ord.* Urticaceæ.)

Succus Mororum; Suc de Mûres, Mûres, *Fr.;* Schwarze Maulbeeren, Maulbeersaft, *G.;* Morone, *It.;* Moras, *Sp.*

Gen. Ch. MALE. *Calyx* four-parted. *Corolla* none. FEMALE. *Calyx* four-leaved. *Corolla* none. *Styles* two. *Calyx* berried. *Seed* one. *Willd.*

Morus nigra. Willd. *Sp. Plant.* iv. 36; *B. & T.* 229. This species of Mulberry is distinguished by its cordate-ovate or lobed, unequally toothed, and scabrous leaves. It is a tree of middle size, supposed to have been brought originally from Persia into Italy, and thence spread over Europe and America. Its leaves afford food for the silk-worm; and the bark of the root, which is bitter and slightly acrid, has been employed as a vermifuge, especially in cases of the tape-worm, in the dose of two drachms infused in eight ounces of boiling water. The juice of the fruit is the officinal portion.

The fruit is oblong-oval, of a dark reddish purple almost black color, and consists of numerous minute berries, united together and attached to a common receptacle, each containing a single seed, the succulent envelope of which is formed by the calyx. It is inodorous, has a sweet, mucilaginous, acidulous taste, and abounds in a deep red juice. In an analysis made by H. Van Hees, 100 parts of mulberries yielded the following percentage results. Glucose and uncrystallizable sugar, 9·19; free acid (supposed to be *malic* with admixture of *tartaric*), 1·86; albuminous matter, 0·39; pectic matter, fats, salts, and gum, 2·03; ash, 0·57; insoluble matters (the seeds, pectose, cellulose, etc.), 1·25; water, 84·71. In amount of grape sugar, the mulberry is surpassed only by the cherry, 10·79, and the grape, 10·6 to 19·0. (*Pharmacographia*, 2d ed., p. 545.)

Medical Properties and Uses. Mulberries are refreshing and laxative, and serve to prepare a grateful drink well adapted to febrile cases. A syrup is made from their juice, and used as an agreeable addition to gargles in inflammation of the throat. They are, however, more used as food than as medicine. Our native mulberry, the fruit of *Morus rubra*, is quite equal to that of the imported species. *Morus alba*, originally from China, and now extensively cultivated as a source of food for the silk-worm, bears a white fruit, which is sweeter and less grateful than the others.

Off. Prep. Syrupus Mori, *Br.*

MORPHINA. *U. S.* *Morphine.*

$C_{17}H_{19}NO_3.H_2O$; 303. (MÖR-PHĪ'NẠ.) $C_{34}H_{19}NO_6.2HO$; 303.

"An alkaloid prepared from Opium." *U. S.*

Morphia, *U. S.* 1870; Morphinum, *P.G.;* Morphium, Morphina; Morphine, *Fr.;* Morphin, *G.*

The U. S. Pharmacopœia no longer contains a process for the extraction of morphine; that of 1870 is given below.*

Various processes for preparing morphine have been employed. In most of them the morphine is extracted from opium by maceration with water either pure or acidulated, is then precipitated by ammonia, and afterwards purified by the agency of alcohol, or by repeated solution in a dilute acid and precipitation.

Sertürner, the discoverer of morphine, made an infusion of opium in distilled water, precipitated the morphine by ammonia in excess, dissolved the precipitate in dilute sulphuric acid, precipitated anew by ammonia, and purified by solution in boiling alcohol, and crystallization.†

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* "Take of Opium, sliced, *twelve troyounces;* Water of Ammonia *six fluidounces;* Animal Charcoal, in fine powder, Alcohol, Distilled Water, each, *a sufficient quantity.* Macerate the Opium with four pints of Distilled Water for twenty-four hours, and, having worked it with the hand, again macerate for twenty-four hours, and strain. In like manner, macerate the residue twice successively with the same quantity of Distilled Water, and strain. Mix the infusions, evaporate to six pints, and filter; then add five pints of Alcohol, and afterwards three fluidounces of the Water of Ammonia, previously mixed with half a pint of Alcohol. After twenty-four hours, pour in the remainder of the Water of Ammonia, mixed, as before, with half a pint of Alcohol; and set the liquid aside for twenty-four hours that crystals may form. To purify these, boil them with two pints of Alcohol until they are dissolved, filter the solution, while hot, through Animal Charcoal, and set it aside to crystallize." *U. S.*

† The process of the French Codex is a modification of that of Sertürner. It is as follows. Take of opium 1000 parts, solution of ammonia a sufficient quantity. Exhaust the opium, by means of cold water, of all its parts soluble in that menstruum. For that purpose, it is sufficient to treat the opium, four times consecutively, with ten parts of water, to one of the drug, provided care be taken to macerate the opium for some hours, and to work it with the hands. Filter the liquors, and evaporate them to a quarter of their volume. Then add sufficient ammonia to render the liquor very sensibly alkaline. Boil for some minutes, always maintaining a slight excess of ammonia. Upon cooling, the morphine, impure and much colored, will be precipitated in granular crystals, which are to be washed with cold water. Reduce this colored morphine to powder, macerate it for twelve hours in alcohol of 24° Cartier [sp. gr. about 0·900]; then decant the alcoholic liquid; dissolve the residuary morphine, already in great measure deprived of color by the cold alcohol, in boiling alcohol of 33° Cartier [sp. gr. about 0·850]; add to the solution a little animal charcoal, and filter. Upon cooling, the morphine crystallizes in colorless needles. In this state the morphine always retains some narcotine, to free it from which, boil it with sulphuric ether in a matrass with a long neck surmounted by a refrigeratory.

The process of the U. S. P. 1870 is an improvement upon the foregoing, and is essentially that of Dr. Edward Staples (*Journal of the Philadelphia College of Pharmacy*, i. 15).

Magnesia was employed by Robiquet instead of ammonia. But his process was soon abandoned,

Properties. Morphine crystallizes from alcohol in the form of small, colorless, shining crystals. It is officinally described as follows. "Colorless or white, shining, prismatic crystals, or a crystalline powder, permanent in the air, odorless, having a bitter taste, and an alkaline reaction. Very slightly soluble in cold water; soluble in 500 parts of boiling water; in 100 parts of alcohol at 15° C. (59° F.), and in 36 parts of boiling alcohol; also in 13 parts of boiling absolute alcohol; almost insoluble in ether and very slightly soluble in chloroform. When heated to 120° C. (248° F.), the crystals lose their water of crystallization (5·94 per cent.). When heated on platinum foil they fuse, then char, and are finally completely dissipated. Nitric acid first reddens Morphine and then renders it yellow. With test-solution of ferric chloride, Morphine yields a blue color which is changed to green by an excess of the reagent, and is destroyed by free acids or alcohol, but not by alkalies. A solution of Morphine, acidified with acetic or sulphuric acid, is not precipitated by tannic acid. On adding 20 parts of colorless solution of soda or of potassa to 1 part of Morphine, a clear, colorless solution should result, without a residue (abs. of other alkaloids). Morphine yields a colorless solution with cold, concentrated sulphuric acid, which should not acquire more than a reddish tint by standing for some time, and which should not assume a purple or violet, but merely a greenish color on the addition of a small crystal of bichromate of potassium (abs. of and difference from strychnine, brucine, etc.)." *U. S.*

Heated in the open air, morphine burns with a bright flame, and at a red heat is wholly dissipated. In the products resulting from the combustion of opium or morphine, this alkaloid may be detected, proving that it is partly volatilized, when burned. (Descharmes, *Arch. Gén.*, Fév. 1855, p. 240.) According to Mr. Guy, morphine melts at 165·5° C. (330° F.), and sublimes at 171° C. (340° F.), leaving a carbonaceous residue. (*P. J. Tr.*, 1868, p. 375.) Morphine in solution is to a considerable extent absorbed by animal charcoal, which, though it will part with most of the alkaloid to alcohol, cannot be wholly deprived of it by repeated washings with that liquid, whether cold or hot. (Lefort, *Journ. de Pharm.*, Août, 1861, p. 98.) Its solution restores the blue color of litmus paper reddened by acids, and turns the yellow of turmeric to brown. With the acid it forms salts, which are generally soluble, and are decomposed by the alkalies. It is dissolved also by the fixed and vola-

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as it was found to occupy more time, to require a greater consumption of alcohol, and to be attended with a greater loss of morphine in consequence of the previous washing, than the processes in which ammonia was employed as the precipitant. For an account of it the reader is referred to former editions of this work.

A process for extracting morphine without the employment of alcohol was devised by MM. Henry, Jr., and Plisson. The opium was exhausted by water acidulated with hydrochloric acid; the resulting solution was sufficiently concentrated, then filtered, and decomposed by ammonia; the precipitate was washed and treated with hydrochloric acid to saturation; and the hydrochloric solution was boiled with animal charcoal, filtered, and evaporated to the point of crystallization. The crystals of hydrochlorate of morphine thus obtained were pressed, purified by repeated solution and crystallization, and finally decomposed by ammonia. (*Journ. de Chem. Méd.*, Mars, 1828.)

Somewhat similar to this is the process of Gregory, of Edinburgh, by which hydrochlorate of morphine is obtained by double decomposition between chloride of calcium and the meconate of morphine of the opium, and the hydrochlorate thus obtained is decomposed by ammonia. This process was adopted by the Ed. College for the preparation of hydrochlorate of morphine, and is retained in the present Br. Pharmacopœia. See *Hydrochlorate of Morphine.*

Mohr has proposed a process founded on the solubility of morphine in water mixed with lime, which he recommends as the shortest and easiest method of procuring the alkaloid, without the use of alcohol, and without the possibility of contamination from narcotine. Opium is three or four times successively macerated with three parts of water, and each time strongly expressed. The liquors are then added to a boiling-hot milk of lime, containing a quantity of lime equal to about a sixth or a quarter of the opium used; and the mixture is boiled for a few minutes. It is then strained through linen, and the residue washed with boiling water and expressed. The whole of the narcotine is left behind, as not a trace of it can be discovered in the filtered liquor. The liquor thus obtained is evaporated till reduced to double the weight of the opium, then quickly filtered through paper, and heated to ebullition. Chloride of ammonium is now added to it in the proportion of 1 part to 16 of the opium used; and the morphine is abundantly precipitated. The use of animal charcoal is unnecessary in the process, as the lime acts even more powerfully as a decolorizing agent. The crystallized morphine obtained is somewhat colored, but may be rendered pure by solution in dilute hydrochloric acid, boiling with milk of lime, filtration, and precipitation by chloride of ammonium. (*Annal. der Pharm.*, xxxv. 119.) Various other processes, or modifications of those above described, have been proposed; but, for the preparation of small quantities of morphine by the apothecary, none are probably better than that of the U. S. P. 1870.

tile oils. The solutions of potassa and soda also dissolve morphine, which is precipitated slowly from them on exposure to the air, in consequence of the absorption of carbonic acid. Solution of ammonia has to a certain extent the same solvent power; and hence the necessity, in precipitating morphine by this alkali, not to employ it in great excess. Solution of iodine with iodide of potassium precipitates the salts of morphine in aqueous solution. With chlorine water morphine and its salts assume an orange color, and the same effect is produced on them by solution of chlorinated soda. (Fairthorne, *A. J. P.*, xxviii. 9.) By the contact of nitric acid, they assume a blood-red color, which ultimately changes to yellow; and this is one of the tests of morphine; but, as the same change of color is produced with brucine and impure strychnine, it cannot be relied on in the absence of other evidence. Nitric acid also produces a red color with oil of cloves, but in this case the red does not change to yellow. When added to a solution of iodic acid, or an acidulous iodate, morphine and its salts redden the liquid and set iodine free. (*Serullas.*) This is a very delicate test, but is not conclusive, as various other organic substances act in a similar manner. M. J. Lefort, however, has found that the color produced by these substances is removed by ammonia, while the redness produced with morphine is greatly intensified by addition of that alkali. This test, thus modified by the addition of ammonia, is so delicate that, according to M. Lefort, it will detect one part of morphine in 10,000 parts of a liquid holding it in solution. (*Journ. de Pharm.*, Août, 1861, p. 113.)* Husemann's test consists in leaving morphine or its salt in contact with concentrated sulphuric acid for 12 or 15 hours, or in heating for half an hour with the acid to 100° C. (212° F.), and then adding either a little nitric acid, a nitrate or chlorate or chlorine water, or chlorinated soda, when a beautiful bluish or reddish violet color, passing into deep blood-red and gradually paling, is developed. The presence of small quantities of coloring matter does not prevent this reaction, if chlorinated reagents are selected. A. Husemann claims that this test will recognize the hundredth part of a milligramme of the alkaloid. (*A. J. P.*, xlvii. 210.) According to R. Schneider, a very delicate test is performed by putting a drop of the suspected liquid on a plate, saturating with sugar, and putting alongside of it a drop of sulphuric acid; if morphine be present, a very intense purple will be developed at the point of contact, passing after half an hour into violet, then bluish green, and finally dirty yellow. (*Journ. de Pharm.*, 4e sér., xviii. 221.) According to H. Weppen, the delicacy of this test is much increased by the addition of a minute quantity of bromine water to the solution. Codeine and aconitine are stated to give the same reaction. (*Ibid.*, 4e sér., xix. 246.)

Froehde's reagent (a fresh solution of ·005 Gm. sodium molybdate in 1 C.c. of pure concentrated sulphuric acid) strikes with morphine and its salts a beautiful blue violet color, passing into blue, then green, finally back to bluish violet. This reaction is stated to be delicate but not characteristic. Prof. A. B. Prescott gives a thorough *résumé* of the views of investigators on this test in *A. J. P.*, 1876, p. 59. In the presence of sulphuric acid morphine exhibits surprising powers as a reducing agent. Among the most notable instances of deoxidation may be mentioned those of the oxide of silver, hydrated oxide of bismuth, the acids of tin, tungsten, vanadium, titanium, and molybdenum. A solution of titanic acid in concentrated sulphuric acid is one of the most delicate reagents for morphine. An intense brown-red to violet color is produced if titanic acid is added to concentrated sulphuric acid containing a trace of morphine in solution. (Flückiger, *N. R.*, Feb. 1880. See also *N. R.*, 1881, p. 237.) M. H. Kalbrunner states that the most sensitive test is made with a solution (No. 1) of crystallized ferric chloride (thirty grains to four fluid-drachms of distilled water) and a fresh solution (No. 2) of ferricyanide of potassium (two grains to four drachms). To the suspected liquor five or six drops of No. 1 are added, and afterwards three or four drops of No. 2. If morphine be present, a color varying from deep blue to pale blue and bluish green, according to the proportion of the alkaloid, is developed. Neither gum, sugar, alcohol, glycerin, atropine, quinine, nor strychnine interferes with this test. An excess of alkali does so by decomposing the perchloride of iron. This test depends upon the fact that the ferricyanide of potassium solution is reduced by morphine to the ferrocyanide. It is stated that even $\frac{1}{60000}$ of one per cent. of morphine can be detected. (*Ibid.*, p. 248.)

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* *Stas's method of extracting the Alkaloïds from Mixtures.* To separate the alkaloid from foreign matters, the mixture is treated alternately with water and alcohol in different degrees of concentration; the liquors thus obtained are filtered; tartaric or oxalic acid, but preferably the former, is added in excess; the mixture is heated to 71·1° or 76·6° C. (160° or 170° F.); the whole is placed upon a filter; the deposited matter is washed with concentrated alcohol; the alcoholic solution is evaporated at a temperature not exceeding 35° C. (95° F.); the residue is introduced into a small bottle; a solution of caustic potassa or soda is added, little by little, and afterwards four or five times the measure of ether; the mixture is shaken and then allowed to stand; and, finally, the ether is decanted, and yields the alkaloid by spontaneous evaporation. Stas included morphine among the alkaloids thus separable, though known to be nearly insoluble in ether; but Lefort has shown that the process is not applicable to that alkaloid. (*Journ. de Pharm.*, Août, 1861, p. 99.) M. Alfred Valser, however, has ascertained that, if acetic ether be substituted for ether, the process is equally applicable to morphine. (See *A. J. P.*, Sept. 1864, p. 439.)

M. Siebold heats gently the suspected substance with some drops of concentrated sulphuric acid and a small quantity of chemically pure perchlorate of potassium; a deep brown color is produced if morphine be present. (*P. J. Tr.*, Oct. 1873.) According to H. S. Wellcome, one part of morphine in ten thousand parts of water can be recognized by chlorine water, provided care be exercised not to decolorize by an excess of the reagent; the color varies from light orange-red to deep red according to the proportion of morphine present. Brucine is the only other alkaloid giving the same reaction; but, while the color produced by morphine is discharged by excess of acid, that caused by brucine is not affected. (*A. J. P.*, 1874, p. 305.) To discover morphine in the presence of quinine, see *Ibid.*, p. 361. Morphine and its salts assume a fine blue color with ferric chloride; at least this is true of the alkaloid, its sulphate, acetate, and oxalate; and the same effect will be produced by the other salts, if previously decomposed by an alkali; but that this test should be satisfactory, it is necessary to operate on morphine either in powder or concentrated solution. (*Lefort.*) Water, acids, and alkalies, added in large quantity to the blue compound formed, destroy its color. According to Pelletier, moreover, there occasionally exists in opium a principle called by him *pseudomorphine*, which becomes red under the action of nitric acid, and changes ferric salts blue, and yet is destitute of poisonous properties; so that the occurrence of these phenomena, in any medicolegal case, cannot be considered as certain evidence of the presence of morphine. (See *A. J. P.*, viii. 77.) Auric chloride precipitates morphine first yellow, then bluish, and lastly violet. (*Larocque* and *Thibierge.*) Peroxide of copper and oxide of silver are precipitated by morphine from their ammoniacal solutions. (*Chem. Gaz.*, No. 367, p. 54.) A solution of acetate or sulphate of morphine, containing only one part of the salt in 100, precipitates silver from a solution of the nitrate of that metal. (*Horsley.*) Morphine is precipitated from its solutions by potassa or soda, and redissolved by an excess of the alkali. Infusions of galls and other vegetable substances containing tannic acid precipitate morphine in the state of a tannate, which is soluble in acetic acid; but, according to Dublanc, the alkaloid is not precipitated by pure gallic acid. If ammonia be added to a mixture of the solutions of chlorine and morphine, a dark brown color is produced, which is destroyed by a further addition of chlorine.

It has been already stated that morphine, obtained in the ordinary manner, contains a considerable portion of narcotine. It is highly probable that this ingredient exercises no influence, either beneficial or injurious, upon the operation of the morphine; but, as the contrary has been supposed, various methods have been employed for separating it. The simplest and easiest is to submit the mixture to the action of ether, which dissolves the narcotine and leaves the morphine. The agency of acetic acid may also be resorted to. Distilled vinegar, or diluted acetic acid of the same strength, will dissolve the morphine and leave the narcotine, and the former may be recovered from the acetic solution by saturating the acid with ammonia. Another mode is to dissolve the mixed bases in strong acetic acid (of 7° Baumé, or sp. gr. 1·0511, for example), and expose the solution to heat. The narcotine is deposited, and the morphine, remaining in solution, may be precipitated by diluting the liquid and adding ammonia. (*Journ. de Pharm.*, xvii. 640.) Wittstock advises one of the following modes. Dissolve the impure morphine in dilute hydrochloric acid, evaporate to the point of crystallization, and strongly express the crystals, which consist solely of the hydrochlorate of morphine, the narcotine being retained in the mother-waters:—or saturate the hydrochloric solution with common salt, which will render the liquor milky, and cause the narcotine to separate after some days; then precipitate the morphine by ammonia:—or pour into the diluted hydrochloric solution a weak ley of caustic potassa, which, if in slight excess, will dissolve the morphine at the moment of its separation, while the narcotine is precipitated; then immediately filter the liquor, and separate the morphine by neutralizing the alkali. If the potassa is in great excess, a little of the narcotine is redissolved. (Berzelius, *Traité de Chim.*) Mohr recommends to dissolve the morphine in dilute hydrochloric acid, and to boil the solution with lime, which throws down the narcotine and holds the morphine dissolved. The liquid being filtered yields the morphine upon the addition of chloride of ammonium. (*Annal. der Pharm.*, xxv. 123.)

The proportion of pure morphine which Turkey opium is capable of affording varies from 9 per cent. or less, to 20 per cent., according to the quality of the drug; but much less than the least quantity mentioned is often obtained, in consequence of the incomplete exhaustion of the opium, the loss in the process for preparing it, or inferiority in the quality of the drug. (See *Opium.*)

Medical Properties. There can be no doubt that morphine is the chief narcotic principle of opium, from which, however, it differs somewhat in its mode of action. The difference probably arises in part from the peculiar state of combination in which morphine exists in opium, but chiefly from other narcotic principles being associated with it. That the former is in some degree the cause, would appear from the circumstance that, long before the discovery of this alkaloid, preparations of opium were habitually used, in which the properties of the medicine were somewhat similarly modified by the agency of vinegar, lemon-juice, or other vegetable acid. In consequence of its insolubility in water, morphine in its pure state is less certain in its effects than some of its saline compounds; as the mode and degree of its action must in some measure depend on the presence or absence of acid in the stomach, and perhaps on the peculiar character of the acid. Its salts are therefore always preferred. The acetate, sulphate, and hydrochlorate have been employed. Between these there is a great similarity of action, and what may be said of one, in regard to its therapeutical effects, will equally apply to the others. They have the anodyne, soporific, and diaphoretic properties of opium, but are less stimulant, and less disposed to constipate the bowels. The morphine salts are perhaps less apt to cause disagreeable after-effects than is opium, but the deodorized tincture is certainly preferable to them for most purposes. A great advantage which they possess is the convenience of their external application to blistered surfaces, and the certainty of their effects when thus applied. In cases which do not admit of the internal use of opium or its preparations, the acetate or sulphate of morphine, sprinkled, in triple the ordinary dose, upon a blistered surface denuded of the cuticle, will be found to exercise upon the system all the influence it is capable of exerting when taken into the stomach. Applied in this manner, these salts are peculiarly useful in relieving violent neuralgic pains, and in controlling obstinate sickness of the stomach. When intended to act on the system through the medium of the skin, they should be applied preferably to the epigastrium; when to act locally, as near the affected part as possible. Solutions of the salts of morphine also sometimes operate very favorably, both generally and locally, when injected, by means of a hypodermic syringe, into the areolar tissue beneath the skin.[*] Given

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[*] *Tartrate of Morphine.* This has been recommended by Erskine Stuart (1880) as the salt particularly suitable for hypodermic injections, because more concentrated solutions can be obtained of it than of the hydrochlorate, sulphate, or acetate. It is very soluble in water and alcohol, forms neutral, wart-like crystals consisting of needles, and is made by dissolving 10 parts crystallized morphine and 2·5 parts (or sufficient) tartaric acid in 40 parts hot distilled water, and evaporating in a moderately warm place. It must be superior to the sulphate for hypodermic purposes, because of its greater solubility.

Hydrocyanate of Morphine. Prof. J. M. Maisch has noticed that when a soluble salt of morphine is added to a solution of soluble cyanide, crystals of hydrocyanate of morphine form. This salt, although sparingly soluble in water, is freely dissolved by that liquid when acidulated. It is eviin doses nearly but not quite sufficient to produce sleep, they sometimes occasion a very troublesome condition of the brain, amounting almost to delirium; but this always subsides spontaneously, or vanishes immediately upon the increase of the dose. An embrocation for external use may be made by dissolving hydrochlorate or acetate of morphine in glycerin, which takes up about 5 per cent. of these salts at common temperatures, and more with the aid of heat. (*Journ. de Pharm.*, xxvi. 90.) Oleic acid has also been proposed as a vehicle for morphine externally used, as it dissolves both the alkaloid and its salts perfectly in considerable proportion. A liniment has been proposed, consisting of 300 parts of oleic acid and 1 of morphine, scented with a little oil of bergamot. (*Ibid.*, xxvi. 302.)

The toxicology of morphine is identical with that of opium.

As the proportion of acid necessary to neutralize morphine is very small, the dose of the alkaloid is the same as that of its salts. One-fourth of a grain (0·016 Gm.) may be considered about equivalent to a grain of opium of the medium strength.

MORPHINÆ ACETAS. *U.S.* *Acetate of Morphine.*

(MÖR-PHĪ'NÆ A̤-CĒ'TĂS.)

$C_{17}H_{19}NO_3.HC_2H_3O_2.3H_2O$; 399. $C_{34}H_{19}NO_6.C_4H_4O_4,6HO$; 399.

"Acetate of Morphine should be kept in small, well-stopped vials." *U. S.*

Morphiæ Acetas, *Br.*, *U. S.*, 1870; Acetate of Morphia; Morphinum Aceticum, *P.G.;* Acetas Morphicus; Acétate de Morphine, *Fr.;* Essigsaures Morphin, *G.*

A process for this salt is no longer officinal; that of U. S. P. 1870 is appended.*

"Take of Hydrochlorate of Morphia *two ounces* [avoirdupois]; Solution of Ammonia, Acetic Acid, Distilled Water, of each, *a sufficiency*. Dissolve the Hydrochlorate of Morphia in *one pint* [Imperial measure] of Distilled Water, and add Solution of Ammonia until the Morphia is precipitated and the liquid rendered slightly alkaline. Collect the precipitate on a filter, wash it with Distilled Water; then, having transferred it to a porcelain dish, add four [fluid]ounces of Distilled Water and a sufficient quantity of Acetic Acid to neutralize and dissolve it. Evaporate the solution by the heat of a water-bath until it concretes on cooling. Lastly, dry the salt with a gentle heat, and reduce it to powder." *Br.*

In the U. S. process of 1870, morphine is saturated with acetic acid, which is employed in preference to vinegar for saturating the alkaloid, because it can leave no impurity in the resulting salt. The solution of the morphine in the water is an indication that it is saturated. A small excess of acid is attended with no inconvenience, as it is subsequently driven off by the heat. Care is required not to employ too much heat in the evaporation; as the acetate is easily decomposed, a portion of the acetic acid escaping, and leaving an equivalent portion of uncombined morphine. With attention to arrest the evaporation at a certain point, the acetate may be obtained in the state of crystals; but the crystallization is attended with some difficulty, and evaporation to dryness is almost universally preferred. Some recommend to dissolve the morphine in boiling alcohol, instead of suspending it in water, previously to the addition of the acetic acid. Less heat is thus required in the evaporation, and impurities in the morphine may often be detected, as they are apt to be insoluble in alcohol. To ascertain, in this case, whether the morphine is saturated, it is necessary to employ litmus paper, the blue color of which should not be restored, if previously reddened by an acid. If the morphine used in preparing the acetate contain narcotine, it will be best to employ as the solvent distilled vinegar, or diluted acetic acid of the same strength, and to favor its solvent power by heat. Under these circumstances it dissolves only the morphine, leaving the narcotine nearly or quite untouched. (Hodgson, *Journ. Phila. Col. Pharm.*, v. 35.)

dent that cyanide of potassium and morphine should not be prescribed together in solution, except in connection with free acid.

Hydrobromate of Morphine, or *Bromide of Morphine* ($C_{17}H_{19}NO_3HBr + 2H_2O$), is made by double decomposition between sulphate of morphine and bromide of barium. (See *A. J. P.*, xliv. 447.)

* *Acetate of Morphine.* "Take of Morphia, in fine powder, *a troyounce;* Distilled Water *half a pint;* Acetic Acid *a sufficient quantity*. Mix the Morphia with the Distilled Water; then carefully drop Acetic Acid into the mixture, stirring it constantly until the Morphia is neutralized and dissolved. Evaporate the solution, by means of a water-bath, to the consistence of syrup, and set aside until it concretes. Lastly, dry the salt with a gentle heat, and rub it into powder." *U. S.* 1870.

The British process differs from that of the U. S. Pharmacopœia 1870 only in obtaining uncombined morphine, as the first step, by precipitating it from a solution of the hydrochlorate; morphine itself not being among its officinal preparations.

It is officinally described as "a white, or yellowish white, crystalline or amorphous powder, slowly losing acetic acid when kept for some time and exposed to the air, having a faintly acetous odor, a bitter taste, and a neutral or faintly alkaline reaction. When freshly prepared, the salt is soluble in 12 parts of water and in 68 parts of alcohol at 15° C. (59° F.); if it has been kept for some time, it is incompletely soluble in water, unless a little acetic acid is added. It is also soluble in 1·5 part of boiling water, in 14 parts of boiling alcohol, and in 60 parts of chloroform. When heated on platinum foil, the salt is entirely dissipated. Solution of soda or potassa added to an aqueous solution of the salt throws down a white precipitate, which is soluble in an excess of the alkali. The precipitate is affected by reagents in the same manner as morphine. (See *Morphina.*) On adding sulphuric acid to the salt, acetous vapors are evolved." *U. S.*

Acetate of morphine crystallizes in the form of slender needles united in fasciculi. As ordinarily obtained, however, by evaporation to dryness, it is not entirely soluble in water, a portion of it being uncombined morphine. To render it soluble, all that is necessary is to add a little acetic acid. The *London College* in the old Pharmacopœia, referred to the property possessed by this and other salts of morphine, when treated first with chlorine and then with ammonia, of presenting a brown color, which disappears on the further addition of chlorine. The *Edinburgh College* gave the following mode of testing its purity: "One hundred measures of a solution of ten grains in half a fluidounce of water and five minims of acetic acid, heated nearly to 100° C. (212° F.), and decomposed by a faint excess of ammonia, yield by agitation a precipitate which in 24 hours occupies 15·5 measures of the liquid."

This and the other officinal salts of morphine are of identical medical value. They are almost invariably preferred to the alkaloid itself, and are given by the mouth, in pill or solution, in doses of an eighth to half a grain (0·008 to 0·03 Gm.). They are employed externally, sprinkled on blistered surfaces, and are very frequently exhibited by subcutaneous injection; but great caution must be observed that they be not thrown into a vein. We have seen the sixth of a grain thus given produce almost instantaneous insensibility, with dropping of jaw, and other evidence of immediate death, from which the patient was saved with difficulty. When given hypodermically fifteen minutes before the anæsthetic, the morphine salt was found by Claude Bernard to prolong and intensify the anæsthesia in animals, and many surgeons have employed it in man in this way, with satisfactory results. The solutions for hypodermic use should be freshly prepared, as the morphine salt is very prone to undergo decomposition, with the growth of a fungus. The solution of the acetate is especially liable to decomposition of its vegetable acid and precipitation of the morphine.

Off. Prep. Liquor Morphiæ Acetatis, *Br.*

MORPHINÆ HYDROCHLORAS. *U. S.* *Hydrochlorate of Morphine.*

(MÖR-PHĪ′NÆ HȲ-DRỌ-C̦HLŌ′RĂS.)

$C_{17}H_{19}NO_3.HCl.3H_2O$; 375·4. $C_{34}H_{19}NO_6.HCl.6HO$; 375·4.

Morphiæ Murias, *Br.*, *U. S.* 1870; Morphinum Hydrochloricum, *P.G.;* Murias (Hydrochloras) Morphicus; Muriate of Morphia; Chlorhydrate de Morphine, *Fr.;* Salzsaures Morphin, *G.*

A process for this salt is no longer officinal; that of U. S. P. 1870 is appended.*

"Take of Opium, sliced, *one pound* [avoirdupois]; Chloride of Calcium *three-quarters of an ounce* [avoird.]; Purified Animal Charcoal *a quarter of an ounce* [avoird.];

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* "Take of Morphia, in fine powder, *a troyounce;* Distilled Water *four fluidounces;* Muriatic Acid *a sufficient quantity.* Mix the Morphia with the Distilled Water; then carefully drop in Muriatic Acid, constantly stirring, until the Morphia is neutralized and dissolved. Evaporate the solution, by means of a water-bath, so that on cooling it may crystallize. Lastly, drain the crystals, and dry them on bibulous paper." *U. S.* 1870.

Diluted Hydrochloric Acid *two fluidounces*, or *a sufficiency;* Solution of Ammonia, Distilled Water, of each, *a sufficiency.* Macerate the Opium for twenty-four hours with two pints [Imperial measure] of the Water, and decant. Macerate the residue for twelve hours with two pints [Imp. meas.] of the Water, decant, and repeat the process with the same quantity of the Water, subjecting the insoluble residue to strong pressure. Unite the liquors, evaporate in a water-bath to the bulk of one pint [Imp. meas.], and strain through calico. Pour in now the Chloride of Calcium previously dissolved in four fluidounces of Distilled Water, and evaporate until the solution is so far concentrated that, upon cooling, it becomes solid. Envelop the mass in a double fold of strong calico, and subject it to powerful pressure, preserving the dark fluid which exudes. Triturate the squeezed cake with about half a pint [Imp. meas.] of boiling Distilled Water, and, the whole being thrown upon a paper filter, wash the residue well with boiling Distilled Water. The filtered fluids having been evaporated as before, cooled, and solidified, again subject the mass to pressure; and, if it be still much colored, repeat this process a third time, the expressed liquids being always preserved. Dissolve the pressed cake in six fluidounces of boiling Distilled Water; add the Animal Charcoal, and digest for twenty minutes; filter, wash the filter and charcoal with boiling Distilled Water, and to the solution thus obtained add the Solution of Ammonia in slight excess. Let the pure crystalline Morphia which separates as the liquid cools, be collected on a paper filter, and washed with cold Distilled Water until the washings cease to give a precipitate with a solution of nitrate of silver acidulated by nitric acid.

"From the dark liquids expressed in the above process an additional product may be obtained by diluting them with distilled water, precipitating with solution of potash added in considerable excess, filtering, and supersaturating the filtrate with hydrochloric acid. This acid liquid digested with a little animal charcoal, and again filtered, gives upon the addition of ammonia a small quantity of pure morphia.

"Diffuse the pure morphia obtained as above, through two fluidounces of boiling Distilled Water placed in a porcelain capsule kept hot, and add, constantly stirring, the Diluted Hydrochloric Acid, proceeding with caution, so that the morphia may be entirely dissolved, and a neutral solution obtained. Set aside to cool and crystallize. Drain the crystals, and dry them on filtering paper. By further evaporating the mother-liquor, and again cooling, additional crystals are obtained." *Br.*

The British process is based upon the plan, originally suggested by Wittstock, improved by Dr. Wm. Gregory, and adopted in the Edinburgh Pharmacopœia, of obtaining hydrochlorate of morphine immediately from opium without the use of alcohol. The meconate and a little sulphate of morphine extracted by water from opium are decomposed by chloride of calcium, yielding hydrochlorate of morphine in solution, and meconate and sulphate of calcium as precipitates. The next step consists in purifying the solution of the hydrochlorate by repeated evaporation, crystallization, expression, and re-solution, and finally the action of animal charcoal; the dark expressed liquors being set aside for future operation. The third step in the process is to obtain the morphine separate by precipitation by means of ammonia from the solution of the hydrochlorate. Lastly, the crystallized morphine is reconverted, by treatment with hydrochloric acid and hot water, into the hydrochlorate of morphine, which crystallizes from the solution as it cools. The reserved expressed liquors are united, and made to give up their morphine by the reagency of potassa in excess, which at once separates and dissolves the alkaloid. The solution yields it in a crystalline state on the addition of hydrochloric acid in excess, and afterwards of ammonia. The morphine thus obtained is added to that first procured, and with it again converted into the hydrochlorate. Dr. Christison says, in favor of Dr. Gregory's process, that the Edinburgh manufacturers, who follow it, produce a salt of unrivalled purity and cheapness. But it is much better calculated for the large laboratory of the manufacturing chemist, than for the smaller operations of the apothecary, who will probably find the U. S. process of 1870 more convenient.

Hydrochlorate of morphine procured by the old Edinburgh process is free from narcotine, but always contains a portion of hydrochlorate of codeine, which, however, is scarcely sufficient to affect its operation upon the system. Dr. Christison found the proportion to vary between a 60th in the hydrochlorate prepared from good Turkey opium, a 30th in that from inferior samples of the same variety, and a 12th in that from the East Indian. This impurity may be separated by precipitating the morphine by means of ammonia, the codeine being left in solution; and this, no doubt, is the object of the last step of the present British process, previously to the final conversion of the morphine into the hydrochlorate.

The late Dr. A. T. Thomson published a process for procuring hydrochlorate of morphine, which he found considerably more productive than the method usually adopted. After macerating the opium in water, as directed by the College, for thirty hours, and expressing, he rubbed it in a mortar with an equal weight of pure white sand, and enough water to form the mixture into a paste, which he placed in a percolator, and subjected to the action of distilled water till the fluid passed without color and taste. He then concentrated the liquor to the consistence of a thin syrup, added acetate of lead, diluted the solution with twice its bulk of distilled water, allowed it to stand for twenty-four hours, decanted the supernatant liquid, washed the precipitate with warm water, added the washings to the decanted solution, and concentrated to one-half. To free the liquid from any remaining acetate of lead, he added diluted sulphuric acid in slight excess, decanted the liquid from the precipitate, washed the latter, added the washings to the solution, and boiled for some minutes to drive off acetic acid. To convert the sulphate of morphine now contained in the solution into hydrochlorate, he added a saturated solution of chloride of barium, washed the precipitate, evaporated the conjoined washings and solution to the point of crystallization, pressed the crystals, diluted and again evaporated the mother-liquor so long as it afforded crystals, which were purified by means of animal charcoal, and by repeated solution, evaporation, and crystallization. (*P. J. Tr.*, i. 459.)

Hydrochlorate of morphine crystallizes in "white, feathery, flexible, acicular crystals of a silky lustre, permanent in the air, odorless, having a bitter taste, and a neutral reaction. Soluble in 24 parts of water and in 63 parts of alcohol at 15° C. (59° F.); in about 0·5 part of boiling water and in 31 parts of boiling alcohol; insoluble in ether. When heated to 130° C. (266° F.), the salt loses its water of crystallization (14·38 per cent.). When heated on platinum foil, it is entirely dissipated. Solution of soda or potassa added to an aqueous solution of the salt throws down a white precipitate, which is soluble in an excess of the alkali. The precipitate is affected by reagents in the same manner as morphine (see *Morphina*). The aqueous solution yields, with test-solution of nitrate of silver, a white precipitate, insoluble in nitric acid, but soluble in ammonia." *U. S.* A saturated solution in boiling water forms a solid crystalline mass on cooling. Dr. Christison constantly found the crystals, when dried at 150°, to contain 12·7 per cent. of water; and the Edinburgh College stated that the loss of weight at 212° is not above 13 per cent. The salt may be known to be a hydrochlorate by responding to the officinal test with nitrate of silver. Potassa throws down from its solution a precipitate which is redissolved by an excess of the alkali. The salt is affected by heat, nitric acid, iodic acid, ferric chloride, and chlorine followed by ammonia, in the same manner as morphine. Sugar is said to have been used largely in the adulteration of this salt. It may be detected by Trommer's test. (See *Saccharum.*) "Twenty grains of the salt dissolved in half a [fluid]ounce of warm water, with ammonia added in the slightest possible excess, give on cooling a crystalline precipitate, which, when washed with a little cold water, and dried by exposure to the air, weighs 15·18 grains." *Br.*

This preparation of morphine is much used in Great Britain, but in this country less than either the sulphate or the acetate. (For medical properties, see *Morphina.*)

Off. Prep. Liquor Morphiæ Hydrochloratus, *Br.;* Suppositoria Morphiæ, *Br.;* Trochisci Morphiæ, *Br.;* Trochisci Morphiæ et Ipecacuanhæ, *Br.*

MORPHINÆ SULPHAS. *U. S.* *Sulphate of Morphine.*

(MŎR-PHĪ'NÆ SŬL'PHĂS.)

$(C_{17}H_{19}NO_3)_2.H_2SO_4.5H_2O$; 758. $C_{34}H_{19}NO_6.HOSO_3.5HO$; 379.

Morphiæ Sulphas, *U. S.* 1870; Morphinum Sulfuricum, *P.G.;* Sulfas Morphicus; Sulphate of Morphia; Sulfate de Morphine, *Fr.;* Schwefelsaures Morphin, *G.*

No process is given in the U. S. P. 1880; that of U. S. P. 1870 is appended.*

In the process of 1870 the morphine is known to be saturated when it is wholly dissolved by the water. To ascertain whether the acid is added in excess, litmus paper may be resorted to. If the morphine employed contain narcotine, this will remain in the mother-liquor, and will not contaminate the product. The mother-liquor remaining after the first crystallization may be evaporated so as to afford a fresh supply of the sulphate; but, if the morphine was not originally quite pure, the second product will contain the impurities, and should not be used till it has undergone further preparation. When impure morphine is employed, the mother-liquor should be mixed with alcohol, or boiled with purified animal charcoal and filtered, and then decomposed by ammonia, which will precipitate the morphine. This may be converted into the sulphate in the manner directed by the Pharmacopœia.

Another mode of obtaining sulphate of morphine is to dissolve the alkaloid in boiling alcohol of 36° Baumé (sp. gr. 0·8428), saturate it while hot with sulphuric acid, add purified animal charcoal, boil for a few minutes, and filter the solution at the boiling temperature. Upon cooling, it deposits most of the sulphate; and the remainder may be obtained by evaporating the mother-liquor.

In the evaporation of the solution of this salt, care should be taken not to carry the heat too far; for, when pushed to incipient decomposition with an excess of acid, a new substance is formed containing no morphine. This salt is sometimes adulterated. Mr. D. B. Dott met with a sample in the English market, which contained 34·63 per cent. of anhydrous sodium sulphate. (*P. J. Tr.*, August 4, 1877.)

Sulphate of morphine crystallizes in beautifully white, minute, feathery crystals, "of a silky lustre, permanent in the air, odorless, having a bitter taste and a neutral reaction. Soluble in 24 parts of water and in 702 parts of alcohol at 15° C. (59° F.); in 0·75 part of boiling water and in 144 parts of boiling alcohol. When heated to 130° C. (266° F.), the salt loses its water of crystallization (11·87 per cent.). When heated on platinum foil, it is entirely dissipated. Solution of soda or potassa added to an aqueous solution of the salt throws down a white precipitate, which is soluble in an excess of the alkali. The precipitate is affected by reagents in the same manner as morphine (see *Morphina*). The aqueous solution yields, with test-solution of chloride of barium, a white precipitate insoluble in hydrochloric acid." *U. S.* By exposure to a heat of 120° C. (248° F.) it loses 9·66 parts of the water, but cannot be deprived of the remainder without decomposition. (*Liebig.*) The officinal tests for it are those for sulphuric acid and for morphine. Considerable discussion has taken place recently in the pharmaceutical journals about the solubility in water of sulphate of morphine. Owing to the ease with which the salt parts with its water of crystallization, even at ordinary temperatures, it is not difficult to account for some of the discrepancies that exist in the text-books on this subject. Yet there can be no doubt that the heretofore commonly quoted solubility, "twice its weight of cold water," is an oft-repeated error. Prof. J. U. Lloyd (*N. R.*, May, 1882) found it soluble in 21·60 parts of cold water. Prof. F. B. Power, after a determination by precipitation with barium chloride, found a commercial specimen of undoubted purity to require very nearly 24 parts of cold water, and the U. S. P. 1880 has adopted his results. (*A. J. P.*, 1882, p. 97.) Virgil Coblentz subsequently examined five commercial samples, and practically confirmed Prof. Power's results, finding the specimens soluble respectively in 21·38, 23·90, 23·18, 17·69, and 18·97 parts of water. Mr. D. B. Dott criticises the methods employed by Prof. J. U. Lloyd, and to some extent those of Prof. Power, but fails to establish a different result. (*P. J. Tr.*, 1882, p. 252.) The dose is from an eighth to a quarter of a grain (0·008 to 0·016 Gm.), which may be given in pill or solution. The *solution of sulphate of morphine* formerly officinal was made by dissolving 1 grain of sulphate of morphine in 1 fluidounce of distilled water, and, although the solution is more stable than any other of the morphine salts in common use, it will in time become weakened through the presence of microscopic plants belonging to the Confervoideæ, and hence it is not desirable to keep it on hand. According to Prof. Hamberg, of Stockholm, the sulphate should be dissolved in boiling distilled water which is free from ammonia, phosphoric, nitric, and nitrous acids; the solution should be filtered through paper not previously moistened, and is best preserved in small well-filled vials closed with a glass stopper. (*Phar. Zeitung*, No. 49; *A. J. P.*, 1881.) It is asserted by M. Vidal that the addition of chloral to a solution of morphine renders it much less liable to spontaneous change. This statement, if it be true, is important. He adds to the solution a quantity of chloral equivalent to twice the weight of the morphine it contains, and affirms that the injection of this mixture is not painful. According to a writer in the *Druggists' Circular*, when ether is added to a strong alcoholic solution of sulphate of morphine, the salt crystallizes in the course of a few hours. (*Phila. Med. Times*, iv. 352.) The same effect apparently is produced to some extent with the watery solution. (For medical properties, see *Morphina* and *Morphinæ Acetas.*)

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* "Take of Morphia, in fine powder, *a troyounce;* Distilled Water *half a pint;* Diluted Sulphuric Acid *a sufficient quantity.* Mix the Morphia with the Distilled Water, then carefully drop in Diluted Sulphuric Acid, constantly stirring until the Morphia is neutralized and dissolved. Evaporate the solution, by means of a water-bath, so that on cooling it may crystallize. Lastly, drain the crystals, and dry them on bibulous paper." *U. S.* 1870.

Off. Prep. Pulvis Morphinæ Compositus; Trochisci Morphinæ et Ipecacuanhæ, *U. S.*

MOSCHUS. *U. S.* *Musk.*

(MŎS′CHŬS.)

"The dried secretion from the preputial follicles of Moschus moschiferus. Linné. (*Class*, Mammalia; *Order*, Ruminantia.)" *U. S.* "The inspissated and dried secretion from the preputial follicles." *Br.*

Musc, *Fr.;* Bisam, Moschus, *G.;* Muschio, *It.;* Almizcle, *Sp.*

Gen. Ch. Horns none. *Fore teeth* eight in the lower jaw. *Tusks* one on each side, in the upper jaw, projecting out of the mouth.

Moschus moschiferus. Gmelin, *Syst. Nat.* i. 172; Reese's *Cyclopædia.* This animal bears a close resemblance to the deer in shape and size. It is usually about three feet in length and two feet high, with haunches considerably more elevated than the shoulders. From its upper jaw two tusks project downwards out of the mouth, each about two inches long, curved backwards, and serving to extract the roots which are used as food by the animal. The ears are long and narrow, and the tail very short. The fleece, consisting of strong, elastic, undulated hairs, varies in color with the season, the age of the animal, and perhaps the place which it inhabits. The general color is a deep iron-gray. The individual hairs are whitish near the root, and fawn-colored or blackish towards the tip. The musk is contained in an oval, hairy, projecting sac, found only in the male, situated between the umbilicus and the prepuce, from two to three inches long, and from one to two broad, opening by a small hairy orifice at its anterior part, and marked posteriorly by a groove or furrow which corresponds with the opening of the prepuce. It is lined internally by a smooth membrane, thrown into a number of irregular folds, forming incomplete partitions. In the vigorous adult animal, the sac sometimes contains six drachms of musk; but in the old, seldom more than two drachms, and none in the young.* The musk is secreted by the lining membrane, and in the living animal forms a consistent mass, which, on the outside, is compact, and marked with the folds of the membrane, but is less firm towards the centre, where there is sometimes a vacant space. As first secreted it is probably liquid, and a portion is occasionally forced out by the animal, to which it communicates its odor. The musk deer inhabits the vast mountainous regions of Central Asia, extending from India to Siberia, and from the country of the Turcomans to China. It is an active and timid animal, springing from rock to rock with surprising agility, and frequenting the snowy recesses and most inaccessible crags of the mountains. Concealing itself during the day, it chooses the night for roaming in search of food, and, though said to be abundant in its native regions, is taken with difficulty. It is hunted for its hide, as well as for the musk. The natives often take it by snaring. As soon as the animal is killed, the sac is cut off, dried, and sent into the market.*

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* According to Col. Frederick Markham, as much as two ounces are sometimes found, and the average for a full-grown animal is an ounce; but, as many of the deer are killed young, the pods in the market do not contain more than half an ounce upon an average. He states that the musk of the young animal is not so strong as that of the old, but much pleasanter. (*P. J. Tr.*, xv. 472.)

Musk varies in quality with the country inhabited by the animal. That procured from the mountains on the southern borders of Siberia, and brought into the market through Russia, is comparatively feeble. The best is imported from China, and is said to be the product of Tonquin. A variety intermediate between these is procured in the Himalaya Mountains and Thibet, and sent to Calcutta. This is sometimes enclosed in the membranous lining of the sac, without the hairy envelope, and in this condition is said to be quite equal if not superior to that surrounded by the skin, as in the former condition it dries readily in the sun, while in the latter the aid of artificial heat is deemed necessary, by which the musk may sometimes be injured. (F. Peake, *P. J. Tr.*, Feb. 1861.) We derive our chief supply from Canton, though portions are occasionally brought hither from Europe.

Two varieties are known in commerce, the Chinese and Russian. Both come in sacs, convex and hairy on one side, flat and destitute of hair on the other. The hairs are brownish yellow, grayish, or whitish, stiff and short, and arranged concentrically around the orifice of the sac. The Chinese, which is the most highly valued, is in bags of a rounder shape, covered with brownish yellow or reddish brown hairs, and containing at most a drachm and a half of large-grained, dark, strong-scented musk, of an ammoniacal odor. The Russian is in longer and larger bags, small-grained, of a light yellowish brown color, and of a weaker and more fetid odor, with less smell of ammonia.

Properties. Musk is in grains or lumps concreted together, soft and unctuous to the touch, and of a reddish brown or ferruginous color resembling that of dried blood. Some hairs of the pod are generally mixed with it. It is officinally described as "in irregular, crummy, somewhat unctuous grains, dark reddish brown, of a peculiar, penetrating and persistent odor, and bitterish taste. It is contained in oval or roundish sacs about one and one-half to two inches (4 to 5 cm.) in diameter, on one side invested with a smoothish membrane, on the other side covered with stiff, appressed, grayish hairs, concentrically arranged around two orifices near the centre. About 10 per cent. of Musk is soluble in alcohol, the tincture being light brownish yellow, and on the addition of water becoming slightly turbid. About 50 per cent. of Musk is soluble in water, the solution being deep brown, faintly acid, and strongly odorous." *U. S.* The odor is strong, penetrating, and so diffusive that one part of musk communicates its smell to more than 3000 parts of inodorous powder. (*Fée.*) In some delicate individuals, it produces headache and other disagreeable symptoms, and has even caused convulsions. The taste is bitter, disagreeable, and somewhat acrid. The color of the powder is reddish brown. Musk is inflammable, burning with a white flame, and leaving a light spongy charcoal. Reduced to ashes, it leaves about 5 per cent. of residue, containing potassa, lime, magnesia, iron, carbonic, phosphoric, and sulphuric acids, chlorine, and traces of ferrocyanide of potassium and sulphide of ammonium. (*W. Bernatzik.*) It yields, upon analysis, a great number of proximate principles. Guibourt and Blondeau obtained water, ammonia, stearin, olein, cholesterin, an oily acid combined with ammonia, volatile oil, chloride of ammonium, chlorides of potassium and calcium, an uncertain acid combined with ammonia, potassa, and lime, gelatin, albumen, fibrin, a highly carbonaceous matter soluble in water, a soluble calcareous salt with a combustible acid, carbonate and phosphate of calcium, hair, and sand. (*Annal. de Chim. et de Phys.*, ix. 327.) Besides these constituents, Geiger and Reinman found a peculiar bitter resin, osmazome, and a peculiar substance in part combined with ammonia. According to Guibourt and Blondeau, it contains 47 per cent. of volatile matter, thought by some to be chiefly ammonia, by others to be a compound of ammonia and volatile oil. Theimann obtained only from 10 to 15 per cent. But the quantity of volatile as well as of soluble matter varies exceedingly in different specimens. Thus, Theimann found from 80 to 90 per cent. of matter soluble in water, Buchner only 54·5 per cent., and other chemists intermediate proportions. The proportion soluble in alcohol, as ascertained by different experimenters, varies from 25 to 62 per cent. Ether is a good solvent. The watery infusion has a yellowish brown color, a bitterish taste, a strong smell of musk, and an acid reaction. The alcoholic tincture is transparent, and of a reddish brown color, with the peculiar odor of the medicine. The action of potassa upon musk is accompanied with the extrication of ammonia, and an increase of its peculiar odor. By the influence of heat and moisture long continued, ammonia is developed, which acts upon the fatty matter, producing a substance resembling adipocere, but, according to Guibourt, without diminishing the activity of the medicine. The correctness, however, of this opinion is perhaps questionable; and it is advisable to preserve the musk as much as possible unaltered. When kept in glass bottles, in a situation neither moist nor very dry, it remains for a great length of time without material change. The odor of musk is very much diminished by mixing it with emulsion or syrup of bitter almonds, or cherry-laurel water. From the experiments of Wimmer, it appears that musk loses its odor when rubbed with kermes mineral, or golden sulphur of antimony, and reacquires it on the addition of a little solution of ammonia. (*Pharm. Centralb.*, 1843, p. 406.) Camphor rubbed up with musk is also said to destroy its odor.

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* Attention has been drawn by Dr. E. Bertherand to the excrement of the *Algerian Gazelle*, *Antilope Dorcas*, L., which possesses a powerful musk-like odor. It is said to contain about 7 per cent. of an acid resin (?) of a musky odor. (*Tr. A. P. Assoc.*, xxvi. 332.)

Adulterations. The price of this medicine is so high, and its sources so limited, as to offer strong temptations to adulteration; and little genuine unmixed musk is to be found in the market. The sophistication commences in China, and is completed in Europe and this country. A common practice in the East is to open the sac, and to supply the place of the musk with an adulterated mixture. Sometimes the scrotum of the animal is filled with this mixture, and not unfrequently the sacs are made out of the skin. Dried blood, from its resemblance to musk, is one of the most common adulterations; but, besides this, sand, lead, iron-filings, hair, animal membrane, tobacco, the dung of birds, wax, benzoin, storax, asphaltum, artificial musk, and other substances are introduced. These are mixed with a portion of musk, the powerful odor of which is diffused through the mass and renders the discovery of the fraud sometimes difficult. It is said that the Chinese sometimes mix the musk of Tonquin with that of Siberia. The bags containing the drug should have the characters before described as belonging to the natural sac, and should present no evidence of having been opened. The slit is sometimes carefully sewed up, sometimes glued together. The former condition may be discovered by close inspection, the latter by immersion in hot water. When the bag is made from any other portion of the skin, the difference may be detected, according to Mr. Neligan, by a microscope which magnifies 300 diameters. The genuine hairs exhibit innumerable cells, which are wanting in the spurious. (*Chem. Gaz.*, Feb. 1846, p. 79.) Musk which burns with difficulty, has a feeble odor and a color either pale or entirely black, feels gritty to the finger, is very moist so as to lose much weight in drying, or contains obvious impurities, should be rejected. Russian musk is said never to be adulterated before leaving Russia.*

Medical Properties and Uses. Musk is stimulant and antispasmodic, increasing the vigor of the circulation, and exalting the nervous energy, without producing, either as an immediate or a secondary effect, any considerable derangement of the purely cerebral functions. Its medical uses are such as may be inferred from its general operation; but peculiar advantage may be expected from it when a prostrate state of the system, attended with great nervous agitation, or irregular muscular action, call for the united influence of a highly diffusible stimulant and powerful antispasmodic. Such are low cases of typhous disease, accompanied with subsultus tendinum, tremors, and singultus. Such also are many instances of gout in the stomach, and other spasmodic affections of that organ. In very obstinate hiccough we have found it more effectual than any other remedy; and, according to Dr. G. B. Wood, it is very effective in those alarming convulsions of infants originating in spasm of the intestines. In the laryngismus stridulus or crowing disease of infants, M. Bouchut relies mainly on musk, having found it more efficacious than any of the narcotics. (*N. Y. Med. Journ.*, Sept. 1868, p. 545.) The chief obstacles to its general use are its high price, and the uncertainty in regard to its purity. Musk was unknown to the ancients. Aëtius was the first writer who noticed it as a medicine. It was introduced into Europe through the Arabians, from whose language its name was derived.

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* For an account of the effects of numerous reagents on musk, and other modes of identification as well as of detecting adulterations, see a paper by Prof. W. Bernatzik, in *A. J. P.*, 1861, p. 427. There is a discrepancy between Prof. Bernatzik's statement of the solubilities of musk and that of the text. According to the latter, ether is a good solvent; according to the former, ether and chloroform possess scarcely any solvent power.

It may be given in the form of pill or emulsion. In preparing mixtures of musk, it is recommended to rub the musk up first with a very little boiling water, containing a trace of solution of potassa, afterwards with a larger quantity, and to add the liquid thus prepared to whatever mixture may be prescribed. The insolubility of musk in cold water, and its much greater solubility in that liquid when boiling hot, render this mode of preparation much preferable to rubbing up with cold water. (*Journ. de Pharm. et de Chim.*, 4e sér., iii. 291.) The medium dose is ten grains (0·65 Gm.), to be repeated every two or three hours. It may often be administered with great advantage in the form of enema.

MUCILAGINES. *Mucilages.*

(MŪ-CI̩-LĂG′I̩-NĒS̩.)

Mucilages, *Fr.;* Schleime, *G.*

Mucilage, in the ordinary acceptation of the term, and in the sense in which it is employed in the U. S. Pharmacopœia, is an aqueous solution of gum, or of substances closely allied to it. In the British Pharmacopœia it is applied also to the semi-liquid, jelly-like substance resulting from the cooling of a hot solution of starch.

MUCILAGO ACACIÆ. *U. S., Br.* *Mucilage of Acacia.*

(MŪ-CI̩-LĀ′GŌ A̩-CĀ′CI̩-Æ.)

Mucilago Gummi Arabici, *P.G.;* Mucilage of Gum Arabic; Mucilage de Gomme arabique, Mucilage arabique, *Fr.;* Gummischleim, *G.*

"Acacia, in small fragments, *thirty-four parts* [or four ounces av.]; Water, *a sufficient quantity*, To make *one hundred parts* [or about eight fluidounces]. Wash the Acacia with cold Water, then add to it *sixty-six parts* [or seven and a half fluidounces] of Water, agitate occasionally until it is dissolved, and strain." *U. S.*

"Take of Gum Acacia, in small pieces, *four ounces* [avoirdupois]; Distilled Water *six fluidounces.* Put the Gum and Water into a covered earthen jar, and stir them frequently until the Gum is dissolved. If necessary, strain the solution through muslin." *Br.*

The gum used for this purpose should be in small fragments, or coarse powder, as it is more readily dissolved in this state than when finely pulverized. Straining is necessary to separate the foreign substances which are often mixed with gum arabic. This mucilage is semi-transparent, almost colorless if prepared from good gum, viscid, tenacious, of a feeble peculiar odor, and nearly tasteless. If the solution of gum should be colored, it may be rendered colorless by the addition of a concentrated solution of chlorine; and, by boiling for about half an hour so as to drive off the chlorine and hydrochloric acid, it may be rendered fit for use. (*Guérin.*) By keeping, mucilage becomes sour, in consequence of the spontaneous generation of acetic acid; and this happens even though it be enclosed in well-stopped bottles. But, according to Guérin, the solution of pure gum undergoes no change in vacuo. Heat in its preparation is said to favor the production of acid; and hence cold has been substituted for boiling water in the present formulas. According to R. Rother (*A. J. P.*, xliv. 113), if glycerin be employed in proportion of one to eight of the mass, and the mixture of water and it be added to the gum in a bottle and solution secured by agitation at intervals over several hours, the resulting mucilage does not spoil. Archer & Co. have found (*Ibid.*, xlvi. 469) that if "Tolu water" be substituted for water the mucilage will keep for months. The Tolu water is made by rubbing two drachms of the tincture with carbonate of magnesium and two pints of water, and filtering. Mucilage is employed chiefly in the formation of pills, and suspending insoluble substances in water. In prescribing it for mixtures, it should be recollected that it is a solution of definite strength, containing, according to the U. S. formula, half an ounce of the gum to each fluidounce of mucilage. The British mucilage is a little stronger. Half a fluidounce is usually sufficient for a six or eight ounce mixture. The adhesiveness of the mucilage is stated to be very much increased by the addition of one part of sulphate of aluminium to one hundred and twenty-five parts of the mucilage.

Off. Prep. Syrupus Acaciæ, *U. S.;* Trochisci Acidi Tannici, *Br.;* Trochisci Bismuthi, *Br.;* Trochisci Catechu, *Br.;* Trochisci Ferri Redacti, *Br.;* Trochisci Ipecacuanhæ, *Br.;* Trochisci Morphiæ, *Br.;* Trochisci Morphiæ et Ipecacuanhæ, *Br.;* Trochisci Potassæ Chloratis, *Br.;* Trochisci Sodæ Bicarbonatis, *Br.*

MUCILAGO AMYLI. *Br.* *Mucilage of Starch.*

(MŪ-CỊ-LĀ'GŌ ĂM'Ỵ-LĪ.)

Mucilage d'Amidon, *Fr.;* Stärkeschleim, *G.*

"Take of Starch *one hundred and twenty grains;* Distilled Water *ten fluidounces.* Triturate the Starch with the Water gradually added; then boil for a few minutes, constantly stirring." *Br.*

This mucilage has an opaline appearance, and gelatinous consistence, and is much used as a vehicle for laudanum and other active medicines given in the form of enema. In consequence of its demulcent properties, it may be usefully employed as an enema in irritation and inflammation of the mucous coat of the rectum and large intestines. Its unpleasant flavor, when it is prepared from ordinary starch, precludes its employment by the mouth.

Off. Prep. Enema Aloes, *Br.;* Enema Magnesiæ Sulphatis, *Br.;* Enema Opii, *Br.;* Enema Terebinthinæ, *Br.*

MUCILAGO CYDONII. *U.S.* *Mucilage of Cydonium.*

(MŪ-CỊ-LĀ'GŌ CỴ-DŌ'NỊ-Ī.)

Mucilage de Semences des Coing. *Fr.;* Quittensamen-Schleim, *G.*

"Cydonium, *two parts* [or thirty-six grains]; Distilled Water, *one hundred parts* [or four fluidounces]. Macerate the Cydonium for half an hour, in a covered vessel, with the Distilled Water, frequently agitating. Then drain the liquid through muslin, without pressure. This preparation should be freshly made, when required for use." *U. S.*

This is a new officinal mucilage. It is admirably adapted as an application to the eye in conjunctivitis, and for a vehicle in gonorrhœal injections.

MUCILAGO SASSAFRAS MEDULLÆ. *U.S.* *Mucilage of Sassafras Pith.*

(MŪ-CỊ-LĀ'GŌ SĂS'SẠ-FRĂS MẸ-DŬL'LÆ.)

Mucilage de Moëlle de Sassafras, *Fr.;* Sassafrasmark-Schleim, *G.*

"Sassafras Pith, *two parts* [or thirty-six grains]; Water, *one hundred parts* [or four fluidounces]. Macerate for three hours, and strain." *U. S.*

This infusion may be prepared in a much shorter time, if the pith be broken into small fragments, and the mixture often agitated. It is much used as an application to the eye in conjunctivitis. It may be taken as a drink, *ad libitum*, in inflammatory and febrile diseases, particularly inflammations of the mucous passages.

MUCILAGO TRAGACANTHÆ. *U. S., Br.* *Mucilage of Tragacanth.*

(MŪ-CI-LĀ′GŌ TRĂG-A-CĂN′THÆ.)

Mucilage de Gomme adragante, Mucilage adragant, *Fr.;* Traganthschleim, *G.*

"Tragacanth, *six parts* [or one hundred and ninety grains]; Glycerin, *eighteen parts* [or one fluidounce]; Water, *a sufficient quantity*, To make *one hundred parts.* Mix the Glycerin with *seventy-six parts* [or five and a half fluidounces] of Water, heat the mixture to boiling, add the Tragacanth, and let it macerate for twenty-four hours, stirring occasionally. Then add enough Water to make the mixture weigh *one hundred parts* [or seven ounces av.], beat it so as to render it of uniform consistence, and strain forcibly through muslin." *U. S.*

"Take of Tragacanth, in powder, *sixty grains;* Distilled Water *ten fluidounces.* To the Water contained in a pint bottle add the Tragacanth, agitate briskly for a few minutes, and again at short intervals, until the Tragacanth is perfectly diffused and finally has formed a mucilage." *Br.*

A part only of tragacanth is soluble in water. The remainder swells up and forms a soft tenacious mass, which may be mechanically mixed with water, but does not form a proper solution. Hence trituration is necessary to complete the incorporation of the ingredients. This mucilage is thick and very viscid, but not permanent, as the water separates from the insoluble portion of the tragacanth on standing. It is chiefly used in making pills and troches. The addition of glycerin in the U. S. process of 1880 renders it more serviceable as an excipient. From its great tenacity, it may be advantageously employed for the suspension of heavy insoluble substances, such as the metallic oxides, in water. When kept long it is apt to undergo decomposition, and to become offensive, but it will keep well if enough carbolic acid be added to impart its characteristic odor faintly. (*A. J. P.*, 1864, p. 97.)

Off. Prep. Trochisci Ferri Subcarbonatis, *U. S.;* Trochisci Magnesiæ, *U. S.;* Trochisci Menthæ Piperitæ, *U. S.;* Trochisci Morphinæ et Ipecacuanhæ, *U. S.;* Trochisci Sodii Carbonatis, *U. S.*

MUCILAGO ULMI. *U. S.* *Mucilage of Elm.*

(MŪ-CI-LĀ′GŌ ŬL′MĪ.)

Mucilage of Slippery Elm Bark; Mucilage d'Écorce d'Orme fauve, *Fr.;* Ulmenrinden-Schleim, *G.*

"Elm, sliced and dried, *six parts* [or one hundred and eight grains]; Boiling Water, *one hundred parts* [or four fluidounces]. Macerate for two hours, in a covered vessel, and strain." *U. S.*

This may be used *ad libitum* as a demulcent and nutritious drink in catarrhal and nephritic diseases, and in inflammatory intestinal affections. It is much employed locally as a demulcent in inflammation of the skin, as in erysipelas, etc.

MYRISTICA. *U. S., Br.* *Nutmeg.*

(MȲ-RĬS′TI-CA.)

"The kernel of the seed of Myristica fragrans. Houttuyn (*Nat. Ord.* Myristicaceæ), deprived of its testa." *U. S.* "The kernel of the seed of Myristica officinalis." *Br.*

Semen Myristicæ, *P.G.;* Nux Moschata, Muscade; Noix muscade, *Fr.;* Muskatnuss, *G.;* Noce moschata, *It.;* Nuez moscada, *Sp.*

Myristica moschata. Thunberg; Willd. *Sp. Plant.* iv. 869.—*M. officinalis.* Linn. *Suppl.* 265; Lindley, *Flor. Med.* p. 21.—*M. fragrans.* Houttuyn, *Nat. Hist.* vol. ii., part iii., p. 333; *B. & T.*, 218. The nutmeg-tree is about thirty feet high, with numerous branches, and an aspect somewhat resembling that of the orange-tree. The leaves stand alternately on short footstalks, are oblong-oval, pointed, entire, undulated, obliquely nerved, bright green, and somewhat glossy on their upper surface, whitish beneath, and of an aromatic taste. The flowers are male and female upon different trees. The former are disposed in axillary, peduncled, solitary clusters; the latter are single, solitary, and axillary; both are minute and of a pale yellowish color. The fruit, which appears on the tree mingled with the flowers, is round or oval, of the size of a small peach, smooth, at first pale green, but yellow when ripe, and marked with a longitudinal furrow. The external covering, which is at first thick and fleshy, and abounds in an austere, astringent juice, afterwards becomes dry and coriaceous, and, separating into two valves from the apex, discloses a scarlet reticulated membrane or arillus, commonly called *mace*, closely investing a thin, brown, shining shell, which contains the kernel or *nutmeg*. *Myristica moschata* is a native of the Moluccas and other neighboring islands, and abounds especially in that small cluster distinguished by the name of Banda, whence the chief supplies of nutmegs were long derived. But numerous varieties of the plant are now cultivated in Sumatra, Java, Singapore, Penang, Ceylon, and other parts of the East Indies, and have been introduced into the Isles of France and Bourbon, Cayenne, and several of the West India islands. The larger part of the nutmegs of commerce is, however, said to still come from the Dutch Banda Islands. The Penang nutmegs are distinguished by not being limed.

The tree is produced from the seed. It does not flower till the eighth or ninth year; after which it bears flowers and fruit together, without intermission, and is said to continue bearing for seventy or eighty years. Little trouble is requisite in its cultivation. A branch of the female tree is grafted into all the young plants when about two years old, so as to insure their early fruitfulness. In the Moluccas the tree yields three crops annually. The fruit is gathered by the hand, and the outside covering rejected. The mace is then carefully separated, so as to break it as little as possible, is flattened, dried in the sun, and afterwards sprinkled with salt water, with the view of contributing to its preservation. Its fine red color is much impaired by drying. The nuts are dried in the sun or by ovens, and exposed to smoke till the kernel rattles in the shell. They are then broken open; and the kernels, having been removed and steeped for a short time in a mixture of lime and water, probably in order to preserve them from the attack of worms, are next cleaned, and packed in casks or chests for exportation. Dr. Lumsdaine has found them to keep better if rubbed over with dry lime, than when prepared in the moist way. (See *Am. Journ. of Sci. and Arts*, Nov. 1851.) Nutmegs are brought to this country either directly from the East Indies, or indirectly through England and Holland. They are also occasionally imported in small quantities from the West Indies.

Properties. The nutmeg (*nux moschata*) is of a roundish or oval shape, obtuse at the extremities, marked with vermicular furrows, of a grayish color, hard, smooth to the touch, yielding readily to the knife or the grater, but not very pulverulent. When cut or broken it presents a yellowish surface, varied with reddish brown, branching, irregular veins, which give to it a marbled appearance. These dark veins abound in oily matter, upon which the medicinal properties depend. The odor of nutmeg is delightfully fragrant, the taste warm, aromatic, and grateful. Its virtues are extracted by alcohol and ether. M. Bonastre obtained from 500 parts, 120 of a white insoluble oily substance, 38 of a colored soluble oil (olein), 30 of volatile oil, 4 of acid, 12 of fecula, 6 of gum, 270 of lignin; and 20 parts were lost. The *volatile oil* is obtained by distillation with water. (See *Oleum Myristicæ*)

Nutmegs have been punctured and boiled in order to extract their essential oil, and the orifice afterwards closed so carefully as not to be discoverable unless by breaking the kernel. The fraud may be detected by their levity. They are also apt to be injured by worms, which, however, attack preferably the parts least impregnated with the volatile oil. The Dutch were formerly said to heat them in a stove in order to deprive them of the power of germinating, and thus prevent the propagation of the tree. The largest nutmegs now command the highest prices. They should be rejected when very light, with a feeble taste and smell, worm-eaten, musty, or marked with black veins.

A kind of nutmeg is occasionally met with, ascribed by some to a variety of *M. moschata*, by others to a different species (*Myristica fatua*), which is distinguished from that just described by its much greater length, its elliptical shape, the absence of the dark brown veins, and its comparatively feeble odor, and disagreeable taste.

It has been called *male, wild*, or *long nutmeg*, the other being designated as the *female*, or *cultivated nutmeg*.*

The *concrete* or *expressed oil of nutmeg* (*Oleum Myristicæ Expressum*, Br.), commonly called *oil of mace*, or *Nutmeg Butter*, is obtained by bruising nutmegs, exposing them in a bag to steam, and then compressing them strongly between heated plates. A liquid oil flows out, which becomes solid when it cools. Nutmegs are said to yield from 10 to 12 per cent. of this oil, but Flückiger and Hanbury obtained as much as 28 per cent.† The best is imported from the East Indies in stone jars, or in rectangular blocks 10 inches long by 2½ inches wide, wrapped in palm leaves. It is solid, soft, unctuous to the touch, of a yellowish or orange-yellow color more or less mottled, with the odor and taste of nutmeg. It is composed, according to Schrader, of 52·09 per cent. of a soft oily substance, yellowish or brownish, soluble in cold alcohol and ether; 43·75 of a white, pulverulent, inodorous substance, insoluble in these liquids; and 4·16 of volatile oil. The pulverulent constituent, which received from Playfair the name of *myristin*, has a silky lustre, melts at 31° C. (88° F.), and yields on saponification glycerin and *myristic acid*, $C_{14}H_{28}O_2$. Myristin, $C_3H_5(OC_{14}H_{27}O)_3$, is a true fat or glyceride of myristic acid. It is also found in spermaceti, cocoanuts, and in the fixed oil of linseed and poppy oil. It may be obtained directly from nutmeg by exhausting it by means of benzol, filtering the liquid, and allowing it to crystallize by spontaneous evaporation. To purify the product, it may be dissolved in a mixture of two parts of absolute alcohol and three of benzol with the aid of heat, then filtering the liquid while hot, and setting it aside. On cooling, it deposits the pure myristin in crystals. (*Journ. de Pharm.*, Juin, 1859, p. 471.) Analyzed by Koller, the expressed oil was found to contain, in 100 parts, 6 of a volatile oil ($C_{10}H_{16}$) analogous to the oil of mace, 70 of myristin, 20 of olein, 3 of resin, and 1 of salts, etc. (*Arch. der Pharm.*, clxxiii. 280.) An inferior kind of the oil is prepared in Holland, and sometimes found in the shops. It is in hard, shining, square cakes, lighter colored than that from the East Indies, and with less smell and taste. It is supposed to be derived from nutmegs previously deprived of most of their volatile oil by distillation. An artificial preparation is sometimes sold for the genuine oil. It is made by mixing various fatty matters, such as suet, palm oil, spermaceti, wax, etc., adding some coloring substance, and giving flavor to the mixture by the volatile oil.

Medical Properties and Uses. Nutmeg unites, with the medicinal properties of the ordinary aromatics, considerable narcotic power. In the quantity of two or three drachms (7·8 or 11·65 Gm.), it has been known to produce stupor and delirium; and dangerous if not fatal consequences are said to have followed its free use in India. It is employed to cover the taste or correct the operation of other medicines, but more frequently as an agreeable addition to farinaceous articles of diet, and to various kinds of drink in cases of languid appetite and delicate stomach. It is usually given in substance, and is brought by grating to the state of a powder. *Mace* possesses properties essentially the same with those of nutmeg, and, like that medicine, has been known, when taken in excess, to produce alarming sensorial disturbance. (G. C. Watson, *Prov. Med. and S. Journ.*, Jan. 26, 1848.) It is, however, less used as a medicine. The dose of either is from five to twenty grains (0·33 to 1·3 Gm.). As the virtues of nutmeg depend chiefly if not exclusively on the volatile oil, the latter may be substituted, in the dose of two or five drops (0·10 or 0·25 C.c.). The expressed oil is occasionally used as a gentle external stimulant, and is an ingredient in the *Emplastrum Picis* of the British Pharmacopœia.

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* A few years since, attention was called to a California product, derived from *Torreya Californica*, and, from its resemblance to nutmeg, called *California nutmeg*. It is, however, quite distinct from the true nutmeg, and cannot be substituted for it. At the same time a variety of nutmeg appeared in our markets, which was at first supposed to be the California product referred to; but, on examination by Prof. Jos. Carson, it was found to be the male, or wild nutmeg, mentioned in the text, and wholly distinct from the fruit of the Torreya. (*A. J. P.*, xxvi. 247, 499.)

† A process for obtaining it by means of carbon disulphide has been proposed by M. Lepage, of Gisors, in France, and has received the sanction of the Society of Pharmacy of Paris. It consists in treating the nutmeg, thoroughly comminuted, with three times its weight of the liquid referred to, well rectified, agitating the mixture frequently for 24 hours, expressing, repeating the process with two parts only of the menstruum, mixing the products of the two macerations, filtering in a covered vessel, and then distilling off the disulphide at a temperature of 160°, until the residue is entirely deprived of the menstruum. (*Journ. de Pharm.*, 3e sér., xxxi. 28.)

The ancients were wholly unacquainted with the nutmeg; and Avicenna is said to be the first author by whom it is noticed.

Off. Prep. of Nutmeg. Acetum Opii, *U. S.;* Oleum Myristicæ Expressum, *Br.;* Pulvis Aromaticus, *U. S.;* Pulvis Catechu Compositus, *Br.;* Pulvis Cretæ Aromaticus, *Br.;* Spiritus Armoraciæ Comp., *Br.;* Tinctura Lavandulæ Comp., *U. S., Br.;* Syrupus Rhei Aromaticus, *U. S.;* Trochisci Cretæ, *U. S.;* Trochisci Magnesiæ, *U. S.;* Trochisci Sodii Bicarbonatis, *U. S.*

Off. Prep. of the Concrete Oil. Emplastrum Calefaciens, *Br.;* Emplastrum Picis, *Br.*

MYRRHA. *U. S., Br.* *Myrrh.*

(MYR'RHA.)

"A gum-resin obtained from Balsamodendron Myrrha. Nees. (*Nat. Ord.* Burseraceæ.)" *U. S.* "A gum-resinous exudation from the stem of Balsamodendron Myrrha." *Br.*

Gummi-Resina Myrrha; Myrrhe, *Fr., G.;* Mirra, *It., Sp.;* Murr, *Ar.;* Bowl, *Hindoost.*

Though myrrh has been employed from the earliest times, the plant which yields it was not determined till quite recently. The *Amyris Kataf* of Forskhal, seen by that traveller in Arabia, was supposed by him to be the myrrh-tree, but without sufficient proof. Afterwards Ehrenberg met on the frontiers of Arabia Felix with a plant, from the bark of which he collected a gum-resin precisely similar to the myrrh of commerce. From specimens of the plant taken by Ehrenberg to Germany, Nees von Esenbeck referred it to the genus Balsamodendron of Kunth, and named it *Balsamodendron Myrrha.* This genus was formed by Kunth from *Amyris*, and includes the *Amyris Kataf* of Forskhal, which may possibly also produce a variety of myrrh. The new genus differs from *Amyris* chiefly in having the stamens beneath instead of upon the germ. It was not thought by De Candolle sufficiently distinct. Berg is said to have found another species in Ehrenberg's collection, to which was attached a label by the discoverer, stating that he had collected myrrh from it; and proposes to call it *Balsamodendron Ehrenbergianum.* (*A. J. P.*, 1873, p. 314.) Both Oliver and Trimen agree that this plant is not specifically distinct from *B. opobalsamum.* The belief that myrrh is the product of *B. myrrha* has been confirmed by the German traveller Hildebrant, who collected the plant in 1873, in the Adel Mountains, on the north Somali coast (*P. J. Tr.*, 3d ser., ix. 893); but it is most probable that some of the myrrh of commerce is the product of *B. Ehrenbergianum*, or of other non-officinal species.

Balsamodendron Myrrha. Fée, *Cours. d'Hist. Nat. Pharm.* i. 641; Carson, *Illust. of Med. Bot.* i. 28, pl. 20; *B. & T.* 60. This is a small tree, with a stunted trunk, covered with a whitish gray bark, and furnished with rough abortive branches terminating in spines. The leaves are ternate, consisting of obovate, blunt, smooth, obtusely denticulate leaflets, of which the two latter are much smaller than the one at the end. The fruit is oval-lanceolate, pointed, longitudinally furrowed, of a brown color, and surrounded at its base by the persistent calyx. The tree grows in Arabia Felix, in the neighborhood of Gison, in dwarfish thickets, interspersed among the Acaciæ and Euphorbiæ. The juice concretes spontaneously upon the bark.

Formerly the best myrrh was brought from the shores of the Red Sea by way of Egypt and the Levant, and hence received the name of *Turkey Myrrh;* while the inferior qualities were imported from the East Indies, and commonly called *India Myrrh.* These titles have ceased to be applicable; as myrrh of all qualities is now brought from the East Indies, whither it is carried from Arabia and the north-eastern coast of Africa. Aden in the former region, and Berbera in the latter, would appear, from the statements of Mr. James Vaughan, to be the chief entrepots of the trade. (*P. J. Tr.*, xii. 226.) Great quantities are collected on the African coast, near the mouth of the Red Sea, whence it is taken to Aden. (*Ibid.*, Oct. 1859, p. 217.) It is usually imported in chests containing between one and two hundred weight. Sometimes the different qualities are brought separate, sometimes more or less mingled. Only the best kind should be selected for medical use.

Properties. Myrrh is in small irregular fragments or tears, or in larger masses, composed apparently of agglutinated portions differing somewhat in their shade of color. The pieces are exceedingly irregular in shape and size, being sometimes not larger than a pea, and sometimes, though rarely, almost as large as the fist. They are often powdery upon the surface. When of good quality, myrrh is reddish yellow or reddish brown and translucent, of a strong peculiar somewhat fragrant odor, and a bitter aromatic taste. It is brittle and pulverizable, presenting, when broken, a shining surface, which in the larger masses is very irregular, and sometimes exhibits opaque whitish or yellowish veins. In powder it is of a light yellowish color. Under the teeth it is at first friable, but soon softens and becomes adhesive. It is inflammable, but does not burn vigorously, and is not fusible by heat. Its sp. gr. is stated at 1·36. The inferior kind, commonly called *India myrrh*, is in pieces much darker than those described, more opaque, less odorous, and often abounding with impurities. We have seen pieces of India myrrh enclosing large crystals of common salt; as if the juice had fallen from the tree, and concreted upon the ground where this mineral abounds. Pieces of *bdellium*, and other gummy or resinous substances of unknown origin, are often mixed with it. Among these is a product which may be called *false myrrh*. It is in irregular pieces, of a dirty reddish brown color, a vitreous brownish yellow fracture, semi-transparent, of a faint odor of myrrh, and a bitter balsamic taste. Myrrh is best purchased in mass; as in powder it is liable to adulterations not easily detected. "With alcohol it yields a brownish yellow tincture which acquires a purple hue on the addition of nitric acid. Dark-colored pieces, the alcoholic solution of which is not rendered purple by nitric acid, and pieces of gum which dissolve completely, as well as those which merely swell in water, should be rejected." *U. S.*

Myrrh is partially soluble in water, alcohol, and ether. Triturated with water it forms an opaque yellowish or whitish emulsion, which deposits the larger portion upon standing. Its alcoholic tincture is rendered opaque by the addition of water, but throws down no precipitate. According to Neumann, alcohol and water severally extract the whole of its odor and taste. By distillation a volatile oil rises, having the peculiar flavor of myrrh, and leaving the residue in the retort simply bitter. The gum-resin is soluble in solutions of the alkalies, and, when triturated with them in a crystalline state, forms a tenacious liquid. Hence carbonate of potassium may be used to facilitate its suspension in water. Braconnot found 2·5 per cent. of volatile oil, 23 of a bitter resin, 46 of soluble, and 12 of insoluble gum. (*Ann. de Chim.*, lxvii. 52.) Pelletier obtained 34 per cent. of resin, with a small proportion of volatile oil, and 66 of gum. A more recent analysis by Ruickoldt gave 2·183 per cent. of volatile oil, 44·760 of resin, 40·818 of gum or arabin, 1·475 of water, and 3·650 of carbonate of calcium and magnesium, with some gypsum and sesquioxide of iron. The volatile oil has been called *myrrhol* or *myrrhenol*, and, according to Ruickoldt, has the formula $C_{10}H_{14}O$. The resin, which he calls *myrrhin*, $C_{48}H_{32}O_{10}$, is neutral, but becomes acid when kept for a short time in fusion. In the latter state, M. Ruickoldt proposes to call it *myrrhic acid*. (*Archiv der Pharm.*, lxi. 1.) According to MM. Bley and Diesel, myrrh containing little volatile oil always has an acid reaction, which they ascribe to the oxidation of the oil. They found *formic acid* in the specimen examined by them. (*Ibid.*, xliii. 304.) The same writers give, as a test of myrrh, the production of a transparent dirty yellow liquid with nitric acid; while false myrrh affords a bright yellow solution in the same fluid, and bdellium is not dissolved, but becomes whitish and opaque. (*A. J. P.*, xviii. 228.) According to M. Righini, if powdered myrrh, rubbed for 15 minutes with an equal weight of chloride of ammonium, and fifteen times its weight of water gradually added, dissolve quickly and entirely, it may be considered pure. (*Journ. de Chim. Méd.*, 1844, p. 33.)

Medical Properties and Uses. Myrrh is a stimulant tonic, with some tendency to the lungs, and perhaps to the uterus. Hence it is employed as a tonic in dyspepsia, and as an expectorant and emmenagogue in debilitated states of the system, in the absence of febrile excitement or acute inflammation. The complaints in which it is usually administered are chronic catarrh, phthisis pulmonalis, other pectoral affections in which the secretion of mucus is abundant but not easily expectorated, chlorosis, amenorrhœa, and the various affections connected with this state of the uterine function. It is generally given combined with chalybeates or other tonics, and in amenorrhœa very frequently with aloes. It is used also as an application to spongy gums, the aphthous sore-mouth of children, and various kinds of unhealthy ulcers. The dose is from ten to thirty grains (0·65 to 1·95 Gm.), and may be given in the form of powder or pill, or suspended in water, as in the famous antihectic mixture of Dr. Griffith, which has become officinal under the name of *Mistura Ferri Composita.* The infusion is also sometimes given, and an aqueous extract has been recommended as milder than myrrh in substance. The tincture is used chiefly as a local application.

A *plaster of myrrh* is made by rubbing together powdered myrrh, camphor, and balsam of Peru, of each an ounce and a half, then adding the mixture to 32 ounces of lead plaster previously melted, and stirring well until the plaster thickens on cooling. It is then to be formed into rolls. This plaster may be employed in all cases where a gentle and long-continued rubefacient effect is desired.

Off. Prep. Decoctum Aloës Compositum, *Br.;* Mistura Ferri Comp.; Pilula Aloës et Myrrhæ, *Br.;* Pilulæ Aloës et Myrrhæ, *U. S.;* Pilulæ Assafœtidæ Comp., *Br.;* Pilulæ Ferri Comp., *U. S.;* Pilulæ Galbani Comp., *U. S.;* Pilulæ Rhei Comp.; Tinctura Aloës et Myrrhæ, *U. S.;* Tinctura Myrrhæ.

NECTANDRÆ CORTEX. *Br.* *Nectandra.* *Bebeeru Bark.*

(NẸC-TĂN′DRÆ CŎR′TĔX.)

"The bark of Nectandra Rodiæi, *Schomburgk*, in *Hooker's Journ. of Bot.*, 2d ser.; the Greenheart tree. Imported from British Guiana." *Br.* (*Nat. Ord.* Lauraceæ.)

Cortex Beberu. s. Bibiru; Greenheart Bark; Ecorce de Bébéeru, *Fr.;* Bibirurinde, *G.*

Gen. Ch. Flowers hermaphrodite. *Calyx* six-parted, rotate, the three outer segments somewhat broader. *Stamens* twelve, in four series, the nine outer fertile; the anthers of the first and second series turned inwards, of the third outwards, all ovate, sub-sessile, four-celled. *Ovary* one-celled, with one ovule. *Style* short. *Stigma* short, truncated. *Berry* one-seeded, partly immersed in the tube of the calyx. *Endlicher.*

Nectandra Rodiæi. Schomburgk; *Hooker's Lond. Journ. of Bot.*, Dec. 1844, p. 624; *B. & T.* 219. The *bebeeru*, *bibiru*, or *sipiri*, as it has been differently named, is a tree sixty feet or more in height, branching near the top, with a smooth, ash-gray bark. The leaves, which are five or six inches long by two or three in breadth, are nearly opposite, coriaceous, oblong-elliptical, shortly acuminate, smooth, shining, and obscurely reticulate on the upper surface. The flowers are yellowish white, in axillary panicles, much shorter than the leaves, and few-flowered. The fruit is a large, obovate or obcordate, somewhat compressed berry, of the size of a small apple, with a single seed about as large as a walnut. The tree inhabits Guiana and neighboring regions of South America, where the wood is used in ship-building, under the name of *greenheart.* It received its specific name of *Rodiei* from Sir Robert Schomburgk, in honor of Dr. Rodie, by whom it was first described. Though the fruit is very bitter, its seeds yield a starch which is said to be used as food by the Indians. The bark was omitted at the recent revision of the U. S. P.

Properties. This is in large, flat, heavy pieces, from one to two feet long, from two to six inches broad, and three or four lines thick, with a rough and somewhat fibrous fracture, of a grayish brown color on its outer surface, and a dark cinnamon color on the inner. It has an intensely bitter, somewhat astringent taste. On microscopical examination it is seen to be composed chiefly of very thick-walled parenchymatous cells. The inner liber contains peculiar short, sharp-pointed, saw-shaped liber cells. Within the cells dark brown masses (colored greenish black by ferrous sulphate) may be seen. Analyzed by Dr. Maclagan, of Edinburgh, it was found to contain tannic acid of the kind that precipitates the salts of iron green, resin, gum, sugar, albumen, fibrin, various salts, and two peculiar alkaloids, named respectively *beberine*, $C_{18}H_{21}NO_3$, and *sipirine*, the former soluble, and the latter insoluble in ether. In the seeds, besides the foregoing principles, Dr. Maclagan found 53 per cent. of starch, and a peculiar white, crystalline, volatile acid, which he named *beberic acid.* The alkaloids are extracted together from the bark, in the form of impure sulphates, by a process similar to that for preparing sulphate of quinine. This preparation is known as the *commercial sulphate of beberine.* The sipirine, which Dr. Maclagan believed to be a distinct alkaloid in the bark, he was afterwards induced to consider as the result of oxidation of beberine. (Pereira, *Mat. Med.*)*

Beberine was obtained pure by Messrs. Maclagan and Tilley by the following process. The impure sulphate is dissolved in water, and precipitated by ammonia. The precipitate, mixed with an equal weight of recently precipitated oxide of lead, and dried, is treated with absolute alcohol, which, being evaporated, leaves the two alkaloids in the form of a translucent resinoid mass. The beberine is separated by means of ether, which yields it by evaporation. Another process is to dissolve the precipitate obtained by ammonia, previously washed, in diluted acetic acid, add acetate of lead, precipitate by potassa, exhaust the precipitate by strong ether, evaporate the ether to the consistence of a syrup, dissolve the residue in absolute alcohol, and pour the solution gradually into water. A flocculent deposit is formed, which, when washed and dried, is the alkaloid in question. Beberine is pale yellow, amorphous, of a resinous aspect, inodorous, very bitter, very slightly soluble in water, freely soluble in alcohol and ether, fusible at 180° C. (356° F.), inflammable, and of an alkaline reaction. It forms uncrystallizable salts with the acids. Its formula is $C_{18}H_{21}NO_3$, and it is believed by Walz to be identical with *buxine*, and by Flückiger with *pelosine.* For a further account of its chemistry, see *P. J. Tr.*, Oct. 1869, p. 102.

Sipirine is left after the separation of the beberine by ether in the foregoing processes. It also is amorphous, very sparingly soluble in water and freely soluble in alcohol, but differs from beberine in being insoluble in ether.

Medical Properties and Uses. Nectandra is tonic, somewhat astringent, and febrifuge, resembling cinchona in its virtues, though much inferior, at least in antiperiodic power. It has generally been employed in the form of the impure sulphate of beberine, and sometimes with great asserted success, in the treatment of intermittent and remittent fevers. Dr. Rodie recommended it so early as 1834; but it did not attract general attention until brought into notice by Dr. Douglas Maclagan, of Edinburgh, who published a number of observations, tending to prove its possession of valuable antiperiodic properties. Others afterwards confirmed his statements in its favor, and it was hoped that a substitute had been found for the alkaloids of Peruvian bark; but later experience shows that, though frequently successful, it often fails, and cannot be relied on as a substitute for quinine. From twenty grains to a drachm (1·3 to 3·9 Gm.) may be given between the paroxysms, in doses of two grains (0·13 Gm.). Prof. A. P. Merrill has employed the sulphate with advantage in menorrhagia, in the dose of five grains (0·33 Gm.). (*N. Y. Journ. of Med*, N. S., xv. 433.)

The *impure sulphate* (*commercial sulphate*) *of beberine* may be prepared by first boiling the powdered bark with a solution of carbonate of sodium, to remove the tannic acid and coloring matter, and afterwards with water acidulated with sulphuric acid, which extracts the alkaloids in the form of sulphates. The solution is then filtered, the alkaloid precipitated by carbonate of sodium, the precipitate dissolved and neutralized with dilute sulphuric acid, the solution, decolorized with animal charcoal, then concentrated, filtered, and finally evaporated in open vessels, with a gentle heat. Thus obtained, the sulphate is fit for medical use, though it is not pure, containing sipirine, a little sulphate of calcium, and coloring matter. It is in brownish, thin, shining scales, which become yellow in powder. It is freely soluble in alcohol, and sparingly in water, but is readily dissolved in the latter if acidulated. It may be given in the form of pill, or of solution in water acidulated with sulphuric acid, one minim of the officinal diluted or aromatic sulphuric acid being added for each grain of the sulphate. The dose is from two to five grains (0·13–0·33 Gm.).

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* Drs. Douglas Maclagan and Arthur Gamgee have since examined the *wood*, and, besides beberine, have detected two other alkaloids, one of which they seem to have pretty thoroughly investigated, and propose to name *Nectandrine.* It was obtained by treating the mixed alkaloids resulting from the same process applied to the wood, by which the British Pharmacopœia obtains sulphate of beberine from the bark, repeatedly with chloroform. The new alkaloid, being very soluble in chloroform, is thus extracted. It is a white powder, amorphous, and intensely bitter. It differs from beberine in being much less soluble in ether, and when treated with strong sulphuric acid and dioxide of manganese, in giving rise to a magnificent green, slowly passing into a beautiful violet, and, lastly, in having a higher molecular weight; its formula being $C_{20}H_{23}NO_4$. After separating nectandrine from the mixed bases, the authors succeeded in extracting another alkaloid, different from beberine, much more soluble in water than nectandrine, but insoluble in chloroform. This they did not name. They ascertained the existence of a third alkaloid (*A. J. P.*, 1869, p. 453.)

NUX VOMICA. *U. S., Br.* *Nux Vomica.*

(NŬX VŎM'Ị-CẠ.)

"The seed of Strychnos Nux vomica. Linné. (*Nat. Ord.* Loganiaceæ.)" *U. S.* "The seeds of Strychnos Nux vomica. Linn. Imported from the East Indies." *Br.*

Semen Strychni, *P.G.;* Semen Nucis Vomicæ; Poison Nut, Quaker Buttons; Noix vomique, *Fr.;* Krähenaugen, Brechnüsse, *G.;* Noce vomica, *It.;* Nuez vomica, *Sp.*

Gen. Ch. Corolla five-cleft. *Berry* one-celled, with a ligneous rind. *Willd.*

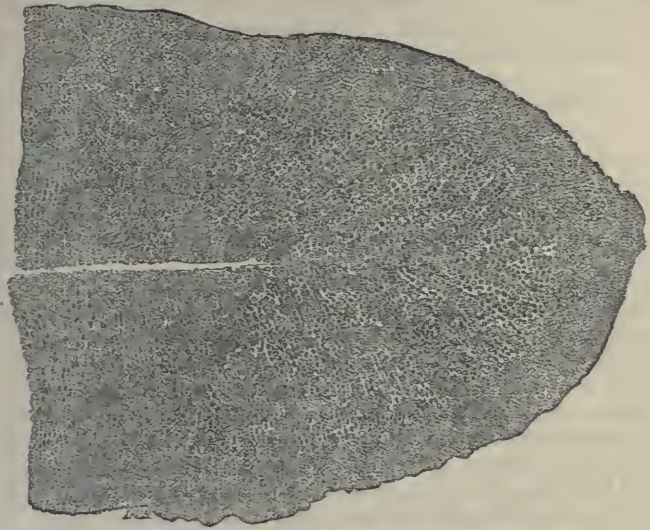
Strychnos Nux vomica. Willd. *Sp. Plant.* i. 1052; *B. & T.* 178. This tree is of a moderate size, with numerous strong branches, covered with a smooth, dark gray bark. The young branches are long, flexuous, smooth, and dark green, with opposite, roundish-oval, entire, smooth, and shining leaves, having three or five ribs, and short footstalks. The flowers are small, white, funnel-shaped, and in terminal corymbs. The fruit is a round berry, about as large as an orange, with a smooth, yellow or orange-colored, hard, fragile rind, and many seeds in a juicy pulp.

The tree is a native of the East Indies, growing in Bengal, Malabar, on the Coromandel Coast, in Ceylon, in many islands of the Indian Archipelago, in Cochin-China, and other neighboring countries. The wood and root are very bitter, and are employed in the East Indies for the cure of intermittents. The *radices colubrinæ* and *lignum colubrinum* of the older writers, long known in Europe as narcotic poisons, have been ascribed to this species of Strychnos, under the impression that it is identical with *Strychnos Colubrina*, to which Linnæus refers them. They have been ascertained by Pelletier and Caventou to contain a large quantity of strychnine. The bark is said by Dr. O'Shaughnessy to answer exactly to the description given by authors of the *false angustura*, and, like that, to contain a large quantity of brucine. The identity of the two barks has been confirmed by Dr. Pereira, from a comparison of specimens. (See *Cuspariæ Cortex.*)

The seeds are circular, about three-quarters of an inch in diameter, and two lines in thickness, flat, or slightly convex on one side, and concave on the other, with a slight ridge extending from the centre of one side to the edge. They are thickly covered with fine, silky, shining, ash-colored or yellowish gray hairs, attached to a thin fragile coating, which closely invests the interior nucleus or kernel. This is very hard, horny, usually whitish and semi-transparent, sometimes dark-colored and opaque, and of very difficult pulverization. It is composed chiefly of a hard, horny albumen, which, on section, is seen to be formed of numerous small parenchymatous cells. In a fissure in the centre lies the embryo. It is about a third of an inch long, with a club-shaped radicle and two cordate, five- to seven-nerved cotyledons. The powder is yellowish gray, and has a faint sweetish odor. The seeds are destitute of odor, but have an acrid, very bitter taste, which is much stronger in the kernel than in the investing membrane. They impart their virtues to water, but more readily to diluted alcohol.

Nux vomica has been analyzed by several chemists, but most accurately by Pelletier and Caventou, who discovered in it two alkaline principles, *strychnine* and *brucine*, united with a peculiar acid which they named *igasuric*. Its other constituents are a yellow coloring matter, a concrete oil, gum, starch, bassorin, a small quantity of wax, and, according to Prof. J. M. Maisch, several earthy phosphates. (*A. J. P.*, Nov. 1860, p. 524.) Mr. Charles Bullock, in preparing the alcoholic extract of nux vomica with a moderate continuous heat, so as to dry it sufficiently to be pulverized, separated from 150 pounds of the seeds 5 pints of a liquid oil. (*A. J. P.*, 1874, p. 405.) M. Desnoix announced the discovery of another alkaloid, which he denominates *igasurine*. These alkaloids are the active principles.

Strychnine ($C_{21}H_{22}N_2O_2$) was discovered by Pelletier and Caventou in 1818, both in the nux vomica and the bean of St. Ignatius, and received its name from the generic title of the plants (*Strychnos*) to which these two products belong. According to these chemists, it exists much more abundantly in the bean of St. Ignatius than in the nux vomica, the former yielding 1·2 per cent., the latter only 0·4 per cent. of the alkaloid; but Dragendorff obtained from the nux vomica 1·9 to 2·1 per cent. of mixed alkaloids, about half of which was strychnine. (*Jahresbericht*, 1874, p. 103.)[*]



Transverse section of Nux Vomica.

Brucine ($C_{23}H_{26}N_2O_4$) was discovered by Pelletier and Caventou, first in the bark called *false angustura*, in combination with gallic acid, and subsequently associated with strychnine in the form of igasurates, in the nux vomica and bean of St. Ignatius. It is crystallizable from alcohol, the crystals then containing $4H_2O$. It is without smell, but of a permanent, harsh, very bitter taste; soluble in 850 parts of cold, and 500 of boiling water; very soluble in alcohol, whether hot or cold; but insoluble in ether and the fixed oils, and only slightly dissolved by the volatile oils. It is permanent in the air, but melts at a temperature a little above that of boiling water, and on cooling congeals into a mass resembling wax. According to Mr. Wm. A. Guy, it melts at 115° C. (239° F.), and sublimes at 204° C. (399·2° F.), changing color, and depositing carbon. (*P. J. Tr.*, Feb. 1868, p. 375.) It forms crystallizable salts with the acids. Concentrated nitric acid produces with brucine or its salts an intense crimson color, which changes to yellow by heat, and upon the addition of stannous chloride becomes violet. A test for brucine, given by M. Stanislas Cotton, consists in adding to a warm solution of brucine (40° to 50° C.) in nitric acid, a concentrated solution of sodium hyposulphite (thiosulphate). The mixture first becomes violet, and then passes to green when the alkaline salt is in excess. (*Journ. de Pharm.*, Juillet, 1869, p. 18.) These effects serve to distinguish brucine from strychnine, and, if produced with the latter alkaloid, evince the presence of the former. According to MM. Larocque and Thibierge, auric chloride produces, with solutions of the salts of brucine, precipitates at first milky, then coffee-colored, and finally chocolate-brown. (*Journ. de Chim. Méd.*, Oct. 1842.) This alkaloid has been detected in the body three months after death, being present in all the solids and fluids, but especially in the liver and kidneys. (*Bost. M. and S. Journ.*, July 10, 1873, p. 36.) Brucine is analogous in its operation to strychnine, but possesses, according to M. Andral, only about one-twelfth of its strength, when the latter principle is entirely pure. It is therefore seldom employed. It may be procured from false angustura bark, in a manner essentially the same as that in which strychnine is procured from nux vomica; with this difference, that the alcoholic extract, obtained from the precipitate produced by lime or magnesia, should be treated with oxalic acid, and subsequently with a mixture of rectified alcohol and ether, which takes up the coloring matter, leaving the oxalate of brucine. This is decomposed by magnesia, and the brucine is separated by alcohol, which, by spontaneous evaporation, yields it in the state of crystals. According to Dr. Fuss and Professor Erdmann, brucine is nothing more than a compound of strychnine and resin.

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[*] Other species of Strychnos contain the poisonous alkaloids, and may some time become a commercial source of them. *Bidara Laut* of the Indian bazaars, believed to be obtained from *S. Ligustrina*, has been analyzed by Prof. Russow, who found the wood to contain 2·26 per cent. and the bark 7·38 per cent. of brucine without strychnine. Mr. Henry G. Greenish has found in the wood and bark respectively of *S. Colubrinum*, 0·96 per cent. and 5·54 per cent. of mixed alkaloids; the same analyst obtained from false angustura bark (*S. nux vomica*), young bark 3·10 per cent., old bark 1·68. (*P. J. Tr.*, 3d ser., ix. 1014.) According to M. Bernelot-Moens, the dry seeds of the *S. tiute* contain 1.469 per cent. of strychnine, with a trace of brucine. (*A. J. P.*, 1866, p. 506.)

Igasurine is said to be found in the mother-waters from which strychnine and brucine have been precipitated by lime. According to Desnoix, it is strongly bitter; readily crystallizable, with 10 per cent. of water of crystallization; more soluble in water and weak alcohol than the two other alkaloids; reddened by nitric acid even more intensely than brucine; rendered by sulphuric acid at first rose-colored, and afterwards yellowish and greenish yellow; dissolved by the diluted acids, which form with it easily crystallizable salts; precipitated from its solution by the alkalies, and redissolved by them in excess, especially by potassa; precipitated yellow by bichloride of platinum, and white by tannic acid; slowly precipitated by iodide of potassium in light reddish yellow crystals; and thrown down as crystalline needles by bicarbonate of sodium, in the presence of tartaric acid, in which property it resembles strychnine, but differs from brucine. One of the asserted most characteristic properties is its degree of solubility in water, of which it requires at 100° C. (212° F.) only 200 parts for solution; while brucine requires 500 parts, and strychnine 2000. M. Desnoix inferred from his experiments on animals that it is intermediate in power between the two other alkaloids of nux vomica.

The nine alkaloids into which Schutzenberger separated igasurine, he distinguished by affixing the letters of the alphabet, as *a* igasurine, *b* igasurine, etc. (*A. J. P.*, Nov. 1858, p. 537.) It is difficult to resist the conjecture that these alkaloids, instead of pre-existing, are formed by changes in brucine during the crystallizing process. Indeed, it is positively denied that there is any such distinct alkaloid as igasurine. (*Journ. Chem. Soc.*, 1881, xxxix. 453.) Jörgensen is said to have shown its identity with brucine (see *A. J. P.*, June, 1872, p. 257), and W. A. Shenstone confirms this view. (*A. J. P.*, Dec. 1881.)

As a test for nux vomica, Vielgruth proposes to treat a few grains of the suspected powder with proof spirit, evaporate the tincture to dryness at a heat not exceeding 96°, then add a drop or two of dilute sulphuric acid, and again raise to the heat mentioned. If nux vomica is present, a beautiful carmine-red color is produced, which disappears in ten or fifteen minutes after cooling, and reappears, but less brightly, on the reapplication of the heat.

Medical Properties and Uses. The medical and toxic properties of nux vomica are those of its alkaloid. (See *Strychnina.*)

Off. Prep. Abstractum Nucis Vomicæ, *U. S.;* Extractum Nucis Vomicæ; Extractum Nucis Vomicæ Fluidum, *U. S.;* Tinctura Nucis Vomicæ, *U. S.;* Strychnia, *Br.*

OLEA. *Oils.*

(Ō′LE-A.)

These are liquid or solid substances, characterized by an unctuous feel, inflammability, and the property of making a greasy stain upon paper. They are divided into two classes, the *fixed* and *volatile*, because distinguished, as their names imply, most readily by their different behavior on the application of heat.

1. OLEA FIXA. *Fixed Oils.*

These are sometimes termed *fatty oils*, because they constitute in part the vegetable and animal fats. The distinction between liquid and solid fats is for the most part a physical one only, as they contain the same chemical compounds, although in relatively different proportions. The fatty oils, though existing in greater or less proportion in various parts of plants, are furnished for use exclusively by the fruit, and, as a general rule, are most abundant in the dicotyledonous seeds. They are obtained either by submitting the bruised seeds to pressure in hempen bags, or by boiling them in water, and skimming off the oil as it rises to the surface. When pressure is employed, it is customary to prepare the seeds for the press by exposing them to a moderate heat, so as to render the oil more liquid, and thus enable it to flow out more readily. Another mode of extracting certain oils is by means of liquids having the power of dissolving them, and this method is now largely used in practice, carbon disulphide being the solvent availed of. Near Berlin, in Germany, is an establishment where the oil existing in various grains, as the colza, flaxseed, and mustard, is extracted by means of the bisulphide of carbon, on a large scale. For the details of the process, see *A. J. P.*, Nov. 1868, p. 549.

The following scheme of classification of the fixed oils, both liquid and solid (Allen, *Commerc. Org. Anal.*, vol. ii. pp. 129–138), gives a general view of their most essential characters, points of difference, etc.

I. Olive Oil Group. *Vegetable Non-drying Oils.* The oils of this group solidify on treatment with nitrous acid or nitrate of mercury, but do not lose their power of producing a greasy stain on paper, however long they may be exposed to the air. Their density varies from ·912 to about ·924, and hence is less than that of Groups II., III., and IV. Their fluidity is notably less than that of the drying oils.

This group includes almond oil (from *Amygdalus communis*), oil of ben (from *Moringa oleifera*), colza oil (from *Brassica campestris oleifera*), earth-nut oil (from *Arachis hypogœa*), oil of black mustard (from *Sinapis nigra*), oil of white mustard (from *Sinapis alba*), olive oil (from *Olea Europœa*), winter rape-seed oil (from *Brassica campestris; B. napus*), summer rape-seed oil (from *Brassica præcox*).

II. Cotton-seed Oil Group. The oils of this group occupy a position intermediate between the vegetable non-drying and the true drying oils (Groups I. and III.). In density they somewhat exceed the oils of Group I., but are lighter than those of Groups III. and IV. They form more or less elaïdin on treatment with nitrous acid or nitrate of mercury, but do not become wholly solidified. On the other hand, they undergo more or less drying on exposure to the air, but not so markedly as the oils of Group III.

This group includes beech-nut oil (from *Fagus sylvatica*), cotton-seed oil (from *Gossypium barbadense* and other species), hazel-nut oil (from *Coryllus avellana*), sesamé or teel oil (from *Sesamum orientale*), sunflower oil (from *Helianthus annuus; H. perennis*), niger-seed oil (from *Guizotia oleifera*).

III. Linseed Oil Group. *Vegetable Drying Oils.* These oils are not solidified by treatment with nitrous acid or mercurous nitrate, but become gradually converted into solid masses or varnishes by exposure to the air. In density, the oils of this group vary from about 0·923 to 0·935, and hence are distinctly heavier than the non-drying oils, and than most of the oils of Group II. On the other hand, they are lighter than the oils of Group IV. The fluidity of the drying oils is also much higher than that of the non-drying oils.

This group includes camelina oil (from *Myagrum sativum*), cress-seed oil (from *Lepidium sativum*), hemp-seed oil (from *Cannabis sativa*), linseed oil (from *Linum usitatissimum; L. perenne*), poppy-seed oil (from *Papaver somniferum*), Scotch fir-seed oil (from *Pinus sylvestris*), tobacco-seed oil (from *Nicotiana tabacum*), walnut oil (from *Juglans regia*), weld-seed oil (from *Reseda luteola*).

IV. Castor Oil Group. The oils of this group are distinguished from those of Groups I., II., and III. by their very high density and viscosity (*i.e.*, deficient fluidity). They are also remarkable for their ready solubility in alcohol, and their marked purgative properties. In their drying characters and behavior with the elaïdin test, they resemble the oils of the cotton-seed oil group. Both castor and croton oil are miscible in all proportions with glacial acetic acid.

This group includes castor oil (from *Ricinus communis*) and croton oil (from *Croton tiglium*).

V. WHALE OIL GROUP. *Marine Animal Oils.* This group comprises the various fluid oils obtained from fish and cetaceous mammals. They are distinguished as a class by their offensive fishy odor; by the brown color they assume when subjected to the action of chlorine; and by the reddish color which is produced on boiling them with a solution of caustic alkali. With sulphuric acid they give colorations varying from light red to purple or brown. Sperm oil is distinguished from the others by its peculiar chemical constitution and low specific gravity. The fish oils do not dry upon exposure to air, and mostly yield but little elaïdin on treatment with nitrous acid. The term "*train oil*" includes whale, seal, shark, cod and all similar oils.

This group includes cod oil (from *Gadus morrhua* and allied species), cod-liver oil (from the same), tanner's cod oil (from various fish), menhaden oil (from *Alosa menhaden*), porpoise oil (from *Delphinus phocœna* and allied species), seal oil (from *Phoca* of various species), shark oil (from *Squalus maximus* and allied species), sperm oil (from the cranial cavities of *Physeter macrocephalus*), and whale oil (from *Balœna mistecetus* and allied species).

VI. LARD OIL GROUP. This group includes those oils fluid at ordinary temperatures which are obtained from terrestrial animals. They resemble the fish oils in their reaction with chlorine, but are not turned red or brown by boiling with caustic soda. On exposure to air and on treatment with nitrous acid or mercuric nitrate, they behave like the non-drying vegetable oils (Group I.).

This group includes bone oil, lard oil, tallow oil, and neat's-foot oil.

VII. TALLOW GROUP. *Solid Fat Oils.* This group comprises such oils as are solid at the ordinary temperature. Their melting points vary somewhat and are capable of permanent alteration. The fats of this division may be arranged in two sub-groups, according as they are derived from the vegetable or the animal kingdom.

A. *Fats of Vegetable Origin.* Cacao butter (from *Theobroma cacao*), coco-nut oil (from *Cocos nucifera* and *C. butyracea*), Japan wax (from *Rhus succedanea* and allied species), laurel oil (from *Laurus nobilis*), palm oil (from *Avoira elais* or *Elais Guineensis*), palm-nut oil, and Shea or Galam butter (from *Bassia Parkii*).

B. *Fats of Animal Origin.* Bone fat, butter fat, butterine and oleomargarine, hog's lard, horse fat, beef tallow and mutton tallow, and wool-fat (suint).

VIII. SPERMACETI GROUP. *Waxes.* Spermaceti and the various waxes differ from the true fixed oils and fats in not forming glycerin when saponified, yielding instead certain of the higher monatomic alcohols, the identity of which varies with the nature of the wax. These alcohols are insoluble in water, and dissolve to but a limited extent in alcohol, but they are soluble in ether, chloroform, carbon disulphide, benzen, and petroleum spirit, and are apt to be mistaken for added paraffin wax when the substance is saponified and the soap extracted with a solvent.

This group includes beeswax (from honey-comb of various species of bees), Carnauba, or Brazil wax (from the leaf coverings of *Copernicea cerifera*), Chinese wax or Pela wax (produced by a species of *Coccus*, which punctures the branches of certain trees), myrtle wax (from berries of *Myrica cerifera*), Ocuba wax (from *Myrica ocuba*), palm wax (from bark of *Ceroxylon andicola* of the Corderillas), and spermaceti (deposit from the oil found in the cranial cavities of the sperm whale, *Physeter macrocephalus*).

When oils are decomposed by heat they yield vapors of *acrolein*, a highly volatile liquid resulting from the decomposition of glycerin, upon which the fumes of oils depend mainly for their irritating effects on the eyes and nostrils. Exposed to a red heat, in close vessels, they yield, among other products of the destructive distillation, a large quantity of combustible compounds of carbon and hydrogen. Heated in the open air, they take fire, burning with a bright flame, and producing water and carbonic acid. When kept in air-tight vessels, they remain unchanged for a great length of time; but, exposed to the atmosphere, they attract oxygen, and ultimately become concrete. Some, in drying, lose their unctuous feel, and are converted into a transparent, yellowish, flexible solid. These are called *drying oils.* Others, especially such as contain mucilaginous impurities, become rancid, acquiring a sharp taste and an unpleasant smell. This change is owing to the formation of an acid, from which the oil may be freed by boiling it for a short time with hydrate of magnesia and water.* The fixed oils are insoluble in water, but are miscible with that fluid by means of mucilage, forming mixtures which are called emulsions. They are in general very sparingly soluble in alcohol, but readily dissolved by ether, which serves to separate them from other vegetable proximate principles. By the aid of heat they dissolve sulphur and phosphorus. The stronger acids decompose them, giving rise, among other products, to oleic, palmitic, and stearic acids. Boiled with diluted nitric acid, some of them give rise to malic and oxalic acids, besides other substances usually resulting from the action of this acid upon vegetable matter. Several acids are dissolved by them without producing any sensible change. They are decomposed by salifiable bases, being resolved into a peculiar substance called glycerin, and into oleic and stearic or other fatty acids, which unite with the base employed. The compounds of these acids with potassa and soda are called soaps. (See *Sapo* and *Emplastrum Plumbi.*) By the addition of one part of carbonate of potassium or of sodium, 160 parts of oil may be brought with distilled water into the form of an emulsion. The potassa and soda soaps and the alkaline sulphides have a similar effect; but not the bicarbonates. The fixed oils also serve as good vehicles for various metallic bases and subsalts, which form soaps to a certain extent soluble in the oil, and thus become less irritant to the tissues. Oils thus impregnated may, like the pure oils, be brought to the state of emulsion with water, for convenient administration, by the addition of a small proportion of carbonate of potassium. (Jeannel et Monsel, *Revue Pharm.*, 1857, p. 48.) The fixed oils dissolve many of the alkaloids, the volatile oils, resin, and other proximate principles of plants. The alkaloids are more readily dissolved in them by being first combined with oleic acid; the oleates being more soluble than the alkaloids themselves. (Attfield, *P. J. Tr.*, March, 1863, p. 308.) According to Buignet, they are, with very few exceptions, indifferent to polarized light; of all those used in medicine, the only exceptions being the liver-oils of the ray and dog-fish, which have a very feeble left rotatory power, and castor oil, which is decidedly dextrogyrate. (*Journ. de Pharm.*, Oct. 1861, p. 264.)

The fixed oils, whether animal or vegetable, in their natural state, consist in most cases of at least two or three distinct oleaginous ingredients, one liquid at ordinary temperatures, and the other two concrete. The liquid is a distinct proximate principle called *olein;* the concrete principles consist of *stearin* and *palmitin*, the former being found most largely in animal, the latter in vegetable oils or fats, and the two not unfrequently existing together in the same oil. As the most frequent of these proximate constituents of the fixed oils, and existing in many different oleaginous substances, olein, palmitin, and stearin merit a special notice. Preliminarily, however, to their individual consideration, it will be proper to refer to the existing views in relation to their nature and composition generally.

These three substances, *olein*, *palmitin*, and *stearin*, together with *butyrin*, *caprin*, and other minor fat principles, are *glycerides;* that is, compound ethers or salts of the triatomic alcohol glycerin, $C_3H_5(OH)_3$, and of the several fatty acids, oleic, palmitic, stearic, etc., all of which are monobasic acids. Thus, olein has the composition

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* M. Cloes has made investigations in relation to the influence of light in promoting oxidation, and obtained some curious results. The general influence of light is very great, as oils undergo comparatively little change in the dark for a long time; though, in relation to some of them, the change is at length as great as under the light. Thus, while the oil of poppies has in thirty days increased about 50 per cent. in weight under colorless light, and has gained only a 5000th in the dark; yet, at the end of 150 days, the weight in the former condition was rather lessened than augmented, and in the latter, or in the dark, had increased 64 per cent. The effect of the different colored rays is also very different. The change is at first most rapid under the white light, less so under the blue, and much less under the red, yellow, and green, being least of all with the green; but, with the advance of time, the blue overtakes and even passes the white, and at the end of three or four months all are about equal in effect. Heat also accelerates the concretion of the oils, by favoring their oxidation; and the same effect is produced by introducing into the unchanged oil a little which has already been altered by exposure to the air. The oxidation of an oil may be very greatly hastened in this way without the aid of heat. (*Journ. de Pharm. et de Chim.*, 4e sér., ii. 345, 1865.)

$$C_3H_5\left\{\begin{matrix}OC_{18}H_{33}O\\OC_{18}H_{33}O\\OC_{18}H_{33}O\end{matrix}\right.\text{, palmitin, } C_3H_5\left\{\begin{matrix}OC_{16}H_{31}O\\OC_{16}H_{31}O\\OC_{16}H_{31}O\end{matrix}\right.\text{, and stearin, } C_3H_5\left\{\begin{matrix}OC_{18}H_{35}O\\OC_{18}H_{35}O\\OC_{18}H_{35}O\end{matrix}\right..$$

When these substances, or oils composed principally of them, are treated with alkali with the aid of heat, the following decomposition takes place:

$$C_3H_5\left\{\begin{matrix}OC_{18}H_{33}O\\OC_{18}H_{33}O\\OC_{18}H_{33}O\end{matrix}\right. + 3(NaOH) = C_3H_5\left\{\begin{matrix}OH\\OH\\OH\end{matrix}\right. + 3(Na.OC_{18}H_{33}O);$$

that is, olein is decomposed by sodium hydrate into *glyceryl hydrate*, or *glycerin* and *sodium oleate*, or a sodium soap.

The waxes differ from the fats proper in being compound ethers of the higher monatomic alcohols, like *cetyl alcohol*, $C_{16}H_{33}.OH$, and *myricyl alcohol*, $C_{30}H_{61}.OH$, instead of being glycerides. The fatty acids present are partly palmitic and stearic, but more largely still higher ones, like *cerotic acid*, $C_{27}H_{54}O_2$.

Olein. Elain. Liquid Principle of Oils. It is extremely difficult to obtain olein pure. Being in most oils associated with the solids stearin and palmitin, it has to be separated by pressure and other mechanical means, which separation is not always perfectly effected. As ordinarily procured, therefore, olein contains more or less of palmitin or stearin, or both. In this somewhat impure state, it is obtained either by the agency of alcohol or by expression. When one of the oils, olive oil, for example, is dissolved in boiling alcohol, the solution, on cooling, deposits the concrete principles, still retaining the olein, which it yields upon evaporation. The other method consists in compressing one of the solid fats, or of the liquid oils rendered concrete by cold, between folds of bibulous paper, which absorb the olein, and give it up afterwards by compression under water. Olein is a liquid of oily consistence, congealing at —6° C. (21·2° F.), colorless when pure, with little odor and a sweetish taste, insoluble in water, soluble in boiling alcohol and ether. Its formula, as already stated, is $C_3H_5(OC_{18}H_{33}O)_3$, being an oleate of the triad radical *glyceryl*, C_3H_5. By reaction with nitric acid, or, more exactly stated, under the influence of nitrous acid fumes, olein is converted into a deep yellow, butyraceous mass. If this be treated with hot alcohol, a deep orange-red oil is dissolved, and a peculiar fatty matter remains called *elaïdin.* This is white, crystalline, fusible at 34° C. (93·2° F.), insoluble in water, readily soluble in ether, and appears to be isomeric with olein. It is resolved by saponification with the alkalies into *elaïdic acid* and glycerin.

Palmitin. Palmitic acid occurs in the more liquid fats, such as palm oil, and coco-nut oil, as well as in butter and human fat, as glyceride; while in spermaceti and some forms of wax it is combined with monatomic alcohol radicals. Palmitin is the *glyceride of palmitic acid* or *tripalmitate of glyceryl.* It is best obtained from palm oil.

Stearin. This exists abundantly in tallow and other animal fats. It may be obtained by treating the concrete matter of lard, free from olein, by cold ether so long as anything is dissolved. The palmitin is thus taken up, and stearin remains. A better method is to dissolve suet in heated oil of turpentine, allow the solution to cool, submit the solid matter to expression in unsized paper, repeat the treatment several times, and finally dissolve in hot ether, which deposits the stearin on cooling. This is concrete, white, opaque in mass, but of a pearly appearance as crystallized from ether, pulverizable, fusible at 66·5° C. (152° F.), soluble in boiling alcohol and ether, but nearly insoluble in those liquids cold, and quite insoluble in water. It consists of glyceryl and stearic acid, in combination as a glyceride, $C_3H_5(OC_{18}H_{30}O)_3$, and has been formed synthetically by heating a mixture of these two materials to 280°–300° C.

Margarin. What was long known under this name was shown by Heintz in 1852 (*Journ. Prakt. Chem.*; 56, p. 1) to be a mixture of stearin and palmitin. The true *margaric acid* has been obtained only by synthesis, not occurring in nature.

The fixed oils are liable to certain spontaneous changes, which have been investigated by MM. Pelouze and Boudet. It appears from their researches that the oils are accompanied, in the seeds which contain them, with principles which act as a ferment, and cause the oils to resolve themselves spontaneously into the several fatty acids which they afford on saponification, and into glycerin. This change takes place in the seeds as soon as the cells containing the oil are broken, so as to permit the contact of the fermenting principle existing in the grain. Sometimes the fermenting principle is to a certain extent separated from the seeds along with the oil. In such a case, the oil undergoes this resolution into the fatty acids and glycerin after expression. Such was ascertained to be the case with palm oil, in which, after long keeping, MM. Pelouze and Boudet detected the presence of glycerin and of palmitic and oleic acids. They, moreover, proved that, under the continued influence of the ferment, the fatty acids themselves undergo changes, among which is the conversion of the oleic into sebacic acid; and it is probable that with a still longer continuance of the same influence the oil would be completely destroyed.

As this rancidity in fats renders them altogether useless for most practical purposes in pharmacy, and as it is not always readily discoverable by the senses in its earlier stages, it becomes desirable to possess a test by which it may be readily detected. Such a test is to be found, according to Mr. Thos. B. Groves, in iodide of potassium, which is rapidly decomposed by the new principles developed, and, by the orange-brown discoloration produced by the liberation of the iodine, indicates the existence of rancidity, and by the rapidity and degree of that discoloration approximatively the extent of the change. The alteration of color is said by Mr. Groves to be plainly perceptible when only one-twentieth of rancid fat is present.

It is also extremely important to be able to protect fats against this change. The complete exclusion of air, light, and moisture—and when in relation to air this may not be entirely practicable, the destruction by heat of the ferment-germs contained in the air, by which the decomposition is often originated—will go far to effect this object; but it would often be very inconvenient, if not impossible, to carry these measures into complete effect; and hence the discovery of substances which may have the effect of retarding, if not wholly preventing, these fermenting processes, whether by the destruction of the ferment-germs or otherwise, is extremely desirable. It is now long since one or more substances having this preservative effect have been made known and practically used; and, since the principle upon which they are supposed to act has been discovered, the number has been much extended. Thus, benzoin rubbed up with fats is well known to preserve them long against rancidity, and *benzoated lard*, made by mixing one part of benzoin with 44 parts of melted lard, is one of the preparations of the present British Pharmacopœia; and the buds of the poplar (*Populus nigra*) are perhaps still more effectual, as, according to M. Deschamps, lard impregnated with their virtues will keep good indefinitely. In the French Codex the poplar buds are employed for this purpose in the "*Pomade Populeum*," in which eight parts of the dried buds are used to 60 parts of the ointment, consisting of lard impregnated with the virtues of several narcotic substances; the fresh narcotic plants being boiled with lard until all their water is evaporated, and the buds afterwards digested in the strained liquid for 24 hours. Mr. Groves made experiments with many volatile oils and other analogous substances to test their preservative power; and, while many of them were found to have considerable effect, as cloves, Peruvian balsam, sassafras, guaiacum, and creasote, yet the one which appeared to act most efficiently was the *oil of pimento;* and he proposes to add to the officinal *prepared lard* of the British Pharmacopœia, either oil of pimento or balsam of Peru, in the proportion of two drops to the ounce, in order to contribute to its preservation. (See *A. J. P.*, 1865, pp. 54, 61.)

Animal fats are especially liable to become rancid when kept; and it is very desirable to obviate this effect; for, instead of having the mild demulcent properties which constitute their chief value, they become irritant, and unfit as vehicles for other substances to be applied to the skin. Prof. Hirzel says that animal fats may be kept in a good condition for a year by the following plan. Mix 14 pounds of the recently melted fat with 5 drachms of common salt and 15 grains of alum, in fine powder, heat till a scum is formed on the surface, separate the scum, and, when the clear liquid has cooled, wash it many times with water with malaxation, so as to remove all the salt, then evaporate the water at a heat insufficient to injure the fat. (*A. J. P.*, 1868, p. 334.)

It is sometimes desirable to deprive the fixed oils of color. The following process for this purpose is recommended by M. Brunner. The oil is first brought to the state of emulsion by strongly agitating it with water rendered mucilaginous by gum or starch; the emulsion is treated for each part of oil with two parts of wood-charcoal, previously well heated, and coarsely powdered, the finer particles being sifted out; the pasty mass is then completely dried at a heat not exceeding 212° F., and exhausted by cold ether in a percolator; finally, the ethereal solution, having been allowed to stand in order that any charcoal present in it may subside, is submitted to distillation so as to separate the ether, and the oil remains colorless in the retort. (*Journ. de Pharm.*, Sept. 1858, p. 214.) M. Berlandt recommends the following method. Shake strongly for some minutes 900 parts of the fixed oil, with 120 parts of water holding in solution 3 parts of permanganate of potassium, allow the mixture to stand for some hours in a warm place, and then filter. The oil becomes colorless. (*Journ. de Pharm. et de Chim.*, Oct. 1867, p. 314.)

2. OLEA VOLATILIA. [*Olea Destillata.*] *Volatile Oils.*

These are sometimes called *distilled oils*, from the mode in which they are usually procured; sometimes *essential oils*, from the circumstance that they possess, in a concentrated state, the properties of the plants from which they are derived. They exist in all odoriferous vegetables, sometimes pervading the plant, sometimes confined to a single part; in some instances contained in distinct cellules, and preserved after desiccation, in others formed upon the surface, as in many flowers, and exhaled as soon as formed. Occasionally two or more are found in different parts of the same plant. Thus, the orange-tree produces one oil in its leaves, another in its flowers, and a third in the rind of its fruit. In a few instances, when existing in distinct cellules, they may be obtained by pressure, as from the rind of the lemon and orange; but they are generally procured by distillation with water. (See page 985.) Some volatile oils, as those of bitter almonds and mustard, are formed, during the process of distillation, out of substances of a different nature pre-existing in the plant.

The volatile oils are usually yellowish, but often brown, red, green, or blue, and occasionally colorless. There is reason, however, to believe that, in all instances, the color depends on foreign matter dissolved in the oils. Septimus Piesse has succeeded, by the fractional distillation of certain volatile oils, in separating a blue liquid, which, by repeated rectification, he has obtained quite pure. In this state, it has the sp. gr. 0·910, and a fixed boiling point of 302·3° C. (576° F.), and yields a dense blue vapor, having peculiar optical properties. He has named this principle *azulene*, and believes that upon it depends the blueness of volatile oils wherever existing. The yellowness of the oils he ascribes to the resin resulting from their oxidation, the green and brown colors to a mixture of azulene and resin in various proportions. The formula of azulene he gives as $C_{16}H_{26}O$. (*Chem. News*, Nov. 21, 1863, p. 245.) Gladstone names this blue coloring constituent *cœruleïn*, and says that it contains nitrogen, and is colored green by acids and alkalies. The volatile oils differ from fixed oils in not forming glycerides when treated with alkalies.

The volatile oils have a strong odor, resembling that of the plants from which they were procured, though generally less agreeable. Their taste is hot and pungent, and, when they are diluted, is often gratefully aromatic. The greater number are lighter than water; some are heavier; and their sp. gr. varies from 0·847 to 1·17. They partially rise in vapor at ordinary temperatures, diffusing their peculiar odor, and are completely volatilized by heat. When distilled alone, they almost always undergo partial decomposition. Heated in the open air, they take fire and burn with a bright flame attended with much smoke. Almost all those hitherto examined have the property of very decidedly deviating the plane of polarization of light, some in one direction, and some in the other; and advantage may sometimes be taken of this property to detect adulterations of one of these oils with another.

Exposed at ordinary temperatures, they absorb oxygen, assume a deeper color, become thicker and less odorous, and are ultimately converted into resin.* This change takes place most rapidly under the influence of light. Before the alteration is complete, the remaining portion of oil may be recovered by distillation. Some of them form well-characterized acids by combination with oxygen.*

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* Some interesting observations have been made by M. Auguste Houzeau, in reference to the chemical influence of the atmosphere, which go to prove that, in reference at least to the air at

The volatile oils are largely hydrocarbons, although mixed with these are alcohol-like bodies called *camphors*, and other products of oxidation known under the general name of resins, and undoubtedly formed from the hydrocarbons. These hydrocarbons are generally known as *terpenes*, from oil of turpentine, which is taken as a type.

They may be divided into three well-defined classes, as follows:

1. The true *terpenes*, having the formula $C_{10}H_{16}$. To this class belong the hydrocarbons, constituting the major parts of the essential oils of turpentine, orange peel, caraway, nutmeg, anise, thyme, myrtle, etc.

These may be again divided into two groups: the turpentine oil group, boiling at from 156° to 163° C., and the orange oil group, boiling at 174° to 178° C.

2. The *cedrenes*, having the formula $C_{15}H_{24}$. To this class belong the essential oils of cloves, rosewood, cubebs, calamus, cascarilla, and patchouli. They boil at from 249° to 260° C.

3. The *colophene* hydrocarbons, having the formula $C_{20}H_{32}$. To this class belongs colophene itself, and perhaps para-cajuputene. Colophene boils at 315° C.

The terpenes in general are practically insoluble in water, but soluble in alcohol, ether, chloroform, benzol, petroleum spirit, and the fixed and volatile oils. (Allen, *Commerc. Org. Anal.*, vol. ii. p. 46.)

The volatile oils are very slightly soluble in water. Agitated with this fluid they render it milky, but separate upon standing, leaving the water impregnated with their odor and taste. This impregnation is more complete when water is distilled with the oils, or from the plants containing them. Trituration with magnesia or its carbonate renders them much more soluble, probably in consequence of their minute division. The intervention of sugar also greatly increases their solubility, and affords a convenient method of preparing them for internal use. The oils which contain no oxygen are scarcely soluble in diluted alcohol; and, according to De Saussure, their solubility generally in this liquid is proportionate to the quantity of oxygen which they contain.

The volatile oils dissolve sulphur and phosphorus with the aid of heat, and deposit them on cooling. By long boiling with sulphur, they form brown, unctuous, fetid substances, formerly called *balsams of sulphur*. They absorb chlorine, which converts them into resin, and then combines with the resin. Iodine produces a similar effect. They are decomposed by the strong mineral acids, and unite with several of those from the vegetable kingdom. When treated with a caustic alkali, some of them are converted into resin, which unites with the alkali to form a kind of soap. Several of the metallic oxides, and various salts which easily part with oxygen, convert them into resin. The volatile oils dissolve many of the proximate principles of plants and animals, such as the fixed oils and fats, resins, camphor, and several of the alkaloids. Exposed to air and light, they acquire a decolorizing property, analogous to that of chlorine, which is ascribed by Faraday to their combination with the ozonized oxygen of the atmosphere. For some interesting observations on this property of the volatile oils, the reader is referred to papers by Dr. J. L. Plummer, of Richmond, Indiana, in *A. J. P.* (xxv. 398 and 508).†

Rouen, in France, which was the site of these observations, this influence varies in degree with the season, being greatest in the advanced spring or early summer (May and June), diminishing sensibly in the summer and greatly in autumn, and increasing at the close of winter and the beginning of spring. If this be generally true, the change in oils, as well as in all other bodies oxidizable in the air, should be greatest at that period of the year when the atmospheric influence is greatest, namely, in May and June, and least when this is least, in the winter months. (*Journ. de Pharm. et de Chim.*, 4e sér., ii. 212–218.)

* *Recovery of volatile oils from their resinified condition.* A process for this purpose, employed by M. Curieux, is to treat the old resinified oil with a solution of borax and animal charcoal, these being first mixed to form a magma, the oil then added, and the mixture shaken for fifteen minutes. The borax unites with the resinous matter; and the magma, adhering to the sides of the vessel, leaves the oil clear and possessed of its original properties. (*A. J. P.*, Sept. 1858, p. 398.)

† See also the same journal (xxviii. 197) for some curious facts in relation to a repulsive influence exerted upon, and changes of color produced in, a mixture of chromate of potassium and sulphuric acid, by different volatile oils, at sensible and sometimes considerable distances from the mixture, effected probably through the vapor of the oils.

The volatile, like the fixed oils, are mixtures of two or more principles, which differ in their point of volatilization or congelation, or in their composition. It is, however, impossible to separate them by distillation alone so as to obtain the several principles entirely pure. When, as often happens, the constituents congeal at different temperatures, they may be separated by compressing the frozen oil between folds of bibulous paper. The solid matter remains within the folds; and the fluid is absorbed by the paper, from which it may be separated by distillation with water. The name of *stearoptene* has been proposed for the former, that of *eleoptene* for the latter. The solid crystalline substances deposited by volatile oils upon standing are also called stearoptenes. Some of them are denominated *camphors*, from their resemblance to true camphor. Some are isomeric with the oils in which they are formed, others are oxides or hydrates, alcohol-like in character. Certain oils, under the influence of water, deposit crystalline hydrates of the respective oils.

The volatile oils may be conveniently divided into three classes: 1, the *non-oxygenated*, consisting exclusively of carbon and hydrogen, as the oils of turpentine and copaiba; 2, the *oxygenated oils*, containing carbon, hydrogen, and oxygen, as oil of cinnamon and most of the aromatic oils; and, 3, the *sulphuretted*, containing sulphur, as the oils of horseradish and mustard. The composition of those which are hydrocarbons simply has already been given.

The volatile oils are often sophisticated. Among the most common adulterations are fixed oils, resinous substances, and alcohol. The presence of the fixed oils may be known by the permanent greasy stain which they leave on paper, while that occasioned by a pure volatile oil disappears entirely when exposed to heat. They may also in general be detected by their comparative insolubility in alcohol. Both the fixed oils and resins are left behind when the adulterated oil is distilled with water. If alcohol is present, the oil becomes milky when agitated with water in a graduated tube, and, after the separation of the liquids, the water occupies more space and the oil less than before. The following method of detecting alcohol was proposed by M. Beral. Put twelve drops of the suspected oil in a perfectly dry watch-glass, and add a piece of potassium about as large as the head of a pin. If the potassium remains for twelve or fifteen minutes in the midst of the liquid, there is either no alcohol present, or less than 4 per cent. If it disappears in five minutes, the oil contains more than 4 per cent. of alcohol; if in less than a minute, 25 per cent. or more. M. Borsarelli employs chloride of calcium for the same purpose. This he introduces in small pieces, well dried and perfectly free from powder, into a small cylindrical tube, closed at one end, and about two-thirds filled with the oil to be examined, and heats the tube to 212° F., occasionally shaking it. If there is a considerable proportion of alcohol, the chloride is entirely dissolved, forming a solution which sinks to the bottom of the tube; if only a very small quantity, the pieces lose their form, and collect at the bottom in a white adhering mass; if none at all, they remain unchanged. (*Journ. de Pharm.*, xxvi. 429.) J. J. Bernoulli proposes as a test dry acetate of potassium, which remains unaffected in a pure oil, but is dissolved if alcohol is present, and forms a distinct liquid. (See *A. J. P.*, xxv. 82.) Mr. George A. Kelly suggests a simple test to detect alcohol: a quantity of the oil is placed in a capsule, which is put in a dark room, and a lighted match applied to it. The alcohol in the oil will burn with its characteristic lambent flame, whilst if no alcohol is present the flame will be yellow and smoky.

Sometimes volatile oils of little value are mixed with the more costly. The taste and smell afford in this case the best means of detecting the fraud. The specific gravity of the oils may also serve as a test of purity. When two oils, of which one is lighter and the other heavier than water, are mixed, they may be separated by long agitation with this fluid, and will take a place corresponding to their respective specific gravities; but it sometimes happens that an unadulterated oil may thus be separated into two portions. The difference of apparent effect produced by iodine with the several oils has been proposed as a test; and bromine has been employed for the same purpose by Prof. John M. Maisch. Mr. Maisch uses both these tests preferably in the state of ethereal solution; which, as it is liable to spontaneous change by keeping, should be prepared when wanted for use. According to Liebig, when iodine is made to act on a volatile oil, a portion of it combines with the hydrogen of the oil, forming hydriodic acid, while another portion takes the place of the lost hydrogen. Oil of turpentine may be detected by remaining in part undissolved, when the suspected oil is treated with three or four times its volume of alcohol of the sp. gr. 0·84; or, according to M. Mero, by causing the suspected oil, when agitated with an equal measure of poppy oil, to remain transparent, instead of becoming milky, as it would do if pure. The latter test will not apply to the oil of rosemary. (*Journ. de Pharm.*, 3e sér., vii. 303.) G. S. Heppe suggests a very delicate test of oil of turpentine and most other non-oxygenated oils, when used to adulterate one of the oils containing oxygen. A piece of nitroprusside of copper, of the size of a pin's head, is put into a little of the suspected oil in a test-tube, and heated until the liquid begins to boil. The boiling must be continued only a few seconds. If the oil be pure and oxygenated, the nitroprusside of copper will become black, brown, or gray; if oil of turpentine or other non-oxygenated oil be present, the deposit will be green or bluish green, and the supernatant liquid colorless or yellowish. (*Chem. Gaz.*, April 15, 1857, p. 155; *Proc. A. P. A.*, 1858, p. 344.)

The different relations of the volatile oils to polarized light may, to a certain extent, be made available for the detection of adulterations, especially where the action of the adulterating oil is in an opposite direction to that of the oil adulterated. Thus, the oils of juniper, lavender, rosemary, rotate the plane of polarization to the left, while American oil of turpentine rotates it to the right; and if this should be added to one of the other oils, it might in some degree neutralize their action, and thus offer one means for its detection. Unfortunately, the French oil of turpentine, from the juice of the *Pinus maritima*, acts strongly in the opposite direction. But the very strength of its left rotatory power might lead to its detection by the abnormal increase of this power which it would impart to the oils in question. An instrument called the *polariscope* is necessary in these investigations; and the reader is referred, for the description of such an instrument, with a table of the direction and degree of this rotating power in several of the oils most employed, to a paper, by Mr. H. Sugden Evans, in the *Pharmaceutical Journal and Transactions* (Oct. 1865, p. 220).

Volatile oils may be preserved without change in small well-stopped bottles, entirely filled with the oil, and secluded from the light.

Manufacture. Most of the volatile oils may be prepared by the general formula of the U. S. P. 1870. "Put the substance from which the Oil is to be extracted into a retort or other vessel suitable for distillation, and add enough water to cover it; then distil by a regulated heat into a large refrigeratory. Separate the Distilled Oil from the water which comes over with it."

Under the general observations on the *Aquæ*, or *Waters*, will be found remarks upon the use of steam in preparing the Distilled Waters, which are to a considerable extent applicable also to the volatile oils.

The substances from which the volatile oils are extracted may be employed either in the recent or the dried state. Certain flowers, however, such as orange flowers and roses, must be used fresh, or preserved with salt, or by means of glycerin, as they afford little or no oil after desiccation. Most of the aromatic herbs, also, as peppermint, spearmint, pennyroyal, and marjoram, are usually distilled while fresh; although it is thought by some that, when moderately dried, they yield a larger and more grateful product. Dried substances, before being submitted to distillation, require to be macerated in water till they are thoroughly penetrated by this fluid; and, to facilitate the action of the water, it is necessary that, when of a hard or tough consistence, they should be properly comminuted by slicing, shaving, rasping, bruising, or other similar mechanical operation.

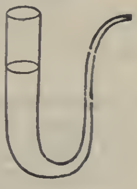
The water which is put with the subject of distillation into the still, answers the double purpose of preventing the decomposition of the vegetable matter by regulating the temperature, and of facilitating the volatilization of the oil, which, though in most instances it readily rises with the vapor of boiling water, requires, when distilled alone, a considerably higher temperature, and is at the same time liable to be partially decomposed. Some oils, however, will not ascend readily with steam at 100° C. (212° F.), and in the distillation of these it is customary to use water saturated with common salt, which does not boil under 110° C. (230° F.). Recourse may also be had to a bath of strong solution of chloride of calcium, or to an oil-bath, the temperature of which is regulated by a thermometer, as suggested by the Edinburgh College in their general directions, given above. Other oils, again, may be volatilized with water at a temperature below the boiling point; and, as heat exercises an injurious influence over the oils, it is desirable that the distillation should be effected at as low a temperature as possible. To prevent injury from heat, it has been recommended to suspend the substance containing the oil in a basket, or to place it upon a perforated shelf, in the upper part of the still, so that it may be penetrated by the steam, without being in direct contact with the water. Another mode of effecting the same object is to distil it *in vacuo.* Dr. Duncan stated that the most elegant volatile oils he had ever seen were prepared in this manner by Mr. Barry, the inventor of the process. The employment of steam heat also prevents injury; and the best volatile oils are now prepared in Philadelphia in this way. Steam can be very conveniently applied to this purpose by causing it to pass through a coil of tube, of an inch or three-quarters of an inch bore, placed in the bottom of a common still. The end at which the steam is admitted enters the still at the upper part, and the other end, at which the steam and condensed water escape, passes out laterally below, being furnished with a stopcock, by which the pressure of the steam may be regulated, and the water drawn off when necessary. In some instances it is desirable to conduct the steam immediately into the still near the bottom, by which the contents are kept in a state of brisk ebullition. This method is used in the preparation of the oil of bitter almond and the oil of mustard. The same method is applicable to the preparation of the distilled waters.

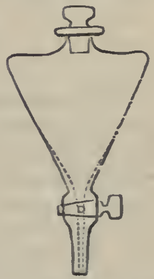
The quantity of water added is not a matter of indifference. An excess above what is necessary acts injuriously by holding the oil in solution, when the mixed vapors are condensed; and, if the proportion be very large, it is possible that no oil whatever may be obtained separate. On the contrary, if the quantity be too small, the whole of the oil will not be distilled, and there will be danger of the substance in the still adhering to the sides of the vessel, and thus becoming burnt. (See page 214.) Enough water should always be added to cover the solid material and prevent the latter accident. Dried plants require more water than the fresh and succulent. The whole amount of materials in the still should not exceed three-fourths of its capacity; as otherwise there would be danger of the liquor boiling over. The form of the still has an influence over the quantity of water distilled, which depends more upon the extent of surface than upon the amount of liquid submitted to evaporation. By employing a high and rather narrow vessel, we may obviate the disadvantage of an excess of water. (See page 582.) Sometimes the proportion of oil in the substance employed is so small that it is wholly dissolved in the water distilled, even though the proportion of the liquid in the still is not greater than is absolutely essential. In this case it is necessary to redistil the same water several times from fresh portions of the plant, till the quantity of oil which comes over exceeds its solvent power. This process is called *cohobation.*

The more volatile of the oils pass with facility along with the steam into the neck of the common still; but some which are less volatile are apt to condense in the head and thus return into the still. For the distillation of the latter, a still should be employed with a very low head. (See cut on page 582.) As, after the distillation of any one oil, it is necessary that the apparatus should be thoroughly cleansed before being used for the preparation of another, it is better that the condensing tubes should be straight, rather than spiral as in the ordinary still. It should be recollected, moreover, that certain oils, such as those of anise and fennel, become solid by a comparatively slight reduction of temperature, and that, in the distillation of these, the water employed for refrigeration should not be below 5·5° C. (42° F.).

The mixed vapors are condensed into a milky liquid, which is collected in a receiver, and, after standing for some time, separates into the oil and a clear solution of it; the former floating on the surface, or sinking to the bottom, according as it is lighter or heavier than water. The distillation should be continued so long as the fluid which comes over has this milky appearance.

The last step in the process is to separate the oil from the water. For this purpose the *Florence receiver* may be used. This is a conical glass vessel, broad at the bottom and narrow towards the top, and very near its base furnished with a tubulure or opening, to which is adapted, by means of a pierced cork, a bent tube so shaped as to rise perpendicularly to seven-eighths of the height of the receiver, then to pass off from it at right angles, and near the end to bend downwards. The condensed liquid being admitted through the opening at the top of the receiver, the oil separates, and, rising to the top, occupies the upper narrow part of the vessel, while the water remains at the bottom, and enters the tube affixed to the receiver. When the surface of the liquid attains in the receiver a higher level than the top of the tube, the water will necessarily begin to flow out through the latter, and may be received in bottles. The oil thus accumulates so long as the process continues; but it is evident that the plan is applicable only to the oils lighter than water. For the heavier oils, cylindrical vessels may be employed, to be renewed as fast as they are filled. But, as all the water cannot be removed by these plans, it is necessary to resort to some other method of effecting a complete separation. An instrument called a *separatory* is usually employed for this purpose. It consists of a glass funnel, bulging at the top, where it is furnished with a stopper, and prolonged at the bottom into a very narrow tube. The lower opening being closed, the mixed liquids are introduced and allowed to stand till they separate. The orifice at the bottom is then opened, and, the stopper at the top being a little loosened so as to admit the air, the heavier liquid slowly flows out, and may be separated to the last drop from the lighter, which floats above it. If the oil is heavier than the water, it passes out of the separatory; if lighter, it remains within. Another mode of separating the oil is to introduce into the vessel containing the two liquids one end of a cord of cotton, the other end hanging out, and terminating in a suitable receptacle beneath the level of that immersed in the liquid. The oil at top passes through the cord, and may thus be wholly removed. The last drops may be collected by pressing the cord between the fingers. According to George Leuchs, all oils obtained by distillation with water, even when perfectly clear, contain some water. (*A. J. P.*, 1873, p. 110.)





The water saturated with oil should be preserved for future distillations; as it can dissolve no more of the oil. One or more volatile acids are frequently found in the distilled water, as acetic, butyric, or valerianic; and Wunder has detected all three of these acids in the water distilled from chamomile flowers. (*Journ. für Prakt. Chem.*, lxiv. 499.)

According to Overbeck, all the volatile oils may be freed from coloring matter by distilling them from an equal weight of poppy-seed oil, and a saturated solution of common salt. (*Archiv der Pharm.*, lxxxiv. 149.)

When first procured, the oils have a disagreeable empyreumatic odor, from which they may be freed by allowing them to stand for some days in vessels loosely covered with paper. They should then be filtered and introduced into small opaque bottles, which should be well stopped so as to exclude the air. When altered by exposure to air, they may sometimes be restored to their original appearance and quality, by agitation with a little recently heated animal charcoal; and the same method may be employed for freeing them from adhering water.

The volatile oils have the medical properties of the plants from which they are derived; and, as their remedial application has been mentioned under the heads of these plants respectively, it will be unnecessary to treat of it in this place. They may be administered upon a lump of sugar; or triturated with at least ten times their weight of sugar, forming an *oleo-saccharate*, and then dissolved in water; or made into an emulsion with water, sugar, and gum arabic. In making emulsions with volatile oils,* it has been recommended first to dissolve them in one of the fixed oils, the oil of almond for example, and then to emulsionize the oleaginous solution with syrup and gum arabic. For 100 parts of water, 15 of the almond oil in which the volatile oil is to be dissolved, 10 of powdered gum arabic, and 25 of syrup may be taken. (*Journ. de Pharm.*, Juin, 1864, p. 461.) The volatile oils are often kept dissolved in alcohol under the name of *essences.* The following suggestions on preparing emulsions of the volatile oils may be useful. Oil of turpentine and other volatile oils, to be emulsionized in quantity, are most successfully treated by rubbing them with the powdered gum, and, when intimately mixed, adding at once, with rapid trituration, one and a half times the weight of the gum used, of water. By this treatment the volatile oil gets thoroughly divided before contact with water, and, if the quantity of water indicated is added at once, the emulsion has the right preliminary consistence, and unites with and emulsionizes the volatile oil. If, however, but a little water is added, this seizes on the gum, forming a pilular mass, and throws the volatile oil out of union. Such an emulsion is more permanent when a little fixed oil is used.

OLEATA. *Oleates.*

(Ō-LE̤-Ā′TA̤.)

Oléates, *Fr.;* Oleate, *G.*

The oleates are a class of preparations which were introduced to the medical profession by Prof. John Marshall, F. R. S., in 1872. They are usually solutions of certain bases in oleic acid, and are made by triturating the solid substance with the oleic acid until it is dissolved. Whenever it is possible, the application of heat should be avoided; and it has been observed that the freshly precipitated oxides of the metals dissolve more readily than those which are old. The title *oleate* is probably the best that could be devised, although it must be understood that they are not pure chemical compounds, but merely compounds of the oxides or alkaloids, as the case may be, with oleic acid dissolved in a great excess of the latter.†

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* It is often important to know how many drops a volatile oil will yield to the fluidrachm; in other words, the relation of a drop of the oil to a minim. This varies extremely according to the circumstances elsewhere noticed as influencing the size of the drop; so that any results obtained are only approximate. At the request of Dr. G. B. Wood, Professor Procter tried the following oils, with the results stated in the table below. The columns of figures represent the number of drops in a fluidrachm of the oils respectively, the first column giving those obtained by dropping the oils from the bottles in which they are commonly kept, the second by dropping them from a minim measure.

Oleum Anisi	85– 86	Oleum Fœniculi	103–103	Oleum Rosmarini	104–105
" Carui	106–108	" Gaultheriæ	102–101	" Sabinæ	102–103
" Caryophylli	103–103	" Hedeomæ	91– 91	" Sassafras	102–100
" Chenopodii	97–100	" Menthæ Piperitæ	103–109	" Tanaceti	92–111
" Cinnamomii	100–102			" Valerianæ	116–110
" Cubebæ	86– 96	" Menthæ Viridis	89– 94	Creasotum	95– 91

For a table giving results as to the specific gravity, the refracting power, and influence on polarized light, of a large number of volatile oils, prepared by Mr. Gladstone, see the *Journ. de Pharm. et de Chim.* (4e sér., ii. 68, 1865); also *A. J. P.* (1865, p. 389).

Enfleurage. This term is applied by the French to the impregnation of fixed oils and fatty matters with the odor of certain sweet-scented plants, such as jasmine, tuberose, and mignonette, the oils of which are so delicate and fugitive that they cannot well be separated by distillation. The process consists in exposing the fatty matter, placed in layers, in suitable frames, to the exhalations from the flowers, which are absorbed, and give their characteristic odor to the fat. Another plan is to expose alternate layers of the flowers, and of cotton impregnated with bland fixed oil, to the sun, and afterwards to express the oil from the cotton. For remarks on this process, as conducted in the south of France, see *A. J. P.* (xxix. 551).

† Dr. L. Wolff has published a process for obtaining oleates as follows. One part of Castile soap (sodium oleo-palmitate) is dissolved in eight parts of water, the solution so obtained is allowed to cool and stand for 24 hours, when there will be a considerable deposit of sodium palmitate, while the supernatant liquor, containing mostly sodium oleate, is drawn off and then decomposed with a concentrated solution of a metallic salt which, if obtainable, should contain no free acid to prevent the formation of free oleo-palmitic acid. The heavy deposit of oleo-palmitate so derived is strained off, pressed out in the strainer and the adherent water evaporated in a water-bath; after this it is dissolved in about six to eight times its quantity of petroleum benzin, and the insoluble palmitate is left to subside while the solution of oleate decanted therefrom is filtered off. The benzin evaporated will yield an oleate that is entitled to that name, as it is a chemical combination and will remain stable and efficacious. The oleates, so prepared, present an amorphous appearance, while the palmitates are of a crystalline character. (*A. J. P.*, 1881, p. 545.)

The *medical properties* of the oleates are, of course, dependent upon the base, so that these preparations may be considered as the equivalents of the corresponding ointments, over which, however, they have certain advantages. They are much cleaner and more elegant in appearance, and, what is more important, owing to the perfect solution of the base the latter penetrates the skin much more readily and affects deep-seated parts, or is even absorbed in notable amount into the general system. They seem to be more irritating than the ointments, and, unless diluted with an equal bulk of cotton-seed, olive, or other bland oil, are, when applied with friction, apt to provoke a cutaneous eruption or even pustulation. Their proposer, Dr. Marshall, recommends that they be applied with a brush, or gently spread over the part with one finger.

OLEATUM HYDRARGYRI. *U. S.* *Oleate of Mercury.*

(Ō-LẸ-Ā'TŬM HȲ-DRĂR'ḈỴ-RĪ.)

Oléate de Mercure, *Fr.;* Oëlsaures Quecksilber, *G.*

"Yellow Oxide of Mercury, thoroughly dried, *ten parts* [or forty grains]; Oleic Acid, *ninety parts* [or one fluidounce], To make *one hundred parts* [or about one fluidounce]. Heat the Oleic Acid, contained in a porcelain vessel, to near 74° C. (165·2° F.), taking care not to exceed this temperature. Gradually add the Oxide of Mercury, and stir until it is dissolved." *U. S.*

This is a new officinal preparation. It was introduced by Prof. John Marshall in 1872. If made from oleic acid which has been purified from the usual contaminations, palmitic and stearic acids, it is a clear yellowish liquid of a thick consistence, and having the peculiar odor of oleic acid. As usually seen, however, it is of the consistence and appearance of petrolatum, due to the presence of small quantities of palmitate and stearate of mercury. (See *Acidum Oleicum*, p. 88.) In making this preparation, care must be exercised in the selection of the oleic acid, and to avoid exceeding the degree of heat directed in the officinal process; indeed, our experience has been that it keeps better if made by the cold process; *i.e.*, by simply mixing the freshly precipitated yellow oxide with the oleic acid, and allowing them to stand at ordinary temperatures until the precipitate has dissolved. In time, even with the best oleic acid that can be procured, some decomposition will take place, and metallic mercury will be found at the bottom of the containing bottle. The rapidity of the change will be in proportion to the impurities in the oleic acid.

Medical Properties. This preparation may often be substituted with advantage for mercurial ointment, which it closely resembles in its medical properties, except that it is more readily absorbed, and therefore more effective. It has been especially commended by Dr. Marshall in cases of chronically inflamed joints, and in hordeolum, indurations after abscesses, and various other forms of superficial local inflammations of a slow type; also in sycosis, tinea, psoriasis, eczema, and as a constitutional alterative in hereditary syphilis. For many purposes it is much improved by dissolving in every drachm of it one grain of morphine. The alkaloid itself must be used in such cases, as its salts are not soluble in oleic acid.

OLEATUM VERATRINÆ. *U. S.* *Oleate of Veratrine.*

(Ō-LẸ-Ā'TŬM VĔR-Ạ-TRĪ'NÆ.)

Oléate de Vératrine, *Fr.;* Oëlsaures Veratrin, *G.*

"Veratrine, *two parts* [or eight grains]; Oleic Acid, *ninety-eight parts* [or one fluidounce], To make *one hundred parts* [or one fluidounce]. Rub the Veratrine with a small quantity of the Oleic Acid, in a warm mortar, to a smooth paste. Add this to the remainder of the Oleic Acid, heated in a porcelain capsule, on a water-bath, and stir until it is dissolved." *U. S.*

This new preparation is simply a solution of the alkaloid in oleic acid. It may be substituted for Unguentum Veratrinæ, but is exactly half the strength. It is well adapted for obtaining all of the advantage that can be derived from an application of veratrine by inunction. (See *Veratrinæ.*) When the veratrine is to be used as a counter-irritant, the ointment is preferable, because less favorable to the absorption of the alkaloid. The *Oleate of Morphine* is made in the same way; but Dr. Squibb makes this oleate and oleate of veratrine of the strength of 10 per cent.

OLEORESINÆ. *Oleoresins.*

(Ō-LẸ-Ō-RẸ-ȘĪ′NÆ.)

Oléo-résines, Extraits éthérés, *Fr.;* Oelharze, Aetherische Extrakte, *G.*

The oleoresins, as a class of Preparations, were introduced into the U. S. Pharmacopœia at the revision of 1860, having been previously classed with the Fluid Extracts. Their peculiarity is that they consist of principles which, when extracted by means of ether, retain a liquid or semi-liquid state upon the evaporation of the menstruum, and at the same time have the property of self-preservation; differing in this respect from the fluid extracts, which require the presence of alcohol in order to prevent decomposition. They consist chiefly, as their name implies, of oil either fixed or volatile, holding resin and sometimes other active matter in solution. Their preparation is very simple, consisting in the exhaustion of the medicine employed with ether, by means of percolation, and the subsequent evaporation of the menstruum. In consequence of the great volatility of ether, it may in great measure be recovered by distillation, thus very materially diminishing the costliness of the process. It is proper not to continue the heat necessary for the distillation till the whole of the ether is driven over, lest, towards the close, a portion of the volatile matters also should pass, and the strength of the oleoresin be impaired. Hence, in every instance, the last portions of the menstruum are allowed to separate by spontaneous evaporation. Benzin has been proposed as a substitute for ether in these preparations, but should not be permitted to supersede it until officinally sanctioned.

OLEORESINA ASPIDII. *U.S.* *Oleoresin of Aspidium.*

(Ō-LẸ-Ō-RẸ-ȘĪ′NẠ ẠS-PĬD′Ị-Ī.)

Oleoresina Filicis, *Pharm.* 1870; Extractum Filicis Liquidum, *Br.;* Liquid Extract of Male Fern, Oil of Fern; Extractum Filicis, *P.G.;* Oleum Filicis Maris; Huile (Extrait Éthéré) de Fougère mâle, *Fr.;* Wurmfarnextrakt, Wurmfarnöl, *G.*

"Aspidium, in No. 60 powder, *one hundred parts* [or sixteen ounces av.]; Stronger Ether, *a sufficient quantity.* Put the Aspidium into a cylindrical glass percolator, provided with a cover and receptacle suitable for volatile liquids, press it firmly, and gradually pour Stronger Ether upon it, until *one hundred and fifty parts* [or two pints] of liquid have slowly passed. Recover the greater part of the Ether by distillation on a water-bath, and expose the residue, in a capsule, until the remaining ether has evaporated. Keep the Oleoresin in a well-stopped bottle.

"NOTE. Oleoresin of Aspidium usually deposits, on standing, a granular-crystalline substance. This should be thoroughly mixed with the liquid portion before use." *U. S.*

"Take of Male Fern, in coarse powder, *two pounds* [avoirdupois]; Ether *four pints* [Imperial measure], or *a sufficiency.* Pack the Male Fern closely in a percolator; and pass the Ether slowly through it, until it passes colorless. Let the ether evaporate on a water-bath, or recover it by distillation, and preserve the oily extract." *Br.*

This is the only preparation of male fern which should be used. It is a thick, dark green liquid, usually containing a granular deposit of *filicic* acid, which is regarded as the active ingredient, and should not be separated. It has the odor of fern, and a nauseous, bitterish, somewhat acrid taste. According to Hayes, when an absolutely dry root and an anhydrous ether containing but little alcohol of a specific gravity below 0·728 are used, the oleoresin remains clear. The dose is one-half to one fluidrachm (1·9 to 3·75 C.c.), administered in gelatin capsules.

OLEORESINA CAPSICI. *U. S.* *Oleoresin of Capsicum.*

(Ō-LẸ-Ō-RẸ-ȘĪ′NẠ CĂP′SỊ-CĪ.)

Oléorésine (Extrait éthéré) de Capsique, *Fr.;* Spanischpfeffer-Oelharz, *G.*

"Capsicum, in No. 60 powder, *one hundred parts* [or sixteen ounces av.];

Stronger Ether, *a sufficient quantity.* Put the Capsicum into a cylindrical percolator, provided with a cover and receptacle suitable for volatile liquids, press it firmly, and gradually pour Stronger Ether upon it, until *one hundred and fifty parts* [or two pints] of liquid have slowly passed. Recover the greater part of the Ether by distillation on a water-bath, and expose the residue, in a capsule, until the remaining Ether has evaporated. Lastly, pour off the liquid portion, transfer the remainder to a strainer, and, when the separated fatty matter, which is to be rejected, has been completely drained, mix all the liquid portions together. Keep the Oleoresin in a well-stopped bottle." *U. S.*

The active principle of capsicum, called capsaicin, is very soluble in ether, and is wholly extracted in the process. Its precise nature has not been determined. (See *Capsicum.*) After the concentration of the ethereal solution, a solid fatty matter separates on standing, but a portion of fixed oil probably still remains. The preparation is a very thick liquid, capable, however, of being dropped, of a dark reddish brown color, and, though opaque in mass, yet transparent in thin layers. It has not very decidedly the odor of capsicum, but to the taste is intensely pungent. It may be usefully employed to give locally stimulant properties to substances administered internally in a pilular form, in cases of gastric insensibility and excessive flatulence. Dr. H. C. Wood has seen one drop given three times a day produce cystic irritation and strangury. The dose is one-fourth to one minim (0·015–0·06 C.c.). It may be used also as a powerful rubefacient, diluted with olive oil or soap liniment.

Off. Prep. Emplastrum Capsici.

OLEORESINA CUBEBÆ. *U. S.* *Oleoresin of Cubeb.*

(Ō-LẸ-Ō-RẸ-ṢĪ'NẠ CŮ-BĒ'BÆ.)

Extractum Cubebarum, *P.G.;* Extractum Cubebæ Æthereum; Oléorésine de Cubèbe, *Fr.;* Aetherisches Kubebenextrakt, *G.*

"Cubeb, in No. 60 powder, *one hundred parts* [or sixteen ounces av.]; Stronger Ether, *a sufficient quantity.* Put the Cubeb into a cylindrical percolator, provided with a cover and receptacle suitable for volatile liquids, press it firmly, and gradually pour Stronger Ether upon it, until *one hundred and fifty parts* [or two pints] of liquid have slowly passed. Recover the greater part of the Ether by distillation on a water-bath, and expose the residue in a capsule until the remaining Ether has evaporated. Transfer the remainder to a close vessel, and let it stand until it ceases to deposit a waxy and crystalline matter. Lastly, pour off the Oleoresin. Keep the Oleoresin in a well-stopped bottle." *U. S.*

This *oleoresin* consists mainly of the volatile oil and resin, with a portion of the cubebin and waxy matter of the cubebs. The consistence differs with the character of the cubebs employed; its degree of fluidity being proportionate to the amount of volatile oil contained in the medicine. The color is usually blackish brown with more or less of a greenish hue, according to the quantity of chlorophyll present, which varies with the character of the cubebs, and with that of the menstruum; pure ether extracting the green coloring matter preferably, while ordinary alcoholic ether extracts also the brown. Cubebs yield from one-eighth to one-fifth of their weight of the oleoresin. The preparation deposits waxy matter and crystals of cubebin on standing, which should be separated; its efficacy is not impaired on this account. It was first introduced into use by Prof. Procter. (*A. J. P.*, xviii. 168.)

From carefully conducted experiments by Mr. F. V. Heydenreich, it would appear that, of the various constituents of cubebs contained in the officinal oleoresin, the cubebin has no perceptible effect in the dose of the medicine ordinarily given, that the volatile oil is simply stimulant and carminative, and, finally, that the soft resin has all the diuretic properties of the cubebs. Of the last-mentioned ingredient, twenty grains (1·3 Gm.) given every two hours till five doses were taken, considerably increased the secretion of urine, producing at the same time a slight burning sensation in the passage, which ceased with the diuretic action. Pushed beyond this amount, it occasioned severe irritation of the urinary passages, with some fever. (*Ibid.*, Jan. 1868, p. 42.)

This oleoresin, as it occurs in the market, often has a decided ethereal odor, and is of a thin consistence. In one specimen three-eighths of its weight of ether were lost, in a short time, by spontaneous evaporation. As the cubebs are very nearly exhausted by the ether before the whole of it has passed, there is a considerable expenditure of that liquid for the sake of a scarcely appreciable portion of the active matter. In case of excess of ether in the oleoresin, it should be allowed to escape by spontaneous evaporation in a capsule. (*Ibid.*, May, 1860, p. 210.)

The dose of this oleoresin is from five to thirty minims (0·3 to 1·9 C.c.), which may be given suspended in water, or mixed with powdered sugar.

Off. Prep. Troschisci Cubebæ, *U. S.*

OLEORESINA LUPULINI. *U. S.* *Oleoresin of Lupulin.*

(Ō-LẸ-Ō-RẸ-ȘĪ′NẠ LŪ-PŪ-LĪ′ṆĪ.)

Oleoresina Lupulinæ, *Pharm.* 1870; Extractum Lupulini Æthereum; Oléorésine de Lupuline, *Fr.;* Aetherisches Lupulinextrakt, *G.*

"Lupulin, *one hundred parts* [or sixteen ounces av.]; Stronger Ether, *a sufficient quantity*. Put the Lupulin into a narrow, cylindrical percolator, provided with a cover and receptacle suitable for volatile liquids, press it firmly, and gradually pour Stronger Ether upon it, until *one hundred and fifty parts* [or two pints] of liquid have slowly passed. Recover the greater part of the Ether by distillation on a water-bath, and expose the residue, in a capsule, until the remaining Ether has evaporated. Keep the Oleoresin in a well-stopped, wide-mouthed bottle." *U. S.*

Lupulin yields its volatile oil and resin, as well as any other active principle it may contain, to ether, and the resulting oleoresin constitutes about three-eighths, or somewhat less than one-half, of the original drug. It is of a very thick semi-fluid consistence, so thick, indeed, that it cannot be conveniently administered by drops. Its color is almost black in mass, but a rich reddish brown in thin layers. It has the odor and taste of lupulin, and possesses all its medical properties. The dose is from two to five grains (0·13 to 0·33 Gm.), and may be most conveniently administered in the form of pill, made with powdered liquorice root, or other proper excipient.

OLEORESINA PIPERIS. *U. S.* *Oleoresin of Black Pepper.*

(Ō-LẸ-Ō-RẸ-ȘĪ′NẠ PĪ′PẸ-RĬS.)

Extractum Piperis Fluidum, *U. S.* 1850; Fluid Extract of Black Pepper; Oléorésine de Poivre noir, *Fr.;* Aetherisches Pfefferextrakt, *G.*

"Pepper, in No. 60 powder, *one hundred parts* [or sixteen ounces av.]; Stronger Ether, *a sufficient quantity*. Put the Pepper into a cylindrical percolator, provided with a cover and receptacle suitable for volatile liquids, press it firmly, and gradually pour Stronger Ether upon it, until *one hundred and fifty parts* [or two pints] of liquid have slowly passed. Recover the greater part of the Ether by distillation on a water-bath, and expose the residue, in a capsule, until the remaining Ether has evaporated, and the deposition of piperine, in crystals, has ceased. Lastly, separate the Oleoresin from the piperine by expression through a muslin strainer. Keep the Oleoresin in a well-stopped bottle." *U. S.*

A substance has long been in use under the name of *oil of black pepper*, consisting mainly of the volatile oil, fixed oil, and resin of the pepper, and belonging, therefore, to the oleoresins. As usually found, it is almost black, and of a thickish consistence, and is a residue of the process for preparing piperine. The officinal oleoresin has the same general character, but is more fluid, and of more uniform strength, and should, therefore, be preferred. It contains almost all the volatile oil and acrid resin of black pepper, with little of the piperine; and, as the last-mentioned principle, when quite pure, is of doubtful efficacy, the extract may be considered as representing the virtues of the fruit. The color is greener than that of the common oil of black pepper, and not so dark, owing to the fact that ether dissolves the green more readily than the brown coloring matter. A pound of black pepper yields about six drachms of the oleoresin. The dose is one-fourth to one minim (0·015 to 0·06 C.c.), given in emulsion, or combined with other substances in the form of pill.

OLEORESINA ZINGIBERIS. *U. S.* *Oleoresin of Ginger.*

(Ō-LẸ-Ō-RẸ-ṢĪ'NẠ ZỊN-ḈĬB'Ẹ-RĬS.)

Extractum Zingiberis Æthereum; Oléorésine (Piperoide) de Gingembre, *Fr.;* Aetherisches Ingwerextrakt, *G.*

"Ginger, in No. 60 powder, *one hundred parts* [or sixteen ounces av.]; Stronger Ether, *a sufficient quantity.* Put the Ginger into a cylindrical percolator, provided with a cover and receptacle suitable for volatile liquids, press it firmly, and gradually pour Stronger Ether upon it, until *one hundred and fifty parts* [or two pints] of liquid have slowly passed, or until the Ginger is exhausted. Recover the greater part of the Ether by distillation on a water-bath, and expose the residue, in a capsule, until the remaining Ether has evaporated. Keep the Oleoresin in a well-stopped bottle." *U. S.*

In the U. S. formula of 1870, for this preparation alcohol was used in connection with ether, on the score of economy; it was added in order to displace the ether, and thus save an unnecessary expenditure of the more costly fluid. A little of the alcohol mixed with the ether at their surface of contact. In the present process alcohol is not used, and there is no good reason for making an exception to the general formula in this case. The whole of the virtues of the root are extracted in this preparation, as the residuary ginger is nearly or quite tasteless. The oleoresin constitutes about 5 per cent. of the dried root. It is the *piperoid of ginger* of M. Beral. (*Soubeiran's Trait. de Pharm.*, i. 371.) It is a clear, dark brown liquid, of a thick consistence, though capable of being dropped, with the flavor of ginger, and intensely pungent. Its dose should not exceed a minim (0·06 C.c.), and should be much diluted.

OLEUM ADIPIS. *U. S.* *Lard Oil.*

(Ō'LẸ-ŬM ĂD'Ị-PĬS.)

"A fixed oil expressed from Lard at a low temperature." *U. S.*

This oil is made in large quantities in this country by exposing lard to low temperatures, and then subjecting it to very powerful pressure. In this way the stearin of the lard is separated from the olein, the latter oozing out from the presses in the form of a yellowish white oil, whilst the stearin is thrown into the market in hard cakes, and is largely used in making soap. (See *Adeps.*)

Properties. Lard oil is "a colorless or pale yellowish, oily liquid, becoming opaque at or below 0° C. (32° F.), having a slightly fatty odor and a bland taste. Sp. gr. 0·900 to 0·920." It is not pure olein, but contains varying proportions of stearin, and is sometimes adulterated with paraffin oil. It has been introduced into the Pharmacopœia for the purpose of using in ointment of nitrate of mercury.

Medical Properties. Lard oil is simply a fatty material, destitute of active medical properties, which is officinal solely for pharmaceutical purposes.

OLEUM ÆTHEREUM. *U. S.* *Ethereal Oil.*

(Ō'LẸ-ŬM Æ-THĒ'RẸ-ŬM.)

"A volatile liquid, consisting of equal volumes of Heavy Oil of Wine and of Stronger Ether." *U. S.*

Oleum Vini: Heavy Oil of Wine; Huile d'Éther, Huile de Vin pésante, Huile volatile éthérée, *Fr.;* Schweres Weinöl, *G.*

Alcohol, *twenty-four parts;* Sulphuric Acid, *fifty-four parts;* Distilled Water, *one part;* Stronger Ether, *a sufficient quantity.* Add the Acid slowly to the Alcohol, mix them thoroughly, and allow the mixture to stand for twelve hours; then pour the clear liquid into a tubulated retort of such capacity that the mixture shall nearly fill it. Insert a thermometer through the tubulure, so that the bulb shall be deeply immersed in the liquid, and, having connected the retort with a well-cooled condenser, distil, by means of a sand-bath, at a temperature between 150° and 157° C. (302° and 314·6° F.), until the liquid ceases to come over, or until a black froth begins to rise in the retort. Separate the yellow, ethereal liquid from the distillate, and expose it to the air, for twenty-four hours, in a shallow capsule. Then transfer it to a wet filter, and when the watery portion has drained off, wash the oil which is left on the filter with the Distilled Water. When this, also, has drained off, transfer the oil to a graduated measure, and add to it an equal volume of Stronger Ether." *U. S.*

In the consolidation of the British Pharmacopœias, this valuable remedy was omitted, partly on account of the uncertainty as to its special antispasmodic virtues, partly from its expensiveness when properly made and its liability to spontaneous change, and partly, moreover, because not only is it often adulterated, but other compounds are substituted for it. (*Med. Times and Gaz.*, March, 1864, p. 248.)

The object of allowing the mixture of acid and alcohol to stand is, to allow the sulphate of lead to deposit, for, according to Dr. Squibb, its presence in the retort causes the mixture to froth over, and this necessitates a suspension of the process so much sooner as greatly to lessen the amount of product the materials are capable of affording. The increase of oil resulting from this simple modification of the process is said to be one-third. The temperature has been slightly decreased. By wetting the filter, the oil is prevented from passing along with the water. Finally, the oil is now ordered to be diluted with an equal measure of stronger ether, as this has been found to contribute greatly to its preservation.

When alcohol is distilled with a large excess of sulphuric acid, there are formed towards the close of the distillation sulphurous acid, heavy oil of wine, olefiant gas, and resino-carbonaceous matter. The product of the distillation is generally in two layers, one consisting of water holding sulphurous acid in solution, and the other, of ether containing the heavy oil of wine. According to the experience of Dr. Squibb, the sp. gr. of these two layers is so nearly equal, that sometimes one and sometimes the other is uppermost; so that the direction in the old formula to separate the supernatant liquor is incorrect, and has been superseded by the present, to separate the yellow ethereal liquid; the color and other sensible properties being considered sufficiently distinctive. After separation, the liquid is exposed for twenty-four hours to the air, in order to dissipate the ether by evaporation; and the oil which is left is washed with water to deprive it of all traces of sulphurous acid.

The nature and mode of formation of heavy oil of wine are generally believed to be the following. It has been explained, in a preceding article, that, in the early stage of the distillation of a mixture of sulphuric acid and alcohol, sulphovinic acid, $C_2H_5HSO_4$, is formed. During its progress this is decomposed so as to yield ether. When, however, the alcohol is distilled with a large excess of sulphuric acid, the sulphovinic acid is decomposed so as to form a small quantity of the *heavy oil of wine.* This is a mixture of ethyl sulphate, $(C_2H_5)_2SO_4$, ethyl sulphite, $(C_2H_5)_2SO_3$ (the sulphurous acid having been formed by reduction of sulphuric acid, as it always is when ethylene is formed from alcohol), with polymeric forms of ethylene, C_2H_4. Two of these forms are known: *etherin*, a solid fusing at 110° C. and boiling at 260° C., and *etherol*, a liquid. This latter is by some considered to have the formula $C_{16}H_{32}$, or $(C_2H_4)_8$, and mixed with the former constitutes the *light oil of wine*, which is produced when the heavy oil is heated with water or alkaline solutions. In this case sulphovinic acid is reproduced, and the separated *etherol* floats on the surface as an oily substance. *Light oil of wine*, as thus obtained, is a pale yellow oil. As ordinarily procured in the process for preparing ether, it contains a portion of that substance. When the pure light oil of wine is kept, it deposits a stearoptene (the *etherin* mentioned above) called concrete oil of wine, or oil of wine camphor; after which the oil is changed, and takes the name of etherol. *Etherol* is a pale yellow oily liquid, having an aromatic odor. Its sp. gr. is 0·921, boiling point 280° C. (536° F.), and freezing point 31° F. below zero. It communicates a greasy stain to paper. *Concrete oil of wine*, or *etherin*, crystallizes in long, transparent, brilliant, tasteless prisms, soluble in alcohol and ether, insoluble in water, and having the sp. gr. 0·980. Dr. Squibb takes a different view of the composition of ethereal oil, and believes it, instead of a sulphate or mixture of sulphate and sulphite, to be a sulphovinate of a hydrocarbon radical; and for this reason, that it fails, especially when pure and recent, to give any of the characteristic reactions of sulphuric acid or the sulphates. (*A. J. P.*, 1861, p. 58.)*

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* Valuable papers have been contributed by Mr. C. Lewis Diehl and Prof. John M. Maisch on this officinal preparation; the former in *Proc. A. P. A.*, 1864; the latter in *A. J. P.*, 1865, p. 160,

Properties. The undiluted *ethereal oil* (*heavy oil of wine*) is a yellowish neutral liquid, possessing an oleaginous consistency, a penetrating aromatic odor, and a rather sharp and bitter taste. It boils at 280° C. (536° F.). Its sp. gr. is, according to the U. S. P. 1850, 1·096; according to the London College, after Mr. Hennell's results, 1·05. The density obtained by Dr. Squibb, U. S. Navy, by following the old formula of the U. S. Pharmacopœia exactly, was 1·129. By Dumas and Serullas its density is stated to be as high as 1·133, which is probably the more correct number for the *pure* oil. When dropped into water it sinks, assuming the form of a globule. It dissolves sparingly in cold water, moderately in hot water, and readily in alcohol and ether. It is devoid of acid reaction, the sulphuric and sulphurous acids present in it being in the form of neutral salts. The sulphuric acid present is not precipitated by the usual reagents for this acid; because sulphovinic acid is formed, and all the sulphovinates are soluble in water. The U. S. ethereal oil of the present Pharmacopœia is the proper oil diluted with an equal volume of stronger ether. This gives it an ethereal odor in addition to that characteristic of the pure oil, and considerably reduces its sp. gr., which is now stated at 0·910. The process by which the officinal oil of wine is formed yields but a small product, being, according to the Pharmacopœia of 1870, only about six fluidrachms, or somewhat more than a fortieth, by measure, of the alcohol employed.

In the officinal ethereal oil, the heavy oil of wine is not only diluted with an equal measure of ether, but is mixed also with variable proportions of free light oil of wine. This fact accounts for the different densities assigned to the heavy oil.

The heavy oil undiluted is liable to spontaneous change by time, being not only rendered brown, but chemically altered so as to separate into two layers. But this tendency is in great measure obviated, in the officinal ethereal oil, by the preservative influence of the ether. It may be kept long without other appreciable change than the acquisition of a brown hue, which does not interfere with its medical virtues. It should not, when tested by dry litmus paper, evince the presence of any free acid.

The article sold in commerce as ethereal oil is too often a mixture of alcohol and ether, containing but a trace of the oil. The ethereal oil is used only for the preparation of the Compound Spirit of Ether, or Hoffman's anodyne, which, when properly made, is a very valuable medicine; and it is much to be regretted that due attention has not been paid by the manufacturing chemists generally to the furnishing of a good ethereal oil to pharmacists. It is necessarily an expensive preparation; but this does not justify the substitution for it of a cheaper but nearly worthless article.

Off. Prep. Spiritus Ætheris Compositus, *U. S.*

OLEUM AMYGDALÆ AMARÆ. *U. S.* *Oil of Bitter Almond.*

(Ō′LE̱-ŬM A̱-MY̆G′DA̱-LÆ A̱-MĀ′RÆ.)

"A volatile oil, obtained from Bitter Almond by maceration with water, and subsequent distillation." *U. S.*

Oleum Amygdalarum (Amararum) Æthereum; Essence d'Amandes amères, *Fr.;* Bittermandelöl, *G.*

When bitter almonds are expressed, they yield a bland fixed oil; and the residuary cake, reduced to powder by grinding, and submitted to distillation with water, yields a volatile oleaginous product, commonly called oil of bitter almond. This does not pre-exist in the almond, but is produced by the reaction of water upon the amygdalin contained in it, through the intervention of another constituent denominated emulsin (see *Amygdala Amara*), according to the reaction: $C_{20}H_{27}NO_{11} + 2H_2O = C_7H_6O + 2(C_6H_{12}O_6) + HCN$. It is obtained also by the

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to which we refer those especially concerned in its manufacture. In Mr. Diehl's paper valuable suggestions are made in reference to the mode of reheating so as properly to regulate the temperature. An important practical fact is stated by Prof. Maisch, that the ethereal oil, in contact with water, undergoes a decomposition into light oil of wine and sulphovinic acid, rapidly and completely if the water is hot or if solution of an alkali or alkaline carbonate is used, and more slowly with cold water. Hence the inference that the washing of the ethereal oil, directed at the close of the U. S. process, should be completed as rapidly as possible.

distillation of the leaves of the cherry-laurel, and of various products of the genera Amygdalus, Cerasus, Prunus, etc. Mr. Whipple obtained, upon an average, from the ground bitter almond cake, 1·35 per cent. of the oil. (*P. J. Tr.*, x. 297.) Pettenkoffer has ascertained that the product is greater if the cake be macerated in water for forty-eight hours before being submitted to distillation. (*Journ. de Pharm.*, Mai, 1862, p. 432.) It is sometimes produced in France from peach kernels.

Oil of bitter almond has a yellowish color, a bitter, acrid, burning taste, and the odor of the kernels in a high degree. It is heavier than water, soluble in alcohol and ether, according to Flückiger soluble in 300 parts of hot or cold water, and deposits, upon standing, a white crystalline substance consisting chiefly of benzoic acid. It is officinally described as "a colorless or yellowish, thin liquid, of a peculiar, aromatic odor, a bitter and burning taste, and a neutral reaction. Sp. gr. 1·060 to 1·070 (after removal of hydrocyanic acid, 1·043 to 1·049). Soluble in 300 parts of water, and in alcohol and in ether in all proportions; also in nitric acid, at the ordinary temperature, without the evolution of nitrous vapors. When heated to 80° C. (176° F.), the oil should yield no distillate having the odor or characteristics of chloroform or of alcohol. If 1 part of the oil be dissolved in 4 parts of alcohol, then 1 part of potassa added, the mixture heated for a few minutes, then evaporated to one-third, and cooled, the resulting liquid should have a brownish yellow color, and should be soluble in water with but slight turbidity, but without depositing a brownish yellow sediment (abs. of nitrobenzol)." *U. S.* Besides a peculiar volatile oil, it contains also hydrocyanic acid, with a small proportion of benzoic acid, and of a concrete principle called *benzoïn*, $C_{14}H_{12}O_2$. It may be obtained pure by agitating it strongly with hydrate of lime and a solution of ferrous chloride, submitting the mixture to distillation, and drying the oil which comes over by digestion with chloride of calcium. Mr. George Whipple states that, if crude oil be redistilled into a solution of nitrate of silver, and again distilled from a fresh solution of the same salt, it is obtained entirely free from hydrocyanic acid, which reacts with the silver, and remains behind as cyanide of silver. (See *A. J. P.*, xxvi. 348.) Thus purified, it is colorless, but still retains its peculiar odor, with a burning, aromatic taste, and is destitute of those poisonous properties of the crude oil which are dependent on hydrocyanic acid. The odor of the oil of bitter almond has been erroneously ascribed to that acid, which, on examination, will be found to smell differently and more feebly. Like most other volatile oils, this may produce deleterious effects if taken very largely. Hippuric acid is found in the urine of animals to which it has been given freely. The sp. gr. of the crude oil varies from 1·052 to 1·082, and is said to be greater when the oil is distilled from salt water, than by the ordinary mode. That of the purified oil is 1·043, and its boiling point 180° C. (356° F.). It is *benzoic aldehyd*, $C_6H_5.COH$, which is produced by the action of oxidizing agents upon *benzyl alcohol*, $C_6H_5.CH_2OH$, and yields itself, when oxidized, *benzoic acid*, $C_6H_5.COOH$. The benzoic acid which the oil of bitter almond deposits on standing does not pre-exist in it, but results from the absorption of oxygen, as just stated. The concrete substance above referred to by the name of *benzoïn* is polymeric with the oil, crystallizable in colorless shining prisms, without smell or taste, fusible at 248°, and volatilizable unchanged at a higher temperature. It is formed abundantly in the original impure oil by the reaction of alkalies, but cannot be produced in it when deprived of hydrocyanic acid.*

Artificial benzoic aldehyd is now made from toluol, C_7H_8. By the action of chlorine upon the hot hydrocarbon, benzyl chloride, $C_6H_5CH_2CL$, results, and this yields benzoic aldehyd on distillation with nitrate of lead and water in an atmosphere of carbon dioxide gas. The product is purified by conversion into the acid sulphite compound. Artificial benzoic aldehyd is free from hydrocyanic acid, but is liable to retain traces of chlorine compounds. (Allen, *Com. Org. Analysis*, i. 341.) Lippmann and Hawliczek have made exhaustive researches on the identity of the artificial with the natural oil of bitter almond, and have found the two oils absolutely identical, physically as well as chemically.

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* *Nitrobenzol, Nitrobenzin, or Artificial Oil of Bitter Almond.* This substance, which was discovered by Mitscherlich, is treated of in Part II.

Zeller mentions, as characteristics of the officinal oil by which its genuineness and purity may be known, its peculiar odor and high specific gravity; its ready solubility in sulphuric acid, with the production of a reddish brown color, but without visible decomposition; the slow action of nitric acid; the slow and partial solution of iodine without further reaction; the want of action of chromate of potassium upon it; and the production of crystals when it is dissolved in an alcoholic solution of potassa. (See *P. J. Tr.*, ix. 575.) Mr. Redwood states that a very small proportion of alcohol may be detected in the oil, by the effervescence, with disengagement of nitrous vapors, which ensues when the oil, thus contaminated, is mixed with an equal volume of nitric acid, of the sp. gr. 1·5. With pure oil no other effect is obvious than a slight change of color. (*Ibid.*, xi. 486.) If sulphuric acid produces with the oil a bright red instead of a brownish red color, it indicates that the oil has been distilled with salt water, in which case it is apt, according to Mr. Ferris, to deposit a blood-red matter, occasionally complained of by druggists. (*Ibid.*, p. 565.)

Mr. Wm. A. Tilden has found that the introduction of a little fused chloride of calcium into purified oil of bitter almond contributes to its preservation, probably by the absorption of the last traces of water contained in it. Of two specimens of the oil, which had been set aside for two years, one without addition, the other containing a fragment of the fused chloride, the former was found filled with crystals of benzoic acid, the latter was perfectly free from crystalline deposit and quite fluid. (*P J. Tr.*, 2d ser., viii. 325, Dec. 1866.)

Prof. J. M. Maisch proposes the following mode of detecting nitrobenzol in adulterated oil of bitter almond. Dissolve half a drachm of the suspected oil in two or three drachms of alcohol, add fifteen grains of pure fused caustic potassa, heat for a few minutes so as to dissolve the potassa, and reduce the liquid to one-third, and then set aside to cool. If the oil be pure, it will remain liquid, while if nitrobenzol be present, there will, after cooling, be a crystalline deposit proportionate to the amount of adulteration. (*A. J. P.*, 1857, p. 544.) The officinal test is based upon this. (See page 996.) R. Wagner proposes the sp. gr. of the two oils as a test; that of the oil of bitter almond being from 1·04 to 1·044, while that of nitrobenzol is 1·18 to 1·201; and a mixture will have a higher sp. gr. than the pure oil. This would lead to the suspicion of the presence of nitrobenzol, which may then be separated by agitation with bisulphite of sodium. The almond oil will dissolve, while the nitrobenzol will float on the surface. (*Journ. de Pharm. et de Chim.*, Mai, 1868, p. 399.) M. E. Bourgoin's method (*Ann. de Thérap.*, 1873, p. 98) consists in acting with sulphide of sodium on the mixed liquids, and separating, by means of ether, the nitrobenzol from the compound which the oil of bitter almond forms with the sulphide. Dr. H. Hager's plan is as follows. On adding 10 drops of the *pure* oil to 10 C.c. of 45 per cent. alcohol, or to a mixture of 5 C.c. of 90 per cent. alcohol and 5 C.c. of water, and, after closing the test-tube with the finger, turning it twice upside down, the oil dissolves to a clear solution. If nitrobenzol, even as little as 1 per cent., is present, the oil of bitter almond dissolves at once, but the nitrobenzol is separated, clouding the liquid at first, but soon collecting to very minute but easily recognizable droplets which float about in the liquid. After standing for a while, these droplets unite to larger drops, when they become still more evident to the eye. The temperature of the alcohol must not exceed 16° C. (60·8° F.); it is best to keep it between 10° and 15° C. (50°–59° F.). Any sample of oil of bitter almond which dissolves on very gentle agitation at once to a clear liquid, in 20 times its volume of 45 per cent. alcohol, does not contain any nitrobenzol, since only traces of the latter are dissolved by that menstruum. Small quantities of nitrobenzol present (up to 3 per cent.) disappear after the mixture stands for some time, but they are always the cause of the milkiness or cloudiness of the solution at the moment of preparation. A short cloudiness even occurs with as small a quantity as ½ per cent. Since most other essential oils yield a cloudy solution with 45 per cent. alcohol, this test may also indicate the presence of foreign essential oils.

Hager's test may also be used quantitatively for the estimation of the amount of nitrobenzol present. Oil of bitter almond requires for solution 16 to 17 times its volume of 45 per cent. alcohol. 2 C.c. of the oil are agitated with 34 C.c. of the 45 per cent. alcohol, and the mixture set aside. After the lapse of a day, the nitrobenzol (all but a trace which remains in solution) will be found collected at the bottom. An important indication of the presence of a sophistication is the cloudiness produced at the first moment. (*N. R.*, Oct. 1880.)

Medical Properties and Uses. The unpurified volatile oil of bitter almond, which is the product directed by the Pharmacopœia, operates upon the system in a manner closely analogous to that of hydrocyanic acid. A single drop is sufficient to destroy a bird, and four drops have caused the death of a dog of middle size. The case of a man is recorded who died in ten minutes after taking two drachms (7·5 C.c.) of the oil. It might be substituted with advantage for medicinal hydrocyanic acid, if it always contained a uniform percentage of the acid, as the acid contained in the oil is much less liable to decomposition, remaining for several years unaltered, if the oil be preserved in well-stopped bottles. According to Schrader, 100 parts of the oil contain sufficient acid for the production of 22·5 parts of Prussian blue; but the proportion is not constant, varying, according to Mr. Groves, from 8 to 12·5 per cent. From one-fourth of a drop to a drop (0·016 to 0·06 C.c.) may be given for a dose, to be cautiously increased till some effect upon the system is observed. It may be administered in emulsion with gum arabic, loaf sugar, and water. It has been employed externally, dissolved in water in the proportion of one drop (0·06 C.c.) to a fluidounce (30 C.c.) in prurigo senilis and other cases of troublesome itching. To facilitate the solution in water, the oil may be previously dissolved in spirit. Oil of bitter almond is sometimes used to conceal the taste of cod-liver oil and of castor oil.

Off. Prep. Aqua Amygdalæ Amaræ, *U. S.*

OLEUM AMYGDALÆ EXPRESSUM. *U. S.* *Expressed Oil of Almond.*

(Ō′LE̤-ŬM A̤-MȲG′DA̤-LÆ E̤X-PRĔS′SŬM.)

"A fixed oil expressed from Bitter or Sweet Almond." *U. S.* "The oil expressed from Bitter and Sweet Almonds." *Br.*

Oleum Amygdalæ, *Br.;* Almond Oil; Oleum Amygdalæ Dulcis, *U. S.* 1860; Oleum Amygdalarum; Huile d'Amandes douces, Huile d'Amandes, *Fr.;* Mandelöl, *G.;* Olio di Mandorle, *It.;* Aceyte de Almendras, *Sp.*

This oil is obtained equally pure from sweet and bitter almonds. In its preparation, the almonds, having been deprived of a reddish brown powder adhering to their surface, by being rubbed together in a piece of coarse linen, are ground in a mill resembling a coffee-mill, or bruised in a stone mortar, and then pressed in canvas sacks between plates of iron slightly heated. The oil, which is at first turbid, is clarified by rest and filtration. Sometimes the almonds are steeped in very hot water, deprived of their cuticle, and dried in a stove, previous to expression. The oil is thus obtained free from color, but in no other respect better, while it is more apt to become rancid on keeping. Bitter almonds treated in this way impart a smell of hydrocyanic acid to the oil. M. Boullay obtained 54 per cent. of oil from sweet almonds, Vogel 28 per cent. from bitter almonds. Munch gives 55·4 per cent. as the yield of the former, and 52 per cent. as that of the latter. (*Journ. de Pharm. et de Chim.*, 4e sér., iii. 400.) Though sometimes expressed in this country from imported almonds, the oil is generally brought from Europe.

Oil of almond is clear and colorless, or slightly tinged of a greenish yellow, is nearly inodorous, and has a bland sweetish taste. Its sp. gr. is from 0·914 to 0·920. It is "only slightly soluble in alcohol, but soluble in ether and in chloroform in all proportions. It does not congeal until cooled to near —20° C. (—4° F.). On placing 2 drops of concentrated sulphuric acid upon about 8 drops of the oil, on a white plate, no dark color should appear at the edge of the acid, and, after stirring, the mixture should not assume a dirty, yellow color retaining its tint for several minutes (difference from most other fixed oils)." *U. S.* From the statement of Braconnot, it appears to contain 76 per cent. of olein and 24 per cent. of a mixture of palmitin and stearin.

According to Dr. H. Hager, the oils expressed from the large sweet and the smaller bitter almonds differ considerably, as shown by the elaïdin test; the former oil congealing more rapidly—almost completely; the latter about twelve hours later, and the more imperfectly the smaller the bitter almond has been. Only about one-third of the bulk congeals, when the oil is from the small Oporto almonds.

Oil of almond is said to be sometimes adulterated with poppy oil, or other drying oils of less value. This sophistication may be detected, as suggested by M. Wimmee, by taking advantage of the property of being converted into solid elaïdic acid by the action of nitric acid, belonging to the olein of the non-drying, but not to that of the drying oils. By treating iron filings with nitric acid in a flask, nitrous acid is produced, which is to be conducted into water upon which the suspected oil is placed. If the almond oil contain even but a small quantity of poppy oil, or other drying oil, this will remain in the form of drops on the surface, while the genuine oil will be converted entirely into crystallized elaïdin. (*Journ. de Pharm.*, Dec. 1862, p. 500.) Colza oil, another not uncommon adulteration, may be detected, according to M. Schneider, by the action of nitrate of silver. Dissolve the oil in twice its volume of ether, add about 30 drops of a concentrated alcoholic solution of the nitrate, shake the mixture, and allow it to stand in the dark. If there be much colza oil, the lower part of the liquid will become first brown and then black; if but little, the brown color will not appear for twelve hours; but always the discoloration will be obvious on the evaporation of the ether. (*P. J. Tr.*, March, 1862.)

It is said that in the south of France the sweet almond oil is sometimes adulterated with a cheaper oil, called the *oil of apricots*. According to M. J. Nicklés, this adulteration may be detected by means of powdered hydrate of lime, which with the oil of apricots forms an emulsion that slowly assumes an unctuous consistence, while it has no such action on the almond oil, merely rendering it opaque for a time, and then gradually separating and leaving the oil clear. A mixture of the two oils emulsionizes with the lime, and on standing deposits the unctuous matter referred to. (See *A. J. P.*, 1866, p. 289.)

According to Dr. Hager, if equal volumes of the oil and of 25 per cent. nitric acid are shaken together in a test-tube, an emulsion-like mixture is produced, which separates on standing. All true almond oils yield a white mixture, and the oils remain white for many hours after separation, but the oils of the *peach* and *apricot seeds* turn yellowish at once, on being shaken with the acid, and the color afterwards deepens, and in half an hour is of a rather deep red-yellow. (*A. J. P.*, 1870, p. 408.) J. D. Bieber communicates the following test. Equal weights of pure concentrated sulphuric acid, red fuming nitric acid, and water are mixed, and the mixture allowed to cool. On mixing five parts of the oil with one part of this acid liquid, *pure almond oil* gives a yellowish white liniment; *oil of peach kernels* assumes the red color of peach blossoms, turning to dark orange; *benne oil* turns pale yellowish red, then dirty orange-red; *poppy* and *walnut oils* yield a somewhat whiter liniment than almond oil. This test permits the detection of 5 per cent. of peach kernel and benne oil. Mixed with pure nitric acid, sp. gr. 1·40, *almond oil* yields a pale yellowish liniment; *peach kernel oil* a red, *benne oil* a yellowish green, afterwards reddish, and *poppy* and *walnut oils* a white mixture. It was found that the oil expressed, cold or warm, from either fresh almonds or from such as had been kept up to ten years, gave the same reaction. Most of the commercial oil was found to be adulterated with the oil of either peach kernels or benne seed. (*A. J. P.*, Dec. 1877.)

Oil of almond may be used for the same purposes with olive oil, and, when suspended in water by means of mucilage or the yolk of eggs and loaf sugar, forms a pleasant emulsion, useful in pulmonary affections attended with cough. From a fluidrachm to a fluidounce (3·75 to 30 C.c.) may be given at a dose.

Off. Prep. Unguentum Aquæ Rosæ, *U. S.;* Unguentum Cetacei, *Br.;* Unguentum Simplex, *Br.;* Unguentum Hydrargyri Oxidi Rubri, *Br.;* Unguentum Plumbi Subacetatis Compositum, *Br.*

OLEUM ANETHI. *Br.* *Oil of Dill.*

(Ō′LẸ-ŬM Ạ-NĒ′THĪ.)

"The oil distilled in Britain from dill fruit." *Br.*

Aneth à Odeur forte, Essence d'Aneth, *Fr.;* Dill, Dillöl, *G.;* Aneto, *It.;* Eneldo, *Sp.*

Oil of dill is of a pale yellow color, with the odor of the fruit, and a hot, sweetish, acrid taste. Its sp. gr. is said to be 0·881. The fruit yields about 3·5 per cent. of it. The oil is a mixture of a hydrocarbon, *anethene*, $C_{10}H_{16}$, a second hydrocarbon, $C_{10}H_{18}$, and an oxidized compound, probably *carvol*, $C_{10}H_{14}O$. R. Nietzki obtained from the fruit of *Anethum graveolens* a volatile oil, which commenced to boil at 155° C. (311° F.), the boiling point rising gradually to 260° C. (500° F.). About 10 per cent. of the oil consists of a carbohydrogen, $C_{10}O_{16}$, having the boiling point 155°–160° C., 60 per cent. boiling at 170°–175° C. (338°–347° F.), of the same composition, and 30 per cent. with the boiling point 225°–330° C. (437°–446° F.), composition $C_{10}H_{14}O$, and identical with carvol. The odor of the first portion of hydrocarbon reminds of turpentine; that of the second portion resembles oil of mace, but when mixed with a little carvol the characteristic dill odor is at once produced. (*A. J. P.*, 1874.) The oil is sometimes used for preparing dill water. The dose is 3 to 10 drops (0·18 to 0·6 C.c.).

OLEUM ANISI. *U. S.*, *Br.* *Oil of Anise.*

(Ō′LẸ-ŬM Ạ-NĪ′SĪ.)

Essence d'Anis, *Fr.;* Anisöl, *G.*

The product of oil from anise is variously stated from 1·56 to 3·12 per cent. The oil employed in this country is imported. It is colorless or yellowish, with the peculiar odor and taste of the seed. At 50° F. it crystallizes in flat tables, and does not melt under 62° F. Its sp. gr. increases with age, and is variously given from 0·9768 to 0·9903. It is soluble in all proportions in alcohol of 0·806; but alcohol of 0·840 dissolves at 77° only 42 per cent. Ether dissolves it in all proportions. (*Gmelin.*) "Its sp. gr. is about 0·976 to 0·990, increasing by age. At 10° to 15° C. (50°–59° F.) it solidifies to a crystalline mass, which does not resume its fluidity until the temperature rises to about 17° C. (62·6° F.). The Oil is soluble in an equal weight of alcohol. *Oil of Illicium* (*Star-Anise*) has nearly the same properties, except that it congeals at about 2° C. (35·6 F.)." *U. S.* It consists of a small quantity of a hydrocarbon, $C_{10}H_{16}$, but mainly of *anethol*, $C_{10}H_{12}O$, which is present, however, in two modifications, one solid at ordinary temperatures and heavier than water (*anise camphor, solid anethol*), the other liquid and more volatile (*liquid anethol*). *Anethol*, both in the liquid and the solid form, is present, and is the chief constituent of the oils of *anise*, *star aniseed*, and *fennel*. By oxidization, by means of nitric or chromic acid, the different forms of anethol yield an acid denominated *anisic acid*, $C_8H_8O_3$. Oil of anise absorbs oxygen from the air, and becomes less disposed to concrete. In consequence of its high price, it is frequently adulterated with spermaceti, wax, or camphor. The first two may be detected by their insolubility in cold alcohol, the last by its odor. In one instance, as much as 35 per cent. of spermaceti was found. Prof. Procter met with a parcel, of which not less than five-sixths were alcohol. (*A. J. P.*, xxvii. 513.) The dose of the oil is from five to fifteen drops (0·3 to 0·9 C.c.). Its comparative mildness adapts it to infantile cases. Most of the oil of anise of commerce is the *oil of star aniseed* (*oleum Badiani*, or *Illicium*), which closely resembles it in flavor, and which is recognized in both Pharmacopœias as the oil of anise.

Off. Prep. Aqua Anisi, *U. S.;* Essentia Anisi, *Br.;* Spiritus Anisi, *U. S.;* Syrupus Sarsaparillæ Compositus, *U. S.;* Tinctura Camphoræ Composita, *Br.;* Tinct Opii Ammoniata, *Br.;* Tinct. Opii Camphorata, *U. S.;* Trochisci Glycyrrhizæ et Opii, *U. S.*

OLEUM ANTHEMIDIS. *Br.* *Oil of Chamomile.*

(Ō′LẸ-ŬM ẠN-THĔM′Ị-DĬS.)

"The oil distilled in Britain from chamomile flowers." *Br.*

Oleum Chamomillæ Romanæ; Essence de Camomille romaine, *Fr.;* Römisch-Kamillenöl, *G.*

This oil has been introduced into the British Pharmacopœia, under the name of

English Oil of Chamomile, and with the direction that it shall be distilled in England. It is seldom prepared or used in this country. Baumé obtained thirteen drachms of the oil from eighty-two pounds of the flowers; according to Mr. Brande, the average product of 100 pounds is two pounds twelve ounces. It has the peculiar smell of chamomile, with a pungent somewhat aromatic taste. When recently distilled it is of a pale sky-blue or greenish blue color, which changes to yellow or brownish on exposure. The sp. gr. of the English oil is said to be 0·9083. The oil was thoroughly investigated in Fittig's laboratory during the years 1878–79. It was found to consist of a mixture of the *angelic* and *tiglinic acids, ethers of isobutyl, isamyl, hexyl*, and probably one higher one. Angelic acid and tiglinic acid are isomeric, and have the formula $C_5H_8O_2$. The relative proportions of these two acids varied in different oils. It has sometimes been employed in spasm of the stomach, and as an adjunct to purgative medicines. Its chief use, however, appears to be as an ingredient of the extract of chamomile of the British Pharmacopœia, to which it is added in order to supply the place of the oil driven off by the heat used in its preparation. This oil must not be confounded with that of *Matricaria Chamomilla*, employed on the continent of Europe under the name of oil of chamomile. (See *Matricaria.*) The dose is from five to fifteen drops (0·3 to 0·9 C.c.).

Off. Prep. Extractum Anthemidis, *Br.*

OLEUM AURANTII CORTICIS. *U.S.* *Oil of Orange Peel.*

(Ō'LĘ-ŬM ÂU-RĂN''TĮ-Ī CŎR'TĮ-CĬS—âw-răn'shę-ī.)

"A volatile oil, extracted by mechanical means, from fresh Orange Peel." *U. S.*

Essential Oil of Orange Peel; Huile d'Orange, *Fr.;* Apfelsinenschalenöl, *G.*

This new officinal is used only for flavoring purposes, and has been introduced principally because of its employment in the Elixir Aurantii (U. S. 1880). Oil of orange is prepared in Calabria and Sicily in three ways: 1, by scraping off the exterior part of the rind and submitting it to expression; 2, by putting the scrapings into hot water, depressing the pulp beneath, and skimming off the oil as it rises; 3, by distillation. The best Sicily orange oil is procured by dexterous compression, within a cask, of the fresh rind by the hand, the oil being driven out in jets. It is sometimes absorbed by a sponge. (*A. J. P.*, 1868, p 27.) It is largely made at Messina, and in the south of France. It is also extracted by the écuelle-process, and partly from the Bigarade and partly from the sweet or Portugal orange, the scarcely ripe fruit being in either case employed. The oil made from the former is much more valuable than that obtained from the latter, and the two are distinguished in price-currents as *Essence de Bigarade* and *Essence de Portugal.*

Properties. The oil of orange peel yields on distillation, besides a resinous product of the composition $C_{20}H_{30}O_3$, a hydrocarbon, *hesperidene*, $C_{10}H_{16}$ (Wright and Piesse, *Chem. News*, xxiv. 147), boiling at 178° C. (352·4° F.). The inner thick part of the rind contains also a bitter principle, called *hesperidin*, discovered by Lebreton in 1828, but more fully studied by Hoffmann (*Ber. Chem. Ges.*, 1876, pp. 26, 685). It is best prepared from the unripe bitter oranges. Its formula is $C_{22}H_{26}O_{12}$, and it is a glucoside, as is shown by the reaction with dilute sulphuric acid.

The U. S. Pharmacopœia describes the oil as "a pale yellowish liquid, having the characteristic, aromatic odor of orange, an aromatic, somewhat bitter taste, and a neutral reaction. Sp. gr. about 0·860. It is soluble in 2 parts of alcohol. By keeping, the Oil becomes thicker and acquires a disagreeable, terebinthinate taste, which may be prevented by mixing it, while fresh, with 5 per cent. of alcohol, and decanting the Oil after it has become clear from the sediment." *U. S.* This oil is one of the most difficult to preserve: hence the officinal method for its preservation. Another plan, which we have used for years, is to shake the oil briskly with one-eighth of its volume of distilled water, and allow it to separate. Then remove the essential oil, filter rapidly if necessary, and mix the filtered oil with 95 per cent. alcohol in the proportion of 1 volume of the oil to 7 volumes of alcohol.

Off. Prep. Elixir Aurantii, *U. S.;* Spiritus Aurantii, *U. S.;* Spiritus Myrciæ, *U. S.*

OLEUM AURANTII FLORUM. *U. S.* *Oil of Orange Flowers.* [*Oil of Neroli.*]

(Ō′LĘ-ŬM ÂU-RĂN″TĮ-Ī FLŌ′RŬM—âw-răn′shę-ī.)

" A volatile oil distilled from fresh Orange Flowers." *U. S.*

Huile de Fleurs d'Orange, Essence de Neroli, *Fr.;* Pomeranzenblüthenöl, *G.*

This new officinal oil is employed only on account of its pleasant odor and taste, and has been introduced as an ingredient in the Spiritus Odoratus, U. S. The best quality of " oil of neroli," as it is universally called in commerce, comes from Nice, and is derived from the flowers of the *Citrus aurantium*, or sweet orange, by distillation with water; this is called "*neroli petale.*" The next quality is obtained in the same way, but by using the blossoms of the *Citrus Bigaradia*, or bitter orange; this is called "*neroli bigarade*," whilst an inferior sort, "*essence de petit grain*," is made by distilling the leaves and unripe fruit.

Properties. It is officinally described as " a yellowish or brownish, thin liquid, having the very fragrant odor of orange flowers, an aromatic, somewhat bitter taste, and a neutral reaction. Sp. gr. 0·850 to 0·890. It is soluble in an equal weight of alcohol. If a little alcohol be poured on the surface of the Oil and the mixture gently undulated, a bright, violet fluorescence will be observed." *U. S.* The greater part of the oil is a hydrocarbon, distilling at 185°–195° C. (365°–383° F.), with which is a small amount of a crystalline solid called *neroli camphor*. According to Flückiger, this is a neutral, inodorous, tasteless substance, fusing at 55° C. (131° F.).

Off. Prep. Spiritus Odoratus, *U. S.*

OLEUM BERGAMII. *U. S.* *Oil of Bergamot.*

(Ō′LĘ-ŬM BĘR-GĀ′MĮ-Ī.)

" A volatile oil, extracted by mechanical means from the rind of the fresh fruit of Citrus Bergamia, *var.* vulgaris. Risso et Poiteau. (*Nat. Ord.* Aurantiaceæ.)" *U.S.*

Oleum Bergamottæ, *P.G.;* Essence de Bergamotte; Huile de Bergamotte, *Fr.;* Bergamottöl, *G.;* Olio di Bergamotta, *It.*

CITRUS. See *Aurantii Cortex.*

Citrus Bergamia. Risso & Poiteau. *B. & T.* 52.—*C. Limetta.* De Cand. *Prodrom.* i. 539. The bergamot-tree has oblong-ovate, dentate, acute, or obtuse leaves, somewhat paler on the under than on the upper surface, and with footstalks more or less winged or margined. The flowers are white, and usually small; the fruit pyriform or roundish, terminated by an obtuse point, with concave receptacles of oil in the rind. The pulp of the fruit is sourish, somewhat aromatic, and not disagreeable. The rind is shining, and of a pale yellow color, and abounds in a very grateful volatile oil. This may be obtained by expression or distillation. In the former case it preserves the agreeable flavor of the rind, but is somewhat turbid; in the latter, it is limpid but less sweet. The mode of procuring it by expression is exactly that used for oil of lemons. (See *Oleum Limonis.*) It is brought from Italy, the south of France, and Portugal.

The oil of bergamot, often called *essence of bergamot*, has a sweet, very agreeable odor, a bitter aromatic pungent taste, a pale greenish yellow color, and a slightly acid reaction. Its sp. gr. varies from 0·870 to 0·888. (*Lewis, Zeller.*) " Sp. gr. 0·860 to 0·890. It is soluble, in all proportions, in alcohol and in glacial acetic acid." *U. S.* It contains several hydrocarbons of the formula $C_{10}H_{16}$, and a solid greasy compound called *bergaptene*, or *bergamot camphor*, to which the formula $C_9H_6O_3$ has been assigned. It is distinguished from lemon and orange oils by readily dissolving in liquor potassæ and forming with it a clear solution. (*Zeller.*) Though possessed of the excitant properties of the volatile oils in general, it is employed chiefly, if not exclusively, as a perfume.

Off. Prep. Spiritus Odoratus. *U. S.*

OLEUM CAJUPUTI. *U. S., Br.* *Oil of Cajuput.*

(Ō′LĘ-ŬM CĂJ-Ų-PŪ′TĪ.)

" A volatile oil distilled from the leaves of Melaleuca Cajuputi. Roxburgh. (*Nat.*

Ord. Myrtaceæ.") *U. S.* "The oil distilled from the leaves of Melaleuca minor. D. C. Imported from Batavia and Singapore." *Br.*

Oleum Cajeputi, *P.G.;* Essence de Cajéput; Huile de Cajéput, *Fr.;* Cajeputöl, *G.;* Olio di Cajeput, *It.;* Kayuputieh, *Mal.*

Gen. Ch. Calyx five-parted, semi-superior. *Corolla* five-petalled. *Stamens* about forty-five, very long, conjoined in five bodies. *Style* single. *Capsule* three-celled. *Seeds* numerous. *Roxburgh.*

It was long supposed that the oil of cajuput was derived from *Melaleuca leucadendron;* but from specimens of the plant affording it, sent from the Moluccas, and cultivated in the botanical garden of Calcutta, it appears to be a distinct species, which has received the name of *M. Cajuputi.* It corresponds with the *arbor alba minor* of Rumphius, and is a smaller plant than *M. leucadendron.* It is possible, however, that the oil may be obtained from different species of Melaleuca; as M. Stickel, of Jena, succeeded in procuring from the leaves of *M. hypericifolia*, cultivated in the botanical garden of that place, a specimen of oil not distinguishable from the cajuput oil of commerce, except by a pale green color. (*Annal. der Pharm.*, xix. 224.) Two other species of Melaleuca, *M. viridifolia* and *M. latifolia*, large trees growing abundantly in the island of New Caledonia, are said to yield a volatile oil very analogous to the oil of cajuput.* The leaves of different species of Melaleuca have been used advantageously, in the form of bath, in chronic rheumatism. (*Annuaire de Thérap.*, 1861, p. 67.)

Melaleuca Cajuputi. Rumphius, *Herbar. Amboinense*, tom. ii. tab. 17; Roxburgh, *Trans. Lond. Med. Bot. Soc.*, 1829; *Journ. of the Phila. Coll. of Pharm.*, vol. i. p. 193.—*Melaleuca minor.* De Candolle. *B. & T.* 108. This is a small tree, with an erect but crooked stem, and scattered branches, the slender twigs of which droop like those of the weeping willow. The bark is of a whitish ash color, very thick, soft, spongy, and lamellated, throwing off its exterior layer from time to time in flakes. The leaves have short footstalks; are alternate, lanceolate, when young sericeous, when full-grown smooth, deep green, three- and five-nerved, slightly falcate, entire, from three to five inches long, from one-half to three-quarters of an inch broad; and when bruised exhale a strong aromatic odor. The flowers are small, white, inodorous, sessile, and disposed in terminal and axillary downy spikes, with solitary, lanceolate, three-flowered bracts. The filaments are three or four times longer than the petals, and both are inserted in the rim of the calyx. This species of Melaleuca is a native of the Moluccas and other neighboring islands. The oil is obtained from the leaves by distillation. It is prepared chiefly in Amboyna and Bouro, and is exported from the East Indies in glass bottles. The small proportion yielded by the leaves, and the extensive use made of it in India, render it costly.

Properties. Cajuput oil is very fluid, transparent, of a fine green color, a lively and penetrating odor analogous to that of camphor and cardamom, and a warm pungent taste. It is very volatile and inflammable, burning without any residue. The sp. gr. varies from 0·914 to 0·9274. Its composition, according to Blanchet and Sell, is $C_{10}H_{16}.H_2O$, and by repeated distillation over phosphoric oxide the hydrocarbon, $C_{10}H_{16}$, called *cajuputene*, can be obtained. The oil is, therefore, said to contain *cajuputene hydrate* or *cajuputol.* It boils at 175° C. (347° F.). It is officinally described as "a light, thin, bluish green, or, after rectification, colorless liquid, of a peculiar, fragrant, somewhat camphoraceous odor, an aromatic, bitterish taste, and a neutral reaction. Freely soluble in alcohol. Sp. gr. about 0·920. On shaking 5 C.c. of the Oil with 5 C.c. of water containing a drop of diluted hydrochloric acid, the Oil loses its green tint and becomes nearly colorless." *U. S.* The oil is wholly soluble in alcohol. When it is distilled, a light colorless liquid first comes over, and afterwards a green and denser one. The green color has been ascribed to a salt of copper, derived from the vessels in which the distillation is performed; and

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* *Miaouli.* Under this name large quantities of the volatile oil of *Melaleuca flaviflora* are exported from New Caledonia to Japan and other Eastern countries. The trees form large forests in New Caledonia, and the hard, dense leaves, softened by partial fermentation, yield to the distiller very freely a colorless volatile oil of a strong fragrant odor and having the chemical constitution of the oil of cajuput. Mixed with nitric acid, it becomes of a rose color changing to deep brown. (*Bull. Thérap.*, xcvii. 404.)

Guibourt obtained two grains and a half of oxide of copper from a pound of the commercial oil. But neither Brande nor Goertner could detect copper in specimens examined by them; and M. Lesson, who witnessed the process for preparing the oil at Bouro, attributes its color to chlorophyll, or some analogous principle, and states that it is rendered colorless by rectification. Guibourt, moreover, obtained a green oil by distilling the leaves of a Melaleuca cultivated at Paris. A fair inference is that the oil of cajuput is naturally green, but that, as found in commerce, it sometimes contains copper, either accidentally present, or added with a view of imitating or maintaining the fine color of the oil. The proportion of copper, however, is not so great as to forbid the internal use of the oil; and the metal may be separated by distillation with water, or agitation with a solution of ferrocyanide of potassium. This statement as to the frequent occurrence of copper in the cajuput oil of commerce, though, at the same time, its presence is not essential, has been confirmed by experiments by Mr. Edward Histed, who found copper in all of six specimens of the commercial oil, obtained from different sources. When redistilled, the oil became perfectly colorless, but, after a few days' exposure to copper filings, reassumed its green color. (*P. J. Tr.*, 1872, p. 804.)

The high price of cajuput oil has led to its occasional adulteration. Oil of rosemary, or that of turpentine, impregnated with camphor and colored with the resin of milfoil, is said to be employed for the purpose. The best test, according to Zeller, is iodine, which, after a moderately energetic reaction, with little increase of temperature and but a slight development of orange vapors, occasions immediate inspissation into a loose coagulum, which soon becomes a dry, greenish brown, brittle mass.

Medical Properties and Uses. This oil is highly stimulant, producing when swallowed a sense of heat, with an increased fulness and frequency of pulse, and exciting in some instances profuse perspiration. It is much esteemed by the Malays and other people of the East, who consider it a panacea. They are said to employ it with great success in epilepsy and palsy. (*Ainslie.*) The complaints to which it is best adapted are probably chronic rheumatism, and spasmodic affections of the stomach and bowels, unconnected with inflammation. It has been extolled as a remedy in spasmodic cholera, and has been used also as a diffusible stimulant in low fevers. It is said to have been used in some cases of cholera in the collapsed state with altogether unexpected success; being administered, in such cases, in the dose of from fifteen grains to a drachm (1 to 3·9 Gm.) in a single potion. (*Ann. de Thérap.*, 1867, p. 71.) Diluted with an equal proportion of olive oil, it is applied externally to relieve gouty and rheumatic pains. Like most other highly stimulating essential oils, it relieves toothache if introduced into the hollow of the carious tooth. M. Delvaux, who has made extensive use of this oil, has found it beneficial, given internally, in dyspepsia with flatulence, in the early stages and milder forms of cholera, in verminose affections in children, in chronic laryngitis and bronchitis, in chronic catarrh of the bladder, in chronic rheumatism of the joints with little or no swelling, and in painful chronic rheumatism of the muscles and fibro-muscular tissues, whether external or internal. Externally applied, M. Delvaux has derived great benefit from it in various cutaneous diseases, as pityriasis, psoriasis, and especially in that extremely obstinate affection of the face, acne rosacea, which he has often succeeded in curing by the simple application of this oil three times a day. (*Annuaire de Thérap.*, 1862, p. 38.) The dose is from five to twenty drops (0·3 to 1·25 C.c.), given in emulsion, in the form of pill, or upon a lump of sugar.

Off. Prep. Linimentum Crotonis, *Br.;* Spiritus Cajuputi, *Br.*

OLEUM CAMPHORÆ. *Oil of Camphor.*

(Ō′LẸ-ŬM CĂM′PHỌ-RÆ.)

Although this oil has been dismissed from the Pharmacopœia, it merits a notice here, on account of its extended use. It was defined in the U. S. P. 1870 as "the volatile oil obtained from Camphora officinarum (Nees, *Laurin*)."

Huile volatile de Camphre, *Fr.;* Flüchtiges Kampferöl, *G.*

As there are two camphors known in commerce, obtained respectively from *Camphora officinarum* and *Dryobalanops Camphora*, so there are two oils of camphor derived from these plants: that of the *Camphora officinarum* is almost exclusively found in commerce. In the article *Camphora* the tree and the mode of procuring the oil, as practised in the island of Formosa, have been sufficiently described.

The commercial oil of camphor, as found in our markets, is a fluid of a light reddish brown color with a yellowish tint, having a strong odor precisely like that of camphor, a bitterish camphorous taste, and the specific gravity, according to Prof. Procter, of 0·940. As described by M. Lallemand, the *oil of the Camphora officinarum* is very fluid, scarcely colored, and of a strong smell of camphor. It acts strongly on polarized light, and is dextrogyrate. It is a solution of common camphor, $C_{10}H_{16}O$, in a hydrocarbon, $C_{10}H_{16}$. It begins to boil at 180° C. (356° F.), but the temperature gradually rises to 205° C. (401° F.), when it remains stationary. The part which first comes over is the hydrocarbon of the oil; that which rises at the higher temperature condenses after distillation, and is true camphor. The former, when duly rectified, distils at 180° C. (356° F.), and is a hydrocarbon isomeric with pure oil of turpentine, forming a crystallizable compound with hydrochloric acid. (*Journ. de Pharm.*, Avril, 1860, p. 289.)

The *Dryobalanops oil of camphor* is a different product, resembling the genuine oil in odor, yet having also something peculiar in addition, which enables it to be readily distinguished when the two are examined together. An account of this oil is given at page 333, in a note treating of the *Dryobalanops Camphora* and its products. A volatile oil, received by M. Biot from Dr. Junghun, who is said to have collected it from the *Dryobalanops Camphora* in the island of Sumatra, was sent to M. Lallemand, who describes it as somewhat viscid, of a strong balsamic odor and reddish color, and as separable by distillation into a volatile liquid and a non-volatile matter, which concretes on cooling into a resinous brittle mass resembling colophony. The volatile liquid consists of two distinct oils, isomeric with each other and with pure oil of turpentine, but differing in their boiling point, and in various other respects. The original oil yielded nothing similar to camphor. It is obviously a very different product from that which has been generally ascribed to the Dryobalanops, and much more closely resembles the turpentines than the camphorous oils. If it really was obtained from the *Dryobalanops Camphora*, this must be a very different tree from what it has been described to be; and the probability is that there has been some mistake as to its origin.

The oil of camphor has properties similar to those of camphor, but more stimulant, and is especially applicable to affections of the stomach and bowels in which an anodyne and stimulant impression is indicated, as flatulent colic and spasmodic cholera. It may also be used externally, as a rubefacient and anodyne liniment, diluted with soap liniment, or olive oil, in local rheumatism and neuralgic pains, bruises, sprains, etc. The dose is two or three drops (0·12 to 0·18 C.c.).

OLEUM CARI. *U. S.* *Oil of Caraway.*

(Ō′LE̤-ŬM CĀ′RĪ.)

"A volatile oil distilled from Caraway." *U. S.* "The Oil distilled in Britain from caraway fruit." *Br.*

Oleum Carui, *Br.;* Oleum Carvi, *P.G.;* Essence de Carvi, *Fr.;* Kümmelöl, *G.*

This oil is prepared to a considerable extent by our distillers. The fresh fruit yields on an average about 4·7 per cent. (*Recluz*); but the product is very variable. The oil of caraway is somewhat viscid, of a pale yellow color, becoming brownish by age, with the odor of the fruit, and an aromatic acrid taste. Its sp. gr. is differently given at 0·946 (*Baumé*), 0·931 (*Brande*), and 0·916 (*Buignet*), U. S. P. 0·920. It is dextrogyrate in its relation to polarized light. (Buignet, *Journ. de Pharm.*, Oct. 1861, p. 261.) It consists of two liquid oils, of different boiling points, and separable by distillation: one, a hydrocarbon called *carvene* ($C_{10}H_{16}$, *Völkel*), of the sp. gr. 0·861, and boiling point 343° F.; the other composed of carbon, hydrogen, and oxygen ($C_{10}H_{14}O$), and named *carvol*, of the sp. gr. 0·953, and boiling point 482° F.

It is officinally described as "a colorless or pale yellow, thin liquid, having the characteristic, aromatic odor of caraway, a mild, spicy taste, and a neutral reaction. Sp. gr. about 0·920. It is soluble in an equal weight of alcohol." *U. S.*

When oil of caraway is distilled from phosphoric acid solution, the distilled liquor being poured back into the retort until it ceases to have the smell of caraway, an oily liquid is obtained, having a very disagreeable odor, and a strong taste. This product, to which the name of *carvacrol* has been applied, has been found to give immediate relief to toothache, when inserted on cotton into the cavity of a carious tooth. (See *Am. Journ. of Med. Sci.*, N. S., xv. 532.) Oil of caraway is much used to impart flavor to medicines and to correct their nauseating and griping effects. The dose is from one to ten drops (0·06 to 0·6 C.c.).

Off. Prep. Confectio Scammonii, *Br.;* Pilula Aloes Barbadensis, *Br.;* Spiritus Juniperi Compositus, *U. S.*

OLEUM CARYOPHYLLI. *U. S.* *Oil of Cloves.*

(Ō′LẸ-ŬM CĂR-Ỵ-Ọ-PHȲL′LĪ.)

"A volatile oil distilled from Cloves." *U. S.* "The Oil distilled in Britain from cloves." *Br.*

Oleum Caryophyllorum, *P. G.;* Essence de Girofles, *Fr.;* Nelkenöl, *G.*

This oil is obtained by distilling cloves with water, to which it is customary to add common salt, in order to raise the temperature of ebullition; and the water should be repeatedly distilled from the same cloves, in order completely to exhaust them. Professor Sharling has found advantage from the application of superheated steam to the distillation of this oil. (*P. J. Tr.*, xi. 469.) It is essential also to use the same water over and over again, in order to avoid loss by the solution of the oil in the water. The product of good cloves is said to be about one-fifth or one-sixth of their weight. The oil was formerly brought from Holland or the East Indies; but, since the introduction of the Cayenne cloves into our markets, the reduced price and superior freshness of the drug have rendered the distillation of oil of cloves profitable in this country; and the best now sold is of domestic extraction. We have been informed that from seven to nine pounds of cloves yield to our distillers about one pound of the oil.

Properties. Oil of cloves, when recently distilled, is very fluid, clear, and colorless, but becomes yellowish by exposure, and ultimately reddish brown. It has the odor of cloves, a hot, acrid, aromatic taste, and a slightly acid reaction. Its sp. gr. is variously stated at from 1·034 to 1·061; the latter being given by Bonastre as the sp. gr. of the rectified oil. "Sp. gr. about 1·050. It is very soluble in alcohol. With an equal volume of a concentrated solution of potassa it forms a semi-solid mass." *U. S.* It is one of the least volatile of the essential oils, and requires for congelation a temperature from zero of Fahrenheit to —4°. It is completely soluble in alcohol, ether, and strong acetic acid. Nitric acid changes its color to a deep red, and converts it by the aid of heat into oxalic acid. The same change to red is produced by nitric acid on morphine, but in this case the red is followed by yellow, which does not happen with the oil of cloves. Besides, if to a solution of morphine with nitric acid a solution of chlorinated lime be added, and the mixture be exposed for some hours to the light, the solution of morphine will retain a straw color, while if oil of cloves be treated in the same manner the color disappears. (Haselden, *B. and F. Med.-Chir. Rev.*, July, 1867, p. 265.) When long kept, the oil deposits a crystalline *stearoptene.* It is frequently adulterated with fixed oils, and sometimes with oil of pimento and with copaiba. When pure, it sinks in distilled water. According to Ed. Sherer, these adulterations may sometimes be detected by attention to the specific gravity and the boiling point, pure oil of cloves varying in specific gravity from 1·03 to 1·06, and boiling at from 240° C. (464° F.) to 255° C. (491° F.). According to Zeller, its character of congealing entirely into a crystalline mass with the alcoholic solution of potassa, losing at the same time its peculiar odor, affords a sufficient criterion of its purity. It appears to be indifferent in its effects on polarized light as regards rotatory power. (*Buignet.*)

According to Ettling, the oil of cloves consists of two distinct oils, one lighter and the other heavier than water. They may be obtained separate by distilling the oil from a solution of potassa. The lighter comes over, the heavier remains combined with the potassa, from which it may be separated by adding sulphuric acid, and again distilling. *Light oil of cloves* is colorless, has the sp. gr. 0·918, and has the formula $C_{15}H_{24}$, being polymeric with pure oil of turpentine. It is said not to possess active properties. (*Kane.*) *Heavy oil of cloves* is colorless at first, but darkens with age, has the odor and taste of cloves, is of the sp. gr. 1·079, boils at 243·3° C. (470° F.), and forms soluble and crystallizable salts with the alkalies. It consists of a phenol-like compound, *eugenol* (eugenic acid), $C_{10}H_{12}O_2$, which has been found capable of conversion into *vanillin*. Cloves also contain a neutral principle, *caryophyllin*, $C_{20}H_{32}O$, which when treated with nitric acid yields as product of oxidation *caryophyllinic acid*, $C_{20}H_{32}O_6$.

Medical Properties and Uses. The medical effects of the oil are similar to those of cloves, and it is used for the same purposes; but its most common employment is as a corrigent of other medicines. It is a powerfully local narcotic, and is often introduced into the cavity of a carious aching tooth. The dose is from two to six drops (0·12 to 0·36 C.c.).

Off. Prep. Confectio Scammonii, *Br.;* Pilula Colocynthidis Composita, *Br.*

OLEUM CHENOPODII. *U. S.* *Oil of Chenopodium.* [*Oil of American Wormseed.*]

(Ō'LẸ-ŬM CHĔN-Ọ-PŌ'DỊ-Ī.)

"A volatile oil distilled from Chenopodium." *U. S.*

Essence de Chénopode anthelmintique, *Fr.;* Amerikanisches Wurmsamenöl, *G.*

This oil is peculiar to the United States. The best is prepared in the vicinity of Baltimore. (See page 401.) It is of a light yellow color when recently distilled, but becomes deeper yellow and even brownish by age. Its reaction is neutral. It has in a high degree the peculiar flavor of the plant. "Sp. gr. about 0·920, increasing by age." *U. S.* When freshly prepared, it has the sp. gr. 0·908, which, according to Mr. S. S. Garrigues, is increased by time to 0·960. A portion examined by him, which was of a brownish yellow color, had the sp. gr. 0·959 at 61° F., boiled at 374° F., and was freely soluble in alcohol and ether. He found it to be composed of two distinct oils, separable by distillation: one of these has the formula $C_{10}H_{16}$, and reacts with hydrochloric acid in a manner analogous to oil of turpentine; the other is heavier, and possesses the formula $C_{10}H_{16}O$. (*A. J. P.*, xxvi. 405.) Wormseed oil is used as an anthelmintic, in the dose of from four to eight drops (0·24 to 0·5 C.c.) for a child, repeated morning and evening for three or four days, and then followed by a brisk cathartic. The case of a child, six years old, is recorded in the *Boston Med. and Surg. Journ.* (xlv. 373), in which death is supposed to have resulted from the use of overdoses.

OLEUM CINNAMOMI. *U. S., Br.* *Oil of Cinnamon.*

(Ō'LẸ-ŬM CĬN-NẠ-MŌ'MĪ)

"A volatile oil distilled from Cinnamon." *U. S.* "The oil distilled from Cinnamon Bark." *Br.*

Oleum Cinnamomii Zeylanici, *P.G.;* Oil of Ceylon Cinnamon, *E.;* Essence de Cannelle, Huile de Cannelle, *Fr.;* Zimmtöl, Zeylonisches Zimmtöl, *G.;* Olio di Cannella, *It.;* Aceyte de Canela, *Sp.*

There are two oils of cinnamon in commerce; one procured from the Ceylon cinnamon, the other from the Chinese cinnamon, and often distinguished by the name of *oil of cassia.* There is no essential difference in the two oils; and that of the Chinese cinnamon, as much the cheaper and more abundant of the two, will probably continue to be generally employed, notwithstanding that the Ceylon product has the finer flavor.*

Oil of cinnamon of Ceylon is prepared in that island from inferior kinds of cinnamon, of insufficient value to pay the export duty. The following account of the method of extraction is given by Marshall. The bark, having been coarsely powdered, is macerated for two days in sea-water, and then submitted to distillation. A light and a heavy oil come over with the water, the former of which separates in a few hours and swims upon the surface, the latter falls to the bottom of the receiver, and continues to be deposited for ten or twelve days. In future distillations, the saturated cinnamon water is employed with sea-water to macerate the cinnamon. Eighty pounds of the freshly prepared bark yield about 2·5 ounces of the lighter oil, and 5·5 of the heavier. From the same quantity kept for several years in store, about half an ounce less of each oil is obtained. The two kinds are probably united in the oil of commerce.

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* Under the name of *Essential Oil of Cinnamon Leaf*, a viscid, brown, volatile oil of a clove-like odor is sometimes exported from Ceylon. *Essential Oil of Cinnamon Root* is a yellow liquid, lighter than water, with a mixed odor of camphor and cinnamon, and a distinctly camphoraceous taste.

Recently prepared oil of Ceylon cinnamon is of a light yellow color, becoming deeper by age, and ultimately red. Pereira states that the London druggists redistil the red oil, and thus obtain two pale yellow oils, one lighter and the other heavier than water, with a loss of about 10 per cent. in the process. The oil has the flavor of cinnamon, and when undiluted is excessively hot and pungent. It is said sometimes to have a peppery taste, ascribable to an admixture of the leaves with the bark in the preparation of the oil. *Oil of Ceylon Cinnamon* has "a slightly acid reaction. Sp. gr. about 1·040. It is readily soluble in alcohol. When cooled to —10° C. (14° F.), it remains clear, but at a lower temperature a solid portion separates from it. *Oil of Chinese Cinnamon* (Oil of Cassia) has the same properties, except that its sp. gr. is about 1·060, and its odor and taste are not quite so agreeable." *U. S.*

Chinese oil of cinnamon is imported from Canton and Singapore. It is pale yellow, becoming red with age. Its flavor is similar to that of the Ceylon oil, though inferior; and it commands a much less price. Zeller states that it is heavier, less liquid, and sooner rendered turbid by cold, and that in the Ceylon oil iodine dissolves rapidly, with a considerable increase of heat, and the production of a tough residue, like extract, while in oil of cassia the reaction is slow, quiet, and with little heat, and the residue is soft or liquid. The following remarks apply to both.

Alcohol completely dissolves oil of cinnamon; and, as it does not rise in any considerable quantity at the boiling temperature of that liquid, it may be obtained by forming a tincture of cinnamon and distilling off the menstruum. When exposed to the air, it absorbs oxygen, and is slowly converted into cinnamic acid, two distinct resins, and water. Of the two resins, one is soluble both in hot and in cold alcohol; the other readily in the former, but sparingly in the latter. *Cinnamic acid*, $C_9H_8O_2$, is colorless, crystalline, sourish, volatilizable, slightly soluble in water, readily dissolved by alcohol, and convertible by nitric acid with heat into benzoic acid. It is sometimes seen in crystals in bottles of the oil which have been long kept. Like benzoic acid, it is said when swallowed to cause the elimination of hippuric acid by urine. (*Journ. de Pharm.*, 3e sér., iii. 64.) It may be obtained by distilling the balsam of Tolu. Oil of cinnamon is almost wholly converted by nitric acid, slowly added, into a crystalline mass, thought to be a compound of the oil and acid. These several facts are explained when it is found that, with the exception of quite small quantities of hydrocarbons, oil of cinnamon consists of *cinnamic aldehyd*, C_9H_8O, which, by moderate oxidation, yields the corresponding cinnamic acid, $C_9H_8O_2$, but by more energetic oxidation yields benzoic acid, $C_7H_6O_2$. The oil has been produced artificially by Strecker from styrone, a derivative from styrax. (See *Styrax.*)

Oil of cinnamon is said to be frequently adulterated with oil of cloves, which, according to Ulex, cannot be detected by the smell or taste. Thus sophisticated, it is stated, on the same authority, to evolve a very acrid vapor when a drop is heated on a watch-glass, to swell up and evolve red vapors if treated with fuming nitric acid, to remain liquid with concentrated caustic potassa, and to assume an indigo-blue color when ferrous chloride is added to its alcoholic solution; none of which reactions occur when the oil is pure. (*Archiv der Pharm.*, Jan. 7, 1853.) It is said also to be frequently adulterated with alcohol and fixed oil, the mode of detecting which is given on page 984.

Medical Properties and Uses. This oil has the cordial and carminative properties of cinnamon, without its astringency, and is much employed as an adjuvant to other medicines, the taste of which it corrects or conceals, while it conciliates the stomach. As a powerful local stimulant, it is sometimes prescribed in gastrodynia, flatulent colic, and languor from gastric debility. The dose is one to three drops (0·06 to 0·18 C.c.), and may be administered in the form of emulsion. Mitscherlich found six drachms to kill a moderate-sized dog in five hours, and two drachms in forty hours. Inflammation and corrosion of the gastro-intestinal mucous membrane were observed after death.

Off. Prep. Aqua Cinnamomi, *U. S.;* Spiritus Cinnamomi, *U. S.*

OLEUM COPAIBÆ. *U. S., Br.* *Oil of Copaiba.*

(Ō'LẸ-ŬM CỌ-PĀ'Ị-BÆ.)

"A volatile oil distilled from Copaiba." *U. S.* "The Oil distilled from copaiva." *Br*

Oleum Balsami Copaivæ; Essence de Copahu, *Fr.;* Copaibaöl, *G.*

The oil constitutes from one-third to one-half or more of the copaiba. From one specimen of recent copaiba as much as 80 per cent. has been obtained. (*A. J. P.*, xxii. 289.) It is prepared largely in Philadelphia by the application of steam heat. As it first comes over it is colorless, but the later product is of a fine greenish hue. By redistillation it may be rendered wholly colorless. It has the odor and taste of copaiba, a neutral reaction, boils at about 470° (*Christison*), solidifies, partly crystalline, at —15° F. (*Gmelin*), is soluble in ether and in an equal weight of alcohol, absorbs hydrochloric acid gas and forms with it crystals of artificial camphor, and when pure consists exclusively of a hydrocarbon, $C_{10}H_{16}$, isomeric with pure oil of turpentine. Sp. gr. about 0·890, *U. S.* From its want of oxygen, it answers even better than naphtha for preserving potassium, a fact first observed by Mr. Durand, of Philadelphia. It dissolves sulphur and phosphorus. (*Gmelin's Handbook*, xiv. 288.)

Its effects on the system are those of copaiba. From the experiments of C. Mitscherlich, it is one of the least injurious of the volatile oils to the animal system; six drachms of it having been introduced into the stomach of a rabbit without causing death. It has been used with success in ascites. (*London Lancet*, Dec. 1870, p. 852.) Externally it produces much less irritation than oil of turpentine. It may be used for the same purposes as copaiba, in the dose of ten to fifteen drops (0·6–0·9 C.c.), given in emulsion, or simply dropped on sugar.

OLEUM CORIANDRI. *U. S., Br.* *Oil of Coriander.*

(Ō'LẸ-ŬM CŌ-RỊ-ĂN'DRĪ.)

"A volatile oil distilled from Coriander." *U. S.* "The Oil distilled in Britain from coriander fruit." *Br.*

Essence de Coriandre, *Fr.;* Korianderöl, *G.*

This is obtained by distillation with water from the bruised seeds in the manner directed in the U. S. Pharm. 1870 for the other volatile oils. Forty-two grains of it are stated by Zeller to be derived from a pound of the fruit. It is pale yellow and colorless, and has the characteristic smell and taste of coriander, and a neutral reaction. Its sp. gr. is from 0·859 to 0·871 (0·870, *U. S.*), and its boiling point 302° F. It is an oxygenated oil, consisting chiefly of a compound, $C_{10}H_{18}O$, from which, however, a molecule of water, H_2O, can be withdrawn by distillation over phosphoric oxide, leaving a hydrocarbon, $C_{10}H_{16}$. *Oil of coriander* is extensively adulterated with colorless rectified oil of orange, which can be detected by its insolubility in 90 per cent. alcohol, in which pure coriander oil dissolves in every proportion; equal parts of oil of orange and 90 per cent. alcohol make a turbid mixture. (*A. J. P.*, Sept. 1878.) Oil of coriander has the medical properties of the fruit, and, like the aromatic oils generally, may be used to cover the taste or correct the nauseating or griping properties of other medicines. It has the great advantage of being more stable and retaining its agreeable odor longer than any other oil of its class.

Off. Prep. Syrupus Sennæ, *Br.*

OLEUM CUBEBÆ. *U. S., Br.* *Oil of Cubeb.* *Oil of Cubebs.*

(Ō′LẸ-ŬM CU̇-BĒ′BÆ.)

"A volatile oil distilled from Cubeb." *U. S.* "The Oil distilled in Britain from cubebs." *Br.*

Oleum Cubebarum; Essence de Cubèbes, *Fr.;* Kubebenöl, *G.*

The oil is obtained from cubebs by grinding them, and then distilling with water. From ten pounds Schönwald procured eleven ounces of oil; and this result very nearly coincides with the experiments of Christison, who obtained 7 per cent. When recently distilled from the fruit, the oil is somewhat greenish, becoming yellowish by age; but when carefully redistilled it is colorless. It has the smell of cubebs, and a warm, aromatic, camphorous taste, and a neutral reaction; is of a consistence approaching that of almond oil; is lighter than water, having the sp. gr. 0·920; and, when exposed to the air, is said to thicken without losing its odor. It is soluble in an equal weight of alcohol. The oil contains a small amount of a hydrocarbon, $C_{10}H_{16}$, boiling at 158°–163° C., and two oils of the formula $C_{15}H_{24}$, boiling at 262°–265° C., one of which unites with HCl, while the other does not. Upon standing, it sometimes deposits rhomboidal prismatic crystals of a stearoptene. This camphor of cubebs has the formula $C_{30}H_{48} + 2H_2O$, is fusible at 67° to 68° C., and volatilizes without change at 148° to 150° C. According to Schmidt, it does not pre-exist in the cubebs, but is formed by the prolonged action of the air. (*Journ. de Pharm.*, Juin, 1875.) The oil has the aromatic properties of cubebs; but it is probably not the sole active ingredient, as it is much less pungent than the fluid extract or oleoresin. It may, however, often be advantageously substituted for the powder, in the commencing dose of ten or twelve drops (0·6 or 0·72 C.c.), to be gradually increased until its effects are obtained, or until it proves offensive to the stomach. It may be given suspended in water by means of sugar, or in the form of emulsion, or enclosed in capsules of gelatin.

OLEUM ERIGERONTIS. *U. S.* *Oil of Erigeron.* [*Oil of Fleabane.*]

(Ō′LẸ-ŬM Ẹ-RĬǤ-Ẹ-RŎN′TỊS.)

"A volatile oil distilled from the fresh, flowering herb of Erigeron canadense. Linné. (*Nat. Ord.* Compositæ.)" *U. S.*

Oleum Erigerontis Canadensis, *U. S.* 1870; Oil of Canada Fleabane.

The oil of fleabane is limpid, of a light straw color, a peculiar aromatic persistent odor, and a mild characteristic taste. By exposure, it becomes darker and thicker. Its reaction is neutral. Its sp. gr., according to Prof. Procter, is 0·845 (0·850 *U. S.*). It probably consists of two distinct oils, as it begins to boil at 154·4° C. (310° F.); and its temperature continues to rise to 185° C. (365° F.). When distilled without water, it comes over colorless, and a little resinous matter is left behind, probably resulting from the oxidation of one or both of the constituent oils. It is readily soluble in alcohol. It consists of carbon, hydrogen, and oxygen. It is slowly reddened by potassa, combines with iodine without explosion, is instantly decomposed by sulphuric acid, and is acted on by strong nitric acid, slowly at ordinary temperatures, but with heat explosively. (Procter, *A. J. P.*, xxvi. 502.)

It was first brought into notice by the so-called eclectic physicians, who use it in diarrhœa, dysentery, and the hemorrhages; and certainly it is a very valuable remedy in hæmoptysis when there is no fever or other marked evidence of constitutional irritation. As long ago as 1854 it was commended highly by Dr. E. Wilson in uterine hemorrhage, while Dr. J. W. Moorman speaks of it most highly in all forms of hemorrhage, in diarrhœa of debility, in dysentery after sufficient evacuation of the stomach and bowels, and especially in hemorrhage from the bowels during typhoid fever. (*Am. Journ. of Med. Sci.*, Oct. 1865, p. 396.) It probably acts very much like the oil of turpentine as a hæmostatic, but is much less irritant and stimulating. For ordinary purposes the dose is from ten minims to half a fluidrachm (0·6 to 0·18 C.c.), which should be repeated every hour or two.

OLEUM EUCALYPTI. *U. S.* *Oil of Eucalyptus.*

(Ō′LE̩-ŬM EŪ-CA̩-LȲP′TĪ—yū-ka̩-lĭp′tī.)

"A volatile oil distilled from the fresh leaves of Eucalyptus globulus or Eucalyptus amygdalina, Labillardière, and some other species of Eucalyptus. (*Nat. Ord.* Myrtaceæ.)" *U. S.*

Essence d'Eucalyptus, *Fr.;* Eucalyptusöl, *G.*

This new officinal is imported from Australia, and is in commerce of several qualities. It is officinally described as "a colorless or very pale yellowish liquid, having a characteristic, aromatic odor; a pungent, spicy and cooling taste, and a neutral reaction. Sp. gr. about 0·900. It is soluble in an equal weight of alcohol." *U. S.* For an account of its chemical and medical properties, see *Eucalyptus* (page 566). It is the only form in which the drug should be exhibited. The dose is from ten to fifteen minims (0·6–0·9 C.c.). On account of the extreme unpleasantness of its taste, it is best to administer it in capsules.

OLEUM FŒNICULI. *U.S.* *Oil of Fennel.*

(Ō′LE̩-ŬM FŒ-NĬC′Ů-LĪ.)

Essence de Fenouil, *Fr.;* Fenchelöl, *G.*

Fennel seeds yield about 2·5 per cent., or, according to Zeller, from 3·4 to 3·8 per cent., of oil. That used in this country is imported. It is colorless or yellowish, with a neutral reaction, and the odor and taste of the seeds. Its sp. gr. is 0·984 to 0·997 (0·960, *U. S.*). "Between 5° and 10° C. (41° and 50° F.) it solidifies to a crystalline mass, which does not resume fluidity until the temperature rises to about 17° C. (62·6° F.). It is soluble in an equal weight of alcohol." *U. S.* It congeals below 50° F. into a crystalline mass, separable by pressure into a solid and a liquid oil (*stearoptene* and *eleoptene*); the former heavier than water, and less volatile than the latter, which rises first when the oil is distilled. Its composition is almost identical with that of oil of anise, containing as it does the liquid and the solid modifications of *anethol*, $C_{10}H_{12}O$, together with small quantities of a hydrocarbon, $C_{10}H_{16}$. As found in the shops, therefore, the oil of fennel is not uniform; and a specimen examined by Dr. Montgomery did not congeal at 22° F. (See *Oleum Anisi.*) It is slightly dextrogyrate. The dose is from five to fifteen drops (0·3 to 0·9 C.c.).

Off. Prep. Aqua Fœniculi, *U. S.;* Spiritus Juniperi Compositus, *U. S.*

OLEUM GAULTHERIÆ. *U. S.* *Oil of Gaultheria.* [*Oil of Wintergreen.*]

(Ō′LE̩-ŬM GÂUL-THĒ′RI̩-Æ.)

Oil of Teaberry, Oil of Partridge-berry.

This oil is a product of the United States, and is prepared largely in New Jersey. The whole plant is usually employed. It has been obtained by Prof. Procter from the sweet birch (see *Betula Lenta*, Part II.), and has been supposed to exist also in the root of *Polygala paucifolia*, and in the roots and stems of *Spiræa ulmaria*, *Spiræa lobata*, and *Gaultheria hispidula*, which have its peculiar flavor. Dr. T. E. De Vrij found it in considerable proportion in the leaves of *Gaultheria leucocarpa* and *G. punctata*, plants which are abundant in the volcanic regions of Java; associated with it was kinic acid. H. Köhler also investigated these oils, and found them to correspond to the oil from *Gaultheria procumbens* (*A. J. P.*, 1879, p. 189).

Oil of partridge-berry when freshly distilled is nearly colorless, but as found in commerce has a brownish yellow or reddish color. It is of a sweetish, slightly pungent, peculiar taste, a very agreeable characteristic odor, and a slightly acid reaction. It is the heaviest of the known essential oils, having the sp. gr. 1·173 (1·18° F., *U. S.*). Its boiling point is 412° F. (*A. J. P.*, iii. 199, and xiv. 213.) It is stated to have been largely adulterated with chloroform. This and other impurities are to be detected by a comparison of the specific gravities and boiling points, or by fractional distillation. "It is readily soluble in alcohol. When heated to about 80° C. (176° F.) the Oil should not yield a colorless distillate having the characteristics of chloroform or of alcohol (*A. J. P.*, 1873, p. 521). On mixing

5 drops of the Oil with 5 drops of nitric acid, the mixture should not acquire a deep red color, and should not solidify to a dark red, resinous mass (abs. of oil of sassafras)." *U. S.* Another distinguishing property is that in watery solution it gives a purple color with ferric salts. Oil of sassafras may be detected by the separation of a deep red resinous mass on treatment with nitric acid in the cold. Prof. Procter proved that oil of gaultheria has acid properties, and contains *salicylic acid.* (See *Salix.*) M. Cahours has confirmed this, and shown that one-tenth of the oil consists of a peculiar hydrocarbon, which he called *gaultherilene*, and the remaining nine-tenths of *salicylate of methyl*, or *methylsalicylic acid*, $CH_3.C_7H_5O_3$: a product having the properties of the latter compound was obtained by distilling a mixture of pyroxylic spirit, salicylic acid, and sulphuric acid. (*Ibid.*, xiv. 211, and xv. 241.) Methylsalicylic acid forms with bases crystalline salts, which are resolved by heat into salicylic acid and wood spirit. Dr. T. J. Gallaher, of Pittsburg, Pa., records the case of a boy, nine years old, who took about half an ounce of this oil, with the effect of producing severe vomiting, purging, epigastric pain, hot skin, frequent pulse, slow and labored respiration, dulness of hearing, and, notwithstanding excessive gastric irritability, an uncontrollable desire for food, from all of which he finally recovered. (*Med. Examiner*, N. S., viii. 347.) Oil of gaultheria is used chiefly on account of its pleasant flavor.

Off. Prep. Spiritus Gaultheriæ, *U. S.;* Syrupus Sarsaparillæ Compositus, *U. S.;* Trochisci Morphiæ et Ipecacuanhæ, *U. S.*

OLEUM GOSSYPII SEMINIS. *U. S.* *Cotton-Seed Oil.*

(Ō′LĘ-ŬM GỌS-SȲP′Į-Ī SĔM′Į-NĬS.)

"A fixed oil expressed from the seed of Gossypium herbaceum, Linné, and of other species of Gossypium (*Nat. Ord.* Malvaceæ), and subsequently purified." *U. S.*

This new officinal fixed oil has no other medical properties than those of a bland neutral oil, and has been introduced especially on account of its use in the officinal liniments of ammonia, lime, camphor, and subacetate of lead. It is stated that there are at present more than forty mills in this country employed exclusively in the manufacture of this oil from cotton-seed, consuming 410,000 tons of seed. The oil-cake is largely exported to England, where it is used as food for cattle, and the oil to France, Italy, and other olive-growing countries of Europe, whence much of it returns to us mixed with olive oil. Thus, of the oil exported from New Orleans in 1880, 88 per cent. was on orders from the Mediterranean ports. The quantity of oil exported in 1880 was 6,967,796 gallons; in 1881, 3,190,836 gallons. The entire product of the country is now about 15,000,000 gallons. (*Oil and Drug News*, May 17, 1881.)

This oil is obtained by expression from the seeds previously deprived of their shells. In this state, they yield two gallons of oil to the bushel. As first obtained, it is thick and turbid, but deposits a portion of its impurities on standing. Besides this crude oil, there are three varieties in commerce, more or less purified, recognized as the *clarified*, the *refined*, and the *winter-bleached.* The last mentioned is of a pale straw color, a mild peculiar odor, and a bland sweetish taste, not unlike that of almond oil. The oil is used in the preparation of woollen cloth and morocco leather, and for oiling machinery. It has been found to be an excellent substitute for almond and olive oil in most pharmaceutical preparations in which they are employed; but it does not answer well in the formation of lead plaster. Citrine ointment carefully prepared with it, too great heat being avoided, retains long a rich orange color and proper unctuous consistence. It is officinally described as "a bright, pale yellow, oily liquid, odorless, having a bland, nut-like taste, and a neutral reaction. Sp. gr. 0·920 to 0·930. It is only slightly soluble in alcohol, but readily so in ether. When cooled to near 2° C. (35·6° F.), it begins to congeal. Concentrated sulphuric acid instantly renders it dark reddish brown." *U. S.* It is dissolved in all proportions by chloroform. By sulphuric acid it is made deep red, almost brown; but it is not obviously affected by nitric or hydrochloric acid. (*A. J. P.*, 1861, p. 208.)

Cotton-seed oil has been examined by Dr. A. Adriani (*Chem. News*, Jan. 7, 1865, p. 5). The following are among the more important statements contained in Dr. Adriani's paper. The product of the expressed seeds is from 15 to 18 per cent. In its impure state it is dark reddish brown, not quite clear, and contaminated with mucilage and albumen. In this state, its sp. gr. varies from 0·930 to 0·932, which is increased, by washing with boiling water, to 0·934. The latter sp. gr. is very nearly that of linseed oil, which this oil also closely resembles in taste and odor and in its drying property. The color is not essential to the oil, being dependent on the oxidation of a peculiar substance contained in the seeds.

The oil is clarified by first boiling it with water to separate the mucilage, and then heating it with a weak solution of caustic potassa, by which the coloring matter is removed. As this oil is said to be much used in England for adulterating olive oil, a test to distinguish it is very desirable; and, according to Mr. R. Reynolds, nitrate of mercury will answer the purpose. Of this a test-solution may be made by dissolving, without heat, 6 parts of mercury in 7·5 parts of nitric acid of 1·36. This salt has the effect, when mixed with olive oil, of entirely solidifying and hardening it upon standing; while under the same circumstances the cotton-seed oil remains fluid. If the two oils are mixed, an intermediate effect is produced; the oil, though possibly solidified, remaining soft and pasty, and not becoming hard like pure olive oil. (*P. J. Tr.*, 2d ser., vii. 226.)

Off. Prep. Linimentum Ammoniæ, *U. S.;* Linimentum Calcis, *U. S.;* Linimentum Camphoræ, *U. S.;* Linimentum Plumbi Subacetatis, *U. S.*

OLEUM HEDEOMÆ. *U. S.* *Oil of Hedeoma.* *Oil of Pennyroyal.*

(Ō′LE̤-ŬM HĔD-E̤-Ō′MÆ.)

This, though analogous in properties to the oil of European pennyroyal, is derived from a distinct plant (*Hedeoma pulegioides*) peculiar to North America. It has a light yellow color, with the odor and taste of the herb, and a neutral reaction. Its sp. gr. is 0·948 (0·940, *U. S.*). It is readily soluble in alcohol. It may be used as a remedy in flatulent colic and sick stomach, to correct the operation of nauseating or griping medicines. It is also much employed as a domestic remedy in amenorrhœa. The dose is from two to ten drops (0·12 to 0·6 C.c.).

OLEUM JUNIPERI. *U. S.*, *Br.* *Oil of Juniper.*

(Ō′LE̤-ŬM JU̇-NĬP′E̤-RĪ.)

"A volatile oil distilled from Juniper." *U. S.*

Oleum Fructus (vel Baccæ) Juniperi; Essence de Genièvre, *Fr.;* Wachholderbeeröl, *G.*

The proportion of oil which juniper berries afford is stated very differently by different authors. Trommsdorff obtained 1 per cent. The highest quantity given in the table of Recluz is 2·34, the lowest 0·31 per cent. Zeller gives as the product of the fresh ripe fruit 1·3 per cent., of that a year old 0·86 per cent. (*Centralb.*, März, 1855, p. 207.) The berries are most productive when bruised. The oil of juniper consumed in this country is brought from Europe, and is believed to be procured chiefly from the tops of the plant, being sold for a price which is altogether incompatible with the idea that it is prepared from the fruit alone. It is colorless, or of a light greenish yellow, with terebinthinate odor, and hot acrid taste. Oil of juniper has a neutral reaction, a sp. gr. from 0·879 to 0·911 (about 0·870, *U. S.*), and is moderately lævogyrate. (*Buignet.*) "It is soluble in about 12 parts of alcohol to a turbid liquid." *U. S.* According to Blanchet, it contains two isomeric oils, of which one is colorless, and the other colored and less volatile. It is, when pure, a mixture of hydrocarbons isomeric with oil of turpentine ($C_{10}H_{16}$); but it does not form a solid compound with hydrochloric acid. (*Journ. de Pharm.*, xxvi. 80.) Oil of turpentine is often fraudulently added, but may be detected by the specific gravity of the mixture, which is considerably less than that of the unadulterated oil of juniper. An empyreumatic oil obtained by destructively distilling the wood is known in commerce as *oil of cade.* (See *Oleum Picis Liquidæ.*)

The oil is stimulant, carminative, and diuretic, and is very useful in combination with other remedies in debilitated dropsical cases. To it Holland gin owes its peculiar flavor and diuretic power. Sir James Simpson, of Edinburgh, considered it an efficient diuretic when administered through the lungs. A teaspoonful of the oil is put into a vessel of hot water, and the patient directed to inhale the vapors. (*Bost. Med. and Surg. Journ.*, March 12, 1868, p. 96.) The dose is from five to fifteen drops (0·3 to 0·9 C.c.), and may be considerably increased.

Off. Prep. Spiritus Juniperi, *U. S.*, *Br.;* Spiritus Juniperi Compositus, *U. S.*

OLEUM LAVANDULÆ. *U. S.*, *Br.* *Oil of Lavender.*

(Ō'LẸ-ŬM LẠ-VĂN'DU̇-LÆ.)

"A volatile oil distilled from the flowering tops or the whole herb of Lavandula vera. De Candolle. (*Nat. Ord.* Labiatæ.)" *U. S.* "The Oil distilled in Britain from the flowers of Lavandula vera." *Br.*

Essence de Lavande, *Fr.;* Lavandelöl, *G.*

This oil is usually distilled from the flowers and flower-stems conjointly, though of finer quality when obtained from the former exclusively. Dried lavender flowers are said to yield from 1 to 1·5 per cent. of oil. According to Zeller, the fresh flowers yield 1·03, the dried 4·3, the whole fresh herb in flower 0·76 per cent. It is stated that the lavender produced by an acre of ground under cultivation will yield from 10 to 12 pounds of the oil. (*P. J. Tr.*, 1864, p. 257.) The oil is very fluid, of a lemon-yellow color, with the fragrance of the flowers, and an aromatic, burning taste. That met with in commerce has the sp. gr. 0·898 at 68° F., which is reduced to 0·877 by rectification (*Berzelius*), or 0·886 (*Buignet*). It is lævogyrate. According to Brande, the sp. gr. of the oil obtained from the whole herb is 0·9206. Alcohol of 0·830 dissolves oil of lavender in all proportions; that of 0·877, only 42 per cent. (*Berzelius.*) "It has a neutral reaction while fresh, and a sp. gr. of about 0·890. It is readily soluble in alcohol, and in acetic acid of 90 or more per cent." *U. S.* Proust states that when allowed to stand in imperfectly-stopped bottles it lets fall a crystalline deposit, which often amounts to one-fourth of its weight. This has been found by M. Dumas to have the same point of volatilization and the same composition as true camphor, but to differ in the total want of rotatory power. It is said that the portion of oil first distilled is most fragrant, and is often kept separate, and sold at a higher price. According to M. Lallemand, oil of lavender consists chiefly of an oil, $C_{10}H_{16}$, isomeric with oil of turpentine, but contains acetic acid in combination, probably in the state of amylacetic ether. (*Journ. de Pharm.*, Avril, 1860, p. 290.) It is used chiefly as a perfume, though possessed of carminative and stimulant properties, and sometimes useful in cases of nervous languor and headache. The dose is from one to five drops (0·06 to 0·3 C.c.).

Oil of Spike is procured from the broad-leaved variety of lavender which grows wild in Europe, the *Lavandula Spica* of De Candolle. Its odor is less fragrant than that of common oil of lavender, and is somewhat analogous to that of oil of turpentine, with which it is said to be often adulterated. It is used by artists in the preparation of varnishes.

Off. Prep. Linimentum Camphoræ Compositum, *Br.;* Spiritus Ammoniæ Aromaticus, *U. S.;* Spiritus Lavandulæ; Tinctura Lavandulæ Composita, *U. S.*, *Br.*

OLEUM LAVANDULÆ FLORUM. *U. S.* *Oil of Lavender Flowers.*

(Ō'LẸ-ŬM LẠ-VĂN'DU̇-LÆ FLŌ'RŬM.)

"A volatile oil distilled from fresh Lavender." *U. S.*

This superior kind of oil of lavender has been introduced into the Pharmacopœia because it was desirable that an inferior sort should not be used in the simple spirit of lavender or in officinal cologne water. In our opinion it would have been better to have made this the *only* officinal kind of oil of lavender, for it is equally important to have the oil of the best quality for use in the compound tincture. The properties of the oil are noticed in the preceding article. It is officinally described as "a colorless or yellowish liquid, having the fragrant odor of lavender flowers, a pungent and bitterish taste, and a neutral reaction while fresh. Sp. gr. about 0·890. It is readily soluble in alcohol and in acetic acid of 90 or more per cent. When heated to about 80° C. (176° F.), it should not yield a colorless distillate having the characteristics of alcohol." *U. S.*

Off. Prep. Spiritus Lavandulæ; Spiritus Odoratus, *U. S.*

OLEUM LIMONIS. *U. S., Br.* *Oil of Lemon.*

(Ō′LẸ-ŬM LỊ-MŌ′NĬS.)

"A volatile oil, extracted by mechanical means from fresh Lemon Peel." *U. S.* "The oil expressed or distilled from fresh lemon-peel. Imported chiefly from Sicily." *Br.*

Oleum Citri, *P.G.;* Huile de Cédrat, Essence de Citron, Huile de Citron, *Fr.;* Citronenöl, *G.;* Olio di Limone, *It.;* Aceyte de Limon, *Sp.*

The exterior rind of the lemon abounds in a volatile oil, which, being contained in distinct cells, may be separated by simple expression. The rind is first grated from the fruit, and then submitted to pressure in a bag of fine cloth. The oil thus obtained is allowed to stand till it becomes clear, when it is decanted, and kept in stopped bottles. By a similar process, the oil called by the French *huile de cédrat* is procured from the citron. (See *Oleum Bergamii* and *Limonis.*) These oils may also be obtained by distillation; but thus procured, though clearer, and, in consequence of the absence of mucilage, less liable to change on keeping, they have less of the peculiar flavor of the fruit; and the mode by expression is generally preferred. A third method of separating the oil, used in Calabria and Sicily, is to put the grated rind into hot water and skim off the oil as it rises to the surface. (*A. J. P.*, 1868, p. 27.) The method employed to obtain the finest oil is, however, that known as the *écuelle* process. The écuelle is an instrument usually made of tinned copper, bowl-shaped, and armed with concentric rows of short spikes. Attached to the bottom of the bowl is a hollow handle, closed at the bottom. This acts as a reservoir for the oil as the fruit is rubbed by the workmen over the sharp teeth. The oils are brought originally from Italy, Portugal, or the south of France.

The oil of lemons and oranges, as well as those of the other Aurantiaceæ, will keep indefinitely upon admixture with a small proportion of alcohol, say one ounce to a pound of the oil. When wanted for use, a quantity of water equal to that of alcohol, added to the mixture, will unite with the alcohol, and subside, leaving the oil free of the alcohol for all practical purposes. (Carl Früh, *A. J. P.*, 1871, p. 201.)

Properties. Oil of lemon is a very volatile liquid, having the odor of the fruit, a warm, pungent, aromatic taste, and a neutral reaction. As commonly procured, it is yellow, and has the sp. gr. 0·8517 (0·85, *U. S.*); but by distillation it is rendered colorless, and, if three-fifths only are distilled, its sp. gr. is reduced to 0·847 at 71° F. It is soluble in 2 parts of alcohol and in all proportions in anhydrous alcohol or disulphide of carbon. In its ordinary state it contains oxygen, but when purified by distillation *in vacuo*, at a low temperature, it consists exclusively of carbon and hydrogen, in the same proportion as in pure oil of turpentine, or camphene, its formula being $C_{10}H_{16}$. In this state it is capable of absorbing almost half its weight of hydrochloric acid gas, by which it is converted into a crystalline substance, $C_{10}H_{16} + 2HCl$, and a yellow, oily, fuming liquid. The crystalline substance is analogous to artificial camphor, produced by the action of hydrochloric acid upon oil of turpentine, and is a compound of the oil and the acid. The oil of lemon is said to consist of two isomeric oils. Dr. W. A. Tilden made a chemical examination of this oil in 1879. The specimens of oil which he examined had a sp. gr. of ·852 at 20° C. (68° F.); the first rough distillates, after being heated with metallic sodium, gave a distillate boiling under 179° C. (354·2° F.). The following substances were recognized. 1. A turpentine, $C_{10}H_{16}$, agreeing in general properties with *terebenthene.* 2. A terpene, $C_{10}H_{16}$, for which the name *citrene* may be retained, and which constitutes at least 70 per cent. of the crude oil; this terpene differs but slightly from the corresponding terpene of orange as to odor, and it boils at the same temperature, 176° C. (348·8° F.); but it is distinguished by the formation of terpene hydrate when treated with nitric acid and alcohol, whereas hesperidene yields no terpene (hydrate?); citrene treated with strong sulphuric acid yields an inactive hydrocarbon, boiling at about 176° C. (348·8° F.), whilst hesperidene yields viscid products, distilling above 240° C. (464° F.). 3. *Cymene*, about 6 per cent. 4. Distillates *c* and *d* consist chiefly of an oxidized compound, $C_{10}H_{18}O$, boiling above 200° C. (392° F.), resembling terpinol, except that it is dextrogyrate. 5. The viscid residue consists of polymeric hydrocarbons $(C_{10}H_{16})_2$, and also of a compound ether, $C_{10}H_{17}(C_2H_3O)O$, which is decomposed by heat into $C_{10}H_{16}$ and acetic acid. (*Journ. Chem. Soc.*, 1879, p. 386.)

"By keeping, the Oil becomes thicker and acquires a disagreeable, terebinthinate taste, which may be prevented by mixing it, while fresh, with 5 per cent. of alcohol, and decanting the Oil after it has become clear from the sediment." *U. S.* It is often adulterated by the fixed oils and by alcohol; but in this country the most frequent sophistication is with oil of turpentine, which is difficult of detection from its similar composition and specific gravity. Perhaps the best test of the presence of this oil is the terebinthinate smell produced when the adulterated oil is evaporated from heated paper. Oil of lemon procured by expression is apt to let fall a deposit, and to undergo chemical change. Mr. J. S. Cobb has found no method so effectual to obviate this result, and at the same time to retain unimpaired the flavor of the oil, as to shake it with a little boiling water, and allow the mixture to stand. A mucilaginous matter separates, and floats on the surface of the water, from which the purified oil may be decanted. (*Annals of Pharm.*, ii. 86.)

Medical Properties and Uses. Oil of lemon has the stimulant properties of the aromatics, but is used chiefly to impart flavor to other medicines.

Off. Prep. Linimentum Potassii Iodidi cum Sapone, *Br.;* Spiritus Ammoniæ Aromaticus; Syrupus Limonis, *U. S.;* Syrupus Acidi Citrici, *U. S.;* Spiritus Odoratus, *U. S.*

OLEUM LINI. *U. S., Br.* *Oil of Flaxseed.* [*Linseed Oil.*]

(Ō′LE-ŬM LĪ′NĪ.)

"A fixed oil expressed from Flaxseed without the use of heat." *U. S.* "The oil expressed without heat from linseed." *Br.*

Huile de Lin, *Fr.;* Leinöl, Leinsamenöl, *G.;* Olio di Lino, *It.;* Aceyte de Linaza, *Sp.*

This oil is obtained by expression from the seeds of *Linum usitatissimum*, or common flax, which, according to M. Berjot, contain 34 per cent. (*Journ. de Pharm.*, Avril, 1863, p. 277.) In its preparation on a large scale, the seeds are usually roasted before being pressed, in order to destroy the gummy matter contained in their coating. The oil is thus obtained more free from mucilage, but more highly colored and acrid, than when procured by cold expression. For medical use, therefore, it should be prepared without heat; and, as it is apt to become rancid quickly on exposure, it should be used as soon after expression as possible. It may, however, be rendered sweet again by agitation with warm water, rest, and decantation. It is said to be obtained purer and in larger proportion by treating the crushed seeds with bisulphide of carbon, than by expression. (See *A. J. P.*, xxvi. 265.) Flaxseed oil has a yellowish brown color,* a disagreeable odor, a bland but nauseous taste, and a neutral reaction; is of the sp. gr. 0·932 (about 0·936, *U. S.*); boils at 600° F.; does not congeal at zero; dissolves in forty parts of cold and five of boiling alcohol, and in one part and a half of ether. "It is soluble in 5 parts of absolute alcohol and in 1·5 parts of ether. It does not congeal above —20° C. (—4° F.)." *U. S.* It has the property of drying or becoming solid on exposure to the air, acquiring during the process a strong odor and taste. The drying property resides in a constituent which, to distinguish it from the olein of the non-drying oils, is named *linolein*, and is the glyceride of *linoleic acid*, $C_{16}H_{28}O_4$. Its acrimony is owing to the presence of a small proportion of an acrid oleoresin. From its drying property, it is useful in painting, and in making printers' ink.

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* The following method of bleaching flaxseed, rapeseed, and poppyseed oils is recommended by C. Puscher. He mixes 100 kilogrammes of the oil with 2 kilogrammes of a mixture of equal weights of sulphuric acid and alcohol of 96 per cent. The sulphuric acid mixes uniformly with the oil; the mixture soon assumes a green turbidness, which afterwards becomes black; and in 24 or 48 hours the liquid becomes clear by the deposition of a black sediment. It is necessary to wash the oil with hot water, to separate the little remaining acid. Linseed oil in bulk shows merely a yellowish tint; the other oils mentioned become quite colorless. (*A. J. P.*, 1873, p. 110.)

It is said that cod-liver oil has recently been used for the adulteration of the oil of flaxseed, especially where the latter is intended for preparing printers' ink. Mr. Aug. Morell detects the adulteration in the following method. Take 10 parts by weight of the suspected oil, mix it in a small cylindrical glass tube with 3 parts of crude nitric acid, agitate the mixture well, and allow it to rest. If cod-liver oil is present, the oily layer at top assumes a dark brown to blackish brown color, while the acid at bottom varies from bright orange to orange or dark yellow. So little as 3 per cent. of cod-liver oil may thus be detected. If the flaxseed oil is pure, it becomes, during the agitation, first sea-green, and afterwards dirty greenish yellow, the acid being bright yellow. (*P. J. Tr.*, Nov. 1873, p. 384.)

Medical Properties and Uses. The oil is laxative in the dose of a fluidounce (30 C.c.), but, on account of its disagreeable taste, is seldom given internally. It has, however, been highly recommended as a cure for piles, in the dose of two ounces (60 C.c.) of the fresh oil morning and evening. It is sometimes added to purgative enemata; but its most common application is externally to burns, usually in combination with lime-water.*

Off. Prep. Ceratum Resinæ Compositum, *U. S.;* Linimentum Calcis, *U. S.*

OLEUM MENTHÆ PIPERITÆ. *U. S., Br.* *Oil of Peppermint.*

(Ō′LE-ŬM MĔN′THÆ PĪ′PE-RĪ′TÆ.)

Essence de Menthe poivrée, *Fr.;* Pfefferminzöl, *G.*

Peppermint varies exceedingly in the quantity of oil which it affords. Four pounds of the fresh herb yield, according to Baumé, from a drachm and a half to three drachms of the oil. Zeller gives as the product of the fresh herb from 0·37 to 0·68 per cent., of the dried 1·14 per cent. The yield is generally less than 1 per cent. This oil is largely distilled in the States of Michigan, Ohio, and New York. It is of a greenish yellow color or nearly colorless, but becomes reddish by age. Its odor is strong and aromatic, its taste warm, camphorous, and very pungent, but succeeded, when air is admitted into the mouth, by a sense of coolness. Its sp. gr. is stated differently from 0·902 to 0·920 (about 0·900, *U. S.*); its boiling point is 365° F.; its reaction neutral. It is soluble in an equal weight of alcohol. It is considerably lævogyrate. (*Buignet.*) Upon long standing it deposits a *stearoptene.* Berzelius states also that at 8° below zero the oil deposits small capillary crystals. These, which are called *peppermint camphor* or *menthol*, $C_{10}H_{19}OH$, melt at 42° C. (107·6° F.), boil at 212° C. (413·6° F.), volatilize unchanged, and, when distilled with anhydrous phosphoric acid, yield a peculiar aromatic product, denominated *menthene*, $C_{10}H_{18}$. (*Gmelin's Handbook*, xiv. 445.) Professor Flückiger has discovered that 50 to 70 drops of peppermint oil, shaken with one drop of nitric acid sp. gr. 1·2, turn faintly yellowish brown, and after an hour or two a most beautiful blue violet or greenish blue, by transmitted light, or copper color by reflected light. Either a greater amount of acid or heating hastens the reaction. The color is very persistent. The presence of 5 per cent. of turpentine does not interfere with the reaction. (*P. J. Tr.*, Feb. 1871.) This oil is frequently adulterated with alcohol, and occasionally, there is reason to believe, with oil of turpentine, and even oil of copaiba. Oil of turpentine is detected by its odor, by its deficient solubility in cold alcohol, and by imparting the property of exploding with iodine. According to H. Martin, the copaiba is to be detected by the mass acquiring the consistency of butter, when heated to boiling with concentrated sulphuric acid. (*Neues Repertor. für Pharm.*, xvii. 635.) It is stated by the Messrs. Hotchkiss that, in much of the land under culture with peppermint in this country, other oil-producing plants are carelessly allowed to grow, which, being gathered and distilled with the peppermint, contaminate the product. (*A. J. P.*, xxvii. 222.) The plant which has proved most troublesome to the mint-growers is of the Erigeron family, and recently (1882) Vigier and Cloez have given the following tests to detect oil of erigeron, which will indicate the presence of eight or ten per cent. of it. Concentrated caustic potash does not saponify erigeron oil, but colors it orange-red in the cold; on heating, the color deepens till part of the oil separates as a reddish purple viscid mass. This reaction does not show itself with oil freshly distilled at 170° C. Pure mint oils do not give this reaction; in the cold, caustic potash converts them into a white emulsion. On heating, the mixture takes a faint, clear, yellow tinge. But, if a few drops of erigeron oil are introduced, the orange-red color appears quickly on shaking, and develops instantly if the tube is warmed. Mint oil is completely soluble, erigeron oil is completely insoluble in its own volume of 85 per cent. alcohol at 15° C. (59° F.). If a suspected sample be agitated with an equal volume of 85 per cent. alcohol, a milky fluid will be produced if erigeron oil be present, and the insoluble essence will separate in the course of twenty-four hours. The oils of Eucalyptus globulus and turpentine behave in much the same way, and the points which would distinguish the three substances have not yet been determined. But a specimen of mint oil which rotates the polarized ray feebly to the left, makes a turbid mixture with its own volume of 85 per cent. alcohol, and takes an orange-red tint with caustic potash, may be safely rejected. (*N. R.*, Jan. 1882; from *Union Pharmaceutique.*) J. J. Quetting & Co. furnish the following test for detecting the presence of oil of pennyroyal. "Take one drachm chloral hydrate and half a drachm C. P. sulphuric acid; mix them in a glass mortar, add a few drops of alcohol, and stir until it becomes clear. Then use this mixture in equal proportions with the suspected oil in a small porcelain dish, and mix thoroughly together. The result is a fine cherry color, if the oil is pure; otherwise, if adulterated with pennyroyal, it turns a dark olive-green, more or less as to the quantity of adulteration." (*N. R.*, Jan. 1882.) Such impurities may usually be detected by the altered odor of the oil. Recently castor oil is said to have been used very largely in adulterating the oil. It is to be detected by the greasy stain left on evaporation on paper. When freshly prepared, oil of peppermint should volatilize completely from paper without leaving a mark, and when dropped into alcohol of 85 per cent. should completely dissolve without agitation. (Bullock, *A. J. P.*, 1859, p. 553.) Very curious differences have been noted in the action of chloral upon it, and further investigation is evidently needed. Jehn pointed out that when chloral hydrate is brought into contact with the oil, a red color, passing from rose to cherry, is gradually produced; the color is readily soluble in alcohol, ether, and chloroform, and is not altered by boiling; it is intensified by sulphuric acid, and on the further addition of chloroform is changed into a dark violet. (*A. J. P.*, 1873, p. 447.) Prof. Flückiger, however, has found that chloral hydrate only develops a slightly brown or yellow color, whilst anhydrous chloral changed some specimens of the oil to brown and others to green. He also found great differences in the action of bisulphate of sodium, the coloring varying from green to rose-red or violet. (*Ibid.*, 1874, p. 274.) M. A. Trebault has noticed Jehn's reaction, but is inclined to attribute it to the formic acid, which most specimens of chloral contain. (*P. J. Tr.*, June, 1874, p. 978.) According to M. A. Trebault, when picric acid is added in the cold no change occurs for half an hour, when a green color instantly develops. The green produced has a showy red fluorescence. Sulphuric acid develops a rose color, passing through reddish yellow to reddish brown; hydrochloric acid a rose color, rather slowly; nitric acid a rose color, then red, soon becoming greenish. (For further particulars, see *P. J. Tr.*, June, 1874, p. 977.) Dr. C. Roucher states that when to acetic acid is added one-twentieth of its weight of oil of peppermint, with agitation, in an hour the liquid becomes deep blue by transmitted and a cinnabar-red by reflected light. The coloration is not stable, but passes through green to yellow in the light. To detect alcohol, Hager puts ten to fifteen drops of the oil in a test-tube with a piece of tannic acid, the size of a pea; if even one-half per cent. of alcohol be present, after two or three hours the tannin will be softened or dissolved. (*A. J. P.*, xliv. 104.)

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* *Oiled Paper.* A substitute for waxed cloth, for the dressings of wounds and ulcers, prepared in the following manner by M. Gauthier, of Geneva, with flaxseed oil, has been highly recommended. To facilitate its drying, 3 litres (about 6·4 pints) of the oil are boiled for an hour or two with 30 grains of acetate of lead, 30 grains of litharge, 15 grains of yellow wax, and 15 grains of turpentine. Thus prepared, the oil is spread upon silk-paper by means of a brush on both surfaces. On the top of the first sheet another is then placed so as to overlap it at one corner. The lower surface of the second sheet thus becomes impregnated with the oil, which now requires to be applied only to the upper. Any desired number of sheets may be thus successively superimposed. They are then separated, and suspended in a drying apartment, attached to a cord by means of hooks or pins. When dry, they should be sprinkled over with chalk to prevent adhesion, and packed away. (*Journ. de Pharm.*, Mai, 1860, p. 363.)

Chinese Oil of Peppermint has not found its way to any extent into commerce, yet it has recently attracted much attention. According to Mr. John Mackey, some of it has reached London in cylindrical tin canisters, and it is to be obtained in San Francisco. Some specimens resemble the ordinary oil, but become solid in cold weather; others remain liquid and show no tendency to deposit a camphor; whilst others are solid crystalline masses at all temperatures. It seems probable that the original Chinese oil contains a great excess of menthol, and constitutes the variety first spoken of, and that the solid and liquid oils are prepared by separating it into its two constituents. The solid oil Flückiger states not to differ from American menthol. (See *P. J. Tr.*, v. 366, 825.)

Oil of peppermint is stimulating and carminative, and is much used in flatulence, nausea, spasmodic pains of the stomach and bowels, and as a corrigent or adjuvant of other medicines. In neuralgia it is one of the best external remedies at our command, and is said to have been used in China from time immemorial. A cloth wet with it is to be laid upon the affected part, evaporation being restrained by oiled muslin or other covering. In rheumatism also it is a very useful anodyne counter-irritant. The dose is from two to six drops (0·12 to 0·36 C.c.), and is most conveniently given rubbed with sugar and then dissolved in water. The oil is frequently employed, dissolved in alcohol, in the form of *essence of peppermint*, which is an officinal preparation. (See *Spiritus Menthæ Piperitæ.*)*

Off. Prep. Aqua Menthæ Piperitæ; Essentia Menthæ Piperitæ, *Br.;* Pilulæ Rhei Compositæ; Spiritus Menthæ Piperitæ; Trochisci Menthæ Piperitæ, *U. S.*

OLEUM MENTHÆ VIRIDIS. *U.S., Br.* *Oil of Spearmint.*

(Ō'LẸ-ŬM MĔN'THÆ VĬR'Ị-DĬS.)

Essence de Menthe verte, *Fr.;* Römisch-Minzöl, *G.*

According to Lewis, ten pounds of spearmint yield an ounce of oil; by others the product is stated not to exceed one part from five hundred. The oil is largely distilled in this country, the whole plant being used. It is pale yellow or greenish when recently prepared, but becomes red with age, and ultimately almost of a mahogany color. Its flavor is analogous to that of the oil of peppermint, but less pungent. Its sp. gr. is stated differently from 0·914 to 0·975 (about 0·900, *U. S.*); its boiling point at 160° C. (320° F.); its reaction neutral. It is soluble in its weight of alcohol. Kane (*Ann. Ch. und Pharm.*, 32, p. 286) states that it contains a stearoptene and a terpene, boiling at 166° C. Gladstone (*Jahresber.*, 1863, p. 548) states that it contains a terpene, $C_{10}H_{11}$, and a compound, $C_{10}H_{14}O$, isomeric with carvol, which boils at 225° C. (437° F.), and has the sp. gr. 0·9515. It is used for the same purposes as the oil of peppermint, in the dose of from two to six drops (0·06 to 0·36 C.c.). An *essence of spearmint*, prepared by dissolving the oil in alcohol, is officinal. (See *Spiritus Menthæ Viridis.*)

Off. Prep. Aqua Menthæ Viridis; Spiritus Menthæ Viridis, *U. S.*

OLEUM MORRHUÆ. *U. S., Br.* *Cod-liver Oil.*

(Ō'LẸ-ŬM MŎR'RHŮ-Æ.)

"A fixed oil obtained from the fresh livers of Gadus Morrhua, Linné, or of other species of Gadus. (*Class*, Pisces; *Order*, Teleostia; *Fam.*, Gadida.)" *U. S.*

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* *Menthol.* Mr. A. D. Macdonald (*Edinburgh Med. Journ.*, Sept. 1879) extols the virtues of menthol as a remedy in the various forms of neuralgia. The solution he uses is the following. Menthol gr. i; spt. vin. rect. ♏ i; ol. caryoph. ♏ x; mix. To be shaken, and painted over the affected tract. Pain is in this way relieved in from two to four minutes, and within a minute or two more the attack ceases. In toothache Mr. Macdonald has cleaned out the cavity of the tooth with a little cotton wool, and then placed a single crystal on another small piece of wool and inserted it, with the result that the pain disappeared. A saturated tincture is equally effective. Mr. Macdonald recommends menthol as a suitable external application in sciatica, intercostal neuralgia, and brachialgia.

"The oil extracted from the fresh liver of the cod, Gadus Morrhua (Linn.), by the application of a heat not exceeding 180°." *Br.*

Oleum Jecoris Aselli, Oleum Hepatis Morrhuæ; Cod Oil, *E.;* Huile de Foie de Morue, Huile de Morue, *Fr.;* Leberthran, Stockfischleberthran, *G.*

Gen. Ch. Recognized by the ventrals attached under the throat, and attenuated to a point.

Gadus Morrhua. Linn. *Syst. Nat., ed. Gmelin*, i. p. 1162; Cuvier, *Règne Animale*, ii. 212; Bloch. *Ichthyologie*, pl. lxiv.—*Morrhua vulgaris.* Storer, *Synops. of Fishes of N. Am.*, p. 216. The *common cod* is between two and three feet long, with brown or yellowish spots on the back. The body is moderately elongated and somewhat compressed, and covered with soft rather small scales, of which the head is destitute. Of the fins, which are soft, there are three on the back, two anal, and a distinct caudal; and the fin under the throat is narrow and pointed. The jaws are furnished with pointed irregular teeth, in several ranks. The gills are large, with seven rays. This species of cod inhabits the Northern Atlantic, and is especially abundant on the Banks of Newfoundland, where it finds food adapted to its wants.

Besides the common cod, several other species of Gadus, frequenting the seas of Northern Europe and America, contribute to furnish the cod-liver oil of commerce. Among these De Jongh mentions *Gadus callarias*, or *dorsch* (*Morrhua Americana* of Storer), *G. molva*, or *ling*, *G. carbonarius*, or *coal fish*, and *G. pollachius*, or *pollock*, as affording the oil on the coast of Norway;* while, from information obtained by Prof. Procter, there is reason to believe that, on our own coast, in addition to the pollock above mentioned, it is obtained also from the *hake* (*G. merluccius*) and the *haddock* (*G. Æglifinus*). It is largely produced on our coast north of Boston. The cod-liver oil exported from Norway in 1875 amounted to 113,415 barrels. (*Special Norwegian Catalogue, Centennial Exposition*, 1876.)†

Preparation. Fishermen have long been in the habit of collecting this oil, which is largely consumed in the arts, particularly in the preparation of leather. Upon the coasts of Newfoundland, Nova Scotia, and New England, the boats which fish near the shore, being small, soon obtain a load, and, running in to land, deliver their cargoes to persons whose business it is to cleanse and salt the fish. The oil is prepared either in the huts of the fishermen, or more largely at establishments to which the livers are conveyed in quantities. These are put into a boiler with water, and heated until they are broken up into a pultaceous mass, which is thrown upon a strainer covering the top of a cask or tub. The liquid portion passes, and upon standing separates into two parts, the oil rising to the surface of the water. The oil is then drawn off, and, having been again strained, is prepared for the market. Another and improved method, which has come into use since the extensive employment of the oil as a medicine, is to heat the livers in a wooden butt by means of low-pressure steam. The pultaceous mass resulting is drained as before mentioned; the livers themselves containing, besides oil, a considerable portion of watery fluid, which passes off with it in the form of emulsion, and separates on standing. In the case of the finest American varieties, the oil, which is only made in the winter months, is drawn off by taps from the bottom of the cooking butt, and then put into a cooling-house to freeze. The solid frozen mass is put into canvas bags, and submitted, whilst at a low temperature, to severe pressure, whereby the pure liquid oil is forced out, leaving a whitish tallow-like mass, composed of stearin and liver débris. This residue is sold to the soap-makers, and the oil bottled without further process. The oil thus variously procured is called *shore oil*, and is the purest kind.

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* For an account of the mode of fishing for cod and of preparing the oil practised in Norway and Denmark, see *P. J. Tr.*, Jan. 1868, p. 312, also April, 1877, p. 810; and *N. R.*, March, 1878; also *Journ. de Pharm. et de Chim.*, 4e sér., iv. 324, 1866.

† *Dugong Oil.* An oil has been brought into notice, as a substitute for cod-liver oil, obtained from two species of *Halecore, H. Australis* (*Owen*) and *H. Dugong* (*Illig.*), cetaceous animals inhabiting the rivers and bays of Northern and Eastern Australia, and many of the East India islands. The flesh of these animals is said to be delicate and palatable, and valued for food. The oil is obtained by boiling the superficial fat. It is bland and sweet, and free from disagreeable taste and smell, so that it may be taken more freely than cod-liver oil, which it is thought to equal in virtues. It was introduced into use by Mr. W. Hobbs, a surgeon of Brisbane. (*Chem. News*, Jan. 28, 1860, p. 87, and *A. J. P.*, 1858, p. 335; 1860, p. 230.)

The crews of the larger boats, which fish upon banks far from land, cleanse the fish on board, and, throwing the offal into the sea, put the livers into barrels or other receptacles, where they undergo a gradual decomposition, the oil rising to the surface, as it escapes from the disintegrating tissue. The oil which first rises, before putrefaction has very decidedly commenced, approaches in purity to the shore oil, but is somewhat darker and less sweet. This is sometimes drawn off, constituting the *straits oil* of the fishermen. The remaining mass, or the whole, if the portion which first rises be not separated, continues exposed for a variable length of time to the heat of the sun, undergoing putrefaction, until the boat, having completed her cargo, returns to port. The contents of the casks are then put into boilers, heated with water, and treated as already described. Before being finally put into barrels, the oil is heated to expel all its water. Thus prepared, it is denominated *banks oil*, and is of the darkest color, and most offensive to the taste and smell. Much of the oil prepared by the fishermen is collected by the wholesale dealers, who keep it in very large reservoirs of masonry in their cellars, where it becomes clarified by repose, and is pumped into barrels as wanted for sale. By the further exposure, however, which it thus undergoes, it acquires a still more offensive odor; while that which has been originally introduced into barrels, and thus kept secluded from the air, is better preserved. For further details, see *A. J. P.*, xxiii. 97; xxvi. 1.

The oil is sometimes procured by expression. Mr. Donovan recommends the following plan, which affords a very fine oil. The livers, perfectly sound and fresh, are to be placed in a clean iron pot over a slow fire, and stirred until they assume the condition of a pulp, care being taken that the mass be not heated beyond 192°. When this temperature is attained, the pot is to be removed from the fire, and its contents introduced into a canvas bag, through which water and oil will flow into a vessel beneath. After twenty-four hours, the oil is to be decanted and filtered through paper. In this state it is pale yellow, with little odor, and a bland not disagreeable taste.

Properties. Three varieties of cod-liver oil are known in the market, the *white* or *pale yellow*, the *brownish yellow*, and the *dark brown*, corresponding to the three commercial varieties already alluded to. These varieties differ in no essential character, but simply from the mode of preparation; the pale being prepared from fresh sweet livers, the dark brown from livers in a state of putrefaction, and the brownish yellow from those in an intermediate state; and the three varieties run together by insensible shades. The color of the pale is from the slightest tint of transparent yellow to a fine golden yellow, and that of the light brown very similar to the color of Malaga wine, that of the dark brown what its name implies, with opacity in mass, but transparency in thin layers. They are of the usual consistence of lamp oil, and have a characteristic odor and taste, by which they may be distinguished from other oils. This smell and taste are familiar to most persons, being very similar to those of shoe-leather; at least as prepared in this country, where the curriers make great use of cod-liver oil. We regard these sensible properties as the most certain test of the genuineness of the oil. They are much less distinguishable in the pale than in the dark brown varieties, but we have met with no specimen which did not possess them in some degree. In the purest they are scarcely repulsive, in the dark brown they are very much so. When a decided smell of ordinary fish oil is perceived, the medicine may always be suspected. It is quite distinct from that peculiar to the cod-liver oil. The taste of all, except the very finest varieties, is more or less acrid, and in the most impure is bitterish, and somewhat empyreumatic. The sp. gr. at 72° F., as ascertained by Prof. Procter, varied from 0·915 to 0·9195; the first being that of the *hake* oil, the second that of the *haddock*, while the sp. gr. of the purest oil from the common cod was 0·917. De Jongh found the sp. gr., at 63° F., of the pale 0·923, of the light brown 0·924, of the dark brown 0·929. The oil from the cod does not congeal at 14° F., though that of *G. carbonarius* and that of the livers of different species of Raja let fall at that temperature a solid fatty matter, supposed to be palmitin. Alcohol dissolves from 2·5 to 6 per cent., water from 0·637 to 1·28 per cent. of different varieties; the pale yielding least to these solvents. (*Journ. de Pharm.*, Jan. 1854, p. 39.) The officinal tests and description are as follows. "A colorless or pale yellow, thin, oily liquid, of a slightly fishy odor, a bland, slightly fishy taste, and a faintly acid reaction. Sp. gr. 0·920 to 0·925. It is scarcely soluble in alcohol, but readily soluble in ether; also in 2·5 parts of acetic ether. When cooled to near 0° C. (32° F.), a white granular matter separates. On the addition of sulphuric acid, the Oil acquires a violet color, soon changing to brownish red; and if 1 drop of the Oil be dissolved in 20 drops of disulphide of carbon, and the solution shaken with 1 drop of sulphuric acid, it acquires a violet-blue tint, rapidly changing to rose-red and brownish yellow. With nitric acid the Oil yields a purple color, changing to brown." *U. S.*

From an analysis of the oil by De Jongh, it appeared to contain a peculiar substance named gaduin; oleic, palmitic, and stearic acids with glycerin; butyric and acetic acids; various biliary principles, as fellinic, cholic, and bilifellinic acids, and bilifulvin; a peculiar substance soluble in alcohol; a peculiar substance insoluble in water, alcohol, or ether; iodine and traces of bromine; phosphoric and sulphuric acids; phosphorus, lime, magnesia, soda, and iron. These were found in all the varieties, though not in equal proportion in all; yet it is quite uncertain whether the difference had any relation to their degree of efficacy. Recently (*P. J. Tr.*, Sept. 4, 1880) Prof. E. A. Van der Burg throws a well-founded doubt on the presence of these inorganic ingredients in light-colored cod liver oil. He was unable to obtain any incombustible matter, and believes that their presence in De Jongh's results were due to impurities in the reagents used, or derived from the vessels used in conducting the analysis. *Gaduin* is obtained by saponifying the oil with soda, decomposing the soap by acetate of lead, and treating the resulting lead soap with ether, which dissolves the oleate of lead and gaduin, leaving the palmitate and stearate of lead behind. The ethereal solution, which is dark brown, is decomposed by sulphuric acid, which liberates the brown oleic acid. This owes its color to gaduin, to separate which soda is added in excess. The resulting oleate of sodium, which is insoluble in an excess of the alkali, is dissolved in alcohol; and the alcoholic solution is cooled below 0° C. (32° F.), by which means the oleate of sodium is separated, the gaduin remaining in solution. This is precipitated from its solution by the addition of sulphuric acid. Gaduin is a dark brown substance, brittle and pulverizable when dry, without odor or taste, quite insoluble in water, and in great measure soluble in ether and alcohol. It is insoluble in nitric and hydrochloric acids, but is dissolved by sulphuric acid, giving a blood-red color to the solution, from which it is precipitated by water and the alkalies. It is soluble in alkaline solutions. Chlorine decolorizes it. Its formula is $C_{35}H_{46}O_9$. Gaduin itself is yellow, but becomes brown by exposure to the air. It has not been ascertained to be in any degree connected with the virtues of the oil. It is not improbable that the biliary principles associated with the oil are concerned in its peculiar influences; as it is by their presence mainly that this differs from other oils. It has been thought that gaduin itself is of biliary origin. Winckler has inferred from his researches that cod-liver oil is an organic whole, differing from all other fixed oils. The fatty acids generated are oleic, palmitic, and stearic. Dr. Luck has found a peculiar fatty acid in turbid oil, which he names *gadic acid*, and the same is obtained from the clear oil by saponification. (*Neues Jahrbuch für Pharm.*, vi. 249.) As, however, about 70 per cent. of cod-liver oil is olein, and about 25 per cent. is palmitin with some stearin, gaduin and gadic acid do not constitute any very important fraction. Indeed, Flückiger considers their very existence as doubtful. By reaction with ammonia in distillation, the oil yields a volatile alkaloid, *propylamine*, C_3H_9N, which has a strong pungent odor, recalling that of herring-pickle, of which the same alkaloid is an ingredient. No other officinal fatty oil yields a similar product. (See *A. J. P.*, xxiv. 343.) Some have been disposed to ascribe the virtues of the oil to its iodine and bromine; but these are in too small proportion for much effect, and the oil has produced results which have never been obtained from iodine and bromine themselves. The presence of iodine cannot be detected by the usual tests. It is necessary to convert the oil into a soap, and to carbonize this, before it will give evidence of iodine. The proportion never exceeds 0·05 per cent., or 1 part in 2000, and it is by no means certain that iodine is always, if ever, present in pure oil. The oil is capable of dissolving a larger proportion of iodine; and, if any specimen contain more than 0·05 per cent., there is reason to suspect that it has been fraudulently added.

Tests of Purity. In consequence of the great demand for this oil, it has not unfrequently been adulterated with other fixed oils, and occasionally others have been fraudulently substituted for it. The importance, therefore, is obvious of ascertaining some mode of testing its purity and genuineness. There is reason to believe that all the oils from the livers of the Gadidæ have analogous properties. They have been indiscriminately used; and upon the results of their employment is based, in part, the present reputation of the medicine. They may, therefore, be considered as in fact one oil, so far as their medicinal use is concerned. Unfortunately, chemistry has yet discovered no perfectly reliable test. The farthest it has yet gone is to point out certain reactions, which may be considered as evidences of the presence of biliary principles in the oil, thus indicating its hepatic origin. Among these probably the most characteristic is that of sulphuric acid, a drop of which, added to fresh cod-liver oil, on a porcelain plate, causes a centrifugal movement in the oil, and gives rise to a fine violet color, soon passing into yellowish or brownish red. Sometimes, instead of assuming the violet hue, the color immediately becomes a clear red, or dark brownish red. This is said to be especially the case with those specimens of the oil which have been prepared by boiling the livers with water. Shark-liver oil responds in like manner to the test of sulphuric acid, but is said to have the sp. gr. 0·866, which is much lower than that of any variety of the genuine oil. Strong nitric acid causes instantly, when agitated with cod-liver oil, a pinkish or rose-red color, which soon becomes brown; while no such effect is produced on other animal or vegetable oils. According to Winckler, the oil should afford the smell of herring-pickle when heated with potassa, lime, and chloride of ammonium. But the most reliable tests are the sensible properties of odor and taste. If there be none of the peculiar shoe-leather smell and taste, or if a strong lamp-oil odor be perceptible, the oil may be suspected. Little of importance can be inferred from the color. Some have been disposed to prefer the dark offensive oil; but our own experience accords with that of those who have found the pale or light brown equally efficient; and, for facility of administration and acceptability to the stomach, the latter is greatly preferable.

It is important that the oil should be secluded from the air, which effects a gradual change, no doubt impairing its efficiency. Hence the vessels containing it should be full; and it should be kept in bottles well stopped, holding about the quantity generally wanted for use at one time, and not exposed to the action of sunlight.

Medical Properties and Uses. Cod-liver oil has long been popularly employed in Northern Europe in rheumatic and strumous diseases. It was first brought to the notice of the profession generally by German practitioners, and had acquired great reputation on the continent before it was used to any extent in Great Britain. At Manchester, in England, it was employed by the medical profession in the treatment of chronic rheumatism and gout, as early as 1766; but it was not until the appearance of the treatise of Professor Bennett, of Edinburgh, in 1841, that it came into general notice in Great Britain and the United States. It is at present one of the most esteemed remedies in the catalogue of the Materia Medica. The diseases in which it has proved most efficient are chronic rheumatism and gout, and the various morbid affections connected with a scrofulous diathesis, such as external glandular scrofula, diseases of the joints and spine, carious ulcers, tabes mesenterica, rickets, and phthisis. It has been found useful also in chronic cutaneous eruptions, lupus, ulcers of the mouth, some varieties of palsy, chronic pectoral complaints not tuberculous, pertussis, obstinate constipation, intestinal worms, and incontinence of urine, and may be employed with the hope of good in all chronic cases in which the disease appears to consist mainly in impaired digestion, assimilation, and nutrition. In pulmonary consumption it is of supreme value. It is necessary, however, to persevere for four or six weeks before looking for any decidedly favorable results, though the change does often begin earlier.

As to its mode of action, there has been much difference of opinion. Some consider it merely as a nutritive agent, having the advantage over other oleaginous substances of a readier entrance into the system and more easy assimilation. But we cannot agree with this opinion. Other oleaginous substances, certainly not less nutritious, have not been equally efficient, though taken in much larger quantities. If this be the true explanation, persons living chiefly on milk, which abounds in oil, or on fat pork, ought to show a special exemption from scrofulous complaints. The probability appears to us to be that, in consequence of some peculiar principle or principles it contains, it exercises a stimulant and alterative influence on the processes of assimilation and nutrition, thereby causing the production of healthy tissue, instead of that abortive material which is deposited by the blood-vessels in scrofula and phthisis. With our views of the modus operandi of cod-liver oil, it would of course be contraindicated in all cases where there is plethora.

The dose is a tablespoonful three or four times a day for adults, a teaspoonful repeated as frequently for children, which may be gradually increased as the stomach will permit, and continued for a long time. It may be taken alone or mixed with some vehicle calculated to conceal its taste and obviate nausea. For this purpose recourse may be had to any of the aromatic waters, to the aromatic tinctures, as the tincture of orange-peel, diluted with water, or to a bitter infusion, as that of quassia. It may be given floating on the vehicle, or mixed with it by means of gum or the yolk of eggs, with sugar, in the form of an emulsion. Perhaps the best vehicle, when not contraindicated, is the froth of porter. Let a tablespoonful of porter be put into the bottom of a glass, upon the surface of this the oil, and over all some of the froth of the porter. A small piece of orange-peel may be chewed before and after taking the medicine.[*] Various other methods have been adopted to conceal or correct the taste and favor administration. Common salt has been recommended; but nothing, perhaps, so effectually destroys the taste as oil of bitter almond, of which one part will answer for 200 parts of the oil. A good plan is to shake strongly, in a flask, one measure of the oil with from one to two of cherry-laurel water, according to the degree of offensiveness, and to separate the liquids after they have been allowed to stand for twenty-four hours. The oil should be filtered if not quite clear. The medicine has sometimes also been given in capsules; but this must be a very tedious method. M. Dufourmantel prepares a jelly by dissolving half a drachm of ichthyocolla in as little hot water as possible, and then gradually mixing with it a fluidounce of the oil with four drops of the oil of anise, taking care not to exceed the heat of 75° F. (*Journ. de Pharm.*, Juin, 1864, p. 72.) M. Bouchut has proposed to give the oil in the form of bread. He incorporates the oil with wheat flour, and has this made into bread, which, he says, is in no degree disagreeable. (*N. R.*, Oct. 1873, p. 522.)[†] The oil is sometimes applied externally by friction, and in cases of ascarides or lumbricoides is injected into the rectum. It has been recommended locally in chronic articular affections, paralysis, various chronic cutaneous eruptions, and in opacity of the cornea after the subsidence of inflammation. In the last-mentioned affection, one or two drops of the oil are applied by means of a pencil to the cornea, and diluted, if found too stimulating, with olive or almond oil. It is said, when long used internally, to occasion sometimes an exanthematous or eczematous eruption.[‡] It is often advantageously combined with lime salts, especially in rickets.[§]

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[*] The following is Carlo Pavesi's formula for deodorized cod-liver oil. Cod-liver oil 1000 parts, ground roasted coffee 50 parts, animal charcoal 25 parts. Place the ingredients in a flask, which is to be well closed, and digest on a water-bath during the space of one hour; then set it aside for three days, occasionally shaking the contents, and filter. This preparation has a peculiar coffee flavor, and is quite pleasant to take. (*N. R.*, Jan. 1876.)

[†] *Phosphorized Cod-liver Oil* may be made by dissolving one grain of phosphorus in four fluidounces of cod-liver oil.

[‡] *Cod-liver Oil and Ferrous Iodide.* The following formula is that of a commission appointed by the Netherlands Pharmaceutical Society. Iodine 1 part; Pulverized Iron 1 part; Pale Cod-liver Oil 80 parts. Triturate the pulverized iron in a mortar with the iodine and one-fourth of the oil, and heat the mixture in a water-bath, with constant stirring, until the brown color of the iodine has entirely disappeared and given place to a deep purple color, showing that the ferrous iodide has been formed and dissolved. Then add the remainder of the oil, mix carefully, and after standing decant into dry bottles, which are to be completely filled. (*N. R.*, Aug. 1876.)

[§] *Cod-liver Oil with Lacto-phosphate of Lime.* Take of Cod-liver Oil, Oj; Oil of Bitter Almond, Oil of Peppermint, Oil of Wintergreen, each, gtt. x; Powdered Gum Arabic, ℥iv; Powdered Sugar, The *olein* of cod-liver oil has been recommended by Dr. Arthur Leared, when the oil itself disagrees with the stomach. He has found it to produce the same remedial effects, and to be borne much better. It may be given in the same dose. A *solution of quinine in the oil* may be made by heating the freshly precipitated alkaloid with the oil, in the proportion of two grains to a fluidounce, by means of a water-bath, until the mixture becomes quite clear.

OLEUM MYRCIÆ. *U. S.* *Oil of Myrcia.* [*Oil of Bay.*]

(Ō'LĘ-ŬM MŸR'CĮ-Æ.)

"A volatile oil distilled from the leaves of Myrcia acris. De Candolle. (*Nat. Ord.* Myrtaceæ.)" *U. S.*

This new officinal has been admitted to the Pharmacopœia as an ingredient of spiritus myrciæ, or bay rum. It is usually imported, although occasionally distilled in this country. Prof. G. F. H. Markoe (*Proc. A. P. A.*, 1877, p. 435) states that in the distillation of oil two kinds come over, a light oil having the sp. gr. 0·870 to 0·990, and a heavy oil, sp. gr. 1·055. The light oil is doubtless a hydrocarbon, identical with that found in cloves and allspice, whilst the heavy oil is probably eugenol. The oil is officinally described as "a brownish or dark brown liquid, of an aromatic, somewhat clove-like odor, a pungent, spicy taste, and a slightly acid reaction. Sp. gr. about 1·040. Soluble in an equal weight of alcohol. With an equal volume of a concentrated solution of potassa it forms a semi-solid mass." *U. S.*

Off. Prep. Spiritus Myrciæ, *U. S.*

OLEUM MYRISTICÆ. *U. S., Br.* *Oil of Nutmeg.* *Volatile Oil of Nutmeg.*

(Ō'LĘ-ŬM MȲ-RĬS'TĮ-ÇÆ.)

"A volatile oil distilled from Nutmeg." *U. S.* "The oil distilled in Britain from nutmeg." *Br.*

Oleum Nucistæ Æthereum; Essence de Muscades, *Fr.;* Ætherisches Muskatöl, *G.*

This oil is obtained from powdered nutmegs by distillation with water. A better method, according to M. J. Cloez, is to exhaust the powder with bisulphide of carbon or ether, distil off the solvent by means of a water-bath, and expose the butter-like residue to a current of steam, the vapor being conveyed into a refrigerated receiver, where it condenses. (*Journ. de Pharm.*, Fév. 1864.) Oil of nutmeg is colorless or of a pale straw color, limpid, lighter than water, soluble in alcohol and ether, with a neutral reaction, a pungent spicy taste, and a strong smell of nutmeg. The sp. gr. is stated differently at 0·920 and 0·948 ("about 0·93," *U. S.*). It consists of two oils, which may be separated by agitation with water, one rising to the surface, the other sinking to the bottom. Upon standing it deposits a crystalline stearoptene, which is called by John *myristin.* Prof. Flückiger examined this stearoptene, and found that, contrary to what had been said, it was not in any degree soluble in water. From its solution in alcohol he obtained it in extremely light crystalline scales, which, after repeated crystallization, had still the odor of nutmeg, were fusible at 31° C. (87·8° F.), and soluble in the ordinary menstrua of substances of the same class, and, as just said, insoluble in water. By glacial acetic acid it is first colored red. (*P. J. Tr.*, March, 1874, p. 714.) M. Cloez found that, when the oil was distilled at a temperature below 175° C. (347° F.), there came over 95 per cent. of a liquid, which, when treated with a little caustic potassa and subsequently distilled from a little sodium, in order to separate traces of a compound of oxygen, was a pure colorless hydrocarbon, remaining liquid at zero of F., of the sp. gr. 0·853 at 15° C. (59° F.), and corresponding in composition with pure oil of turpentine, having the formula $C_{10}H_{16}$. It differs,

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℥vi; Solution of Lacto-phosphate of Lime (ʒi to f℥i), f℥viss; Lime Water, f℥viss. Mix the gum and sugar in a capacious mortar, and make a smooth mucilage with the lime water and three ounces of the solution of lacto-phosphate of lime. Add the volatile oils to the cod-liver oil, and graduallly triturate them with the mucilage until a perfect emulsion is formed. Finally, add the rest of the solution of lacto-phosphate of lime, and mix thoroughly. Dose, one-half to one fluidounce (15 to 30 C.c.). (J. T. Shinn, *A. J. P.*, March, 1873.)

however, in yielding, when acted on by a current of hydrochloric acid gas, a liquid instead of solid compound with the acid. In this purified state the oil has an odor recalling that of nutmeg, but, when the oil is diluted, approaching to that of the oil of lemons. It absorbs oxygen slowly, losing its fluidity. Chlorine and bromine act on it vigorously, nitric acid violently with the disengagement of red vapors, and concentrated sulphuric acid dissolves and darkens it. (*Ibid.*, pp. 150–2.) The oil may be used for the same purposes as nutmeg, in the dose of two or three drops (0·12 or 0·18 C.c.), but is not often employed.

Off. Prep. Pilula Aloës Socotrinæ, *Br.;* Spiritus Myristicæ, *U. S.*

OLEUM MYRISTICÆ EXPRESSUM. *Br.* *Expressed Oil of Nutmeg.*

(Ō′LẸ-ŬM MȲ-RĬS′TỊ-ÇÆ ẸX-PRĔS′SỤM.)

" A concrete oil obtained by means of expression and heat from nutmeg." *Br.*

Myristicæ Adeps, *Br.* 1864; Oleum Myristicæ, *P.G.;* Oleum Nucistæ Expressum, Adeps (vel Butyrum) Nucistæ; Nutmeg Butter; Beurre de Muscade, *Fr.;* Muskatnussöl, Muskatbutter, *G.*

The *concrete* or *expressed oil of nutmeg*, commonly called *oil of mace*, is obtained by exposing bruised nutmegs in a bag to steam, and then compressing strongly between heated plates. A liquid oil flows out, which becomes solid when it cools. Nutmegs are said to yield from 10 to 12 per cent. of this oil. The best is imported from the East Indies in stone jars. It is solid, soft, unctuous to the touch, of a yellowish or orange-yellow color more or less mottled, with the odor and taste of nutmeg. It is composed, according to Schrader, of 52·09 per cent. of a soft oily substance, yellowish or brownish, soluble in cold alcohol and ether; 43·75 of a white, pulverulent, inodorous substance, insoluble in these liquids; and 4·16 of volatile oil. The pulverulent constituent, which received from Playfair the name of *myristin*, has a silky lustre, melts at 31° C. (88° F.), and yields on saponification glycerin and *myristic acid.* It may be obtained directly from nutmeg by exhausting it by means of benzol, filtering the liquid, and allowing it to crystallize by spontaneous evaporation. To purify the product it may be dissolved in a mixture of two parts of absolute alcohol and three of benzol with the aid of heat, then filtering the liquid while hot, and setting it aside. On cooling, it deposits the pure myristin in crystals. (*Journ. de Pharm.*, Juin, 1859, p. 471.) Analyzed by Koller, the expressed oil was found to contain, in 100 parts, 6 of a volatile oil ($C_{10}H_{16}$) analogous with the oil of mace, 70 of myristin, 20 of olein, 3 of resin, and 1 of salts, etc. (*Arch. der Pharm.*, clxxiii. 280.) An inferior kind of the oil is prepared in Holland, and sometimes found in commerce. It is in hard, shining, square cakes, lighter colored than that from the East Indies, and with less smell and taste. It is supposed to be derived from nutmegs previously deprived of most of their volatile oil by distillation. An artificial preparation is sometimes sold for the genuine oil. It is made by mixing various fatty matters, such as suet, palm oil, spermaceti, wax, etc., adding some coloring substance, and flavoring with the volatile oil.

OLEUM OLIVÆ. *U. S., Br.* *Olive Oil.*

(Ō′LẸ-ŬM Ọ-LĪ′VÆ.)

" A fixed oil expressed from the ripe fruit of Olea europæa. Linné. (*Nat. Ord.* Oleaceæ.)" *U. S.* " The oil expressed in the south of Europe from the ripe fruit of Olea europæa (Linn.). " *Br.*

Oleum Olivarum, *P.G.;* Sweet Oil; Huile d'Olive, *Fr.;* Olivenöl, *G.;* Olio delle Olive, *It.;* Aceyte de Olivas, *Sp.*

Gen. Ch. Corolla four-cleft, with subovate segments. *Drupe* one-seeded. *Willd.*

Olea Europæa. Willd. *Sp. Plant.* i. 44; *B. & T.* 172. This valuable tree is usually from fifteen to twenty feet in height, though sometimes much larger, especially in Greece and the Levant. It has a solid, erect, unequal stem, with numerous straight branches, covered with a grayish bark. The leaves, which stand opposite to each other on short footstalks, are evergreeen, firm, lanceolate, entire, two or three inches in length, with the edges somewhat reverted, smooth and of a dark green color on their upper surface, whitish and almost silvery beneath. The flowers are small, whitish, and disposed in opposite axillary clusters, about half as long as the leaves, and accompanied with small, obtuse, hoary bracts. The fruit, or olive, is a smooth, oval drupe, greenish at first, but of a deep violet color when ripe, with a fleshy pericarp, and a very hard nut of a similar shape. Clusters of not less than thirty flowers yield only two or three ripe olives.

The olive-tree, though believed by some to have been originally from the Levant, flourishes at present in all the countries bordering on the Mediterranean, and has been cultivated from time immemorial in Spain, the south of France, and Italy. It begins to bear fruit after the second year, is in full bearing at six years, and continues to flourish for a century. There are several varieties, distinguished by the form of the leaves, and the shape, color, and size of the fruit. The variety *longifolia* of Willdenow is said to be chiefly cultivated in Italy and the south of France, and the *latifolia* in Spain. The latter bears much larger fruit than the former; but the oil is less esteemed. The olive is largely cultivated in the north of Africa, especially in the vicinity of Tunis, and considerable quantities of the oil are exported from that city. (*P. J. Tr.*, Sept. 1873, p. 204.) Attempts to cultivate it have been made in some of our Southern States, though not successfully in a commercial point of view; but in California the tree has found a congenial climate, and considerable quantities both of pickled olives and oil are produced. The tree has been introduced into South Australia, and will probably become of commercial importance there.

The leaves and bark of the olive-tree have an acrid and bitterish taste, and have been employed as substitutes for cinchona, though with no great success. Attention has been called, in France, to a hydro-alcoholic extract of the leaves, as having considerable febrifuge powers. In the quantity of from ten to twenty grains daily, in divided doses, it has been found useful in preventing the hectic paroxysms. In hot countries, a substance resembling the gum-resins exudes spontaneously from the bark. It was thought by the ancients to possess useful medicinal properties, but is not now employed. Analyzed by Pelletier, it was found to contain resin, a little benzoic acid, and a peculiar principle analogous to gum, which has been named *olivile.* But the fruit is by far the most useful product. In the unripe state it is hard and insupportably acrid; but, when macerated in water or an alkaline solution, and afterwards introduced into a solution of common salt, it loses these properties, and becomes a pleasant and highly esteemed article of diet. Mannit has been found in all parts of the tree while in vital activity, as in the green leaves and unripe fruit, but cannot be detected in the yellow fallen leaves, or in the perfectly ripe fruit. (*A. J. P.*, 1866, p. 179.) The pericarp, or fleshy part of the ripe olive, abounds in a fixed oil, which constitutes its greatest value, and for which the tree is chiefly cultivated in Southern Europe. In the unripe olive a peculiar green substance, together with mannit, has been found by M. S. de Lutz, both of which disappear as the fruit ripens, being probably converted into oil, which now takes their place. (*Journ. de Pharm.*, Juin and Déc. 1862.) The olives ripen from November to March, and the oil is obtained by first bruising them in a mill, and then submitting them to pressure. The product varies much, according to the state of the fruit, and the circumstances of the process. The best, called *virgin oil*, is obtained from the fruit picked before perfect maturity, and immediately pressed. It is distinguished by its greenish hue. The common oil used for culinary purposes, and in the manufacture of the finest soaps, is procured from very ripe olives, or from the pulp of those which have yielded the virgin oil. In the latter case the pulp is thrown into boiling water, and the oil removed as it rises. An inferior kind, employed in the arts, especially in the preparation of the coarser soaps, plasters, unguents, etc., is afforded by fruit which has been thrown into heaps, and allowed to ferment for several days, or by the *marc* left after the expression of the finer kinds of oil, broken up, allowed to ferment, and again introduced into the press. The remarks made under the head of Oleum Myristicæ (page 1025), in relation to the extraction of that oil by means of bisulphide of carbon, are applicable also to olive oil.

Olive oil is imported in glass bottles, or in flasks surrounded by a kind of net-work of grass, and usually called Florence flasks. The best comes from the south of France, where most care is exercised in the choice of the fruit.

Properties. The pure oil is an unctuous liquid, of a pale yellow or greenish yellow color, with scarcely any smell, and a bland, slightly sweetish taste. Its sp. gr. is 0·9153. It is soluble in twice its volume of ether, but is only partially soluble in alcohol, at least unless this liquid be in very large proportion. "Sp. gr. 0·915 to 0·918. When cooled to about 10° C. (50° F.), it begins to be somewhat cloudy from the separation of crystalline particles, and, at about 5° C. (41° F.), it begins to deposit a white, granular sediment; below 2° C. (35·6° F.), it forms a whitish, granular mass. If 12 parts of the Oil be shaken frequently, during two hours, with 1 part of a freshly-prepared solution of 6 Gm. of mercury in 7·5 Gm. of nitric acid (sp. gr. 1·420), a perfectly solid mass of a pale straw color will result. If 1 Gm. of Olive Oil be agitated, in a test-tube, with 2 Gm. of a cold mixture prepared from equal volumes of strong sulphuric acid and of nitric acid of sp. gr. 1·185, and the mixture be set aside for half an hour, the supernatant, oily layer should not have a darker tint than yellowish; nor should a green or red layer separate on standing, if 1 Gm. of the Oil be shaken for a few seconds with 1 Gm. of a cold mixture of sulphuric acid (sp. gr. 1·830) and nitric acid (sp. gr. 1·250), and 1 Gm. of disulphide of carbon; and if 5 drops of the Oil are let fall upon a thin layer of sulphuric acid in a flat-bottomed capsule, no brown-red or dark brown zone should be developed within three minutes, at the line of contact of the two liquids (abs. of appreciable quantities of other fixed oils of similar physical properties)." *U. S.*

The concrete portion, which separates at a freezing temperature, consists chiefly of the glyceride of *palmitic acid*, $C_{16}H_{32}O_2$, together with the corresponding compound of *arachic acid*, $C_{20}H_{40}O_2$; the liquid portion is uncombined olein, $C_3H_5(O.C_{18}H_{33}O)_3$. According to Braconnot, the oil contains 72 per cent. of olein, and 28 of palmitin. Olive oil is solidified by nitrous acid and nitrate of mercury, and converted into a peculiar fatty substance, called *elaïdin.* The olein of all oils which have not the drying property undergoes the same change when acted on by nitrous acid.[*]

The greenish color is owing to the presence of a trace of chlorophyll, and a trace of cholesterin is also extracted by repeated agitation with glacial acetic acid.[†]

Olive oil, when exposed to the air, is apt to become rancid, acquiring a disagreeable smell, a sharp taste, a thicker consistence, and a deeper color; and the change is promoted by heat. It is frequently adulterated with the cheaper fixed oils, especially with that of poppies; but the adulteration may be detected by reducing the temperature to the freezing point. As other oils are less readily congealed than the olive oil, the degree of its purity will be indicated by the degree of concretion. Another mode has been indicated by M. Poutet, founded on the property possessed by mercuric nitrate of solidifying the oil of olives, without a similar influence upon other oils. Six parts of mercury are dissolved at a low temperature in seven and a half parts of nitric acid of the sp. gr. 1·35; and this solution is mixed with the suspected oil in the proportion of one part to twelve, the mixture being occasionally shaken. If the oil is pure, it is converted after some hours into a yellow solid mass; if it contains a minute proportion, even so small as a twentieth, of poppy or cotton-seed oil, the resulting mass is much less firm; and a tenth prevents a greater degree of consistence than oils usually acquire when they concrete by cold. M. Gobel has invented an instrument called the elaïometer, by which the smallest quantity of poppy oil can be detected. (See *A. J. P.*, xvi. 24.) According to M. Marchand, strong sulphuric acid produces with poppy oil a lemon-yellow color, which rapidly becomes darker, and, after ten or fifteen minutes, is followed by tints of rose-color and bright violet, which are never afforded with the same reagent by pure olive oil. (*Ibid.*, xxvi. 432.) Within recent years immense quanti-

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[*] The following table gives the solubility of various alkaloids in olive oil as ascertained by Pettenkoffer. At the ordinary temperature, 100 parts of the oil dissolve of

Morphine	0·00	Quinine	4·20	Atropine	2·62
Narcotine	0·25	Strychnine	1·00	Veratrine	1·78
Cinchonine	1·00	Brucine	1·78		

(*Journ. de Pharm.*, Juin, 1859, p. 486.)

[†] For discussion of the spectra of olive oil, see *P. J. Tr.*, 3d series, vii. 22, 110.

ties of cotton-seed oil[*] have been exported to Italy, where it is used in the adulteration of olive oil. It may be detected by the following test of Dr. R. Codina Langlies. In a test-tube, or a small vial with a ground glass stopper, 3 grammes of the oil to be examined are mixed with 1 gramme of the reagent, composed of three parts of pure nitric acid at 40°, and one part of distilled water; and the mixture is heated on a water-bath. If the oil is pure, the mixture becomes clearer, and assumes a yellow color, as the purified oil; if falsified by a grain oil, it becomes transparent like pure oil, but acquires a red color. With 5 per cent. of the grain oil, the reddish color is characteristic, with 10 per cent. it is decisive. The experiment does not require more than 15 or 20 minutes; the change of color persists for three days. (*Journ. de Pharm.*, Janv. 1870, p. 57.) The presence of colza oil may be detected by the test of nitrate of silver, as stated under the head of Oleum Amygdalæ Expressum. M. Diesel states that the pure oil is colored green by common nitric acid; whereas, if mixed with rape oil, it is rendered of a yellowish gray color. (*Arch. der Pharm.*, xlvi. 287.) According to M. Behrens, whose statement is confirmed by MM. Guibourt and Reveil, the presence of oil of sesamum is known by the beautiful deep green color immediately produced, when the suspected oil is added, in equal weight, to a mixture of equal parts of sulphuric and nitric acids; which acids cause with the pure oil, at first, a bright yellow color. (*Journ. de Pharm.*, 3e sér., xxiv. 351.) Merz proposes as a test of olive oil to put a few drops on a glass plate and maintain it for 12 hours at a temperature of 100° C. (212° F.). No change occurs in pure oil; linseed oil treated similarly solidifies, and a mixture thickens. (Dragendorff, *Jahresbericht*, 1876, p. 326.) For a method of detecting the *oil of arachis* (*ground nut oil*) in olive oil, see the *Journ. de Pharm.*, Janv. 1872, p. 48. Immense quantities of lard oil are exported from this country to France and employed in the adulteration of olive oil. The reaction with nitric acid would probably serve to detect this adulteration, which, however, in a pharmaceutical point of view, is of little inconvenience.[†]

M. A. Lailler, a French pharmaceutist, has found in the joint action of chromic and nitric acids a test by which he believes that olive oil can be distinguished from most other oils. If a mixture of twenty grains of liquid chromic acid and ten grains of nitric acid of 40° be agitated in a glass tube with two drachms of olive oil, there will be no oxidation nor any disengagement of heat, but at the end of forty-eight hours, at most, a beginning of concretion, which in some days becomes complete, and is followed by the entire absorption of the reagent by the oil, and a blue coloration of the latter. Every specimen of olive oil which does not present these phenomena completely must be considered as falsified. (*Journ. de Pharm. et de Chim.*, 4e sér., i. 187–8.)

Medical Properties and Uses. Olive oil is nutritious and mildly laxative, and is occasionally given as a feeble purgative in cases of irritable intestines. Taken into the stomach in large quantities, it serves to involve acrid and poisonous substances and mitigate their action. It has also been recommended as a remedy for worms, and is a very common ingredient in laxative enemata. Externally applied, it is useful in relaxing the skin, and sheathing irritated surfaces from the action of the air; and is much employed as a vehicle or diluent of more active substances. But the most extensive use of olive oil is in pharmacy, as a constituent of liniments, ointments, cerates, and plasters.

The dose as a laxative is from one to two fluidounces (30 to 60 C.c.).

Off. Prep. Cataplasma Lini, *Br.;* Charta Epispastica, *Br.;* Ceratum Camphoræ, *U. S.;* Ceratum Cetacei, *U. S.;* Emplastrum Ammoniaci cum Hydrargyro; Emplastrum Cerati Saponis, *Br.;* Emplastrum Hydrargyri; Emplastrum Picis, *Br.;*

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[*] Of 140,840 barrels, or nearly 6,000,000 gallons, shipped from New Orleans during the year 1880, 88 per cent. was exported on orders from Europe to Mediterranean and French ports, and one-half of this to Italy. This is more than the entire olive oil production of France, and one-fifth that of Italy itself. The United States imports only one-tenth of this amount of olive oil so called. (*A. J. P.*, July, 1881, p. 343.)

[†] For the changes effected in olive oil, when bleached by sunlight, see *A. J. P.*, 1872, p. 300. These changes are such as to interfere materially with the action of the ordinary tests, as nitric acid, sulphuric acid, and caustic soda.

Emplastrum Plumbi; Enema Magnesiæ Sulphatis, *Br.;* Linimentum Ammoniæ, *Br.;* Linimentum Calcis, *Br.;* Unguentum Cantharidis, *Br.;* Unguentum Diachylon, *U. S.;* Unguentum Hydrargyri Compositum, *Br.;* Unguentum Hydrargyri Nitratis, *Br.;* Unguentum Veratriæ, *Br.*

OLEUM PHOSPHORATUM. *U.S., Br.* *Phosphorated Oil.*

(Ō′LẸ-ŬM PHŎS-PHỌ-RĀ′TŬM.)

Huile phosphorée, Liniment phosphoré, *Fr.;* Phosphorhaltiges Oel, *G.*

"Phosphorus, *one part* [or four grains]; Stronger Ether, *nine parts* [or one fluidrachm]; Expressed Oil of Almond, *a sufficient quantity*, To make *one hundred parts* [or one fluidounce]. Introduce *a sufficient quantity* of Expressed Oil of Almond into a flask, heat it, on a sand-bath, to 250° C. (482° F.), and keep it at that temperature for fifteen minutes. Then allow it to cool, and filter it. Put *ninety parts* [or seven fluidrachms] of the filtered Oil, together with the Phosphorus, previously well dried by blotting paper, into a dry bottle capable of holding somewhat more than *one hundred parts* [or one fluidounce], insert the stopper and heat the bottle in a water-bath until the Phosphorus melts, agitate it until the Phosphorus is dissolved, allow it to cool, and add the Ether. Lastly, transfer the solution to small, glass-stoppered vials, which should be completely filled, and kept in a cool and dark place." *U. S.*

"Take of Phosphorus, Oil of Almonds, of each, *a sufficiency*. Heat the Oil in a porcelain dish to 300°, and keep it at this temperature for about fifteen minutes, then let it cool, and filter it through paper. Put four fluidounces of this Oil into a stoppered bottle, capable of holding four and a half fluidounces, and add to it twelve grains of Phosphorus. Immerse the bottle in hot water until the Oil has acquired the temperature of 180°, removing the stopper two or three times to allow the escape of expanded air, then shake the Oil and Phosphorus together until the latter is entirely dissolved." *Br.*

The U. S. process does not differ essentially from that of the British. The U. S. P. oil is a 1 per cent. solution, whilst the British contains but 0·75 per cent.* The object of heating the oil is to expel air and traces of water, which would aid in oxidizing the phosphorus. The ether not only assists in the preservation of the finished preparation, but is of use in rendering the oil less disagreeable to the taste. Dr. E. R. Squibb passes a current of carbonic acid gas through the oil contained in the bottle that it is to be kept in, to expel the air and prevent oxidation.

This new officinal is a clear and colorless or but slightly colored oil; phosphorescent in the dark, having the odor and taste of phosphorus quite distinctly. It may be administered in the form of an emulsion, preferably the officinal almond emulsion, and flavored with oil of bitter almond, or in capsules; each minim contains about $\frac{1}{115}$ of a grain of phosphorus. It affords a good way of exhibiting the drug. The dose of the U. S. solution is from three to five minims (0·18 to 0·3 C.c.).

OLEUM PICIS LIQUIDÆ. *U.S.* *Oil of Tar.*

(Ō′LẸ-ŬM PĪ′CĬS LĬQ′UỊ-DÆ—lĭk′wẹ-dē.)

"A volatile oil distilled from Tar." *U. S.*

Huile volatile de Goudron, *Fr.;* Theeröl, *G.*

This new officinal is prepared by distilling tar; the residue left in the still being known as pitch. It represents thoroughly the medicinal properties of tar, and is preferable on account of its less offensive taste. (See *Pix Liquida.*)† It is officinally described as "an almost colorless liquid when freshly distilled, but soon acquiring a dark, reddish brown color, having a strong, tarry odor and taste, and an acid reaction. Sp. gr. about 0·970. It is readily soluble in alcohol." *U. S.*

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* It is often desirable to be acquainted with the degree of solubility of phosphorus in the different fixed oils in ordinary use, in reference to its exhibition as medicine. The following list is taken from the *Journal de Pharmacie* (Févr. 1869, p. 94), where it is given on the authority of M. C. Mere. The oils of sweet almonds, of olives, of sesamum, and of ground-nuts will retain, at common temperatures, $\frac{1}{80}$ of their weight of phosphorus. It may even descend to $\frac{1}{78}$ for almond and ground-nut oils; but it is not prudent, in practice, to keep too near the limits of saturation. The oils of colza and flaxseed, brown cod-liver oil, and neat's foot oil, retained $\frac{1}{70}$ of their weight, even after eight days' exposure in a cellar. Castor oil is far removed from these figures, 105 parts of it being required to dissolve one of phosphorus. The author has observed no sensible difference in the dissolving power of overheated and not overheated oils.

† *Oil of Cade. Oleum Cadinum. Huile de Cade.* French. This is a kind of tar, obtained by distillation *per descensum*, from the interior reddish wood of *Juniperus communis*, or more strictly

OLEUM PIMENTÆ. *U. S., Br.* *Oil of Pimenta.* [*Oil of Allspice.*]

(Ŏ′LẸ-ŬM PĪ-MĔN′TÆ.)

Essence de Piment de la Jamaïque, *Fr.;* Nelkenpfefferöl, *G.*

The berries yield from 1 to more than 4 per cent. of the volatile oil, which, as found in commerce, is brownish red, and has the odor and taste of pimenta, though warmer and more pungent. It has a slightly acid reaction. It is said, when freshly distilled, to be colorless or yellowish. Nitric acid reddens it. Its sp. gr. is stated at 1·021, but varies (about 1·040, *U. S.*). It is readily soluble in alcohol. With a concentrated solution of potassa it forms a semi-solid mass. It consists, like oil of cloves, of two distinct oils, a lighter and heavier, the former of which comes over first in distillation. They may be separated by distilling the oil from caustic potassa. The light oil comes over, and the heavy remains combined with the potassa. The latter may be obtained by distilling the residue with sulphuric acid. The light oil is lighter than water, and is a pure hydrocarbon. The heavy has the acid property of forming crystalline compounds with the alkalies. They are analogous to the light and heavy oils of cloves. Indeed, the heavy has been found to be identical with the *eugenic acid* of that oil. (See *Oleum Caryophylli.*) The oil of pimenta is given for the same purposes as the other stimulant aromatic oils. The dose is from three to six drops (0·18 to 0·36 C.c.).

Off. Prep. Spiritus Myrciæ, *U. S.*

OLEUM RICINI. *U. S., Br.* *Castor Oil.*

(Ŏ′LẸ-ŬM RỊ-CĪ′NĪ.)

"A fixed oil expressed from the seed of Ricinus communis. Linné. (*Nat. Ord.* Euphorbiaceæ.)" *U. S.* "The oil expressed from the seeds of Ricinus communis. Linn. Imported chiefly from Calcutta." *Br.*

Huile de Ricin, *Fr.;* Ricinusöl, *G.;* Olio di Ricino, *It.;* Oleum Palmæ Christi; Aceyte de Ricino, *Sp.*

Gen. Ch. MALE. *Calyx* five-parted. *Corolla* none. *Stamens* numerous. FEMALE. *Calyx* three-parted. *Corolla* none. *Styles* three, bifid. *Capsules* three-celled. *Seed* one. *Willd.*

Ricinus communis. Willd. *Sp. Plant.* iv. 564. The castor oil plant, or *palma Christi*, attains in the East Indies and Africa the character of a tree, and rises sometimes thirty or forty feet. In the temperate latitudes of North America and Europe it is annual; though M. Achille Richard saw, in the south of France, in the vicinity of Nice, on the sea-coast, a small wood consisting entirely of what he supposed to be this species of Ricinus.[*] The following description applies to the plant as cultivated in cool latitudes. The stem is of vigorous growth, erect, round, hollow, smooth, glaucous, somewhat purplish towards the top, branching, and from three to eight feet or more in height. The leaves are alternate, peltate or supported upon

of *J. Oxycedrus*, which grows in the south of France, where the substance is prepared. It is a thick liquid, black, and of a smell analogous to that of common tar. It has long been employed in the treatment of the cutaneous diseases of horses, sheep, etc., and is also applied by the peasantry to their own skin affections. More recently, it has acquired much reputation in these complaints, in consequence of its extensive and successful use in the hospitals of Paris. M. Bazin has employed it with success in psora, lichen agrius, the different scaly affections, the advanced stage of eczema, and favus. In most of these complaints we have long been in the habit of employing common tar ointment, and with probably equal success. A kind of soap is prepared from the oil of cade, which affords a convenient method of applying it. In the *Ed. Monthly Journ.*, for July, 1852 (page 66), it is stated that the soap is made by distilling the tar, incorporating the volatile oil obtained with a fixed oil, and then saponifying this with soda. It is in the form of black balls, readily unites with water, and may be applied to the surface like any other soap. The best plan is probably to apply it at bedtime, and wash it off next morning. A *glycerate of tar* has been recommended for external use, made by mixing, with the aid of heat, an ounce of glycerin, half a drachm of the purified oil of cade, and half an ounce of powdered starch. (*Am. Journ. of Med. Sci.*, Jan. 1859.)

[*] While at Montpellier, in France, in the spring of 1861, Dr. Geo. B. Wood was assured by Dr. Martius, Professor of Botany in the University of that city, that the species seen by Richard was not the *Ricinus communis*, but the *Ricinus Africanus;* also that all the plants of the genus Ricinus growing wild on the borders of the Mediterranean were the *R. Africanus.*

footstalks inserted into their lower disk, palmate with seven- or nine-pointed serrate lobes, smooth on both sides, and of a bluish green color. The flowers are monœcious, stand upon jointed peduncles, and form a pyramidal terminal raceme, of which the lower portion is occupied by the male flowers, the upper by the female. Both are destitute of corolla. In the male flowers the calyx is divided into five oval, concave, pointed, reflected, purplish segments, and encloses numerous stamens, united into fasciculi at their base. In the female the calyx has three or five narrow lanceolate segments; and the ovary, which is roundish and three-sided, supports three linear, reddish stigmas, forked at their apex. The fruit is a roundish glaucous capsule, with three projecting sides, covered with tough spines, and divided into three cells, each containing one seed, which is expelled by the bursting of the capsule. This species of Ricinus is a native of the East Indies and Northern Africa, naturalized in the West Indies, and cultivated in various parts of the world, in few countries more largely than in the Middle and Western United States. The flowers appear in July, and the seeds ripen successively in August and September. A decoction of the leaves is said to be employed effectively, as a local application to the breast, for promoting the secretion of milk; and an infusion of the leaves has been given internally, for a similar purpose, by Dr. Routh, with great supposed success. (*London Lancet*, Dec. 24, 1859.)

1. THE SEEDS. These are about as large as a small bean, oval, compressed, obtuse at the extremities, very smooth and shining, and of a grayish or ash color, marbled with reddish brown spots and veins. At one end of the seed is a small yellowish tubercle, from which an obscure longitudinal ridge proceeds to the opposite extremity, dividing the side upon which it is situated into two flattish surfaces. In its general appearance the seed is thought to resemble the insect called the *tick*, the Latin name of which has been adopted as the generic title of the plant. Its variegated color depends upon a very thin pellicle, closely investing a hard, brittle, blackish, tasteless, easily separated shell, within which is the kernel, highly oleaginous, of a white color, and a sweetish taste, succeeded by a slight degree of acrimony. The seeds easily become rancid, and are then unfit for the extraction of the oil, which is acrid and irritating. In 100 parts Geiger found, exclusive of moisture, 23·82 parts of envelope, and 69·09 of kernel. These 69·09 parts contained 46·19 of fixed oil, 2·40 of gum, 20·00 of starch and lignin, and 0·50 of albumen. Mr. Henry Bower could find no starch, but separated from the seeds an albuminoid principle, which acted with amygdalin and water like emulsin, producing the odor of oil of bitter almond, though in a less degree. (*A. J. P.*, xxvi. 208.) It is highly probable that it is this principle which, acting as a ferment on the oily matter of the seeds, gives rise to changes in its nature which render them rancid. Mr. G. J. Scattergood found the odor of castor oil to be developed in the beans when bruised with water, and much more powerfully in those long kept than in the fresh. The water distilled from the seeds has a peculiar nauseous odor, quite distinct from that of the oil. (*Ibid.*, xxviii. 207.)[*]

Taken internally the seeds are powerfully cathartic, and often emetic. Two are sufficient to purge with great violence, and three have taken life in the adult. This property depends upon an acrid principle, which, according to Guibourt, pervades the whole kernel, in connection with the oil. The integuments of the seeds have been proved to be inert. This principle is considered by some as volatile, and is said to be dissipated by the heat of boiling water. This view is strengthened by the experiments of Mr. Scattergood above referred to; as the water distilled from the seeds proved decidedly purgative in the dose of half a fluidounce, and in twice the quantity both purged and vomited. The same experimenter found that the residue, after the seeds had been exhausted by ether and alcohol, was inert in the dose of 28 grains; and the ethereal extract proved a mild cathartic in the dose of from two to five fluidrachms. After expression of the oil, and treatment with pure alcohol, M. Calloud found the residue to be powerfully emetic in the quantity of 30 grains, taken in two doses. (*Journ. de Pharm.*, 3e sér., xiv. 190.)[*] E. L. Boerner (*A. J. P.*, 1876, p. 481) obtained butyric acid by macerating the exhausted marc of the seeds with water until decomposed. M. Parola states that ether also is incapable of extracting the acrid emetic principle from the seeds. At a temperature much above 100° C. (212° F.) the oil itself becomes altered and acrid.

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[*] *Ricinine or Ricinia.* Professor Tuson announced the discovery in the seeds of a peculiar alkaloid, which he named *ricinine.* To obtain it, the crushed seeds are exhausted by successive portions of boiling water; the decoction is filtered through wet muslin; the filtered liquor is evaporated to dryness over a water-bath; the extract thus obtained is exhausted by boiling alcohol; the alcoholic solution is allowed to cool, then filtered to separate a little resinous matter, and lastly concentrated and permitted to stand. In the course of some hours, a mass of nearly white crystals is deposited, which when recrystallized from alcohol, and decolorized by animal charcoal, are the alkaloid in a pure state. Ricinine crystallizes in rectangular prisms and tables, has a feebly bitter taste, somewhat resembling that of bitter almonds, is fusible and crystallizes on cooling, volatilizable unchanged, inflammable, soluble most readily in water and alcohol, and very slightly in ether or benzol. Heated with hydrate of potassa it evolves ammonia, and therefore contains nitrogen. It appears to combine with sulphuric, nitric, and hydrochloric acids. But a more accurate investigation is needed, before it can be admitted to be undoubtedly a distinct and pure alkaloid. A minute quantity is said to be obtained from castor oil by shaking it with water, evaporating the liquid, treating the residue with boiling benzol, and allowing the solution to evaporate spontaneously. Professor Tuson does not claim for the new alkaloid the possession of purgative properties. Two grains given to a rabbit produced no observable effect. Prof. E. S. Wayne obtained from the leaves of *Ricinus communis* a substance apparently identical with Tuson's ricinine, but he does not consider it to be an alkaloid. (*A. J. P.*, 1874, p. 97.)

2. THE OIL. This may be extracted from the seeds in three ways: 1, by decoction; 2, by expression; and, 3, by the agency of alcohol or other solvent.

The process by decoction, which has been practised in the East and West Indies, consists in bruising the seeds, previously deprived of their husk, and then boiling them in water. The oil, rising to the surface, is skimmed or strained off, and afterwards again boiled with a small quantity of water to dissipate the acrid principle. To increase the product it is said that the seeds are sometimes roasted. The oil is thus rendered brownish and acrid; and the same result takes place in the second boiling, if care is not taken to suspend the process soon after the water has been evaporated. Hence it happens that the West India oil has generally a brownish color, an acrid taste, and irritating properties.

The oil is obtained in this country by expression. The following, as we have been informed, are the outlines of the process usually employed by those who prepare it on a large scale. The seeds, having been thoroughly cleansed from the dust and fragments of the capsules with which they are mixed, are conveyed into a shallow iron reservoir, where they are submitted to a gentle heat insufficient to scorch or decompose them, and not greater than can be readily borne by the hand. The object of this step is to render the oil sufficiently liquid for easy expression. The seeds are then introduced into a powerful hydraulic press. A whitish oily liquid is thus obtained, which is transferred to clean iron boilers, supplied with a considerable quantity of water. The mixture is boiled for some time, and, the impurities being skimmed off as they rise to the surface, a clear oil is at length left upon the top of the water, the mucilage and starch having been dissolved by this liquid, and the albumen coagulated by the heat. The latter ingredient forms a whitish layer between the oil and the water. The clear oil is now carefully removed; and the process is completed by boiling with a minute proportion of water, and continuing the application of heat till aqueous vapor ceases to rise, and till a small portion of the liquid, taken out in a vial, continues perfectly transparent when it cools. The effect of this last operation is to clarify the oil, and to render it less irritating by driving off the acrid volatile matter. But much care is requisite not to push the heat too far; as the oil then acquires a brownish hue, and an acrid peppery taste. After the completion of the process, the oil is put into barrels, and sent into the market. See article on the preparation of castor oil (*A. J. P.*, 1879, p. 481). There is reason, however, to believe that much of the American oil is prepared by merely allowing it to stand for some time after expression, and then drawing off the supernatant liquid. One bushel of good seeds yields five or six quarts, or about 25 per cent., of the best oil. If not carefully prepared, it is apt to deposit a sediment upon standing; and the apothecary may find it necessary to filter it through coarse paper before dispensing it. Perhaps this may be owing to the plan just alluded to of purifying the oil by rest and decantation. We have been told that the oil in barrels usually deposits in cold weather a copious whitish sediment, which is redissolved when the temperature rises. A large proportion of the drug consumed in the eastern section of the Union has been derived, by way of New Orleans, from Illinois and the neighboring States, where it has been at times so abundant that it has been used for burning in lamps, and for lubricating machinery.* According to the census reports, there were manufactured in the United States in the year 1880, 893,802 gallons of castor oil, valued at $790,741.†

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[*] A case is reported in the *Archives Générales de Médecine* (Mars, 1869, p. 284), by Prof. Houzé de l'Aubnoit, in which a middle-aged woman was fatally poisoned by from 6 to 10 grammes of the seeds of the castor-oil plant. After taking them she was very speedily seized with violent vomiting and purging, with bloody stools, which continued almost incessantly for five days, when she died. Examination showed signs of violent inflammation of the alimentary canal, especially of the small intestines.

The process for obtaining castor oil by means of alcohol has been practised in France; but the product is said to become rancid more speedily than that procured in the ordinary mode. Such a preparation has been employed in Italy, and is asserted to be less disagreeable to the taste, and more effective, than the common oil obtained by expression. According to M. Parola, an ethero-alcoholic extract, and an ethereal or alcoholic tincture of the seeds, operate in much smaller doses than the oil, and with less disposition to irritate the bowels or to cause vomiting. (See *Am. Journ. of Med. Sci.*, N. S., xiii. 143.)

Properties. Pure castor oil is a thick, viscid, colorless liquid, with little or no odor, and a mild though somewhat nauseous taste, followed by a slight sense of acrimony. As found in the shops it is often tinged with yellow, and has an unpleasant smell; and parcels are sometimes though rarely met with of a brownish color and hot acrid taste. It does not readily congeal by cold. When exposed to the air it slowly thickens, without becoming opaque. "When cooled, it becomes thicker, generally depositing white granules, and at about —18° C. (0·4° F.) it congeals to a yellowish mass." *U. S.* It is heavier than most of the other fixed oils; its sp. gr. having been stated to be 0·969 at 55° F. (0·950 to 0·970, *U. S.*). It differs also from other fixed oils in being soluble in all proportions in cold absolute alcohol. Weaker alcohol, of the sp. gr. 0·8425, takes up about three-fifths of its weight. It has been supposed that adulterations with other fixed oils might thus be detected, as the latter are much less soluble in that fluid; but Pereira has shown that castor oil has the property of rendering a portion of other fixed oils soluble in alcohol; so that the test cannot be relied on. (*P. J. Tr.*, ix. 498.) Such adulterations, however, are seldom practised in this country.‡ Castor oil is soluble also in ether, and in its weight of glacial acetic acid. Its proximate composition * has been repeatedly investigated. By saponification it yields several fatty acids, one of which appears to be palmitic acid, $C_{16}H_{32}O_2$, but the prevailing acid is *ricinoleic acid*, $C_{18}H_{34}O_2$, which is solid below 0° C., does not solidify in contact with the air by absorption of oxygen, and is not homologous with oleic or linoleic acid, neither of which is found in castor oil. Castor oil is thickened if warmed with 1 part of starch and 5 parts of nitric acid (sp. gr. 1·25), *ricinelaïdin* being formed. From this *ricinelaïdic acid* may be obtained in brilliant crystals. Ricinoleic acid is converted by caustic potassa into caprylic alcohol and sebacic acid, with disengagement of hydrogen; and the same products are obtained by the reaction of potassa with the oil itself. (See *Journ. de Pharm.*, Août, 1855, p. 113.) Its purgative property is supposed by MM. Bussy and Lecanu to belong essentially to the oil, and not to any distinct principle which it may hold in solution. According to M. O. Popp, castor oil differs from all other fixed oils in turning the plane of polarized light to the right. (*A. J. P.*, Aug. 1871, p. 354; from *Arch. de Pharm.*, 1871.) Various substances containing coloring principles which they yield to castor oil produce beautiful fluorescence in that fluid when heated with it; such as logwood, turmeric, camwood, etc. (Charles Horner, *P. J. Tr.*, Oct. 1874, p. 282.)

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* For a particular account of the mode of cultivating the castor-oil plant and preparing the oil in the Western States, see a paper by Prof. Procter in *A. J. P.* (xxvii. 99).

† *Italian Castor Oil.* The castor oil plant is cultivated throughout Italy, but especially in the neighborhood of Verona, where the oil is prepared with great care, and is remarkably free from the peculiar odor and taste which render this medicine so repulsive to many palates. As it is highly desirable, for certain purposes, that the oil should be as free from these properties as possible, though as a mere purgative perhaps less powerful when deprived of them, it is a point worthy of investigation, why it is that the Italian oil is superior to most if not all other commercial varieties of the oil in these respects. The following facts in relation to the mode of preparing the oil practised at Verona, published by Mr. H. Groves, of Florence, acquire on this account a special value. One point of importance is that the seeds are used fresh, as the oil rapidly becomes rancid in them when kept. Another fact is that the seeds are entirely deprived of their coating before being submitted to pressure. This is effected by passing them between two revolving wooden rollers, with a winnowing machine beneath; and, to secure the complete absence of integument, they are afterwards assorted by the hand; all being rejected which are not perfectly decorticated. They are then put into hempen bags, which are arranged in layers, with a sheet of iron heated to 90° F. between them, so as to enable the oil to flow. Lastly, they are submitted to pressure in hydraulic presses. The oil which now flows is of the finest quality. An inferior kind is obtained by pressing the marc at a somewhat higher heat. (*P. J. Tr.*, Oct. 1866.)

‡ *Cohesion figures as a means of testing liquids.* A mode of testing oily or resinous liquids has been proposed by Mr. Charles Tomlinson, which is applicable to this oil, and may succeed when purely chemical methods fail. When one liquid is dropped on the surface of another, there are often curious figures produced, as the drop spreads out on the surface of the liquid upon which it falls, occasioned by the conflict between the cohesion of the drop and the forces which cause its diffusion. These the author calls *cohesion figures.* As a general rule, each liquid has its own characteristic figures, which are modified by the admixture of other liquids, and thus the means are afforded of testing not only the identity of any suspected liquid, but also its purity. To one not acquainted with the characteristic cohesion figures, it would be sufficient to try the experiment with a specimen known to be pure, and then to compare with the figure it forms, those formed by the specimen to be tested. The experiment should always be made under precisely similar circumstances. In

Castor oil which is acrid to the taste may sometimes be rendered mild by boiling it with a small proportion of water. If turbid, it should be clarified by filtration through coarse paper. On exposure to the air, it is apt to become rancid, and is then unfit for use.

Medical Properties and Uses. Good castor oil is a mild and speedy cathartic, usually operating with little griping or uneasiness, and evacuating the contents of the bowels without much increasing the alvine secretions. Hence it is particularly applicable to constipation from collections of indurated fæces, and to cases in which acrid substances have been swallowed, or acrid secretions have accumulated in the bowels. From its mildness it is also especially adapted to diseases attended with irritation or inflammation of the bowels; as colic, diarrhœa, dysentery, and enteritis. It is habitually resorted to in cases of pregnant and puerperal women, and is decidedly, as a general rule, the best and safest cathartic for children. Infants usually require a larger relative dose than adults.

The dose for an adult is half a fluidounce (15 C.c.), for an infant from one to three or four fluidrachms (3·75–11·25–15 C.c.). It is difficult of administration, from its peculiarly disagreeable taste, and from its clamminess and adhesiveness to the mouth. In a few cases, the disgust which it excites is utterly unconquerable by any effort of resolution. A common method of disguising the drug is to give it floating in mint or cinnamon water; but that which we have found upon the whole the least offensive, is to give it floating on the froth of sarsaparilla syrup mixed with carbonic acid water. Some take it in wine, or spirituous liquors, or the froth of porter; but these are often contraindicated by their stimulant property. An excellent method is to mix it with an equal amount of glycerin and strongly aromatize with a volatile oil. It separates on standing, but can readily be reincorporated by shaking. When the stomach is unusually delicate, the oil may be made into an emulsion with mucilage or the yolk of an egg, loaf sugar, and an aromatic water. Tragacanth has been recommended as producing a better emulsion than gum arabic. Laudanum may be added in cases of intestinal irritation. Castor oil may also be beneficially used as an enema, in the quantity of two or three fluidounces (60 or 90 C.c.), mixed with some mucilaginous liquid. It has been recommended as a local application to the breasts of nursing women, to promote the secretion of milk.

reference to castor oil, it should be dropped from the end of a glass rod upon the surface of perfectly clear water, in a glass vessel scrupulously clean; as any imperfection in these respects might interpose a physical impediment to the success of the experiment. (*Chem. News*, Feb. 13, 1864, p. 79. See also *A. J. P.*, July, 1864.)

Effect on light. Another test for castor oil is its influence on polarized light. The fixed oils generally have little or no power. Castor oil deviates the plane of polarization to the right, but loses this property if heated to 270° C. (518° F.). (*Journ. de Pharm.*, Nov. 1861, p. 339.)

* When distilled in vacuo it yields at first about one-third of its volume of nearly pure œnanthol, and after this, with great rise of temperature, a crystallizing body belonging to the oleic acid group and having the formula $C_{11}H_{20}O_2$. (*A. J. P.*, 1878, p. 182.)

Though apt to become rancid by itself, it loses much of its susceptibility when mixed with lard; and some druggists are said to use it as a substitute for olive oil in ointments and cerates. But the slightly irritating properties of even the mildest castor oil render it unfit for those preparations which are intended to alleviate irritation.

Off. Prep. Collodium Flexile, *U. S.;* Linimentum Sinapis Compositum, *Br.;* Pilula Hydrargyri Subchloridi Composita, *Br.*

OLEUM ROSÆ. *U. S.* *Oil of Rose.*

(Ō′LĘ-ŬM RŌ′ŞÆ.)

"A volatile oil distilled from the fresh flowers of Rosa damascena. Miller. (*Nat. Ord.* Rosaceæ, Roseæ.)" *U. S.*

Oleum Rosarum; Attar, Otto of Rose; Essence de Rose, *Fr.;* Rosenöl, *G.*

This is commonly called *attar*, *otto*, or *essence of roses.* It is prepared on a large scale in Turkey in Europe, especially in the Balkan Mountains, in Egypt, Persia, Cashmere, India, and other countries of the East; but European and American commerce is at present supplied chiefly from the region constituting the southern slope of the Balkans. Kizanlik is said to be the district in which the oil is most largely produced; 500,000 metticals (about 3000 avoirdupois pounds) being at present the annual amount obtained. The roses are gathered in May, and are distilled with the green leaves of the calyx. They are put, to the amount of 30 or 60 pounds, into a tinned copper boiler of the capacity of about 150 pounds. The heat is applied over an open fire, and a boiling temperature is continued for two hours, when the first part of the distilled fluid is returned to the boiler, and the process is continued to completion. The oil collects on the top of the water in the receiver, where it is removed from time to time as it accumulates. (*P. J. Tr.*, June, 1872, p. 1051.) In the south of France it is prepared in small quantities by distilling the petals of the rose with water. The oil concretes and floats upon the surface of the water when it cools. The precise species of rose from which the oil is extracted is not in all instances certainly known; but it is said to be obtained from *R. damascena* in Northern India, *R. moschata* in Persia, and *R centifolia* (*provincialis*) in the north of European Turkey. Dr. Hochstell of the Vienna University, who travelled in the region of the rose-culture, and from whose paper the facts just mentioned were chiefly derived, states that the most important species cultivated in the valley of Kizanlik are *R. damascena*, *R. sempervira*, and *R. moschata.* It is furnished in very minute proportion; not more than three drachms having been obtained by Colonel Polier, in Hindostan, from 100 lbs. of the petals. It is usually imported in small bottles, and is very costly.* Oil of rose is said to be prepared in Macedonia by crushing the petals in mills, expressing the fluid part, filtering it, and then exposing it to the sun in small glass vessels. The oil gradually collects on the surface of the liquid, and is removed. (*Pharm. Centralb.*, 1847, p. 783.) Landerer states that at Damascus and other parts of Asia Minor the oil is prepared by dry distillation. The buds being collected before sunrise are placed in a glass retort; and the distillation is effected by a salt-water bath, care being taken so to regulate the heat as not to scorch the petals. The water of the fresh roses and their oil come over together, and the latter floating on the top is readily separated.

Oil of rose is nearly colorless, or presents some shade of green, yellow, or red; but, according to Polier, the color is no criterion of its value. It is concrete below 80° F., and becomes liquid between 84° and 86° F. Its odor is very powerful and diffusive. At 90° F. its sp. gr. is 0·832. Alcohol dissolves it, though not freely when cold. "A slightly acid reaction. Sp. gr. about 0·860. It is but slightly soluble in alcohol. When slowly cooled to near 10° C. (50° F.), the Oil becomes a transparent solid, interspersed with numerous, slender, shining, iridescent, scale-like crystals. When rapidly cooled to 12·5° C. (54·5° F.), it congeals to a solid mass of light, feathery, shining scales or plates." *U. S.* It consists of two oils, one liquid, the other concrete at ordinary temperatures. These may be separated by freezing the oil, and compressing it between folds of blotting paper, which absorbs the liquid oil, and leaves the concrete or stearoptene. The latter consists exclusively of carbon and hydrogen; the former, of these with oxygen. The odor resides exclusively in the liquid oil, the pure stearoptene being scentless.

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* For an account by Dr. R. Bauer, of Constantinople, of oil of roses, its production, properties, adulteration, etc., see *P. J. Tr.*, Dec. 1867, p. 286; also *A. J. P.*, 1881, p. 367.

Sandal-wood oil, other volatile oils, fixed oils, spermaceti, etc., are said to be added almost universally as adulterations. The volatile additions may be detected by not being concrete; the fixed, by the greasy stain they leave on paper when heated. Guibourt has offered certain tests by which he thinks the purity of the oil may be determined. (See *A. J. P.*, xxi. 318.) A. Ganswindt recommends the following tests. Agitate 1 drop of the oil with 45 Gm. of warm water, and sprinkle the solution in a moderately warm room, which will soon be filled with a rose odor, in which foreign odors may be detected without difficulty. An adulteration with a fixed oil produces a permanent grease stain upon paper, and spermaceti is left behind on the evaporation of a few drops of the oil from a watch crystal in a water-bath. On mixing a few drops of pure oil of rose with an equal bulk of sulphuric acid, the rose odor is not changed, but oils used for adulteration change their odor, which becomes apparent in the rose odor. Or 5 drops of the oil are mixed in a dry test-tube with 20 drops of pure concentrated sulphuric acid; when the mixture is cool it is agitated with 20 Gm. of absolute alcohol, when a nearly clear solution should be obtained, which, heated to boiling, remains clear yellowish brown on cooling. In the presence of the oils of rose-geranium, palma rosa, etc., the alcoholic mixture is turbid, and on standing separates a deposit without becoming clear. (*Seifens. Ztg.*, 1881, p. 32; *A. J. P.*, May, 1881.) It is said that the oil of one of the sweet-scented Pelargoniums, perhaps the *rose-geranium*, is much employed in Turkey for the purpose of adulteration; and this is undoubtedly correct. According to Mr. Hanbury, who appears to have thoroughly investigated the subject, two substances especially are used in Constantinople for adulterating the oil; one spermaceti, the other a volatile oil, produced by certain grasses in the East Indies belonging to the genus *Andropogon*, large quantities of which are exported from Bombay, partly directly to Europe, partly through the Arabian Gulf, whence it reaches Constantinople. The same oil is imported into London under the name of *Turkish essence of geranium*, or *geranium oil.**

A test of the genuineness of oil of rose has been proposed by Hager, consisting in the action of strong sulphuric acid, which, added in the quantity of twenty drops to five drops of the oil, produces a reddish brown mixture, which, if shaken when cold with three drachms of absolute alcohol, will, if the oil be pure, change into a tolerably clear yellowish brown solution, remaining clear if heated to ebullition; whereas, if the oil be adulterated, the mixture will continue very cloudy, and sometimes a deposit will form. Professor Redwood, however, on trying the test, did not find it satisfactory. (*P. J. Tr.*, Feb. 1866, p. 424.)

According to Baur, the best tests of the purity of the oil are found in its congealing, in five minutes, at a temperature of 12·5° C. (54·5° F.), and its crystallizing, as a solid mass, in light, shiny plates, present everywhere throughout the liquid. These crystals are truncated semi-sided prisms, the angles of which are unequal, and which must be classed in the rhombic system. This stearoptene, melted, and allowed to cool, crystallizes in a manner so complete that the microscope can readily reveal the presence of foreign substances, such as spermaceti, fatty bodies, wax, and other analogous amorphous substances. (See *Journ. de Pharm. et de Chim.*, Juillet, 1869, p. 30.)

Oil of rose may be added, as a grateful perfume, to various spirituous preparations for internal use, and to cerates and ointments.

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* *Oil of Rhodium.* This is said to be the oil from the wood of *Convolvulus Scoparius* or *Genista Canariensis*. It is used to adulterate oil of rose. An oil of rhodium is sold to rat-catchers as a lure for rats, which is made by mixing one part of oil of rose with twenty parts of oil of copaiba.

OLEUM ROSMARINI. *U.S., Br.* *Oil of Rosemary.*

(Ō′LẸ-ŬM RŎŞ-MẠ-RĪ′NĪ.)

"A volatile oil distilled from Rosemary." *U. S.*

Oleum Anthos; Essence de Romarin, *Fr.;* Rosmarinöl, *G.*

The fresh leaves of rosemary yield, according to Baumé, 0·26 per cent. of volatile oil; but the product is stated much higher by others. According to Brande, a pound of the fresh herb yields about a drachm of the oil, which is about 1 per cent.; and Zeller gives very nearly the same product for the dried herb. This oil is colorless, with an odor similar to that of the plant, though less agreeable. Its sp. gr. is said to be 0·911, but reduced to 0·8886 by rectification (about 0·900, *U. S.*). Buignet gives the sp. gr. of the rectified oil 0·896, and states that it is moderately dextrogyrate. Its reaction is neutral. It is soluble in all proportions in alcohol of 0·830, but requires for solution at 64° forty parts of alcohol of 0·887. (*Berzelius.*) Kane gives its sp. gr. 0·897, its boiling point 365°. Kept in bottles imperfectly stopped, it deposits a *stearoptene* analogous to camphor, sometimes amounting, according to Proust, to one-tenth of the oil. Both Gladstone and Flückiger find that most of the oil consists of a hydrocarbon of the composition $C_{10}H_{16}$, and boiling at 165° C. (329° F.); but there is a smaller fraction boiling at from 200° C. to 210° C. (392° to 410° F.), which at low temperatures deposits a camphor, $C_{10}H_{18}O$. Bucholz states that it affords camphor when digested with from one-half its weight to an equal weight of potassa, and distilled. It is said to be sometimes adulterated with oil of turpentine, which may be detected by mixing the suspected liquid with an equal volume of pure alcohol. The oil of rosemary is dissolved, and that of turpentine left. This oil is stimulant, but is employed chiefly as an ingredient of rubefacient liniments. The dose is from three to six drops (0·18 to 0·36 C.c.). A case of death is recorded, in a child four or five years old, from a mixture of six measures of this oil, and two of oil of wormseed, given in repeated doses of a tablespoonful. (*A. J. P.*, xxiii. 286.)

Off. Prep. Linimentum Saponis; Spiritus Odoratus, *U. S.;* Spiritus Rosmarini, *Br.;* Tinctura Lavandulæ Composita.

OLEUM RUTÆ. *U.S., Br.* *Oil of Rue.*

(Ō′LẸ-ŬM RŪ′TÆ.)

"A volatile oil distilled from Ruta graveolens. Linné. (*Nat. Ord.* Rutaceæ, Ruteæ.)" *U. S.*

Essence de Rue, *Fr.;* Rautenöl, *G.*

Rue yields a very small proportion of a yellow or greenish volatile oil, which becomes brown with age. According to Zeller, the product from the fresh herb is 0·28 per cent., from the seeds about 1 per cent. The oil has the strong unpleasant odor of the plant, and an acrid taste. Kane gives its sp. gr. 0·837, its boiling point 230° C. (446° F.). "A neutral reaction. Sp. gr. about 0·880. It is soluble in an equal weight of alcohol." *U. S.* It consists mainly of an oxidized constituent, which Strecker proved to be *methyl-nonyl-ketone*, $CH_3.CO.C_9H_{19}$; that is, a ketone analogous to acetone, $CH_3.CO.CH_3$. This accounts for its yielding under treatment with oxidizing agents pelargonic acid, $C_9H_{18}O_2$. The methyl-nonyl-ketone, when pure, is a colorless liquid, fluorescing blue, boiling at 225° C. (437° F.), and crystallizing at about 5° C. (41° F.). When treated with nitric acid, it yields, among other products, pelargonic acid, which is used in the preparation of a fruit essence denominated *pelargonic ether.* (See *Fruit Essences*, in Part II.) It is stimulant and antispasmodic, and has been given in hysteria, convulsions, and amenorrhœa. The dose is from two to five drops (0·12 to 0·3 C.c.).

OLEUM SABINÆ. *U. S., Br.* *Oil of Savine.*

(Ō′LẸ-ŬM SẠ-BĪ′NÆ.)

Essence de Sabine, *Fr.;* Sadebaumöl, *G.*

According to the more recent authorities, the proportion of volatile oil obtained from savine varies from less than 1 to 2·5 per cent. The oil is nearly colorless or yellow, limpid, strongly odorous, and of a bitterish, extremely acrid taste. "A neutral reaction. Sp. gr. about 0·910. It is soluble in an equal weight of alcohol." *U. S.* Kane gives its sp. gr. 0·915, its boiling point 157·2° C. (315° F.), and its composition $C_{10}H_{16}$, equivalent to that of oil of turpentine. According to Winckler, it is converted by sulphuric acid into an oil not distinguishable from that of thyme. (*Chem. Gaz.*, Jan. 1847, p. 11.) With iodine it becomes heated, detonates, and gives off yellow and violet-red vapors. (*Flaschoff.*) Distilled with 24 parts of water and 8 of chloride of calcium, it evolves carbonic acid with effervescence, and yields *chloroform.* (*Gmelin's Handbook*, xiv. 310.) The oil of savine is stimulant, emmenagogue, and actively rubefacient, and may be given for the same purposes as the plant in substance. It has been much employed empirically in amenorrhœa, and with a view to produce abortion, and in some instances with fatal effects. The dose is from two to five drops (0·12 to 0·3 C.c.). Externally, Dr. Pincus has used it successfully in the proportion of five to thirty drops in an ounce of spirit for the cure of alopecia pityroides. He has it rubbed on the head and also applied by means of compresses.

OLEUM SANTALI. *U. S.* *Oil of Santal.*

(Ō′LE̩-ŬM SĂN′TA̩-LĪ.)

Oil of Sandal Wood; Essence de Santal, *Fr.;* Santelöl, *G.*

"A volatile oil distilled from the wood of Santalum album. Linné. (*Nat. Ord.* Santalaceæ.)" *U. S.*

This is a new officinal oil. It is prepared by distilling the wood of the *Santalum album*, a tree growing in the East, but there now nearly exterminated. Santal wood is now derived chiefly from the island of Timor and Western Australia. (See *Santalum Album*, Part II.) According to Piesse, "one hundred weight yields thirty ounces of otto." This oil is usually very largely adulterated with castor oil. The officinal description is as follows. "A pale yellowish or yellow liquid, of a peculiar, strongly aromatic odor, a pungent and spicy taste, and a slightly acid reaction. Sp. gr. about 0·945. It is readily soluble in alcohol." *U. S.*

Medical Properties. Oil of santal wood is very largely used as a perfume, but is also employed in practical medicine. It is when in concentrated form a local irritant, and probably is capable of causing more or less systemic excitement. The effects of large doses are not, however, well known, as it has been used exclusively for its influence upon mucous membranes, in chronic bronchitis, and especially in gonorrhœa. In the latter disease it was first recommended by Dr. Thos. B. Henderson, who is, however, stated to have used the oil of *S. myrtifolium.* In the advanced stages of the disease, from twenty to thirty minims (1·25 to 1·9 C.c.) of it may be given in capsule or emulsion three times a day, often with most excellent results.

OLEUM SASSAFRAS. *U. S.* *Oil of Sassafras.*

(Ō′LE̩-ŬM SĂS′SA̩-FRĂS.)

"A volatile oil distilled from Sassafras." *U. S.*

Essence de Sassafras, *Fr.;* Sassafrasöl, *G.*

The proportion of oil yielded by the root of sassafras is variously stated at from less than 1 to somewhat more than 2 per cent. The bark of the root, directed by the U. S. Pharmacopœia, would afford a larger amount. Very large quantities of the oil are distilled in Maryland, and sent to Baltimore for sale. The usual yield is said by Mr. Sharp to be one pound from three bushels of the root. From fifteen to twenty thousand pounds were sent annually, before the war, to the Baltimore market. (A. P. Sharp, *A. J. P.*, Jan. 1863, p. 53.) At Richmond, Va., in 1871, it was being manufactured at the rate of forty gallons of pure oil per week. The root, chopped fine by machinery, has steam forced through it in a closed tub, and the oil is then distilled in the ordinary way. 800 pounds of unrectified oil are said to be obtained from 40,000 pounds of the root. (*Med. and Surg. Reporter*, Aug. 26, 1871.) The oil is of a yellow color or colorless, becoming reddish by age. It has the fragrant odor of sassafras, with a warm, pungent, aromatic taste, and a neutral reaction. It is among the heaviest of the volatile oils, having the sp. gr. 1·094, or 1·087 on the authority of Buignet, who states also that it is very slightly dextrogyrate (about 1·090, *U. S.*). "It is readily soluble in alcohol. When treated with cold nitric acid, it becomes dark red, and is finally converted into a red resin." *U. S.* MM. Grimaux and Ruothe state that it is a mixture of a hydrocarbon, *safrene*, $C_{10}H_{16}$, and an oxidized compound, *safrol*, $C_{10}H_{10}O_2$. This latter constitutes nine-tenths of the weight of the oil. It crystallizes well in hard four- or six-sided prisms, with the odor of sassafras. It liquefies at 8·5° C. (47° F.), boils at 232° C. (449·6° F.), and is destitute of rotatory power. Safrene, on the other hand, boils at 155° C. to 157° C. (311° to 314·6° F.), and is dextrogyrate. (See *Sassafras.*)

OLEUM SESAMI. *U. S.* *Oil of Sesamum.* [*Benné Oil.*]

(Ō'LẸ-ŬM SĔS'Ạ-MĪ.)

"A fixed oil expressed from the seed of Sesamum indicum. Linné. (*Nat. Ord.* Pedaliaceæ.") *U. S.*

Huile de Sésame, Sésame, *Fr.;* Sesam, Sesamöl, *G.;* Sesamo, *It.;* Anjonjoli, *Sp.*

Gen. Ch. *Calyx* five-parted. *Corolla* bell-shaped, five-cleft, with the lower lobe largest. *Stamens* five, the fifth a rudiment. *Stigma* lanceolate. *Capsule* four-celled. *Willd.*

Sesamum orientale. Willd. *Sp. Plant.* iii. 358; Rheed. *Hort. Malab.* ix. 54. "Leaves ovate-oblong, entire."

Sesamum Indicum. Willd. *Sp. Plant.* iii. 359; Curtis, *Bot. Mag.* vol. xli. t. 1688; *B. & T.* 198. "Leaves ovate-lanceolate, the inferior three-lobed, the superior undivided. Stem erect." There is reason to believe that this species is the one chiefly cultivated in our Southern States. At least Dr. Geo. B. Wood found plants, raised in Philadelphia from seeds obtained from Georgia, to have its specific character, as given by Willdenow.

The benné plant of our Southern States is annual, with a branching stem four or five feet high, and bearing opposite, petiolate leaves, varying considerably in their shape. Those on the upper part of the plant are ovate-lanceolate, irregularly serrate, and pointed; those near the base three-lobed and sometimes ternate; and lobed leaves are not uncommon at all distances from the ground. The flowers are reddish white, and stand solitarily upon short peduncles in the axils of the leaves. The fruit is an oblong capsule, with small, oval, yellowish seeds.

These two species of Sesamum are natives of the East Indies, and have been cultivated from time immemorial in various parts of Asia and Africa. From the latter continent it is supposed that seeds were brought by the negroes to the United States, where, as well as in the West Indies, one or both species are now cultivated to a considerable extent. The plant above described will grow vigorously in the gardens so far north as Philadelphia, though it does not usually ripen its seeds in this vicinity. The seeds are employed as food by the negroes, who parch them over the fire, boil them in broths, make them into puddings, and prepare them in various other modes. By expression they yield a fixed oil, which was introduced in the Pharmacopœia at the last revision. M. Berjot obtained 53 per cent. of the oil by means of bisulphide of carbon.

1. *Benné Leaves.* These abound in a gummy matter, which they readily impart to water, forming a rich, bland mucilage, much used in the Southern States as a drink in various complaints to which demulcents are applicable; as in cholera infantum, diarrhœa, dysentery, catarrh, and affections of the urinary passages. The remedy has attracted attention also in the North, and has been employed with favorable results in Philadelphia. One or two fresh leaves of full size, stirred about in half a pint of cool water, will soon render it sufficiently viscid. With dried leaves hot water is used. The leaves also serve for the preparation of emollient cataplasms.

2. *Benné Oil.* This is inodorous, of a bland, sweetish taste, of a neutral reaction, and will keep long without becoming rancid. Flückiger finds that 76 per cent. of the oil consists of *olein*, and that the solid portions yield on saponification *palmitic*, *stearic*, and *myristic acids.* The oil also contains a small quantity of what is prob-

ably a resinoid substance, which may be removed by glacial acetic acid or alcohol. It bears some resemblance to olive oil in its properties, and may be used for similar purposes. It is not a drying oil. At 12·7° C. (55° F.), it has the sp. gr. 0·919; and its point of congelation is —5° C. (23° F.). "Sp. gr. 0·914 to 0·923. When cooled to near 5° C. (23° F.), it congeals to a yellowish white mass. Concentrated sulphuric acid converts it into a brownish-red jelly. If 10 C.c. of the Oil be agitated with 3 drops of a cold mixture of equal volumes of nitric and sulphuric acids, the Oil will acquire a green color, soon changing to brownish red." *U. S.* Its relation with nitric and sulphuric acids may serve for its detection when used as an adulterant, although it is said that if the other oil be in great excess, the oil of benné will not respond. It was known to the ancient Persians and Egyptians, and is esteemed by the modern Arabs and other people of the East, both as food, and as an external application to promote softness of the skin. It is laxative in large doses.

OLEUM SINAPIS VOLATILE. *U. S.* *Volatile Oil of Mustard.*

(Ō′LẸ-ŬM SỊ-NĀ′PĬS VỌ-LĂT′Ị-LĒ.)

"A volatile oil obtained from Black Mustard by maceration with water and subsequent distillation." *U. S.*

Oleum Sinapis, *Br., P.G.;* Oleum Sinapis Æthereum; Essence de Moutarde, *Fr.;* Aetherisches Senföl, *G.*

The *volatile oil of mustard* is usually obtained from seeds which have been deprived of their fixed oil by pressure. It is a colorless or pale yellow liquid, rather heavier than water, of an exceedingly pungent odor, and an acrid burning taste; with alkaline solutions it yields sulphocyanates. "Sp. gr. 1·017 to 1·021. It boils at 148° C. (298·4° F.). It is freely soluble in alcohol and in ether. If 1 part of the Oil is gradually added to 3 parts of sulphuric acid, keeping the mixture cool, the odor of mustard disappears, sulphurous acid vapor is given off, and the mass becomes thick and only slightly darker. On heating the Oil to 50° C. (122° F.), in a flask connected with a well-cooled condenser, no liquid having the odor and characteristics of disulphide of carbon should pass over." *U. S.* Dr. Will considers it to be iso-sulphocyanate of *allyl* (C_3H_5), the compound radical of oil of garlic, which is considered a sulphide of allyl. (*Chem. Gaz.*, Nos. 62 and 64.) It is the principle upon which black mustard seeds depend for their activity. Volatile oil of mustard has been produced artificially, by MM. Berthelot and S. de Luca, by treating iodide of propionyl, or allyl (C_3H_5I), with sulphocyanate of potassium. The iodine unites with potassium, and the liberated radical (C_3H_5) combines with the sulphocyanic acid radical, CNS, to form volatile oil of mustard, $C_3H_5.CNS$. Iodide of allyl is procured by treating glycerin with iodide of phosphorus, and differs from volatile oil of garlic (sulphide of allyl), only in containing iodine instead of sulphur. (*Journ. de Pharm.*, Août, 1855, p. 124.) According to Zeller, the seeds yield from 0·33 to 0·63 per cent. of the oil. Will and Koerner in 1863 explained the occurrence of this iso-sulphocyanate of allyl in mustard oil. It does not occur ready formed in the seeds, but is produced by the decomposition of a compound, *sinigrin* (*myronate of potassium*), occurring there. This sinigrin, $C_{10}H_{18}KNS_2O_{10}$, is decomposed under the influence of *myrosin*, an albuminous ferment which is present, and yields as products of decomposition C_3H_5CNS (iso-sulphocyanate of allyl), $HKSO_4$ (acid potassium sulphate), and $C_6H_{12}O_6$ (glucose). "The aqueous solution of myrosin coagulates at 60° C. (140° F.), and then becomes inactive; hence mustard seed which has been heated to 100° C. (212° F.), or has been roasted, yields no volatile oil, nor does it yield any if powdered and introduced at once into boiling water." (*Pharmacographia*, p. 67.) As it is often adulterated with other oils, a test has been proposed consisting of concentrated sulphuric acid, 50 drops of which are to be mixed with 5 drops of the suspected oil in a small glass tube. If the oil is pure, little change of color is produced; but if any adulterating oil be present, a red or brown color will soon appear. Rectified oil of petroleum is the only exception, as the color of this is not affected by the acid; but it would be recognized by its insolubility in sulphuric acid. (See *A. J. P.*, July, 1865, p. 285.) Adulteration with alcohol is readily detected by its much lower boiling point, which also enables it to be separated by distillation. The volatile oil of mustard has recently been employed as a substitute for the mustard plaster. For this purpose one part may be mixed with sixty parts of alcohol, and the mixture applied sprinkled not too thickly on piline. It acts speedily and efficiently. (*P. J. Tr.*, July, 1865, p. 34.)

White mustard seeds yield different products. When deprived of fatty oil they yield to boiling alcohol colorless crystals of *sinalbin*, an indifferent substance readily soluble in cold water, but sparingly in cold alcohol. According to Will, it breaks up under the action of myrosin into *sulphocyanate of acrinyl*, $C_7H_7O.CNS$, *sulphate of sinapine*, $C_{16}H_{25}NSO_9$, and *glucose*, $C_6H_{12}O_6$. This sulphocyanate of acrinyl is a nearly colorless, non-volatile oil, and the rubefacient and vesicating principle of white mustard. *Sinapine* has not yet been isolated, but it is an unstable alkaloid.

A practical application of the principles developed in the foregoing paragraphs has been suggested by M. Lebaigue, who proposes applying to one sheet of paper a concentrated solution of *myronate of potassium*, and to a second a concentrated solution of *myrosin*, and drying them. When used, the leaves are to be moistened and applied to the surface, one over the other. Volatile oil of mustard is formed by the reaction of the two principles, and a sinapism is obtained. (*Journ. de Pharm.*, Août, 1868, p. 118.)

From the foregoing account of the chemical relations of mustard, it is obvious that admixture with alcohol or the acids, or the application of a boiling heat, can only have the effect of impairing its medical virtues, and that the best vehicle, whether for external or internal use, is water at common temperatures.

Off. Prep. Linimentum Sinapis Compositum, *U. S.*

OLEUM SUCCINI. *U. S.* *Oil of Amber.*

(Ō'LẸ-ŬM SỤC-CĪ'NĪ.)

"A volatile oil obtained by the destructive distillation of Amber, and purified by subsequent rectification." *U. S.*

Oleum Succini Rectificatum, *U. S.* 1870; Huile volatile de Succin, *Fr.;* Bernsteinöl, *G.*

Amber is a fossil resin, occurring generally in small detached masses, in alluvial deposits, in different parts of the world. According to Goefert, there are about fifty species of extinct coniferous trees of which amber represents the resinous exudation. It is found chiefly in Prussia, either on the sea-shore, where it is thrown up by the Baltic, or underneath the surface, in the alluvial formations along the coast. It is said that the whole annual product of the Baltic coast of Prussia was in 1879 from 100,000 to 130,000 kilogrammes (100 to 130 tons). Large deposits occur in some lakes on the eastern coast of Courland, and an extensive bed of yellow amber was discovered in 1854, on sinking a well in the coal mines near Prague. The largest mass of amber yet found weighed thirteen pounds. Amber also occurs in considerable quantities near Catania, in Sicily. It is usually associated with lignite, and sometimes encloses insects and parts of vegetables. In the United States, it was found at Cape Sable, Maryland, by Dr. Troost. In this locality it is associated with lignite and iron pyrites. It has also been discovered in New Jersey. The amber consumed in this country is brought from the ports of the Baltic. A mine of it is said to have been discovered near Rockwood in Australia.

It is a brittle solid, generally in small irregular masses, permanent in the air, having a homogeneous texture and vitreous fracture, and susceptible of a fine polish. It becomes negatively electric by friction. Its color is generally brownish yellow, either light or deep, but is occasionally reddish brown or even deep brown, and a Sicilian variety is green or bluish from staining with phosphate of iron. It has no taste, and is inodorous when cold, but exhales a peculiar, aromatic smell when heated. It is usually translucent, though occasionally transparent or opaque. Its sp. gr. is about 1·07. Water and alcohol scarcely act on it. When heated in the open air, it softens, melts at 548°, swells, and at last inflames, leaving, after combustion, a small portion of ashes. Subjected to distillation in a retort furnished with a tubulated receiver, it yields, first, a yellow acid liquor; and afterwards a thin yellowish oil, with a yellow waxy substance, which is deposited in the neck of the retort, and the upper part of the receiver. This waxy substance, exhausted by cold ether of the part soluble in that menstruum, is reduced to a yellow micaceous matter, identical with the *chrysen* of Laurent. A white crystalline substance, identical with the *idrialin* of Dumas, may be separated from the micaceous substance by boiling alcohol. Both chrysen and idrialin are hydrocarbons. (Pelletier and Walter, *Journ. de Pharm.*, v. 60.) As the distillation proceeds, a considerable quantity of combustible gas is given off, which must be allowed to escape. By continuing the heat, the oil gradually deepens in color, until, towards the end of the distillation, it becomes black and of the consistence of pitch. The oil obtained is called *oil of amber*, and the acid liquor is a solution of impure *succinic acid.* Repeatedly distilled from nitric acid, amber yields an acid liquor, from which, after it has been neutralized with caustic potassa, ether separates pure camphor. (Doepping, *Journ. de Pharm.*, vi. 168.) Camphor is also obtained by distilling to dryness powdered amber with an extremely concentrated solution of caustic potassa. (G. Reich, *Ibid.*, xiii. 33.)

According to Berzelius, amber consists of—1, a volatile oil of an agreeable odor in small quantity; 2, a yellow resin, intimately united with a volatile oil, very soluble in alcohol, ether, and the alkalies, easily fusible, and resembling ordinary resins; 3, another resin, also combined with a volatile oil, soluble in ether and the alkalies, sparingly soluble in cold, but more soluble in boiling alcohol; 4, succinic acid; 5, a bituminous principle insoluble in alcohol, ether, and the alkalies, having some analogy to the lac resin of John, and constituting more than four-fifths of the amber. It also contains a strongly odorous, bright yellow substance, which hardens by time, but preserves in part its odor. The ultimate composition of amber is carbon 80·59, hydrogen 7·31, oxygen 6·73, ashes (silica, lime, and alumina) 3·27 = 97·90, representing, after the deduction of the ash, a formula $C_{10}H_{16}O$. A minute proportion of sulphur has also been found among its constituents. (*Journ. de Pharm.*, Mai, 1864, p. 404.)

Amber was held in high estimation by the ancients as a medicine; but at present is employed only in pharmacy and the arts. In pharmacy it is used to prepare oil of amber and succinic acid. In the arts it is made into ornaments, such as beads, and instruments of use, as mouth-pieces, and is employed in preparing varnishes. When put to the latter use it requires to be first subjected to roasting, whereby it is rendered soluble in a mixture of linseed oil and oil of turpentine. This solution forms *amber varnish.*

No directions have been given in the U. S. Pharmacopœia for preparing crude oil of amber since the edition of 1850.* The amber by its destructive distillation affords, among other products, an empyreumatic oil, which floats in the receiver upon the surface of an acid liquor. The heat requisite for the complete decomposition of the amber cannot be supported by a glass retort; and, in order that all the oil which it is capable of yielding may be collected, the distillation should be performed in a tubulated iron or earthenware retort, which may be placed immediately upon the fire. The sand is added to prevent the amber from swelling too much. The oil may be separated from the acid liquor by means of the separating funnel. As first procured, it is a thick, very dark-colored liquid, of a peculiar strong empyreumatic odor. In this state it is occasionally employed as a liniment; but for internal use it should be rectified. It has the composition $C_{10}H_{16}$, but is probably a mixture of hydrocarbons.

Oleum Succini Rectificatum. *Rectified Oil of Amber.* The U. S. P. 1870 gave the following process for its preparation. "Take of Oil of Amber *a pint;* Water *six pints.* Mix them in a glass retort, and distil until four pints of water have passed with the Oil into the receiver; then separate the Oil from the Water, and keep it in a well-stopped bottle." *U. S.* 1870.

By successive distillations oil of amber becomes thinner and more limpid, till at length it is obtained colorless. The first portions which distil are less colored than those which follow, and may be separated for keeping, while the remainder is submitted to another distillation. For practical purposes, however, the oil is sufficiently pure when once redistilled. As usually found in commerce, the rectified oil is of a light yellowish brown or amber color. As first distilled it has an amber color, the sp. gr. 0·903 at 15·6° C. (60° F.), and a boiling point from 170·5° C. to 186·1° C. (339° to 367° F.). (*Ebert.*) When quite pure it is said to be colorless, as fluid as alcohol, of the sp. gr. 0·758 at 23·8° C. (75° F.), and to boil at 85·5° C. (186° F.). It has a strong, peculiar, unpleasant odor, and a hot acrid taste. It imparts these properties in some degree to water, without being perceptibly dissolved. It is soluble in eight parts of alcohol of the sp. gr. 0·847, in five parts of the sp. gr. 0·825, and in all proportions in absolute alcohol, ether, chloroform, bisulphide of carbon, and the fixed oils. (*Ebert.*) On exposure to light and air, it slowly changes in color and consistence, becoming ultimately black and solid. It appears, when quite pure, to be a carbohydrogen, consisting, according to Doepping, of 88·46 parts of carbon and 11·54 of hydrogen in 100. (*Chem. Gaz.*, Nov. 1845, p. 447.) It is said to be sometimes adulterated with oil of turpentine, which may be detected by passing hydrochloric acid gas through the suspected oil. If pure it will remain wholly liquid; while oil of turpentine, if present, will give rise to the formation of solid artificial camphor. (*P. J. Tr.*, xiii. 292.) It is officinally described as "a colorless or pale yellow, thin liquid, becoming darker and thicker by age and exposure to air, having an empyreumatic, balsamic odor, a warm, acrid taste, and a neutral or faintly acid reaction. Sp. gr. about 0·920. It is readily soluble in alcohol. When mixed with fuming nitric acid, it acquires a red color, and, after some time, is almost wholly converted into a brown, resinous mass of a peculiar musk-like odor." *U. S.*

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* *Crude Oil of Amber.* "Take of Amber, in powder, *any quantity.* Put the Amber, previously mixed with an equal weight of sand, into a glass retort, which is to be only half filled; then distil, by means of a sand-bath, with a gradually increasing heat, an acid liquor, an oil, and a concrete acid impregnated with oil. Separate the oil from the other matters, and keep it in well-stopped bottles." *U. S.* 1850.

From a communication by Mr. A. E. Ebert in *A. J. P.* (March, 1866, p. 146), it appears that there is very little genuine oil of amber now to be found in commerce; the substances sold as such being either an oil strongly resembling kerosene, or oil of turpentine holding resin in solution. It would be advisable that the apothecary should either prepare it himself from amber, or obtain it from a chemical manufacturer in whom he has entire confidence.

Medical Properties and Uses. Rectified oil of amber is stimulant and antispasmodic, and occasionally promotes the secretions, particularly that of urine. It has been employed with advantage in amenorrhœa, and in various spasmodic and convulsive affections, as tetanus, epilepsy, hysteria, hooping-cough, and infantile convulsions from intestinal irritation, etc. The dose is from five to fifteen drops (0·3 to 0·9 C.c.), diffused in some aromatic water by means of sugar and gum arabic. Externally applied the oil is rubefacient, and is considerably employed as a liniment in chronic rheumatism and palsy, and in certain spasmodic disorders, as hooping-cough and infantile convulsions. In the latter affection it should be rubbed along the spine, and was highly recommended by the late Dr. Joseph Parrish, mixed with an equal measure of laudanum, and diluted with three or four parts of olive oil and of brandy.

OLEUM TEREBINTHINÆ. *U. S., Br.* *Oil of Turpentine.*

(Ō′LE̩-ŬM TĔR-E̩-BĬN′THI̩-NÆ.)

"A volatile oil distilled from Turpentine." *U. S.* "The oil distilled from the oleoresin (turpentine) obtained from Pinus palustris (*Miller's Dict.*), Pinus Tæda (*Linn.*), and sometimes Pinus Pinaster (*Aiton.*)" *Br.*

Essence de Térébenthine; Huile volatile de Térébenthine, *Fr.;* Terpentinöl, *G.;* Olio della Tremertina, *It.;* Aceyte de Trementina, *Sp.*

This oil is commonly called *spirits* or *spirit of turpentine.* It is prepared by distillation from our common turpentine, though equally afforded by other varieties. It may be distilled either with or without water; but in the latter case a much higher temperature is required, and the product is liable to be empyreumatic. To obtain it quite pure it should be redistilled from a solution of caustic potassa. The turpentine of *Pinus palustris* is said to yield about 17 per cent. of oil; while the common turpentine of Europe affords 24 per cent. Large quantities are distilled in North Carolina for exportation.

Pure oil of turpentine is perfectly limpid and colorless, of a strong, penetrating, peculiar odor, a hot, pungent, bitterish taste, and a neutral or faintly acid reaction. It is much lighter than water, having the sp. gr. 0·855 to 0·870, *U. S.;* is highly volatile and inflammable; boils at a temperature somewhat higher than 148·8° C. (300° F.); is very slightly soluble in water, less soluble in alcohol than most other volatile oils, and readily soluble in ether. Boiling alcohol dissolves it with facility, but deposits most of the oil upon cooling. 100 parts of alcohol sp. gr. 0·840 dissolve 13·5 parts of the oil at 22·2° C. (72° F.). "It is soluble in 6 parts of alcohol. Bromine and powdered iodine act violently upon it. When brought into contact with a mixture of nitric and sulphuric acids, it takes fire." *U. S.* As found in commerce, it always contains oxygen; but, when perfectly pure, it consists exclusively of carbon and hydrogen, and is thought to be isomeric with the radical of camphor. Rectified oil of turpentine, prepared from French turpentine, consists chiefly of a terpene, $C_{10}H_{16}$, known as *terebenthene*, and lævogyrate in character. On the other hand, from English or American oil of turpentine (obtained from *Pinus australis*) is obtained chiefly the terpene, $C_{10}H_{16}$, known as *australene*, which is dextrogyrate. Both boil at about 156° C. (312·8° F.). On heating oil of turpentine to about 300° C. (572° F.) in a sealed tube for several hours it is converted into a polymer called *iso-terebenthene*, $C_{20}H_{32}$, which is so oxidizable that it is converted into a viscid mass on exposure to the air for a few hours. It has, moreover, a marked odor, resembling oil of lemon, and boils at 176° to 177° C. (348·8 to 350·6° F.). On treatment with a small portion of sulphuric acid, oil of turpentine yields an optically inactive liquid, which boils at 160° C. (320° F.). This is a mixture resolvable by repeated fractional distillation into *terebene*, $C_{10}H_{16}$, boiling at 150° C. (302° F.); *cymene*, $C_{10}H_{14}$, boiling at 175° C. (347° F.); a small quantity of a camphor-like body, boiling at 200° C. (392° F.); *colophene*, $C_{20}H_{32}$, boiling at 318° C. (604·4° F.), and a mixture of semi-solid products of higher boiling point. Oil of turpentine absorbs hydrochloric acid gas, forming with it two compounds, one a red dense liquid, the other a white crystalline substance resembling camphor, and hence called *artificial camphor.* Both are *mono-hydrochlorides*, $C_{10}H_{16}.HCl$, but the latter is much more stable, and can be purified by crystallization from alcohol or ether. When turpentine oil is left in contact with concentrated hydrochloric acid a *dihydrochloride* is formed, $C_{10}H_{16}.2HCl$. This forms rhombic plates, insoluble in water and decomposed by boiling with alcoholic potash with formation of *terpinol* $(C_{10}H_{16})_2.H_2O$. (*Allen's Com. Org. Analysis*, vol. ii. p. 51.) Nitric acid converts oil of turpentine into resin, and by long boiling into *terebic acid*, $C_7H_{10}O_4$. Mixed with water and chloride of lime, and then distilled, the oil yields a liquid which M. Chautard found to be identical with chloroform. (*Ibid.*, 3e sér., xxi. 88.) On exposure to air and light, it deposits white acicular crystals, which are without taste or smell, insoluble in cold water, but soluble in ether and alcohol. (Boissenot, *Journ. de Chim. Méd.*, ii. 143.) White crystals of stearoptene, heavier than water and fusible at 6.6° C. (20° F.), separate from the oil at the temperature of 18° below zero, F. These are probably a hydrate of the oil. The hydrate may be produced by exposing on a plate four volumes of the oil recently distilled, three of alcohol, and one of nitric acid. Crystals form at the end of a week or more, having the composition $C_{10}H_{20}O_2.H_2O$. This happens though the oil may be mixed with others, and may serve to detect adulterations with it of oils which do not have the same composition. (Berthelot, *Journ. de Pharm. et de Chim.*, xxviii. 451.) The name of *terpin* has been given to this crystalline hydrated oil of turpentine; and similar crystals, if not identically the same in character, have been taken from the interior of an old pine log, where they were probably formed from the oil remaining in the structure of the wood. (John M. Blake, *Am. Journ. of Sciences and Arts*, 1867, xliii. 202.) Oil of turpentine may be made to yield cymene identical with that existing in the oil of cummin, and with that obtained by dehydrating camphor. (See *Cumin Seed*, in Part II.)

Exposed to the air the oil absorbs oxygen, becomes thicker and yellowish, and loses much of its activity, owing to the formation of resin. A small proportion of formic acid is said also to be generated. Hence the Edinburgh College directed the oil to be rectified by distilling it with about four measures of water. But the process is difficult in consequence of the great inflammability of the vapor, and its rapid formation, which causes the liquid to boil over. In this country it is scarcely necessary; as the recent oil can be obtained at an expense less than that which would be incurred by redistillation on a small scale. Another mode of purifying the oil is to agitate it with one-eighth of alcohol, which dissolves the resinous portion. About one-fifth of the alcohol is retained by the oil, but is readily separated by agitation with water.

Berthelot has shown that oil of turpentine has, under certain conditions, the power, while undergoing oxidation itself, of causing the oxidation of other bodies, to which it imparts a portion of the oxygen absorbed from the air. All that is necessary to give this power to the oil is that, soon after distillation, it should be exposed to the air, as in a bottle half filled. Solar light assists, but is not essential to, the change, which goes on even in the dark. The oil retains the property thus acquired indefinitely, but may be deprived of it by exposure to a boiling heat, or by agitation with certain other substances, as pyrogallate of potassium. No other chemical or physical change can be detected in the oil. (*Journ. de Pharm.*, Mai, 1860, p. 351.)

In this country, the oil of turpentine, though often more or less impure from the presence of resin, is probably not often adulterated. An instance, however, has been put on record, in which a sample of the oil, having a pale green color, was found to contain copper. This was easily separated by shaking the oil with a little saturated solution of ferrocyanide of potassium, and allowing it to stand for two or three days to settle. (C. Lewis Diehl, *A. J. P.*, 1867, p. 386.)

The several species of pine indigenous to California and the slopes of the Sierra Nevada appear to yield quite different products. Wenzell (*A. J. P.*, March, 1872) described, under the name of *abietene*, an oil distilled from the exudation of the *Pinus Sabiniana* (*Nut-Pine* or *Digger-Pine*). He found it to have a sp.gr. ·694, and a boiling point 101° C. (213·8° F.). Sadtler (*A. J. P.*, April, 1879, p. 176) examined an oil of turpentine from California said to have been obtained from the *Pinus ponderosa* (*Heavy Pine*), and found it to agree with Wenzell's abietene substantially. It had a sp. gr. at 16·5° C. (62° F.) of ·6974, boiled at 101° C. (213·8° F.), and was slightly lævogyrate. It gave negative results when treated with hydrochloric acid for the formation of a hydrochloride, did not form a hydrate, was not acted upon by sulphuric acid or by nitrosyl chloride. Thorpe asserts (*A. J. P.*, 1879, p. 293) that this exudation of the California pine is almost pure *heptane*, C_7H_{16}, one of the chief constituents of American petroleum.

Medical Properties and Uses. Oil of turpentine is stimulant, diuretic, occasionally diaphoretic, anthelmintic, in large doses cathartic, and externally rubefacient. Swallowed in moderate quantities it produces a sense of warmth in the stomach, accelerates the circulation, and increases the heat of the skin, without especially affecting the functions of the brain. In small doses, frequently repeated, it stimulates the kidneys, augmenting the secretion of urine, and often producing, especially if long continued, painful irritation of the urinary passages, amounting sometimes to violent strangury. At the same time it imparts the odor of violets to the urine; and this effect is also produced by its external application, or even by breathing the air of an apartment impregnated with its vapors. In large doses it occasions slight vertigo, or a sense of fulness in the head, sometimes amounting to intoxication, attended frequently with nausea, and succeeded generally, though not always, by speedy and brisk catharsis. When this effect is experienced, the oil is carried out of the bowels, and, no time being allowed for absorption, is less apt to irritate the kidneys and bladder than in small and repeated doses. In some constitutions it produces, even when taken internally, an erythematic eruption on the skin. Persons who inhale its vapor are liable to strangury and even bloody urine. Hæmaturia is sometimes caused in seamen on board vessels loaded with turpentine. A case is on record in which a woman was found dead after having swallowed a large quantity of the oil, probably about six ounces. The muscles were in a state of rigid contraction; the brain and spinal marrow greatly congested; the lungs and right cavities of the heart gorged with blood. (*Am. Journ. of Med. Sci.*, Oct. 1858, p. 562.)

The oil is employed in numerous diseases. As a stimulant it sometimes proves serviceable in low forms of fever. We have found it extremely useful in the advanced stage of typhoid or enteric fever; and especially in cases in which the tongue has partially or completely thrown off its fur in flakes, and afterwards become dry, with a surface destitute of its ordinary papillary appearance, and often contracted and fissured. The remedy has, in our hands, proved almost uniformly successful under these circumstances. With small doses of the oil frequently repeated, the tongue becomes moist and again coated, the tympanitic state of the bowels disappears, and the patient goes on to recover as in a favorable case of fever. Its efficiency, however, in typhoid fever, is ascribable not so much to its stimulant properties, as to an alterative influence upon the ulcerated surface of the bowels characteristic of that disease. In chronic rheumatism, particularly sciatica and lumbago, the oil has often been given with great benefit. It has also been much extolled as a remedy in some forms of puerperal fever, in neuralgia, in passive hemorrhages, particularly from the bowels, in disordered conditions of the alimentary canal attended with sallow countenance, foul tongue, tumid abdomen, sour or fetid eructations, and general depravation of health, in chronic dysentery and diarrhœa, in obstinate gleets and leucorrhœa, and retention and incontinence of urine from debility, in chronic nephritic and calculous affections, and in various conditions of hooping-cough. In certain cases of dysentery, whether acute or chronic, when the tongue is quite dry, and smooth as if from defect of the papillary structure, no remedy has proved so efficient in our hands as oil of turpentine. We have seen it also very beneficial in hæmoptysis. As a vermifuge it is highly esteemed, especially in cases of tænia. It appears to destroy or debilitate the worm, which, losing its hold upon the bowels, is then easily discharged. In cases of worms in the stomach it is very useful. The worms, in this instance, are destroyed, and then digested as any other animal matter. In dropsies with feeble action the oil may sometimes be advantageously given as a diuretic; and in amenorrhœa from torpor of the uterine vessels it is occasionally useful. (*A. J. P.*, March, 1869, p. 176.)

The dose for ordinary purposes is from five to thirty drops (0·3 to 1 9 C.c.), repeated every hour or two in acute, and three or four times a day in chronic diseases. In rheumatism it is recommended by some in the dose of a fluidrachm (3·75 C.c.) every four hours. As a remedy for the tape-worm it is given in the quantity of half to one fluidounce, and should be followed by castor oil if it do not operate in three or four hours. It has also proved successful in tænia in the dose of half a drachm (1·9 C.c.), twice a day, continued for a considerable time. In ordinary cases of worms, the usual dose may be given. It may be administered on sugar, or in emulsion with gum arabic, loaf sugar, and cinnamon or mint-water. As to some its taste is very disagreeable, the form of capsules or pills has been recommended.*

In the form of enema, the oil is highly useful in cases of ascarides, obstinate constipation, and distention of the bowels from accumulation of air. No remedy is more effectual in tympanites than injections of oil of turpentine. From half a fluidounce to two fluidounces (15 to 60 C.c.) may be administered, suspended by the yolk of eggs in half a pint or a pint of water, or some mucilaginous fluid.

Externally applied, oil of turpentine irritates and speedily inflames the skin, and is one of the most efficacious rubefacients; and is used in rheumatic affections, and various internal inflammations. When only a slight impression is desired, it may be diluted with olive oil; but in some constitutions, even in this state, it produces such violent inflammation of the skin, with extensive eruptions, as to render its external use in any shape improper. Mixed with some mild oil, and introduced on cotton into the ear, it is sometimes beneficial in deafness arising from a deficient or unhealthy secretion of wax. Applied to recent burns, it is thought by some to be highly useful in allaying the burning pain and promoting a disposition to heal. For this purpose, however, it is usually mixed with resin cerate (*basilicon ointment*), so as to form a liniment capable of being spread upon linen rags. (See *Linimentum Terebinthinæ.*)* The oil has been recommended also in anthrax and erysipelas. M. Beullard has found it useful in eczema, applied directly to the affected part. It causes immediately severe pain and much swelling, and in a few minutes must be removed, and followed by cooling and demulcent measures. A modification of the disease is thus produced, which renders ordinary applications successful that had been previously useless. (*Ann. de Thérap.*, 1865, p. 138.) It is thought by Profs. Von Erlach and Lucke, of Berne, to be peculiarly efficacious in parasitic affections of the scalp, by destroying the parasites and preventing the development of the spores. (*Am. Journ. of Med. Sci.*, July, 1869, p. 248.)

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* It has been objected to the form of capsule, that, in consequence of the breaking of its coating, the oil may come undiluted in contact with the mucous membrane, and thus produce undue irritation. M. Lacambre gives the following process for making a pill of the oil. Take of oil of turpentine 8 grammes, white wax 20 ditto, powdered sugar 9 ditto, oil of lemon 2 drops. Melt the wax in the oil of turpentine, pour into a mortar, allow to cool, then add the sugar, and form a mass to be divided into pills of 25 centigrammes (3 or 4 grs.) each. Roll them in powdered starch, and keep in a well-stopped bottle. (*Journ. de Pharm.*, Sept. 1873, p. 223.)

Oil of turpentine has been recommended in the form of bath, in affections in which its constitutional impression is desired. For this purpose Dr. T. Smith, of Cheltenham, England, employs from five to ten fluidounces of the oil, with half a fluidounce of the oil of rosemary, and two pounds of carbonate of sodium, in each bath. The breath becomes strongly impregnated with the terebinthinate odor. (*Braithwaite's Retrospect*, xxi. 355.) Applied in vapor, the oil is said to be a very speedy cure for the itch. The bed- and night-clothes are sprinkled with thirteen drachms of the oil, and the patient finds himself cured on awaking in the morning. (*Am. Journ. of Med. Sci.*, July, 1857, p. 232.) Baths of the vapor of turpentine are stated to be very beneficial in chronic rheumatism. They are said to be borne well, for twenty-five minutes, at a temperature from 60° C. to 71·1° C. (140° F. to 160° F.). (*Arch. Gén.*, 4e sér., xxviii. 80.) Inhalation of the vapor has been recommended by Skoda in gangrene of the lungs.

Off. Prep. Confectio Terebinthinæ, *Br.;* Enema Terebinthinæ, *Br.;* Linimentum Cantharidis, *U. S.;* Linimentum Terebinthinæ; Linimentum Terebinthinæ Aceticum, *Br.;* Unguentum Terebinthinæ, *Br.*

OLEUM THEOBROMÆ. *U. S., Br.* *Oil of Theobroma.* [*Butter of Cacao.*]

(Ō′LẸ-ŬM THĒ-Ọ-BRŌ′MÆ.)

"A fixed oil expressed from the seed of Theobroma Cacao. Linné. (*Nat. Ord.* Sterculiaceæ.)" *U. S.* "A concrete oil obtained by expression and heat from the ground seeds of Theobroma Cacao. Linn." *Br.*

Oleum (Butyrum) Cacao, *P.G.;* Beurre de Cacao, *Fr.;* Kakaobutter, *G.*

Gen. Ch. *Calyx* sepalled. *Petals* five, vaulted at the base, ligulate above. *Stamens* fifteen, connected into an urceolus at the base; sterile filaments five, alternate with the petals; fertile ones short, united into five filaments, each opposite to a petal and bearing two anthers. *Style* five-cleft at the apex. *Stigmas* simple. *Fruit* indehiscent, five-celled. *Seeds* embedded in a buttery pulp.

Theobroma Cacao. Linn. *Sp. Plant.* 1100; Hayne, *Darstel. und Beschreib., etc.*, ix. 35; *B. & T.* 38. This is a handsome tree, from twelve to twenty feet in height, growing in Mexico, the West Indies, and South America, in some parts of which it is largely cultivated, particularly in Guayaquil and Venezuela. The fruit is an oblong-ovate capsule or berry, six or eight inches in length, with a thick, coriaceous, somewhat ligneous rind, enclosing a whitish pulp, in which numerous seeds are embedded. These are ovate, somewhat compressed, about as large as an almond, and consist of an exterior thin shell, and a brown oily kernel. Separated from the matter in which they are enveloped, they constitute the *cacao*, or *chocolate nuts* of commerce. They have a slightly aromatic, bitterish, oily taste, and, when bruised or heated, an agreeable odor. Analyzed by Mitscherlich, they were found to contain, in 100 parts, from 45 to 49 of fixed oil (*cacao butter*), 14 to 18 of starch, 0·34 of glucose, 0·26 of cane sugar, 5·8 of cellulose, 3·5 to 5 of coloring matter, 13 to 18 of albuminoid matter, 1·2 to 1·5 of theobromine, 5·6 to 6·3 of water, with 3·5 of ashes. The coloring matter is probably the result of chemical change, as the fresh seeds are white. Theobromine has been found also in the shells in the proportion of about 1 per cent. (*A. J. P.*, 1862, p. 509.) The latter impart to boiling water a taste analogous to that of chocolate, but weaker, and are used for making a table beverage.

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* The following is the formula adopted by the Philadelphia College of Pharmacy for the rubefacient liniment known as *British Oil.* ℞. Olei Terebinth. f℥viij, Olei Lini f℥viij, Olei Succini f℥iv, Olei Juniperi f℥iv, Petrolei Barbadensis f℥iij, Petrolei Americani (crude petroleum) f℥j. M.

Theobromine was discovered by M. Woskresensky, who obtained it in the following method. The kernels are exhausted with water by means of the water-bath; the solution is strained through linen, precipitated by acetate of lead, and filtered; the filtered liquor is freed from lead by sulphuretted hydrogen, and evaporated; the brown residue is treated with boiling alcohol, and the liquor filtered while hot. Upon cooling, the theobromine is deposited in the form of a reddish white powder, which is rendered colorless by repeated crystallization. Keller obtained it still purer by heating the powder between two watch-glasses, by which a brilliant white sublimate was obtained. According to O. Donker and C. Treumann, theobromine is contained not only in the cotyledons, but also in the shells of the cacao seeds. Four kilos. of the latter yielded 13·5 Gm. of pure theobromine. (*Archiv der Pharmacie*, July, 1878.) Theobromine is a crystallizable alkaloid, capable of forming salts with the acids, very bitter, volatilizable without change, freely soluble in hot alcohol, sparingly so in hot water, and is very simply related to caffeine, this latter being the methyl derivative of theobromine. Its formula is $C_7H_8N_4O_2$. It has been converted into caffeine by Strecker, and quite recently E. Fischer (*Ber. Chem. Ges.*, 1882, p. 453) has obtained it from xanthine, $C_5H_4N_4O_2$, which is easily obtained from the guanine of guano, $C_5H_5N_5O$, by the action of nitrous acid. In the *Edinb. Med. Journal* (Oct. 1873), theobromine is said to be identical in effects on the system with caffeine or theine. (*N. R.*, 1874, p. 8.)

Chocolate is differently prepared in different countries. In Great Britain and the United States, it usually consists, when pure, exclusively of the kernel of the cacao or chocolate nuts, which are first roasted, then deprived of their shell, and lastly reduced, by grinding between heated stones, to a paste, which is moulded into oblong cakes. Not unfrequently rice flour or other farinaceous substance, with butter or lard, is added; but these must be considered as adulterations. On the continent of Europe, sugar is generally incorporated with the paste, and spices, especially cinnamon, are often added. Vanilla is a favorite addition in South America, France, and Spain. Cacao, called *cocoa*, is often sold in powder, which is sometimes mingled with other ingredients, such as ground rice, barley, flour, sugar, etc. Chocolate is prepared for use by reducing it to powder, and boiling it in milk, water, or a mixture of these fluids. In this state it is much employed as a drink at breakfast and tea, and serves as a substitute for coffee in dyspepsia. It is also a good article of diet for convalescents, and may sometimes be given advantageously as a mild nutritive drink in acute diseases.

Oil of Theobroma. Cacao Butter. This is the fixed oil of the chocolate nut. It is extracted either by expression, decoction, or the action of a solvent. Soubeiran recommends that the seeds, previously ground, be mixed with one-tenth of their weight of water, and then pressed between hot plates of tinned iron. It is advisable that the heat should not exceed that of boiling water, and even a lower heat will answer. When the method of decoction is used, the cacao should be slightly roasted before boiling. As a solvent, bisulphide of carbon has been found to answer well, as recommended in the preparation of the expressed oil of nutmeg. (See *Oleum Myristicæ.*) Upon the whole, the method of expression is perhaps preferable. The presence of water in the ground seeds is said greatly to facilitate the process. The expressed oil, which is now made in Philadelphia, occurs in the shape of oblong cakes, like those of chocolate, weighing about half a pound each. It is "a yellowish white solid, having a faint, agreeable odor, a bland chocolate-like taste, and a neutral reaction. It melts between 30° and 35° C. (86° to 95° F.). If 2 parts of Oil of Theobroma be dissolved in 4 parts of ether, in a test-tube, by immersing the tube in water of 17° C. (63° F.), and if this be afterward plunged into water of 0° C. (32° F.), the mixture should not become turbid, nor separate a granular deposit in less than three minutes; and if the mixture, after congealing, be exposed to a temperature of 15° C. (59° F.), it should gradually become entirely clear (abs. of paraffin, wax, stearin, tallow, etc.)." *U. S.* It was analyzed by Specht and Gössman, who found it to consist of stearin, palmitin, and olein, with the glyceride probably of *arachic acid*, $C_{20}C_{40}O_2$, or, as suggested by Kingzett, *theobromic acid*, $C_{64}H_{128}O_2$. From its large proportion of stearin, it is one of the best fats for the preparation of stearic acid. (*Chem. Gaz.*, Aug. 15, 1854, p. 306.) It is said to be frequently adulterated with animal fats, which, according to Mr. E. Lamhofer, may be detected by attention to the fact that pure cacao butter dissolves entirely in ether or benzin, separating out in minute granular crystals when immersed in water of 0° C. (32° F.), the liquid portion remaining transparent for 30 or 40 minutes, when the whole solidifies. After solidification, if the oil is kept at a temperature of about 14·4° C. (58° F.), it redissolves without turbidity. (*A. J. P.*, 1877, p. 238.) Mr. G. Ramsperger concludes, as the result of much experimentation, that ether affords the best test of purity. Dissolving the suspected cacao butter in 2 parts of ether, if it becomes turbid after standing, or forms on spontaneous evaporation little crystals or grains not soluble in 2 parts of ether at common temperature, it is impure.

Butter of cacao is used as an ingredient in cosmetic ointments, and in pharmacy for coating pills and preparing suppositories. For the last purpose it is well adapted by its consistence and blandness, and is now largely consumed. It was, indeed, on this account chiefly that it was introduced into the U. S. Pharmacopœia of 1860.* F. Bringhurst prepared a lip salve by melting together 28 ounces of cacao butter, 4 ounces of yellow wax, and a drachm, each, of balsam of Peru and benzoic acid, straining, adding perfuming oils, as those of rose, bergamot, and bitter almonds, in sufficient quantity, and finally, when nearly cool, an ounce of glycerin. (*A. J. P.*, July, 1867, p. 348.)

Off. Prep. Suppositoria Hydrargyri, *Br.;* Suppositoria Plumbi Composita, *Br.*

OLEUM THYMI. *U. S.* *Oil of Thyme.*

(Ō′LE̦-ŬM THȲ′MĪ.)

"A volatile oil distilled from Thymus vulgaris. Linné. (*Nat. Ord.* Labiatæ.)" *U. S.*

Essence de Thym, *Fr.;* Thymianöl, *G.*

In the south of France thyme grows wild in great abundance, and is largely collected for distillation. The oil is taken from France to England, and thence reaches this country under the name of *oil of origanum*, having, probably from its greater cheapness, been substituted for the genuine oil. For all the purposes for which oil of origanum was used, that of thyme is not less useful, and it is more agreeable.

Thymus vulgaris is a very common plant, indigenous in the south of France, and cultivated in our gardens. It is a labiate plant, and characterized as a genus by its subcampanulate calyx, having its throat closed with hairs, and its corolla with the upper lip flat and emarginate, and a longer lower lip. It is a low under-shrub, procumbent at the base, with ovate-linear, revolute leaves, and flowers in a whorled spike. The herbaceous portion, which should be gathered when the plant is in flower, has a peculiar, strong, aromatic, agreeable odor, not lost by drying, and a pungent, aromatic, camphorous taste. Its active constituent is the volatile oil, which is obtained separate by distillation with water.

The oil, as prepared in the south of France, is, after one distillation, of a reddish brown color, and called the *red oil*, but when again distilled is colorless, and in this condition is distinguished as the *white oil*. It is officinally described as "a colorless or pale yellow, thin liquid, becoming darker and thicker by age and exposure to air, having a strong odor of thyme, a warm, pungent, and afterward cooling taste, and a neutral reaction. Sp. gr. about 0·880. It is readily soluble in alcohol." *U. S.* According to Zeller, one pound of the fresh herb yields 45·7 grains of the oil, of the dried herb 38 grains. The oil, as found in commerce, is of a reddish brown color, and of an odor recalling that of thyme, but less agreeable. Its sp. gr. is stated at 0·905, but probably varies, as the oil is a complex body. The more volatile portion, that coming over below 180° C. (356° F.) in distillation, is a mixture of *cymene*, $C_{10}H_{14}$, boiling at 175° C. (347° F.), and *thymene*, $C_{10}H_{16}$, boiling at 165° C. (329° F.). The less volatile portion is chiefly *thymol*, $C_{10}H_{14}O$, a white crystalline solid, melting at 44° C. (111·2° F.), and possessing a pungent taste. (See *Thymol.*)

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* *Mafurra Tallow.* This is a fatty matter obtained from the fruit of a tree growing in Mozambique, and the Isles of Madagascar and Bourbon, and bearing a close resemblance in qualities to cacao butter. The kernel of the fruit is described as of the size of the cacao bean, having the same characteristic odor when bruised, and a bitter taste. The fatty matter is extracted by boiling the kernels in water. It is of a firm solid consistence, less fusible than tallow, of a yellowish color, and the odor of cacao butter. It agrees, moreover, with that substance in containing olein and palmitin, and yields palmitic acid largely when saponified. (*A. J. P.*, xxviii. 163.)

OLEUM TIGLII. *U.S.* *Croton Oil.*

(Ō′LẸ-ŬM TĬG′LỊ-Ī.)

"A fixed oil expressed from the seed of Croton Tiglium. Linné. (*Nat. Ord.* Euphorbiaceæ.)" *U. S.* "The oil expressed from the seeds of Croton Tiglium. Linn." *Br.*

Oleum Crotonis, *Br.;* Huile de Croton, Huile de Graines de Tilly, *Fr.;* Crotonöl, *G.;* Nervalum unnay, *Tamool.*

Croton Tiglium. Willd. *Sp. Plant.* iv. 543; *B. & T.* 239. This species of Croton is a small tree or shrub, with a few spreading branches, bearing alternate petiolate leaves, which are ovate, acuminate, serrate, smooth, of a dark green color on the upper surface, paler beneath, and furnished with two glands at the base. The flowers are in erect terminal racemes, scarcely as long as the leaf; the lower being female, the upper male, with straw-colored petals. The fruit is a smooth capsule, about the size of a filbert, with three cells, each containing a single seed.

The tree is a native of Hindostan, Ceylon, the Moluccas, and other parts of India. It is pervaded by an acrid purgative principle, probably analogous to that found in other plants belonging to the family of Euphorbiaceæ. Rumphius says that the root is employed in Amboyna, in the dose of a few grains, as a drastic purge in dropsy; and, according to the same author, the leaves are so acrid that, when chewed and swallowed, they excite inflammation in the lips, mouth, and throat, and along the whole course of the alimentary canal. The wood is said in small doses to be diaphoretic, in larger, purgative and emetic. But the seeds are the most active part. These have been long used in India as a powerful purgative, and were employed so early as 1630 in Europe, under the names of *grana Molucca* and *grana tiglia.* But in consequence of their violent effects they fell into neglect, and had ceased to be ranked among medicines, when, at a comparatively recent period, attention was again called to them by the writings of some English physicians in India. They are now imported for their oil, which is the only product of the plant considered officinal.

These seeds are rather larger than a grain of coffee, oblong, rounded at the extremities, with two faces, the external considerably more convex than the internal, separated from each other by longitudinal ridges, and each divided by a similar longitudinal ridge, so that the whole seed presents an irrregular quadrangular figure. Sometimes, as in the coffee grain, their internal surface is flat with a longitudinal groove, owing to the presence of only two seeds in the capsule, the groove being produced by the central column or axis. The shell is covered with a soft, yellowish brown epidermis, beneath which the surface is black and smooth; and, as the epidermis is often partially removed by friction during their carriage, the seeds as they come to us are frequently mottled, and sometimes nearly black. The kernel or nucleus is yellowish brown, and abounds in oil. In India the seeds are prepared for use by submitting them to slight torrefaction, by which the shell is rendered more easily separable. In the dose of one or two grains (·065 or 0·13 Gm.) the kernel purges severely.

The oil is obtained by expression from the seeds, previously deprived of the shell. It may also be separated by decoction in water, or by the action of ether, or bisulphide of carbon, which dissolves the oil, and leaves it behind when evaporated.*

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* *Extraction by ether.* Having washed and dried the seeds, grind them in a coffee-mill, and form a soft paste with ether. Introduce this into a narrow percolation tube, and gradually pour ether upon it until exhausted. Evaporate the ether by means of a water-bath, and filter the remaining oil through paper. (*Journ. de Pharm.*, Août, 1862, p. 116.)

Extraction with bisulphide of carbon. The seeds, well bruised, are introduced into a bottle with

Guibourt recommends, after the first expression, to digest the residue with alcohol at a temperature of 48·8° to 60° C. (120° to 140° F.), and then submit it to a new expression. The alcohol is to be separated by distillation from the oil, which is then to be mixed with the first product. According to Dr. Nimmo, the seeds consist of 64 per cent. of kernel and 36 of envelope. From the seeds imported into England, about 22 per cent. of oil is obtained by simple expression. Guibourt, by his process, obtained 52 per cent. from the kernels, equivalent to about 35 from the seeds. Croton oil consists chiefly of the glycerides of stearic, palmitic, myristic, and lauric acids. There are also present, in the form of glycerin ethers, the more volatile acids, as formic, acetic, isobutyric, and one of the valerianic acids. The volatile part of the acid yielded by croton oil contains, moreover, a peculiar acid, named by Geuther and Fröhlich *tiglinic acid*, $C_5H_8O_2$. It is isomeric with angelic acid, but the melting points (angelic acid 45° C., tiglinic acid 64° C.) and the boiling points (angelic acid 185° C., tiglinic acid 198·5° C.) differ. *Crotonic acid*, $C_4H_6O_2$, was thought by Schlippe to be present, but later investigation does not confirm the statement. *Crotonol*, announced by Schlippe as the vesicating principle of the oil, has likewise been found only by the discoverer.*

Properties. Croton oil, as found in the shops, varies from a pale yellow to a dark reddish brown. That imported from India is usually pale, that expressed in Europe dark, like the deepest-colored sherry. Its consistence is rather viscid, and is increased by time. Its smell is faint, but peculiar, its taste hot and acrid, leaving in the mouth a disagreeable sensation which continues for many hours. "Sp. gr. 0·940 to 0·955. When fresh, it is soluble in about 60 parts of alcohol, the solubility and therapeutic activity increasing by age. It is freely soluble in ether, chloroform, or disulphide of carbon." *U. S.* The oil is wholly soluble in ether and oil of turpentine. Its relations to pure alcohol differ somewhat with the variety of the oil. That obtained by expression in England was formerly wholly and readily soluble, but according to Mr. Harold Senier, the croton oil now produced acts towards alcohol as do foreign oils (*P. J. Tr.*, 3d ser., xiv. 704), forming a solution which is permanent at ordinary temperatures; while the India or pale oil forms an opaque mixture, which becomes clear and uniform upon being heated, but separates on standing into two portions, one consisting of alcohol somewhat diminished in bulk, the other of the oil correspondingly increased in bulk by retaining a portion of the alcohol. It is possible that the difference in color, and in their relations to alcohol, between the India and English oils, may be owing to a change in the kernels from being kept. Some croton oil examined by M. Dublanc, of Paris, when agitated with ten times its weight of alcohol, was separated into two parts, one of which, amounting to 6 per cent., was dissolved by the alcohol, the other remained undissolved, but retained 50 per cent. of alcohol. The latter, upon being repeatedly treated with alcohol, lost all its acrimony; while the portion dissolved was extremely acrid. From these observations it would appear that the acrid and probably active principle of the oil is dissolved by alcohol; while a bland fixed oil, which constitutes the chief part of it, is not taken up by that liquid. It is thought that croton oil is often adulterated with other fixed oils. In the Br. Pharmacopœia of 1864, it was given as a test of the purity of the oil expressed from the imported seeds, that when agitated with an equal volume of alcohol and gently heated, it forms a clear solution, from which about three-fourths of the oil separates on cooling; but the statement is asserted to be untrue of the English expressed oil, though correct of the imported. The test was intended to detect the presence of

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three times their weight of bisulphide of carbon well rectified; the mixture is allowed to stand, with frequent agitation, for 24 hours; the whole is then poured upon a cloth and rapidly expressed. The residue is similarly treated with twice its weight of the bisulphide, and expressed, after standing as before. The products of the two macerations are mixed, then filtered in a covered funnel, and finally submitted to distillation, by means of a water-bath, in a glass retort, at the temperature of 71·1° or 76·6° C. (160° or 170° F.). The bisulphide should be recovered by condensing its vapor in a refrigerated receiver. The oil is to be poured into a capsule, to show that it contains none of the bisulphide, and then introduced into a bottle. (*Journ. de Pharm.*, 3e sér., xxxi. 28.)

* Prof. Tuson believes that he has obtained from croton seeds a peculiar alkaloid, analogous to cascarillin, by the same process as that which he used for ricinine from the castor-bean. But further experiments are required for satisfactory results. (*A. J. P.*, 1864, p. 418.)

castor oil, which would be dissolved by the alcohol, and thus occasion a diminution of the bulk. It has been omitted in the present Pharmacopœia.*

According to the late Dr. M. Burrough, who was for some time in India, much of the oil there prepared is derived from the seeds of *Jatropha Curcas*, or *Curcas Purgans*, the so-called *Barbadoes nuts.* This oil, though weaker than the genuine, was said by Dr. Burrough to be an efficient cathartic in the dose of three or four drops (0·18 or 0·24 C.c.). Dr. Hamilton states that croton seeds are afforded by *Croton pavana*, growing in Ava and the eastern parts of Bengal; and it is probable that a portion of the croton oil of commerce is obtained from these seeds. (*Trans. Linn. Soc.*, xiv. 257.) These facts may explain some of the discrepancies in reference to the effects of alcohol above mentioned.

Medical Properties and Uses. Croton oil is a powerful drastic purgative, in large doses apt to excite vomiting and severe griping pains, and capable, if immoderately taken, of producing fatal effects. It acts with great rapidity, frequently evacuating the bowels in less than an hour, and generally exciting a rumbling sensation in half that period. It possesses also great advantage in the minuteness of the dose, on account of which it may frequently be given when we should fail with more bulky medicines; as in mania, coma, and the cases of children. A drop placed on the tongue of a comatose patient will generally operate. Though long used in India, and known for two centuries to the Dutch physicians, it did not attract general notice till about 1820, when it was introduced into England by Mr. Conwell. It is chiefly employed in cases of obstinate constipation, in which it often produces the happiest effects after the failure of other medicines; but it may also be advantageously used in almost all cases in which powerful and speedy purging is demanded, especially where an irritation of the gastric mucous membrane and a derivative action are desired. The seeds are said to have been used with great success in India in amenorrhœa. Applied externally, the oil produces inflammation of the skin, attended with pustular eruption, and has been used in this way in rheumatism, gout, neuralgia, glandular and other indolent swellings, and in laryngeal and pulmonary diseases. It should be diluted with three parts of olive oil, soap liniment, oil of turpentine, or other convenient vehicle, and applied as a liniment twice or oftener in twenty-four hours. Sometimes the insusceptibility of the skin is such as to require its application undiluted. The oil may also be applied externally, in the form of a plaster, made by incorporating one part of it with four parts of lead plaster, melted by a very gentle heat. Sometimes it appears to produce inflammation in parts distant from those to which it was directly applied. It has been said that four drops, used externally by friction around the umbilicus, will produce a purgative effect, but this is denied by Dr. Barlai, of Tuscany, who states that it is only when the oil is applied to the skin divested of the cuticle that it will operate upon the bowels. Nævus has been cured by the introduction of croton oil into the little tumor by means of needles.†

The dose for an adult is one or two drops (0·06 or 0·12 C.c.), and is most conveniently administered in the form of pill. A safe and convenient plan is to make two drops into four pills with crumb of bread, and to give one every hour till they operate. The oil may also be given in emulsion. The form of tincture may be advantageously resorted to when a minute quantity of the medicine is required; as it affords the means of readily dividing the dose.

Off. Prep. Linimentum Crotonis, *Br.*

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* Prof. Maisch detects croton oil in any mixture by the following plan. The suspected oil is agitated with an alcoholic solution of soda or potassa, and the solution, having been separated, is then saturated with hydrochloric or sulphuric acid. If croton oil be present, its acrid principle, crotonol, will rise to the surface in the form of an oil, which, when applied to the skin, will produce in three or four hours not only inflammation, but also the peculiar eruptive affection excited by croton oil. (*A. J. P.*, 1860, p. 307.)

† *Croton Oil Crayons.* In order to prevent the spreading of croton oil beyond the limits intended, Limousin prepared crayons by melting 1 part each of cacao butter and white wax in a small glass flask, and then adding 2 parts of croton oil, taking care to close the orifice of the flask at once with a cork. When the mixture begins to get thick, it is poured into cylindrical moulds, where it speedily solidifies. These crayons may be made of a thickness of about 8 or 9 millimetres (⅓ inch), and may be covered with tin foil. (*N. R.*, May, 1877.)

OLEUM VALERIANÆ. *U.S.* *Oil of Valerian.*

(Ō'LE̤-ŬM VA̤-LĒ-RI̤-Ā'NÆ.)

Essence de Valériane, *Fr.;* Baldrianöl, *G.*

This volatile oil is obtained from the root of *Valeriana officinalis* by the usual process of distillation with water. According to Zeller, the dried root of the best quality yields 1·64 per cent. of the oil. Very good oil has been distilled from the root cultivated in this country. As first procured, it is of a pale greenish color, of the sp. gr. 0·934, with a pungent odor of valerian, and an aromatic taste. Upon exposure, it becomes yellow and viscid. "A slightly acid reaction. Sp. gr. about 0·950. It is readily soluble in alcohol." *U. S.* It is a complex substance, containing—1, a hydrocarbon, $C_{10}H_{16}$, isomeric with pure oil of turpentine; 2, a liquid compound, $C_{10}H_{18}O$, which by means of chromic acid affords common camphor and formic, acetic, and valerianic acids, which are met with in old valerian root, owing no doubt to the slow oxidation of the compound $C_{10}H_{18}O$; 3, a crystallizable compound of the same composition, probably *borneol* (from *Dryobalanops aromatica*). This substance seems to be of alcoholic nature, being combined in the root with the three organic acids mentioned under 2. On distilling, these compound ethers are resolved partly into the alcohol, $C_{10}H_{18}O$ (borneol), and the acids. Addition of alkaline water during maceration and after addition of a slight excess of sulphuric acid facilitates this decomposition. At 300° C. (572° F.) a greenish portion comes over, not examined as yet. (*Pharmacographia*, p. 379.) The oil of valerian exercises the same influence as the root on the nervous system, and is frequently administered as a substitute for it in the dose of four or five drops (0·24 to 0·3 C.c.).

OPII PULVIS. *U. S.* *Powdered Opium.*

(Ō'PI̤-Ī PŬL'VĬS.)

"Opium, dried at a temperature not exceeding 85° C. (185° F.), and reduced to a moderately fine (No. 50) powder. Powdered Opium, for pharmaceutical or medicinal uses, should contain not less than 12 nor more than 16 per cent. of morphine, when assayed by the process given under Opium. Any Powdered Opium of a higher percentage may be brought within these limits by admixture with Powdered Opium of a lower percentage, in proper proportions." *U. S.*

The strength of powdered opium has been *increased* from not less than 10 per cent. (U. S. P. 1870) to not less than 12, nor more than 16 per cent., of morphine. This change was made necessary by the improvement in the quality of opium now imported, the better grades coming fully within the officinal requirements.

Off. Prep. Acetum Opii, *U. S.;* Opium Denarcotisatum, *U. S.;* Pilulæ Opii, *U. S.;* Pulvis Ipecacuanhæ et Opii, *U. S.;* Tinctura Opii, *U. S.;* Tinctura Opii Camphorata, *U. S.;* Tinctura Opii Deodorata, *U. S.;* Vinum Opii, *U. S.*

OPIUM. *U. S., Br.* *Opium.*

(Ō'PI̤-ŬM.)

"The concrete, milky exudation, obtained in Asia Minor by incising the unripe capsules of Papaver somniferum. Linné. (*Nat. Ord.* Papaveraceæ.)" *U. S.* "The juice, inspissated by spontaneous evaporation, obtained by incision from the unripe capsules of the poppy, Papaver somniferum (Linn.), grown in Asia Minor." *Br.*

"On exhausting 100 parts of Opium, previously dried at a temperature of 105° C. (221° F.), with cold water, and evaporating the solution to dryness, an extract is obtained which should weigh between 55 and 60 parts. Opium, in its normal, moist condition, should yield not less than 9 per cent. of morphine, when assayed by the following process." *U. S.*

Meconium, Succus Thebaicus; Opium, *Fr.;* Opium, Mohnsaft, *G.;* Oppio, *It.;* Opio, *Sp.;* Affioni, *Turk.;* Ufyoon, *Arab.;* Sheerikhaskash, *Pers.;* Ufeem, *Hindoo.*

Gen. Ch. *Corolla* four-petalled. *Calyx* two-leaved. *Capsule* one-celled, opening by pores under the persistent stigma. *Willd.*

Opium is generally believed to be derived exclusively from *Papaver somniferum;* though every species of poppy is capable of yielding it to a greater or less extent, and some authors assert that *Papaver orientale* is its real source. The United States, British, and French Pharmacopœias recognize only the first-mentioned species.

Papaver somniferum. Willd. *Sp. Plant.* ii. 1147; *B. & T.* 18. There are several varieties of this species, of which the two most prominent are distinguished by the titles of the white and the black poppy, derived from the color of their seeds. It is the former which is usually described as the proper opium plant. The *white poppy* is annual, with a roundish, smooth, erect, glaucous, often branching stem, usually rising two or three feet in height, but sometimes five or even six feet in favorable situations. The leaves are large, variously lobed and toothed, and alternately disposed on the stem, which they closely embrace. The flowers are terminal, very large, and of a white or silver-gray color. In India they appear in February, in Europe and the United States not earlier than June, July, or August. The calyx is smooth and composed of two leaves which fall when the petals expand. These are usually four in number; but there is a variety in which the flower is double. The germen, which is smooth and globular, supports a radiated stigma, and is surrounded by numerous short and slender filaments, with erect, oblong, compressed anthers. The capsule is smooth and glaucous, rounded, from two to four inches in diameter, somewhat flattened at the top and bottom, and crowned with the persistent stigma, the diverging segments of which are arranged in a circle upon the summit. It contains numerous minute white seeds, which, when perfectly ripe, escape through small openings beneath the stigma. In the *black poppy*, the flower, though sometimes white, is usually violet-colored or red, the capsule somewhat smaller and more globular, and the seeds of a brown or blackish color.

All parts of the poppy contain a white, opaque, narcotic juice; but the leaves, analyzed by M. Blondeau, yielded none of the active principles by which opium is characterized. (*Journ. de Pharm.*, vii. 214.) It is in the capsule that the juice most abounds, and the virtues of the plant chiefly reside. Hence this part is sometimes employed medicinally. (See *Papaver.*) The seeds are destitute of narcotic properties, and are even used as food. The Romans employed them in the preparation of various dainties. They abound with a bland oil, called commercially *poppy-seed oil*, which may be extracted by expression. It is of a straw-yellow color, without odor, and of a pleasant almond taste. It is without narcotic properties, and much resembles olive oil, as a substitute for which and an adulterant of which it is very largely used on the continent of Europe. It has a low congealing point, thickening only at —15° C. (5° F.) and solidifying at —20° C. (—4° F.). According to M. Berjot, the seeds yield from 46 to 50 per cent. (*Journ. de Pharm.*, Avril, 1863, p. 277.) This is an article of much importance on the continent of Europe, particularly in France and Germany. The oil is employed for culinary and pharmaceutic purposes, in painting and the manufacture of soap, and in other ways, as a substitute for olive oil. The poppy does not appear to elaborate the milky fluid in which its narcotic properties reside before a certain period of its growth; for we are told that, in Persia, the young plants which are pulled up to prevent too thick a crop are used as pot-herbs; and the *μήκων* of the Greeks, which is believed to be identical with the *Papaver somniferum*, is said by Hippocrates to be nutritive.

Though generally believed to be a native of Asia, this species of poppy grows wild in the south of Europe, and even in England,* whither its seeds are supposed to have been brought at a very early period. It was cultivated by the ancient Greeks, and is mentioned by Homer as a garden-plant. It is at present cultivated very extensively in India, Persia, Egypt, and Asiatic Turkey, for opium; and in several parts of Europe, especially in the northern departments of France, and in the south of Germany, mainly for the seeds; though in both countries good opium is at the same time produced. It is said that in some parts of China,* especially in the province of Szy-tschuan, notwithstanding that the drug is so abundantly imported from India, great quantities of it are produced for the supply of the masses of the people; the Bengal opium being used only by the rich. (*Neues Repertorium*, xii. 80, 1863.) In this country it was until recently found only in our gardens as an ornamental flower. But of late attempts have been made to cultivate it, on a somewhat large scale, in the United States.† The opinion that a hot climate is not necessary for the production of the narcotic principles has the support of Guibourt (*Journ. de Pharm.*, Sept. 1867, p. 222), and would seem to be established by the facts that the opium of Anatolia is richer in morphine than that of the much hotter regions of Bengal and Upper Egypt, and that, while the best Smyrna opium seldom yields more than 12 per cent. of the alkaloid, that produced in the north of France yields from 20 to 24 per cent. (M. Bussy, *Ibid.*, p. 221.) Efforts have been made to introduce the opium-culture into Australia, and, in the province of Victoria, with success, but as yet this drug has not become a valuable object of export.

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* Various attempts have been made in England to cultivate the poppy, some of them with asserted commercial success; but they seem all to have resulted in final failure. (For particulars, see previous edition U. S. D.; also *Edinb. Phil. Journ.*, i. 258.) In France, Aubergier, of Clermont-Ferrand, has been perseveringly producing opium since 1844. According to the earlier statements of his methods, instead of allowing the juice after the incision to inspissate on the capsule, he collected it immediately, and dried it by artificial heat. One workman collected in a day 300 grammes (9·64 troyounces) of juice, which yielded one-quarter of its weight of opium. The product differed in strength very greatly, according to the variety of poppy used; the yield of morphine having varied from 3 to 17·8 per cent.; the *purple poppy* was the best. (*Ann. de Thérap.*, 1853, p. 29.) At present he operates so as to produce a uniform product, which he calls *affium*, containing always 10 per cent. of morphine. Decharme, in a series of careful experiments made near Amiens, in France, determined that when the opium dries quickly the percentage of morphine rises. From 14,725 capsules he obtained 205 grammes of opium, containing 16 per cent. of morphine. It is asserted that the opium can be taken without interfering with the ripening of the seed and production of oil. The cultivation of the poppy does not seem, however, to be on the increase in France, partly, according to M. Lallier, on account of the uncertainty of the weather.

The process for procuring opium from the poppy, as practised by the modern inhabitants of India and Persia, according to the reports of Kerr and Kaempfer, is very nearly the same as that described by Dioscorides as employed in his own times, about eighteen hundred years since; and the accounts of Bélon, Olivier, Texier, and more recently M. Bourlier, as to the mode of collection in Asia Minor, are not materially different. As the capsules abound most in the narcotic juice, it is from these that the opium is procured. According to Texier, a few days after the fall of the flower, men and women proceed to the fields, and make horizontal incisions into the capsule, taking care not to penetrate its cavity. A white juice exudes, and appears in the form of tears upon the edges of the incisions. The field is left in this state for twenty-four hours, after which the juice is scraped off by means of large blunt knives. A portion of the epidermis of the capsule is also removed, and constitutes about one-twelfth of the whole product. Each poppy-head affords opium but once. Thus collected, the opium is in the state of an adhesive and granular jelly. It is placed in smaller vessels, where it is beaten, and at the same time moistened with saliva.

Another method of extracting the virtues of the capsules is to select such as have ceased to yield their juice by exudation, to beat them with a small proportion of water, and to inspissate the liquid thus obtained by artificial heat. The ancient Greeks were acquainted with both processes, as appears from the writings of Dioscorides. The term *ὀποίν*, derived from *ὀπός*, juice, they applied to the substance procured by incisions, which answers precisely to the modern opium. The inspissated expressed juice they called *μηκώνιον*, from *μήκων*, the name of the plant. Tournefort states that the latter preparation is exported from Turkey as opium; the former being much more valuable, and therefore retained in the country for the use of the great and wealthy,—an error which at one time received wide credence.

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* In spite of the prohibitions of the Imperial Government, the production of opium is said to be greatly on the increase in China, the cultivation of the poppy paying much better than does that of wheat. (*P. J. Tr.*, ix. 1878, p. 246.)

† In 1865, Mr. P. Robertson, of Campbell Co., Virginia, produced opium which yielded to the analysis of Mr. I. J. Grahame 4 per cent. of morphine, besides narcotine. (*A. J. P.*, 1867, p. 50.) Dr. H. Black, of Bolivar, Tennessee, produced an opium from which Mr. E. S. Wayne obtained 10·2 per cent. of morphine. (*Ibid.*, Jan. 1868.) In 1868 considerable interest was aroused in pharmaceutical circles by the statements of Mr. W. C. Wilson. He claimed to have made nearly 1000 dollars an acre by the cultivation of the poppy, and the assay of opium at first submitted by him to Prof. Procter yielded 6·25 per cent. of morphine. Subsequent analyses by Prof. Procter and other persons proved, however, that his drug, which was chiefly an extract of the poppy, contained habitually less than 1 per cent. of the alkaloid. Details as to his methods may be found in *A. J. P.*, 1868 and 1869; also in the 14th edition of the Dispensatory. Very fine opium has been produced by Mr. J. H. Flint, of California. (*A. J. P.*, 1874, p. 105.) Although the recently collected drug was found to contain 7¾ per cent. of morphine, equivalent to about 10 per cent. in perfectly dried opium, yet, according to Mr. Flint, the expense of cultivation and collection exceeded the commercial returns, and therefore forbade its introduction as an article of agriculture. It is evident that, whilst there are no climatic difficulties, the high price of labor will long prevent the development of opium-culture in the United States.

Commercial History. Commerce is supplied with opium chiefly from Hindostan, Persia, Egypt, and Asiatic Turkey.* Immense quantities are produced in the Indian provinces of Bahar and Benares, and in the more interior province of Malwa. The opium of Hindostan is distributed extensively through continental and insular India, where it is habitually employed in the place of spirituous liquors. Great quantities are also sent to China, into which it finds an easy entrance, notwithstanding prohibitory laws. Much was formerly imported by the East India Company into England, through which a small proportion reached our own country. For various reasons, India opium no longer enters Western commerce to any extent. It is produced in Hindostan chiefly under government supervision. The drug as first obtained is semi-liquid, owing to the excessive dews, but is allowed to drain and dry by spontaneous evaporation until only 30 per cent. of moisture is left, when it is taken to the government factories. Great care is exercised to prevent adulteration. In the factories it is worked up with the drainings (known as *passēwā*), poppy petals, and ground poppy plant into balls of standard strength. These are called "*cakes*," are about six inches in diameter, and are prevented from adhering by being rolled in the ground poppy plant. *Malwa* opium is a variety not made in Hindostan proper, nor under government supervision. Its quality varies greatly. Of the opium produced in Persia, very little is brought to this country; and it is scarcely known in our market as a distinct variety. Much was formerly produced in Upper Egypt, especially in the district of ancient Thebes, which was supposed to yield it in greatest perfection. Hence it was long known by the name of *Opium Thebaicum*, and laudanum is still sometimes directed in prescriptions as *Tinctura Thebaica*. Its cultivation has been again introduced into Egypt; and considerable quantities are exported.

Turkey opium is produced in Anatolia, and shipped chiefly from the port of Smyrna. It is brought to the United States, either directly from the Levant, or indirectly through different European ports. The amount of opium imported in 1878 was 207,752 lbs.; in 1879, 273,554 lbs.; in 1880, 372,000 lbs. Turkey opium usually comes to us in masses of irregular size and shape, generally more or less flattened, covered with leaves, or the remains of leaves, and with the reddish capsules of some species of *Rumex*, which are said to be absent in the inferior kinds, and may, therefore, be considered as affording some indication of the purity of the drug. We may account for this circumstance upon the very probable supposition that these capsules are removed during the operation which the masses undergo in the hands of the merchants after leaving those of the cultivators. We are told by the French writers that extensive frauds are practised at Marseilles in this branch of commerce. The opium taken thither from the Levant is first softened, and then adulterated with various matters which are incorporated in its substance. To use a strong expression of Guibourt, they make the opium over again at Marseilles. Our traders to the Mediterranean would do well to bear this assertion in mind. According to Dr. A. T. Thomson, one-fourth part of Turkey opium generally consists of impurities. Sand, ashes, the seeds of different plants, extracts of the poppy, *Lactuca virosa*, *Glycyrrhiza glabra*, and *Chelidonium glaucum*, gum arabic, tragacanth, salep, aloes, even small stones, and minute pieces of lead and iron, are mentioned among the substances employed in the sophistication of the drug. Mr. Landerer, of Athens, was informed by a person who had been engaged in the extraction of opium, that grapes, freed from their seeds and crushed, were almost universally mixed with the poppy juice, and that another adulteration consisted of the epidermis of the capsules and stem of the plant, pounded in a mortar with the white of eggs. (*A. J. P.*, xv. 238.) According to Mr. Wilkins, who witnessed the collection of opium, the inspissated juice of the grape, thickened with flour, is often used for the same purpose. (*P. J. Tr.*, xiv. 400.) In England a sophisticated opium was some years since prepared, which, though so nearly resembling good Turkey opium in appearance that by the eye alone it was difficult to detect the fraud, was yet wholly destitute of the active principle of the drug. Portions of it were sent into the markets both of France and of this country. A sample of a similar drug, perhaps the same, was examined by Prof. Aiken, examiner of drugs for the port of Baltimore, and found to contain but 1·10 per cent. of morphine. (See *A. J. P.*, July, 1859, p. 374.) It was probably the genuine drug, deprived of its morphine by some process which did not materially disturb the visible arrangement of its particles.* (*Ibid.*, x. 261.)

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* For information in regard to the methods of culture in Turkey and Asia Minor, see *Journ. de Pharm.*, 3e sér. xiii. 105; *P. J. Tr.*, March, 1854; *A. J. P.*, 1863, p. 362; also 14th edition U. S. D,

Opium is regarded as inferior when it has a blackish color; a weak or empyreumatic smell; a sweet or slightly nauseous and bitter taste; a soft, viscid, or greasy consistence; a dull fracture; or an irregular, heterogeneous texture, from the intermixture of foreign substances. It should not impart a deep brown color to the

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* The great importance of opium renders it desirable that all its commercial varieties should be accurately described, and their relative value, so far as possible, ascertained. The following statement has been drawn up from the most recent published accounts, and from personal observations.

The varieties of this drug may be discussed according to the countries in which they are produced, an arrangement which we here adopt.

I. TURKEY OPIUM. This title belongs to the opium produced in the Turkish province of Anatolia, and exported from Smyrna and Constantinople. According to some authorities, there is no essential difference between the parcels of the drug brought from these two ports. Others maintain that they are distinct varieties, differing in their interior structure, and probably also in the precise place of their production, and the mode of their collection. The truth probably is, that most of the opium shipped at Constantinople is produced in the more northern parts of the opium districts of Anatolia; while that from Smyrna is collected in the provinces more convenient to the latter city; and, though it is possible that an identical drug may often be brought from the two ports, yet there are grounds for arranging it under different varieties, as derived from these different sources. There can be little doubt also that a portion of opium which is taken to Constantinople is produced in Macedonia in Europe, which must, therefore, be added to the opium-producing regions. (*Neues Repert.*, xvi. 751, 1867.)

1. *Smyrna Opium.* This is the variety which is, beyond all comparison, most abundant in our markets; and it is from this that the ordinary descriptions of opium are drawn up. It comes to us in masses of various size, usually from half a pound or somewhat less to a pound in weight, sometimes, though rarely, as much as two or even three pounds, originally, perhaps, of a globular form, but variously indented, and rendered quite irregular in shape by the pressure to which they have been subjected, while yet soft, in the cases which contain them. Sometimes they are even pressed out into flat cakes. As brought into market, the lumps are usually hard on the outside, but still soft within. They are covered externally with the remains of leaves, and with the reddish capsules of a species of Rumex, which have no doubt been applied in order to prevent the surfaces from adhering. Notwithstanding, however, this coating, the masses sometimes stick together, and two or more become consolidated into one. In this way the fact may be accounted for, that the seeds of the Rumex are occasionally found in the interior of the masses. In the finer parcels of Smyrna opium, the color internally is light brown; in the inferior it is darker. A peculiar character of this variety is that, when a lump of it is cut into and then carefully torn, numerous minute shining tears are observable, particularly under a microscope, bearing some resemblance to small seeds, but readily distinguishable by pressure between the fingers. They are undoubtedly formed from the drops of juice which escape from the incisions in the capsules, and which, according to Bélon, are allowed to concrete before they are removed. From the account of the same author it appears that, after the juice has been collected, it is not subjected to the process of kneading or beating, as in the case of other varieties of the opium; so that the tears preserve their original shape in the mass. It is probably owing to the peculiar mode of collecting Smyrna opium, that minute pieces of the skin of the poppy capsules are found intermingled in the mass; these being separated in the process of removing the adhering tears. In the best specimens of Smyrna opium, these fragments of the capsules are the only impurities. This variety of the drug is of very different qualities; the finest kinds yielding, according to Merck, as much as 13 per cent. of pure morphine, while from some very bad parcels he could not procure more than 3 or 4 per cent. In these inferior specimens the color is darker, the smell is often musty, and there is very generally more or less mouldiness both upon the surface, and in the interior of the masses, indicating perhaps too much moisture in the opium originally, or its subsequent exposure to an injurious degree of dampness. Good Smyrna opium ought to yield 10 or 11 per cent. of morphine. Dr. Christison, however, states that he has not been able to procure more than 9 per cent. from the finest Smyrna opium. According to Landerer, little of the opium is produced in the immediate neighborhood of Smyrna; the greater portion being brought, on the back of camels, from a distance of from ten to eighteen days' journey. (*Journ. de Pharm.*, 3e sér., xxiii. 33.) The same writer states that the opium is chiefly prepared at Kara Chissar, near Magnesia. The incisions are generally made before sunrise. The juice is partly caught in mussel-shells, and dried in the sun. This is considered the best. Every evening the juice which has dried upon the capsules is scraped off, with a portion of the epidermis. The poppy is then cut down, and stripped of its leaves, which are boiled in water; and the liquor is evaporated to the consistence of an extract. With this the inspissated juice is incorporated, and the mixture is then formed into cakes, wrapped in poppy leaves, and placed on shelves to dry. (See *A. J. P.*, xxiii. 251.) It is very evident, from the interior structure of the *best Smyrna opium*, that it has not been prepared in the way described by Landerer; though his account is probably true in reference to inferior varieties.

2. *Constantinople Opium.* Most of the Constantinople opium is in lumps from half a pound to two and a half pounds in weight, and scarcely distinguishable in exterior appearance from those of the former variety, being equally irregular in shape, and in like manner covered with the capsules of the Rumex. According to Merck, however, it often differs strikingly from the Smyrna opium in its interior constitution, being wholly destitute of the tears which characterize that variety. This would indicate some difference in the mode of collecting and preparing the juice. In the case of the Constantinople opium, it is probably removed from the capsules before concretion. Merck says that he has not discovered in this variety those minute portions of the poppy capsules which are usually present in Smyrna opium. The average quality of the Constantinople opium, as above described, is about equal to that of the drug from Smyrna; but it appears to be occasionally purer; as Merck obtained from one specimen as much as 15 per cent. of pure morphine. Dr. R. Bauer, of Constantinople, who for many years had the opportunity of becoming familiar with the varieties of opium which reach that city, in 1867 denied that any of the varieties produced near Smyrna contain tears, except the single one from Magnesia. (*Neues Repert.*, xvi. 751.)

In an account, by M. Bourlier, of the culture of the poppy and collection of opium in Bithynia, a province of Asia Minor, near Constantinople, it is stated that the lumps, when formed out of the concrete juice, are enveloped in poppy leaves; and no mention is made of the use of the Rumex capsules to prevent adhesion. It is the opium here collected which, according to M. Bourlier, is known throughout the Levant and in Europe as Constantinople opium. The same authority states that the yolk of eggs is sometimes largely used for adulterating opium; a fraud which may be detected by the large proportion of fatty matter which the adulterated drug yields to ether, and by the impossibility of drying it so as to fit it for pulverization. (*Annuaire de Thérap.*, 1859, p. 4.)

Guibourt describes another variety of Constantinople opium of much inferior character. "It comes," he observes, "in small flattened cakes, sufficiently regular and of a lenticular shape, from two to two and a half inches in diameter, and always covered with a poppy leaf, the midrib of which divides the surface into two equal parts. It has an odor similar to that of the preceding variety, but feebler, and it blackens and dries in the air. It is more mucilaginous than Smyrna opium, and contains only half as much morphine." These characters are obviously those of Egyptian opium; and, though the parcels which came under the notice of Guibourt may have been imported directly from Constantinople, it is highly probable that they were originally from Alexandria. Mr. Stettner, of Trieste, though well acquainted with the opium commerce of that port, admits no such Constantinople opium as that described by Guibourt. (*Annal. der Pharm.*, xxiv. 65.) According, however, to Dr. Bauer, the opium collected in the districts nearest Constantinople is mostly in small pieces, often of only two or three ounces, which are always invested with poppy leaves, or more rarely with grape leaves, generally smooth, and without Rumex capsules; and this description corresponds with Guibourt's. (*Neues Repert.*, xvi. 754, 1867.)

A number of varieties of opium produced in European and Asiatic Turkey circulate more or less in Austria and other parts of Germany, which have been described by Dr. C. Finckh in *Buchner's Repertory* (vol. xvi. p. 749), and of which we propose to give a brief account here.

Opium of Ghévé or *Gévé* is gathered from a poppy with red flowers, and comes in the form of small rounded cakes, weighing 2 or 3 ounces, enveloped in the leaves of the poppy, with a smooth and shining surface, which seems to be divided into two halves by the median nerve of the leaf. The interior is in layers of light- and deep-colored opium; and its yield of morphine is from 12 to 15 per cent.

Opium of Amasia differs from the preceding only in this, that there are two enveloping poppy leaves, placed crosswise, and with their lower surface outward, so as to give a rugose appearance to the cakes. In the interior the mass is homogeneous, but is very analogous to the *Gévé* opium.

Opium of Mallatia is in small loaves, round or somewhat oval, from 4 to 5 ounces in weight, made with the greatest care, and enveloped in poppy leaves, with a rugose surface, and the median line corresponding to the middle of the loaves. The borders of these, frequently deprived of the leaf, are very delicate. The substance of the loaf is homogeneous, but generally poor in morphine.

Opium of Magnesia is in irregular cakes or loaves, from 1 to 4 ounces in weight. They are covered first with a layer of Rumex seeds, and afterwards with poppy and vine leaves, and owe their irregular form to the envelopes, for originally they are rounded. The interior is composed of agglutinated tears, and is of excellent quality.

Opium of Salonica, or of *Kutchina*, has a strong analogy in all respects with that of Gévé, for which it is often substituted.

The following represent the varieties in which Smyrna opium appears in the market.

The *Opium of Balukhissar*, which is the chief source of the Smyrna opiums, is in cakes of from 4 to 12 ounces, irregular, though originally globular-ovoid. They are covered with Rumex seeds, and present, besides, on their surface poppy leaves irregularly applied. The mass is formed of tears lighter or deeper colored, and is so rich in morphine as to cause this variety to be always sought for in the market.

The *Opium of Cutaya* is generally in lumps half as large as the preceding, which it approaches closely in its characters, and in its yield of the alkaloid.

The *Opium of Taushan* or *Taushauly* is in irregular lumps, twice as long as broad, and weighing from 3 to 5 ounces. The mass consists of tears, and is carelessly enveloped with the poppy leaf and a few Rumex seeds. This variety is rich in morphine.

The *Opium of Angora* or *Engiri* is readily known by its under surface being covered only with one leaf of the poppy. The masses, being almost spherical, appear to have been originally in balls. Their weight is from 6 to 8 ounces, the interior homogeneous, and the quality inferior.

The *Opium of Kara-Hissar* is in balls, flattened beneath, of the weight of 6 or 8 ounces, and covered with poppy leaves and Rumex seed. Though carefully prepared, this variety, from its deficiency in morphine, is of inferior quality.

saliva, nor leave a dark uniform trace when drawn over paper, nor form with water a thick viscid solution.

The *Opium of Cigusti* is in irregular loaves, 6 or 8 ounces in weight, enveloped in poppy leaves and Rumex seed. Though rarely falsified, it often contains fragments of the poppy capsules, and forms a mass sometimes of distinct tears, sometimes not. Occasionally rich, it is almost always mixed with the various forms of Smyrna opium.

Dr. Finckh has noticed the following adulterations: opium of Macedonia, with clay; of Angora, with wax; of Amasia, with gum; of Tauschan, with liquorice; of Balukhissar, with melted pitch. He has even found an opium evidently made almost entirely of clay and cow-dung. The opiums of Macedonia are most frequently adulterated. (*Journ. de Pharm.*, Nov. 1869, p. 377.)

II. EGYPTIAN OPIUM. This is in flat roundish cakes, of various dimensions, sometimes as much as six inches in diameter, and a pound in weight, usually, however, much smaller, and sometimes not weighing more than half an ounce. These cakes are either wrapped in a poppy leaf, so placed that the midrib divides the surface into two equal parts, or exhibit vestiges of such a covering. Occasionally the brown color of the opium is seen through the leaf, and the surface appears as if uncovered, while the leaf is still present. This variety of opium is always destitute of the Rumex capsules, and differs from the Smyrna opium also in being brittle instead of tenacious, and as hard in the centre as at the surface of the mass. Its fracture is conchoidal and of a waxy lustre, and small fragments of it are translucent. Its color is usually redder than that of Smyrna opium, though sometimes dark. Some of the pieces, on exposure to the air, become damp and sticky on the surface, indicating the fraudulent addition of a deliquescent substance. The odor is similar to that of Smyrna opium, but weaker. It is an inferior variety; as the best of it, examined by Merck, yielded only 6 or 7 per cent. of morphine; and a specimen of it was found by Mr. J. Evans, of Philadelphia, to contain not more than 3·55 per cent. Egyptian opium, therefore, should never be dispensed by the apothecary, or employed in the preparation of his tinctures; as the prescription of the physician is based upon the strength of good Smyrna opium, which is about twice that of the Egyptian. That the deficiency of morphine in Egyptian opium is not climatic would seem to be proved by the fact that M. Gastinel has produced opium in his garden at Cairo, containing 12 per cent. of morphine. (*Journ. de Pharm. et de Chim.*, 4e sér., iv. 415, 1866.)

III. INDIA OPIUM. Little if any of this opium reaches our market. There appear to be two chief varieties of it; one produced in Bahar and Benares, in the Bengal Presidency, and called *Bengal opium*, the other in the interior provinces, and designated by the name of *Malwa opium*.

1. *Bengal Opium.* For a minute account of the cultivation and preparation of this variety of opium, the reader is referred to elaborate papers by Dr. Eatwell, of Calcutta, contained in the eleventh and twelfth volumes of the *London Pharmaceutical Journal and Transactions*, an abstract of which will be found in *A. J. P.* (xxiv. 118), and in the last edition of Pereira's *Materia Medica* (vol. ii. p. 1009, Am. ed.). Bengal opium is identical with the variety sometimes called *Patna opium.* It is in round balls, weighing three pounds and a half, invested by a coating half an inch thick, composed of agglutinated leaves and poppy petals. The interior of the mass is of a brownish black color, of the consistence of a stiff paste, and possessed in a high degree of the characteristic odor and taste of opium. The analyses of India opium vary decidedly in their results. Eatwell, 2·17 to 3·67 per cent. of morphine, 3·85 to 5·70 per cent. of narcotine; Procter (Patna opium), morphine, 5 per cent.; Flückiger and Hanbury (Khandesh opium), morphine, 6·07 per cent. (Patna opium), morphine, 8·6 per cent., narcotine, 4 per cent.; Solly (Khandesh opium), morphine, 7 per cent.; Watson (a number of varieties), 3·5 to 6·1 per cent. of morphine. (*P. J. Tr.*, xi. 362; *A. J. P.*, xxi. 194; *Pharmacographia*, 2d ed., p. 61.) India opium is, therefore, much inferior to the best Smyrna opium in its yield of morphine, while it is richer in narcotine. Its inferior character is possibly, in some degree, owing to the circumstance that the juice, after collection, is kept for some time before it is made up, and consequently undergoes fermentation. Prof. Carson, of the University of Pennsylvania, in describing a specimen of this variety in *A. J. P.* for July, 1849 (p. 194), speaks of acicular crystals, which he had noticed by the aid of the microscope; and on examining a specimen of the same opium, in 1860, then perfectly dry, he found similar crystals. No such crystals, he stated, are to be found in Smyrna opium.

There is a variety of Bengal or Patna opium, called *garden Patna opium*, which was described in the fifth edition of this work, on the authority of Dr. Christison, as Malwa opium. Dr. Christison has subsequently ascertained its true origin. It is prepared in Bahar with peculiar care, from juice which has not been suffered to undergo fermentation. It is in cakes three or four inches square, and about half an inch thick, which are packed in cases with a layer of mica between them. These cakes are without covering, hard, dry, and brittle, of a uniform shining fracture, and not unlike an extract in appearance. The color is sometimes almost black, and sometimes of a light brown, not unlike that of Egyptian opium. Dr. Christison states that it is much superior to the globular Bengal opium, and that some specimens are little inferior to Turkey opium in the proportion of morphine.

2. *Malwa Opium.* This sometimes occurs in flat, roundish cakes, five or six inches in diameter, and from four to eight ounces in weight. In other instances it is in rectangular masses called bricks, or even in roundish balls. It seems never to be encased in poppy remnants. They are commonly quite hard, dry and brittle, of a light brown color, a shining fracture, a compact homogeneous texture, and free from mechanical impurities. The quality is very variable. A specimen of Malwa opium described by Dr. Carson (*A. J. P.*, xxi. 195) broke with a rough fracture, which was of a blackish brown color, here and there showing irregular oily spots.[1] Prof. Procter obtained from it 9½ per cent. of morphine.

In consequence of the recent discovery that the poppy growing in the Himalayas yields opium having a much larger proportion of morphine than that produced in the lowlands, the cultivation of the plant is about to be greatly extended in the mountainous regions. (*Journ. de Pharm.*, Fév. 1874, p. 158.) In the "Report on the Progress and Condition" of India, for 1871–2, it is stated

Properties. Good opium has a peculiar, strong, narcotic odor, and a bitter, somewhat acrid taste. When long chewed it excites much irritation in the lips and tongue, and may even blister the mouth of those unaccustomed to its use. Its color is reddish brown or deep fawn; its texture compact; its sp. gr. 1·336. When drawn over paper it usually leaves an interrupted trace of a light brown color. It is often soft in the interior of the mass, and in this state is tenacious; but when exposed to the air it gradually hardens, and ultimately becomes brittle, breaking with a shining fracture, and affording, when pulverized, a yellowish brown powder, which becomes adhesive upon a slight elevation of temperature. It readily inflames upon the appli-

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that the cultivation of opium in India is increasing; there being at the time of the report 500,000 acres in Bengal and 608 in Bombay, planted with the poppy. During the same years, the exports of opium amounted to 893,364 chests, valued at £13,365,288. (*P. J. Tr.*, Dec. 1873, p. 498.)

IV. PERSIAN OPIUM. The cultivation of opium has greatly increased in Persia, the crop being estimated for 1880 at about 1,200,000 lbs.; consequently, whilst formerly it was a rare variety of opium, since 1870 it has been in constantly increasing quantities in European commerce, and comes to some extent to this country. It is in different forms. Sometimes it is in cylindrical pieces, about three and a half inches long, and half an inch thick, wrapped in glossy paper, and tied with a cotton thread, and each weighing about half an ounce; more frequently it is in short rounded cones weighing from 6 to 10 ounces; it also occurs in flat circular cakes. It is of a uniform consistence, but exhibits, nevertheless, under the microscope, small agglutinated tears, much less than those of Smyrna opium. It has the liver-brown color of Egyptian opium, a virose musty odor, and a very bitter taste, and, like Egyptian opium, softens in a moist atmosphere. The character of the opium has undoubtedly changed of late years, and it is said that the Persians now produce two distinct forms; one pure, destined for the Western market, and one adulterated and oiled, for the China trade.

In 1860 Persian opium was described by Dr. Reveil as being in three forms in Paris. *One* was in spherical cakes, without envelope or Rumex capsules. In physical characters it closely resembled the cylindrical variety, though softer and more hygrometric. It had a strongly virose odor, and a bitter slightly sweetish taste. The *second* was in irregular masses, liver-colored, of a virose smell and bitter taste, brittle, smooth and shining, compact, and very hygrometric. The *third* was in the form of flat cakes, covered with an unknown leaf with some Rumex capsules, of a reddish brown color, tasting and smelling like the preceding, compact, and smooth. Of these the first and third contained, each, 31·6 per cent. of glucose; the second 13·9 per cent. All these varieties were remarkable by the absence of obvious impurities, such as are insoluble in water and alcohol. From 75·2 to 84·2 per cent. was soluble in water, from 71·6 to 81·6 in alcohol at 85°. The *cylindrical* variety yielded 8·15 per cent. of morphine; the *spherical* 6·4 per cent.; the *irregular* 7·1 per cent.; and the *flat and coated* 5·10 per cent. The presence of glucose in such large proportions may be explained by the asserted fact that honey is sometimes mixed with opium at the time of its collection. Though the proportion of morphine is considerable in these varieties, yet, in consequence of their large proportion of soluble matter, they yield comparatively feeble extracts. (*Journ. de Pharm.*, Août, 1860, p. 101.) Since M. Reveil's investigation, two samples of Persian opium have been examined by M. Séput of Paris, one of which yielded 9·33 and the other 9·37 per cent. of morphine. (*Ibid.*, Mars, 1861, p. 163.)

Recent analyses show a great improvement in Persian opium. Consul-General Ross states that it now, as prepared for the European market, averages 12 per cent. of morphine. (*P. J. Tr.*, May, 1873, p. 883; June, 1880, p. 1002.) Messrs. Rosengarten, the well-known manufacturing chemists, of Philadelphia, inform us that they have used large quantities of the Persian opium, and obtained from it an average of 10 per cent. of morphine. Mr. W. D. Howard examined a sample of fine Persian opium, sent to England as "perfectly pure," which yielded to him on analysis, without previous drying—morphine, crystallized from alcohol, 10·40 per cent.; codeine, anhydrous, 0·29 per cent.; narcotine, 2·50 per cent.; thebaine, 0·57 per cent.; cryptopine, 0·09 per cent.; papaverine, trace. He is unable to say whether it contained any narceine. It was of a light brown color, and had been collected without the excessive use of oil. (*P. J. Tr.*, March 11, 1876.)

V. MOZAMBIQUE OPIUM. The poppy culture has been introduced into Mozambique for the production of opium for the Chinese market. A specimen of the product is said to have yielded 4 per cent. of morphine, 4·3 per cent. of narcotine, and 40 per cent. of moisture. (*P. J. Tr.*, x. 63.)

The following exhibits the results obtained by Guibourt in the analysis of various opiums.

			Soft.	Hard.	Dried.
Anatolia (Smyrna)	opium	lowest	9·60 per c. morphine.	10·82 per c.	11·70 per c.
do. do.	do.	highest	18·24	19·77	21·46
do. do.	do.	mean	12·40	13·57	14·78
Constantinople	do.	lowest	10·90	13·32	14·40
do.	do.	highest	14·00	15·72	17·00
Egyptian	do.	lowest		5·19	5·81
do.	do.	highest		11·45	12·21
Persian	do.			10·52	11·37
Indian (Patna)	do.	lowest		5·09	5·27
do. do.	do.	highest		6·93	7·72
French	do.	lowest		14·21	14·83
do.	do.	highest		21·10	22·88
do.	do.	mean		16·77	17·69

(*Journ. de Pharm.*, Janv., Fév. et Mars, 1862.)

cation of a lighted taper. It yields its virtues to water, alcohol, and diluted acids, but not to ether. To all these menstrua it imparts a deep brown color. Alcohol dissolves about four-fifths of it. Pelletier states that the proportion taken up by water varies in all specimens. He never found the quantity of extract prepared with cold water to exceed 12 parts out of 16. (*Journ. de Pharm.*, Nov. 1832.)

Chemical Constituents. Much attention has been devoted to the chemical constitution of opium. It was through the researches into the nature of this substance that chemists were led to the discovery of the alkaloids, which are usually the active principles of the plants in which they are found, and have attracted much notice, and been applied so advantageously to the treatment of disease. To Sertürner, an apothecary at Eimbeck, in Germany, belongs the credit of having opened this new and most important field of research. In the year 1803, M. Derosne made known the existence of a crystallizable substance which he had discovered in opium, and which he erroneously believed to be the active principle. In the following year, Seguin discovered another crystallizable body, which experience has proved to be the true narcotic principle of opium; but he did not fully investigate its nature, and no immediate practical advantage accrued from his excellent analysis. About the same time Sertürner was engaged in a similar investigation, the results of which, very analogous to those obtained by Seguin, were published in a German journal, without, however, attracting general attention. In this state the subject remained till 1817, when Sertürner announced the existence of a saline compound in opium, consisting of a peculiar alkaline principle united with a peculiar acid, and clearly demonstrated the precise nature of a substance which, though before discovered both by Seguin and himself, had been hitherto but vaguely known. To the alkaloid, in which he correctly conceived the narcotic powers of opium to reside, he gave the name of *morphium*, which has been subsequently changed to *morphine*, in order to render it conformable with the titles of the other alkaloids. The acid he called *meconic*, a term derived from the Greek name of the poppy. The correctness of the statements of Sertürner was confirmed by Robiquet, who also satisfactorily demonstrated that the substance obtained by Derosne, and called by him the *salt of opium*, was a principle altogether distinct from morphine, though supposed to possess considerable influence over the system. In the belief of its narcotic powers, Robiquet denominated it *narcotine*, a title which it still retains. A number of other alkaloids have since been discovered in opium, although most of these are in very limited amount, and the existence of some is not quite definitely established. According to the views of its constitution at present accepted, it contains: 1, *Morphine*; 2, *Narcotine*; 3, *Codeine*; 4, *Thebaine*; 5, *Papaverine*; 6, *Narceine*; 7, *Hydrocotarnine*; 8, *Pseudomorphine*; 9, *Protopine*; 10, *Laudanine*; 11, *Codamine*; 12, *Rhœadine*; 13, *Meconidine*; 14, *Cryptopine*; 15, *Laudanosine*; 16, *Lanthopine*; 17, *Gnoscopine*. Besides these, Hesse has announced another, *Deuteropine*, but has not as yet isolated it. Still others, like *Apomorphine* (see p. 211), can be produced from those existing in the opium. *Opianine*, described by Hinterberger in 1851, was found by Hesse to be merely impure narcotine. Two acids at least occur combined with these bases in opium, *meconic acid*, $C_7H_4O_7$, and *lactic acid*, $C_3H_6O_3$. This latter, supposed by T. and H. Smith to be a peculiar variety of lactic acid, and named by them *thebolactic acid*, was ascertained by Stenhouse to be the ordinary variety. Sulphuric acid is found in the ash along with the bases calcium, magnesium, and potassium. Opium also contains *mucilage*, *pectic matter*, and a *glucose sugar*. The wax gathered from the refuse of opium yielded Hesse *palmitate* and *cerotate of cerotyl*. Two neutral principles have, moreover, been extracted from opium—*meconin* (*opianyl*), $C_{10}H_{10}O_4$, and *meconoiosin*, $C_8H_{10}O_2$. The first of these forms prisms, which fuse under water at 77° C., or *per se*, at 110°, and boil at 155° C.; the second melts at 80° C. In relation to their optical properties, all the organic bases of opium produce deviation of the plane of polarization to the left. (Bouchardat and Boudet, *Journ. de Pharm.*, 3e sér., xxiii. 294.)*

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* M. Lakens, of Toulouse, found glucose in a tincture of poppy capsules, and in all the commercial varieties of opium, in proportions varying from 3 to 14·5 per cent. Its presence in opium is therefore not a proof of sophistication. (*Journ. de Pharm.*, Oct. 1854, p. 265.)

Of the principles above mentioned, *morphine* is by far the most important. It is generally admitted to exist in opium united with meconic acid in the state of meconate, and to a certain extent also as a sulphate. Of morphine and its preparations we shall treat under another head. (See *Morphina.*)

NARCOTINE. *Narcotina*, $C_{22}H_{23}NO_7$. It exists in opium, chiefly at least, in the free state, and is left behind in considerable quantity when the drug is macerated with water. It is white, tasteless, and inodorous, and crystallizes in silky flexible needles, usually larger than the crystals of morphine, fusible at 115·5° C. (240° F.), and volatilizable at 154·4° C. (310° F.) (*W. A. Guy*),* insoluble in cold water, soluble in 400 parts of boiling water, in 100 parts of cold and 24 of boiling alcohol which deposits it upon cooling, and very soluble in ether. The fixed and volatile oils, and the diluted acids, also dissolve it; and it has recently been found to be soluble in the volatile oil of turpentine, which, aided by heat, will extract it from opium, and yield it in crystals by evaporation. (*Journ. de Pharm. et de Chim.*, 4e sér., ii. 156.) As it exerts no alkaline reaction upon vegetable colors, and does not prevent the acids from reddening litmus paper, there would appear to be some reason for denying it the rank of an alkaloid. But it unites with some of the acids forming definite compounds, which may be procured in a separate state; and Robiquet obtained the sulphate and hydrochlorate of narcotine well crystallized. (*Journ. de Pharm.*, xvii. 639, and xix. 59.) Hence it is now generally considered as a weak base; and perhaps this view of it is the most convenient. It must be admitted, however, to have a very feeble neutralizing power. With acetic acid it does not appear to form a permanent combination; for, though dissolved by cold acetic acid, it is separated by heating the solution. It is decomposed by long boiling, or by heating with nitric acid, into *cotarnine*, $C_{12}H_{13}NO_3$, and *meconin*, $C_{10}H_{10}O_4$. It may be distinguished from morphine by its insipidity, solubility in ether, and insolubility in alkaline solutions, by not affecting vegetable colors, by assuming a yellowish instead of a blood-red color under the action of strong nitric acid, by not decomposing iodic acid, and by not producing a blue color with ferric salts. It is, however, reddened by a mixture of nitric and sulphuric acids. Hence, if to a mixture of it with strong sulphuric acid a small piece of nitre is added, a deep blood-red color is produced; while morphine, under the same circumstances, yields a brownish or olive-green color. It gives a greasy stain to paper when heated upon it over a candle. Heated with an excess of sulphuric acid and black oxide of manganese, it is converted into an acid called *opianic acid*, $C_{10}H_{10}O_5$, and into a substance of feeble alkaline properties, which has been mentioned above, *cotarnine*. (*Journ. de Pharm.*, 3e sér., vi. 99.) Meconin is said also to be among the results of its decomposition by oxidizing agents. When distilled with potassa, it yields a colorless volatile liquid having alkaline properties, with the strong smell of herring-pickle together with that of ammonia. This is an ammonia derivative, known as *propylamine*, $C_3H_7.NH_2$. (Wertheim, *Pharm. Centralb.*, June 1, 1850, p. 421, and Dec. 17, 1851, p. 918.) Water extracts narcotine partially from opium, in consequence of the acid which the latter contains, either free or combined with the narcotine. It is usually obtained mixed with morphine in the processes for procuring that principle, and may be separated by the action of ether, which dissolves it without affecting the morphine, and yields it upon evaporation. It may also be obtained by digesting opium in ether, and slowly evaporating the ethereal solution, which deposits crystals of narcotine. It is said that the same result may be obtained by using the oil of turpentine as the menstruum, first heating it with opium, and

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Proportionate quantity of the more important constituents of Opium. The following are given as the relative quantities of the ingredients mentioned, obtained by the Messrs. Smith, of Edinburgh, from 100 parts of fine opium: 10 parts of morphine, 6 of narcotine, 0·15 of thebaine, 1 of papaverine, 0·3 of codeine, 0·02 of narceine, 0·01 of meconin, 4 of meconic acid, and 1·25 of thebolactic acid. (*P. J. Tr.*, Oct. 1865, p. 183.)

* The results here given, on the authority of Mr. Wm. A. Guy, as regards the fusing and subliming points of the alkaloids, were obtained through a very careful application of heat, in a special manner, and are recorded in *P. J. Tr.*, Feb. 1868, p. 374. It should be noticed, however, that in the process of sublimation the alkaloids undergo a partial decomposition, leaving a more or less copious carbonaceous residue, by which, as Mr. Guy observes, the alkaloids and glucosides are distinguished from most other bodies.

then evaporating the solution. Another mode of procuring it is to treat opium, exhausted by previous maceration in water, with dilute acetic acid, filter the solution, precipitate by an alkali, wash the precipitate with water, and purify it by solution in boiling alcohol, from which it crystallizes as the liquid cools. Should it still be impure, the solution in alcohol and crystallization may be repeated.

The proportion of narcotine in opium varies extremely in the different varieties, and in different specimens of the same variety. Thus, in Smyrna opium it has been found by different observers, in quantities varying from 1·30 to 9·36 per cent.

Though narcotine itself is tasteless, its salts are very bitter, even more so than those of morphine. (*Berzelius.*) Their solution reddens litmus, and yields precipitates with the alkalies and infusion of galls. It has already been stated that Robiquet obtained the sulphate and hydrochlorate crystallized.

Different opinions have been advanced relative to the action of narcotine on the system. Derosne believed it to be the active principle of opium; though upon experimenting with it, he obtained effects but little stronger than those produced by an equal dose of opium itself. Others found it possessed in different degrees of narcotic properties; and the results of various experiments which led to the conclusion may be seen in former editions of this work. But a more thorough investigation has led to the conclusion that it cannot be ranked among narcotic medicines. It has been asserted that narcotine is identical with *aconella*, an alkaloid said to have been extracted by the Messrs. Smith, of Edinburgh, from aconite; but Groves failed to find aconella. (See page 79, U. S. D., 14th edition.) The effects of a narcotic character which have been attributed to it have probably arisen from the employment of a preparation not entirely freed from other principles contained in the opium. Indeed, so little has it of this character, that the name of *anarcotine* has been proposed for it, expressive of its total want of narcotic power. Dr. O'Shaughnessy, Professor of Chemistry in the Medical College of Calcutta, recommends narcotine very highly in intermittent fever, and believes that he has discovered in it even stronger antiperiodic properties than those of quinine. In the cases reported by him, it was employed in combination with hydrochloric acid. Given in this form, though powerfully febrifuge, it was found not to produce narcotic effects, not to constipate the bowels, and never to occasion the distressing headache and restlessness which sometimes follow the use of quinine. It proved, moreover, powerfully sudorific. It was given in doses of three grains (0·20 Gm.), three times a day. Dr. O'Shaughnessy was induced to commend its employment to his medical friends in India, from a knowledge that it had proved effectual in mild agues, in the hands of Dr. Roots and Mr. Jetson in England. The different effects obtained by different experimenters from narcotine are readily explicable, should the statements as to the existence of a powerful alkaloid (opianine), which may have been mixed with the narcotine, and of several different modifications of narcotine itself, prove to be correct.

CODEINE. *Codeia*, $C_{18}H_{21}NO_3$, was discovered in 1832 by Robiquet in the hydrochlorate of morphine prepared according to the process of Gregory. It exists in opium combined like morphine with meconic acid, and is extracted along with that alkaloid in the preparation of the hydrochlorate. (See *Morphina.*) When the solution of the mixed hydrochlorates of morphine and codeine is treated with ammonia, the former alkaloid is precipitated, and the codeine, remaining in solution, may be obtained by evaporation and crystallization. It may be purified by treating the crystals with hot ether, which dissolves them, and yields the codeine in colorless crystals by spontaneous evaporation. This alkaloid is now officinal. (See *Codeina.*)

THEBAINE (*Paramorphia*). *Paramorphine*, $C_{19}H_{21}NO_3$, was discovered by Pelletier in the precipitate thrown down from an infusion of opium treated with milk of lime. The precipitate being washed with water till the liquid came away colorless, and then treated with alcohol, instead of affording morphine to this solvent, as was anticipated, yielded a new alkaloid, which was obtained separate by evaporating the alcohol, acting on the residue with ether, allowing the ethereal solution to evaporate spontaneously, and then purifying the resulting crystalline mass by dissolving it in an acid, precipitating by ammonia, and recrystallizing by means of alcohol or ether. Pelletier named it paramorphine, from its close analogy in composition with morphine, from which, however, it is quite distinct in properties. The name of *thebaine* was proposed for it by M. Couërbe, who was disposed to give the credit of its discovery to M. Thiboumery, the director of Pelletier's laboratory. It is white, crystallizable, of an acrid and styptic rather than bitter taste, fusible at about 148·8° C. (300° F.), according to Guy fusible at 98·8° C. (210° F.) and volatilizable at 160° C. (320° F.), scarcely soluble in water, very soluble in alcohol and ether when cold, and still more so when heated, and capable of combining with the acids, with which it forms salts not crystallizable from their aqueous solution. Alkalies precipitate it from its acid solutions, and, unless in very concentrated solution, do not dissolve it when added in excess. It is not, like morphine, reddened by nitric acid, nor does it become blue with solutions of ferric salts. From codeine it differs in never being in large crystals, in not forming crystallizable salts, in being always precipitated from its acid solutions by ammonia, and in not melting in oily drops. From narcotine, which it most resembles, it may be distinguished by its shorter crystals, which want the pearly appearance of those of narcotine, by its different taste, by its much greater solubility in cold alcohol, of which 10 parts will dissolve 1 of this principle, while narcotine requires 100 parts, and by the action of nitric acid, which converts it into a resin-like matter before dissolving it, while the same acid instantly dissolves narcotine. Magendie considered it closely analogous, in its effects on the system, to strychnine and brucine, producing tetanic spasms in the dose of a grain (0·065 Gm.).

PAPAVERINE. *Papaverina*, $C_{21}H_{21}NO_4$. The discovery of this alkaloid was announced by Dr. G. Merck. It is crystallizable in needles, fusible at 98·8° C. (210° F.), and volatilizable at 154·4° C. (310° F.) (*Guy*), insoluble in water, very sparingly soluble in cold alcohol or ether, more soluble in these liquids boiling hot, and deposited by them on cooling. With acids it forms salts, most of which are very sparingly dissolved by water. The hydrochlorate crystallizes with extraordinary facility. The alkaloid is readily dissolved by moderately concentrated hydrochloric acid, from which, on the addition of more acid, the hydrochlorate separates, assuming the form of an oily layer at the bottom of the vessel, which is readily converted on standing into a mass of acicular crystals. These crystals are very sparingly soluble in cold water. The hydrochlorate yields with bichloride of platinum a yellow precipitate which is insoluble in boiling water or alcohol. Papaverine is prepared by precipitating the aqueous infusion of opium with soda, exhausting the precipitate with alcohol, evaporating the tincture to dryness, treating the residue with a dilute acid, filtering, precipitating by ammonia, dissolving the precipitate in hydrochloric acid, mixing acetate of sodium with the solution, and treating the resulting precipitate with boiling ether. The ethereal solution deposits the papaverine on cooling. A characteristic property of this alkaloid is that its crystals, when moistened with concentrated sulphuric acid, acquire a dark blue color. Papaverine has been further investigated by Dr. Thomas Anderson, who confirms the statements of Merck. (*Chem. Gaz.*, Jan. 15, 1855, p. 21.)

NARCEINE. *Narceia*, $C_{23}H_{29}NO_9$, discovered by Pelletier in 1832, is in white, silky crystals, inodorous, of a bitter taste, fusible at 91·6° C. (197° F.), according to Guy 76·6° C. (170° F.), and volatilizable at 215·5° C (420° F.), soluble in 375 parts of cold and 220 of boiling water, soluble also in alcohol, and insoluble in ether. It forms a bluish compound with iodine, the color of which is destroyed by heat and the alkalies. Besides, according to Stein, the blue color is not produced when there is too much of the iodine present, which then causes a brown color with narceine; the blue color appearing, under such circumstances, only when the excess of iodine is saturated by ammonia. (*Journ. de Pharm.*, Janv. 1872, p. 59.) It is rendered blue by the action of mineral acids so far diluted as not to decompose it; but does not, like morphine, become blue by the action of ferric salts, nor red by that of nitric acid. It is dissolved by the acids, but was thought not to neutralize them, and, though at first considered alkaline by Pelletier, was afterwards ranked with indifferent bodies. At present, however, its alkaloidal character is admitted; it unites with sulphuric acid to form a crystallizable sulphate. (*Journ. de Pharm.*, Avril, 1864,

p. 367.) Dr. Dragendorff has announced that solution of narceine gives a crystalline precipitate with the double iodide of zinc and potassium. This reaction may be employed with iodine as a test of narceine. If a solution of this salt, with a little iodized water, be added to solutions of narceine, and the mixture then agitated with ether to remove the iodine in excess, a solution containing a very small quantity of narceine will distinctly assume a blue color. The other alkaloids of opium are destitute of this property. (*Journ. de Pharm.*, Avril, 1870, p. 346.) Pelletier obtained it in the course of his analysis of opium. Having formed an aqueous extract of opium, he treated it with distilled water, precipitated the morphine by ammonia, concentrated the solution, filtered it, threw down the meconic acid by baryta-water, separated the excess of baryta by carbonate of ammonium, drove off the excess of the ammoniacal salt by heat, evaporated the liquor to the consistence of syrup, set it aside till a pulpy matter formed containing crystals, separated and expressed this pulpy matter, then treated it with alcohol, and concentrated the alcoholic solution. This, on cooling, deposited crystals of narceine, which were easily purified by repeated solution and crystallization. Meconin, which often crystallizes with it, may be separated by the agency of ether. Experiments have been performed with narceine, which go to prove that it closely resembles morphine in its influence on the system, though somewhat weaker; and that, while capable of producing sleep, relieving pain and irritation, alleviating cough, and checking diarrhœa, it is not followed by the unpleasant sensations about the head and other disagreeable symptoms which often attend the action of morphine, is less disposed to constipate, and less stimulant to the circulation. In cases in which morphine disagrees with the patient, or is otherwise contraindicated, narceine may be resorted to for most of the purposes for which the other alkaloid is employed. It may be administered in pill or syrup. From one-third to three-quarters of a grain (0·02 to 0·05 Gm.) may be given for a dose, the smaller to relieve cough, the larger to remove pain or produce sleep.

HYDROCOTARNINE. *Hydrocotarnia*, $C_{12}H_{15}NO_3$, is obtained from the mother-waters of thebaine, after the removal of cryptopine and protopine with warm benzin, by precipitation with ammonia; laudanosine, which is also precipitated, is removed by treatment of the benzin solution with bicarbonate of sodium. The hydrocotarnine is retained in solution, by the benzin, from which the laudanosine has been deposited on cooling. Hydrochloric acid gas being made to pass through this solution, the hydrochlorate of hydrocotarnine crystallizes. This alkaloid seems to result from a transformation of narcotine. If the latter be made to boil some time with baryta-water, a portion of it is decomposed, giving rise to a crystallizable matter, soluble in ether, which appears to be identical with hydrocotarnine. This alkaloid is very soluble in alcohol, acetone, chloroform, benzin, and ether. It melts at 50° C. (122° F.), and loses, at a somewhat greater heat, the molecule of water with which it crystallizes. Sulphuric acid dissolves it, coloring it yellow in the cold, and crimson-red if heated. Nitric acid colors it yellow; ferric chloride does not affect its color.

PSEUDOMORPHINE. *Pseudomorphia*, $C_{17}H_{19}NO_4$, was discovered by Pelletier more than thirty years since; but, as it exists in small quantities, and was thought to be only an occasional ingredient in opium, little attention has been paid to it. An interesting fact, however, in relation to it, and one of some toxicological importance, is that it possesses two properties considered characteristic of morphine, those, namely, of being reddened by nitric acid, and of striking a blue color with ferric salts, and yet is without any poisonous influence upon the animal economy. (*Journ. de Pharm.*, xxi. 575.) Hesse has investigated the subject, with the following results. He found that it accompanies morphine procured by Gregory's method, and may be separated from that alkaloid by adding ammonia in excess to an alcoholic solution containing both. The morphine is precipitated, and pseudomorphine, remaining in solution, may be obtained by evaporating the mother-liquid. It is tasteless, insoluble in water, alcohol, ether, chloroform, and dilute sulphuric acid, but easily soluble in solution of potassa, soda, and lime, and in alcoholic solution of ammonia, though sparingly in an aqueous solution of the last-mentioned alkaloid. It does not neutralize hydrochloric acid, dissolves in concentrated sulphuric acid with the production of an olive-green color, in concentrated nitric acid with an intense orange-red, and in solution of sesquichloride of iron with a blue color. At 120° C. (248° F.) it loses two molecules of water of crystallization, and at higher temperatures is decomposed without melting. It forms sparingly soluble salts with sulphuric, nitric, oxalic, and tartaric acids, and a crystalline deposit, very slightly soluble in hydrochloric acid, with solution of corrosive sublimate. (*Chem. News*, April 12, 1867, p. 188.)

PROTOPINE. *Protopia*, $C_{20}H_{19}NO_5$, is an alkaloid which Hesse separated from cryptopine. Both are precipitated as insoluble hydrochlorates by hydrochloric acid in excess; but if the precipitate be dissolved by an excess of oxalic acid, the acid oxalate of cryptopine will crystallize, and protopine remain in the mother-waters. The liquid is separated, precipitated by ammonia, and agitated with ether; and the ethereal solution is taken up by hydrochloric acid. The hydrochlorate of protopine being dense and granular, while that of cryptopine is very light, the two are separated by levigation; eighty grammes of crude cryptopine furnishing one and a half of protopine.

Separated from the hydrochlorate by ammonia, protopine constitutes a crystalline powder, insoluble in water, soluble in alcohol, and in hot benzin and acetone, more soluble in chloroform, insoluble in the alkalies generally, but slightly soluble in ammonia. It melts at 202° C. (395·6° F.), undergoing decomposition, and is in anhydrous crystals. Ferric chloride does not color it; nitric acid colors it yellow; sulphuric acid dissolves it, coloring it first yellow, then red, and lastly violet. The alcoholic solution has an alkaline reaction. The salts are neutral and crystallizable.

LAUDANINE. *Laudania*, $C_{20}H_{25}NO_4$, as first prepared, is mixed with cryptopine, from which it is separated by dissolving it in acetic acid, and adding a slight excess of dilute solution of soda, by which the cryptopine is entirely precipitated. The liquid being filtered, and treated with chloride of ammonium, lets fall the laudanine, which soon assumes the crystalline form. The acetate, with the addition of iodide of potassium, gives rise to the hydriodate of laudanine, from which ammonia separates the base perfectly pure.

This alkaloid is dissolved at 18° C. (64·4° F.) by 647 parts of ether. Sulphuric acid gives with it characteristic reactions. When pure, at common temperatures, it assumes a pale rose color, and at 150° C. (302° F.) a reddish violet. When ferric oxide is added, it exhibits the same changes, but with much greater intensity. Laudanine is an energetic base, and with potassa forms a crystallizable compound. Its salts, with the exception of the neutral sulphate, oxalate, and tartrate, are crystallizable.

CODAMINE. *Codamia*, $C_{20}H_{25}NO_4$, is isomeric with laudanine, but is readily distinguished from it by the effect of ferric chloride and nitric acid, both of which color it deep green. It is in anhydrous crystals. It can be purified by taking advantage of the feeble solubility of its iodohydrate. Having decomposed this salt by ammonia, dissolve the precipitate in ether, wash the ethereal solution with solution of bicarbonate of sodium; then filter through animal charcoal. By evaporation the liquid deposits the alkaloid in beautiful colorless crystals. Codamine crystallizes also from benzin; but, thus obtained, it melts at 126° C. (258·8° F.), while that procured through ether melts at about 120° C. (248° F.). The acid iodohydrate, tartrate, and oxalate are crystallizable.

RHŒADINE, $C_{21}H_{21}NO_6$, was discovered by Hesse in 1865, is crystallizable, but not distinctly alkaline. It can be sublimed. It is nearly insoluble in ether, alcohol, benzol, chloroform, water, and ammonia. Its solutions in dilute acids acquire an intense purple color on addition of strong hydrochloric or sulphuric acid. This alkaloid occurs also in *Papaver Rhœas*.

MECONIDINE, $C_{21}H_{23}NO_4$, was discovered by Hesse in 1870. It is amorphous, alkaline, melts at 58° C. (136·4° F.), and is not stable, the salts also being easily altered. It is easily soluble in alcohol, ether, benzol, chloroform, and acetone. It is dissolved by sulphuric acid with an olive-green, and by nitric acid with an orange-red color.

CRYPTOPINE. *Cryptopia*, $C_{21}H_{23}NO_5$. The discovery of this alkaloid was announced by Messrs. T. & H. Smith, of Edinburgh, in *P. J. Tr.*, 1867 (p. 595). The Messrs. Smith obtained it from the weak alcoholic washings of crude morphine after precipitation, by first neutralizing the liquid with dilute sulphuric acid, and then, after recovering the alcohol by distillation, and washing out the still copiously with hot water, by precipitating the mixed liquor of the still and the washings by milk of lime in large excess. The liquid is then filtered off, and the pitch-like precipitate, having been thoroughly washed, is boiled with alcohol in large quantity, the solution filtered, and the alcohol distilled off. The pitchy substance which remains in the retort, and which consists mainly of thebaine, is separated from the supernatant watery liquid, and heated to ebullition with enough alcohol to dissolve it. The solution, having been put aside, will be found in a day to have set into a mass of crystals, which consist of crystallized thebaine. This mass is now strongly pressed in a cloth, and the residuary cake powdered and dissolved in dilute hydrochloric acid; care being taken that the acid be not in excess. The filtered liquid is evaporated and crystallized, and the process of evaporation and crystallization repeated, so as to separate all the hydrochlorate of thebaine. If now the mother-waters be set aside, the hydrochlorate of cryptopine will in the course of some weeks crystallize out of them, but mixed with crystallized hydrochlorate of thebaine; and the separation of the two is extremely difficult. But as the crystals of the two alkaloids are very different, those of thebaine being hard and strong, those of cryptopine soft and generally tufted, by careful management, and by repeating the crystallization many times, so as to get rid of most of the thebaine, the hydrochlorate of cryptopine may be seen forming on the surface of the harder salt in the solution. The mother-liquors being now poured off, and allowed to evaporate spontaneously, the whole at length sets into a soft mass, which, being pressed in a cloth, is found to consist of almost pure hydrochlorate of cryptopine. To obtain the pure alkaloid, it is to be precipitated from the solution of hydrochlorate by ammonia, then washed, dried, and finally washed with ether or alcohol, which readily dissolves thebaine, but has little effect on cryptopine. It may be obtained in a crystallized state by boiling it with a large quantity of alcohol, which, on cooling, will slowly deposit the alkaloid in crystals. The quantity of cryptopine obtained from opium is extremely small.

Cryptopine is without color or smell; and its salts, though at first bitter to the taste, afterward cause a sense of coolness in the mouth, like that produced by peppermint. It melts at about 204·4° C. (400° F.), and, heated to redness, is decomposed, blackening and giving forth aqueous vapors, but without properly subliming. According to Guy, it melts and sublimes at the same temperature of 176·6° C. (350° F.). It is insoluble in water, quite insoluble in ether, and very sparingly soluble in alcohol, requiring 1265 parts of that liquid when cold to dissolve it. Chloroform dissolves it almost as freely as narcotine. Oil of turpentine and benzol do not appear to dissolve it. It has very strong alkaline powers, and forms crystallizable salts with the acids, which are distinguishable from all the other salts of the opium alkaloids by a strong tendency to gelatinize. If the hydrochlorate be dissolved in about 30 parts of hot water, and set aside, instead of crystallizing, it forms a jelly closely resembling that of pure gelatin. From all the constituents of opium, except the stronger alkaloids, morphine, codeine, and thebaine, it is distinguished by its strong alkaline properties, as it neutralizes the strongest acids. From morphine it is distinguished by its very sparing solubility in alcohol, and from codeine and thebaine by its total insolubility in ether. It differs also in the effect of strong sulphuric acid, which produces a blue color with the minutest quantity of cryptopine, a blood-red with thebaine, and none with morphine or codeine. The tendency of its salts to gelatinize is another distinguishing property of cryptopine.

LAUDANOSINE. *Laudanosia*, $C_{21}H_{27}NO_4$, exists in the mother-waters of thebaine, with cryptopine and protopine. The thebaine having been precipitated by tartaric acid, the mother-water is neutralized by ammonia, and bicarbonate of sodium is added. After eight days' rest, a blackish mass separates. The limpid liquid with an excess of ammonia yields a copious precipitate, which, agitated with heated benzin, gives to that liquid a mixture of several alkaloids. The benzin solution, upon cooling to 40° C. (104° F.), deposits the cryptopine and protopine. On agitation anew with heated bicarbonate of sodium, and subsequent complete refrigeration, the laudanosine crystallizes. It is entirely purified by ether, which dissolves it abundantly; and its iodohydrate is but slightly soluble in water. It is itself insoluble in water and the alkalies, but it is soluble in alcohol, acetone, and chloroform. It melts at 89° C. (192·2° F.), and is decomposed at 110° C. (230° F.). Ferric chloride does not color it. Sulphuric acid gives it a rose color in the cold, and violet when heated. Nitric acid transforms it into a nitrous base. The crystals are anhydrous. It forms crystallizable salts, which are soluble and bitter.

LANTHOPINE. *Lanthopia*, $C_{23}H_{25}NO_4$, differs from pseudomorphine in not becoming blue with ferric chloride, and in giving, when entirely pure, with sulphuric and nitric acids, colorless solutions. Its acid oxalate and tartrate are crystallizable. The alkaloid is crystallizable, does not have an alkaline reaction, is sparingly soluble in hot or cold alcohol, ether, or benzol, but readily soluble in chloroform.[*]

GNOSCOPINE, $C_{34}H_{36}N_2O_{11}$, is the latest discovered alkaloid (found by T. and H. Smith in 1878). It is crystallizable, melts at 233° C. (451·4° F.), soluble in chloroform and carbon disulphide, slightly so in benzol, not in ether. The salts have an acid reaction.

According to Hesse, opium contains at least fifteen alkaloids. They may be divided into four groups, in relation to the modification they undergo when heated with pure concentrated sulphuric acid. The changes of color produced show that there are four products of decomposition, which, if not identical, at least are nearly so. Of the four groups, two may be subdivided, each into two minor groups. They are as follows:

I. *Group of Morphine.* *a.* Group of morphine, properly called; morphine, codeine, and pseudomorphine. *b.* Group of laudanine; laudanine, codamine, and laudanosine. Of these, group *a* yields a deep dirty green; group *b*, a dirty reddish violet.

II. *Group of Thebaine.* Thebaine, cryptopine, protopine; a dirty green, passing to violet.

III. *Group of Papaverine.* *a.* Group of papaverine, properly called, comprehends actually only papaverine itself. *b.* Group of narceine; narceine, lanthopine. *a.* A deep violet; *b*, a brownish black, or deep brown.

IV. *Group of Narcotine.* Narcotine, hydrocotarnine, a dirty reddish violet.[†]

[*] O. Hesse obtained most of the alkaloids announced by him from the black mother-liquors left behind in the process for procuring hydrochlorate of morphine, first employed by Dr. Gregory, and adopted by the British Pharmacopœia. This liquor, diluted with an equal volume of water, was precipitated by an excess of ammonia: the clear liquid was exhausted with ether, and this treated as described in *Ann. Chem. Pharm.*, clxxx. 47. (*P. J. Tr.*, Jan. 1872, p. 549.) The method in which these alkaloids were first separated from opium by Hesse was as follows. An aqueous infusion is prepared, and precipitated by caustic soda or lime-water in excess. In the liquid, a substance is retained, which may be extracted by ether, and one of the characteristics of which is, that it yields with sulphuric acid a purple color. This appears to be the porphyroxin of Merck. This Hesse found to be a mixture of several alkaloids, which he separated in the following manner. The liquid above referred to as containing the coloring matter, is well shaken with ether; this, being separated, is acidulated with acetic acid, and the impure acetates are obtained by evaporating off the ether. The residue is mixed gradually with a dilute alkaline solution, and agitated so as to cause the resin which separates to form a mass. After twenty-four hours, the precipitate is separated; the liquid containing the alkaloids is mixed with hydrochloric acid in slight excess, and the alkaloids then precipitated with ammonia. The whole is now shaken with chloroform, acetic acid is added in slight excess, the chloroform is evaporated, and the residue neutralized with ammonia. The precipitate produced is reddish-colored, and, though at first resinoid, soon crystallizes. This, which consists of impure lanthopine, is separated by filtration, and the filtered liquid, after twenty-four hours, is mixed with caustic soda, in quantity but very little more than necessary to decompose the ammonia salts in solution. It is then shaken repeatedly with ether to separate codeine, which renders it turbid. This alkaloid is separated more readily by ether than the other alkaloids present, meconidine, codamine, laudanine, and another which the author designated by the letter *x*. Ether does not extract the last-mentioned bases from the solution containing fixed alkali, until after chloride of ammonium has been mixed with it. When the ethereal solution is allowed to evaporate very slowly, *laudanine* first crystallizes; the other three bases remaining as an almost amorphous mass when the ether has all escaped. But if, before the ether has entirely evaporated, the liquid be mixed with solution of bicarbonate of sodium, crystals of *codamine* are deposited as the ether further evaporates. If the mother-liquor, from which the two alkaloids have been separated, is now treated with acetic acid and chloride of sodium, hydrochlorate of *meconidine* is precipitated, the base *x* remaining in solution. The latter is quite separated from meconidine by repeatedly dissolving the hydrochlorate in water, shaking it with bicarbonate of sodium and ether, and then evaporating off the ether. (*P. J. Tr.*, Sept. 1870, p. 205.)

[†] The following table by Hesse gives a brief abstract of the characteristic properties of most of

MECONIN, $C_{10}H_{10}O_4$, a neutral principle before referred to, the existence of which was announced in 1832 by M. Couërbe, is identical with a substance discovered several years previously by M. Dublanc, Jr., but of which no account was published. It is perfectly white, in the form of acicular crystals, soluble in about 265 parts of cold and 18 of boiling water, very soluble in ether, alcohol, and the essential oils, fusible at 90·5° C. (195° F.), volatilizable without change (fusible at 48·8° C. (120° F.), sublimable at 82·2° C. (180° F.), *Guy*), and possessed of a degree of acrimony which favors the supposition that it may not be without action upon the system. It is neither acid nor alkaline, and contains no nitrogen. Meconin is obtained by precipitating the aqueous infusion of opium with ammonia, washing the precipitate with water until the latter nearly ceases to acquire color, mixing the watery fluids, evaporating them to the consistence of molasses, setting them aside for two or three weeks, during which a mass of granular crystals is formed, then decanting the liquid, expressing the mass, and drying it with a gentle heat. The meconin may be separated from the mass by treating it with boiling alcohol of 36° Baumé, evaporating so as to obtain crystals, dissolving these in boiling water with animal charcoal, filtering the liquid while hot, and subjecting the crystals formed upon the cooling of the solution to the action of ether, which dissolves the meconin, and yields it in a state of purity by spontaneous evaporation.

MECONOIOSIN, $C_8H_{10}O_2$. This principle was discovered by T. and H. Smith in 1878, who obtained it from the oleaginous-like liquid containing meconin, which, upon being left to itself for some days, sets into a mass of crystals. These crystals, upon being drained, and cautiously washed with cold weak spirit, are to be boiled in a large quantity of water. The filtered liquid gives a crystallization of meconin, and the mother-liquor, when concentrated, and upon being set aside for a time, yields beautiful leaf-like crystalline masses of meconoiosin. This principle is neutral, and it may be distinguished from meconin by the following test of T. and H. Smith's. "When heated with slightly diluted sulphuric acid, and when the evaporation has reached a certain point, meconin produces a beautiful green color. With meconoiosin, under the same circumstances, the coloration is deep red, becoming purple."

PORPHYROXIN was obtained, according to Merck, by treating powdered opium, previously exhausted by boiling ether, and then made into a pulp by means of water, with carbonate of potassium, agitating it with ether, evaporating the ethereal solution, dissolving the residue in dilute hydrochloric acid, and precipitating with ammonia. Paramorphine and porphyroxin are thus obtained together. These are to be dissolved in ether, which, by spontaneous evaporation, deposits the former in crystals, and the latter in the form of resin. The porphyroxin is separated by the cautious use of alcohol, and obtained by the evaporation of the alcoholic solution. It is neutral, crystallizable in shining needles, insoluble in water, soluble in alcohol and ether, and characterized by the property of assuming a purple-red or rose color when

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the alkaloids, discovered by himself, and of codeine and cryptopine, which, though previously discovered, he examined along with the others.

	DISSOLVED IN PURE SULPHURIC ACID.		IN ACID WITH FERRIC OXIDE.	
	At 20° C.	At 150° C.	At 20° C.	At 150° C.
Codeine	Colorless	Dirty green	Blue	Dirty green.
Codamine	Colorless	Dirty red-violet	Intense green blue	Deep violet.
Laudanine	Very faint rose-red	Deep red-violet	Brown-red, similar to solution of nitrate of cobalt	At first green, then deep violet.
Laudanosine	Faint rose-red, somewhat stronger than laudanine.	Deep red-violet	Brown-red, similar to solution of nitrate of cobalt	At first green, then deep violet.
Cryptopine	At first yellow, then violet, and finally deep violet...	Dirty green	Deep violet	Dirty green.
Protopine	At first yellow, then red, and finally bluish red....	Dirty greenish brown.	Deep violet	Dirty greenish brown.

(*P. J. Tr.*, 1872, p. 549.)

heated in dilute hydrochloric acid. (*Journ. de Pharm.*, 3e sér., xiv. 188.) Since its discovery by Merck, it has been fully investigated by Hesse, and ascertained to be in fact a very complex substance, instead of a proximate principle, consisting of several alkaloids associated together, of which an account, derived from Hesse, is given in the preceding pages.

MECONIC ACID is in white crystalline scales, of a sour taste followed by bitterness, fusible and volatilizable by heat, soluble in four parts of boiling water, soluble also in cold water and alcohol, with the property of reddening vegetable blues, and forming salts. Its compounds with the earths and heavy metallic oxides are generally insoluble in water. Its characteristic properties are, that it produces a blood-red color with ferric salts, a green precipitate with a weak solution of ammoniated sulphate of copper, and white precipitates soluble in nitric acid, with acetate of lead, nitrate of silver, and chloride of barium. It is obtained by macerating opium in water, filtering the infusion, and adding a solution of chloride of calcium. Meconate and sulphate of calcium are precipitated. The precipitate, having been washed with hot water and with alcohol, is treated with dilute hydrochloric acid at 82·2° C. (180° F.). The meconate of calcium is taken up, and, upon the cooling of the liquid, bimeconate of calcium is deposited. This is dissolved in warm concentrated hydrochloric acid, which deposits pure meconic acid when it cools. It may be freed from coloring matter by neutralizing it with potassa, decomposing the crystallized meconate thus obtained by hydrochloric acid, and again crystallizing. Meconic acid has little or no action on the system, and is not used separately in medicine; but its natural relation to morphine requires that it should be understood.

THEBOLACTIC ACID, which was discovered by the Messrs. T. and H. Smith, of Edinburgh, appears to be a constant ingredient in opium. These chemists were led to search for it by the consideration that the quantity of meconic acid present is insufficient to saturate the whole of the morphine and other bases, which must, therefore, be neutralized by some other acid. They obtained it from the impure mother-liquid of morphine, after all the alkaloids had been thrown down by the addition of an alkali, by concentrating the liquors to a thick consistence, adding alcohol largely, filtering, precipitating all basic matter by sulphuric acid, filtering again, carefully neutralizing by milk of lime, distilling to recover the alcohol, and finally evaporating the residuary contents of the still to a syrupy consistence. After standing for about a week, the syrupy liquid will be seen to have set into a crystalline mass of thebolactate of calcium. This, being purified by repeated solution and crystallization, and by animal charcoal, is decomposed by adding the equivalent quantity of sulphuric acid, and separating the liberated thebolactic acid by means of alcohol. Stenhouse showed that the new acid had the composition of lactic acid, and was identical with the common variety, and his results were confirmed by J. Y. Buchanan. (*Ber. Chem. Ges.*, 1870, p. 182.) The ready crystallization of its salt with lime is a characteristic property.

Incompatibles. All the substances which produce precipitates with opium do not necessarily affect its medical virtues; but the *alkalies*, and all vegetable infusions containing *tannic* and *gallic acids*, are strictly incompatible; the former separating and precipitating the active principles, the latter forming with it an insoluble compound.

Morphiometric Assays of Opium. The proportion of morphine which any particular specimen of opium will furnish, may be considered as the best test of its value, except that of actual trial upon the system. Good opium should yield not less than 9 per cent. of morphine when assayed by the officinal process. The Br. Pharmacopœia requires at least from 6 to 8 per cent. of morphine. The U. S. Pharmacopœia directs that opium, dried, at a heat not exceeding 85° C. (185° F.), should contain not less than 12, nor more than 16, per cent. of morphine when assayed by the officinal process, which is as follows:

"Opium, in any condition to be valued, *seven grammes;* Lime, freshly slaked, *three grammes;* Chloride of Ammonium, *three grammes;* Alcohol, Stronger Ether, Distilled Water, each, *a sufficient quantity.* Triturate together the Opium, Lime, and 20 C.c. of Distilled Water, in a mortar, until a uniform mixture results; then add 50 C.c. of Distilled Water, and stir occasionally, during half an hour. Filter the mixture through a plaited filter, three to three and one-half inches (75 to 90 mm.) in diameter, into a wide-mouthed bottle or stoppered flask (having the capacity of about 120 C.c. and marked at exactly 50 C.c.), until the filtrate reaches this mark. To the filtered liquid (representing 5 grammes of opium), add 5 C.c. of Alcohol and 25 C.c. of Stronger Ether, and shake the mixture; then add the Chloride of Ammonium, shake well and frequently during half an hour, and set it aside for twelve hours. Counterbalance two small filters, place one within the other in a small funnel, and decant the ethereal layer as completely as practicable upon the filter. Add 10 C.c. of Stronger Ether to the contents of the bottle and rotate it; again decant the ethereal layer upon the filter, and afterward wash the latter with 5 C.c. of Stronger Ether, added slowly and in portions. Now let the filter dry in the air, and pour upon it the liquid in the bottle, in portions, in such a way as to transfer the greater portion of the crystals to the filter. Wash the bottle, and transfer the remaining crystals to the filter, with several, small portions of Distilled Water, using not much more than 10 C.c. in all, and distributing the portions evenly upon the filter. Allow the filter to drain, and dry it, first by pressing it between sheets of bibulous paper, and afterward, at a temperature between 55° and 60° C. (131° to 140° F.). Weigh the crystals in the inner filter, counterbalancing by the outer filter. The weight of the crystals in grammes, multiplied by *twenty* (20), equals the percentage of morphine in the Opium taken." *U. S.*

For other methods of assay see U. S. Dispensatory, 14th edition, p. 675; *A. J. P.*, 1876, p. 358; 1878, p. 184; 1879, p. 369; *N. R.*, Feb. 1880, Dec. 1880, 1881, p. 174. E. Mylius proposes a process which is a modification of Flückiger's. 8 grammes of powdered opium, air-dry, are macerated with 80 grammes of water for 12 hours, and 42·5 grammes of the filtrate (=4 grammes of opium) are mixed in a flask having a capacity of 100 C.c., with 12 grammes of alcohol, sp. gr. 0·830; 10 grammes of ether, sp. gr. 0·728, and 1·5 gramme of ammonia, sp. gr. 0·960. The mixture is set aside for 24 hours, at the expiration of which time the morphine crystals are collected on a filter having a diameter of 3 or 4 centimetres; the crystals remaining in the flask are loosened, either by means of a glass rod, or by shaking with a piece of platinum foil, and are also transferred to the filter, where the morphine is washed with 10 grammes of a mixture of equal bulks of ether and alcohol. The filter is then dried by pressing with bibulous paper and by keeping it at 100° C. (212° F.) for half an hour; it is allowed to regain its hygroscopic water by remaining in the air for half an hour, and is then weighed. The morphine is now removed from the filter, and the latter again weighed. To the quantity of morphine thus determined 0·088 gramme is added, the sum being the total amount of morphine present in 4 grammes of opium. (*Archiv der Pharm.*, Oct. 1879, p. 310; *A. J. P.*, Jan. 1880.)

Tests of Opium. It is sometimes highly important to be able to ascertain the presence or absence of opium in any suspected mixture. As meconic acid and morphine have been found only in the products of the poppy, if either or both of them be shown to exist in any substance, very strong evidence will be afforded of the presence of opium. The test should, therefore, be applied in reference to the detection of these two principles. If an aqueous infusion of the substance examined yields a red color with the tincture of chloride of iron, there is presumptive evidence of the presence of meconic acid. Greater certainty may be obtained by the following process. Add in excess to the filtered liquor a solution of acetate of lead. If opium be present, there will be a precipitate of meconate of lead, and the acetates of morphine and lead will remain in solution. The precipitate is then to be suspended in water, and decomposed, either by adding a little dilute sulphuric acid, which forms sulphate of lead and leaves the meconic acid in solution, or by passing through it a stream of sulphuretted hydrogen, removing by filtration the precipitated sulphide of lead, and heating the clear liquor so as to drive off the sulphuretted hydrogen. With the clear liquor thus obtained, if it contain meconic acid, the tincture of chloride of iron will produce a striking red color, ammoniated sulphate of copper a green precipitate, and acetate of lead, nitrate of silver, and chloride of barium, white precipitates soluble in nitric acid. Sulphocyanate of potassium, which, according to Dr. Wright, is an invariable constituent of saliva (*Simon's Chemistry*, ii. 6), produces a red color with ferric salts, resembling that produced by meconic acid; but, according to Mr. Everitt, this color is entirely and at once destroyed by a solution of corrosive sublimate, which has no effect on the red color of the meconate of iron. (*A. J. P.*, xii. 88.) On the contrary, chloride of gold reddens a solution of sulphocyanic acid or a sulphocyanate, but not of meconic acid. Pereira says the acetates also redden ferric salts, but do not afford the results just mentioned with acetate of lead and chloride of barium. To test the presence of morphine, the liquid from which the meconate of lead has been precipitated, and which may be supposed to contain the acetates of morphine and lead, must be freed from the lead by a stream of sulphuretted hydrogen, and then from the sulphuretted hydrogen by heat; after which the following reagents may be applied:—viz., 1, nitric acid, which colors the morphine red; 2, iodic acid, which is decomposed by the morphine with the extrication of iodine, which colors the liquid reddish brown, and, if starch is present, unites with it to form a blue compound; 3, solution of ammonia, which, if carefully added, so as not to be in excess, throws down a precipitate of morphine soluble in a great excess of that alkali or of potassa; and, 4, tannic acid, which precipitates tannate of morphine. If the precipitate thrown down by ammonia afford a deep red color becoming yellow with nitric acid, and a blue color with ferric chloride, the proofs may be considered as complete.*

Though opium is little injured by time if well kept, yet it does undergo spontaneous change, and M. Guibourt found less morphine in a specimen which had been in his possession nearly twenty years than it had yielded in its recent state. There was also more coloring matter. (*Ann. de Thérap.*, 1863, p. 5.)

Among the adulterations of opium, starch has been detected in a specimen examined by Mr. J. T. King. The drug was unduly brittle, and evidences of starch were afforded both by the microscope and by iodine. From the size and form of the granules, Mr. King inferred that the starch was that of the bean. (*A. J. P.*, Jan. 1869, p. 1.) The probability is that powdered beans were the substance used.

Medical Properties and Uses. Opium is a stimulant narcotic. Taken by a healthy person in a moderate dose, it increases the force, fulness, and frequency of the pulse, augments the temperature of the skin, invigorates the muscular system, quickens the senses, animates the spirits, and gives new energy to the intellectual faculties. Its operation, while thus extending to all parts of the system, is directed with peculiar force to the brain, the functions of which it excites sometimes even to intoxication or delirium. In a short time this excitation subsides; a calmness of the corporeal actions, and a delightful placidity of mind, succeed; and the individual, insensible to painful impressions, forgetting all sources of care and anxiety, submits himself to a current of undefined and unconnected but pleasing fancies, and is conscious of no other feeling than that of a quiet and vague enjoyment. At the end of half an hour or an hour from the administration of the narcotic, all consciousness is lost in sleep. The soporific effect, after having continued for eight or ten hours, goes off, and is often succeeded by more or less nausea, headache, tremors, and other symptoms of diminished or irregular nervous action, which soon yield to the recuperative energies of the system; and, unless the dose is frequently repeated, and the powers of nature worn out by over-excitement, no injurious consequences ultimately result. Such is the obvious operation of opium when moderately taken; but other effects, very important in a remedial point of view, are also experienced. All the secretions, with the exception of that from the skin, are in general either suspended or diminished; the peristaltic motion of the bowels is lessened; pain and inordinate muscular contraction, if present, are allayed; and general nervous irritation is composed, if not entirely relieved.

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* Merck has proposed a test of opium, founded on the property, which characterizes porphyroxin, of assuming a red color when heated in dilute hydrochloric acid. The suspected liquid is first to be carefully evaporated, a few drops of solution of potassa are to be added, and the mixture agitated with ether. The ethereal solution being filtered off, a slip of unsized paper is to be dipped into it and dried; and the moistening and drying should be repeated several times. The paper thus prepared is to be moistened with dilute hydrochloric acid, and then exposed to the vapor of boiling water. If it become reddened, opium may be inferred to exist in the liquid tested. Hensler states that this test is not applicable to the aqueous solution or extract of opium, because porphyroxin is insoluble in water; but Mr. Robertson, of Rotterdam, has found it to succeed with the watery extract, and infers that the porphyroxin is so combined in opium as to render it in some measure soluble. (*Journ. de Pharm.*, 3e sér., xxii. 190.)

In doses insufficient to produce the full soporific effect, the stimulant influence upon the mental functions continues longer, and the subsequent calming effect is sustained for hours; sleep being not unfrequently prevented, or rendered so light and dreamy that, upon awaking, the patient will scarcely admit that he has slept at all. From large doses the period of excitement and exhilaration is shorter, the soporific and anodyne effects are more intense and of longer duration, and the succeeding symptoms of debility are more obvious and alarming.

From quantities sufficient to destroy life, after a brief excitement, the pulse is reduced in frequency, though not in force, muscular strength is diminished, and feelings of languor and drowsiness supervene, which soon eventuate in a deep apoplectic sleep. A stertorous respiration; a dark suffusion of the countenance; a full, slow, and laboring pulse; an almost total insensibility to external impressions; and, when a moment of consciousness is obtained by violent agitation or irritating applications, a confused state of intellect, and an irresistible disposition to sink back into comatose sleep, are symptoms which, for the first few hours, attend the operation of the poison. The pulse is slow, but it is full and strong. In the space of a few hours, varying according to the quantity of the narcotic taken, and the powers of the patient's constitution, a condition of debility ensues; and this condition will be hastened in point of time, though it will be more under the control of remedies, if the opium be evacuated from the stomach. Called to an individual laboring under the influence of a fatal dose of opium, at a period from six to twelve hours after it has been swallowed, the practitioner will generally find him with a cool, clammy skin; cold extremities; a pallid countenance; a feeble, thread-like, scarcely perceptible pulse; a slow, interrupted, almost gasping respiration; and a torpor little short of absolute, death-like insensibility. Death soon follows, unless relief is afforded.

After death from opium there are no characteristic lesions discoverable. The active principles of opium are undoubtedly absorbed, and act directly upon the nerve-centres, affecting in man chiefly the cerebrum, but in some of the lower animals the spinal system more profoundly than the brain. The slow, full pulse seen early in the poison is due to an excitement of the pneumogastric centres in the medulla, whilst the rapidity of the pulse late in the poisoning is probably, in part at least, the result of a paralysis of these centres. The great feebleness of the pulse seems to be partially produced by vaso-motor paralysis, partially by exhaustion of intra-cardiac ganglia. The contraction of the pupil is caused by stimulation of the oculo-motor centres, whilst the sudden dilatation which immediately precedes dissolution seems to have its origin in a giving out of these centres. The immediate cause of death is failure of respiration, which is due to a direct action of the poison upon the respiratory centre in the medulla oblongata.

On some individuals opium produces peculiar effects, totally differing from the ordinary results of its operation. In very small quantities it occasionally gives rise to excessive sickness and vomiting, and even spasm of the stomach; in other cases it produces restlessness, headache, and delirium; and we have known it, even in large doses, to occasion obstinate wakefulness. The headache, want of appetite, tremors, etc., which usually follow, in a slight degree, its narcotic operation, are uniformly experienced by some individuals to such an extent as to render the use of the medicine very inconvenient. It is possible that some of these disagreeable effects may arise not from the meconate of morphine contained in the opium, but from some other of its ingredients; and those which do result from the meconate may not be produced by other salts of morphine. It is very commonly believed that narcotine is the most depressant of all the active principles. As water does not dissolve it, watery preparations of opium are least apt to cause unpleasant after-effects.

An occasional effect of opium, which has not yet been alluded to, is a disagreeable itching or sense of pricking in the skin, sometimes attended with a species of miliary eruption. We have found the effect to result equally from all the officinal preparations of this narcotic.

The general operation of opium may be obtained by injecting it into the cellular tissue or into the rectum, or by applying it to the surface of the body, especially upon a part denuded of the cuticle. The salts of morphine are preferred for hypodermic injection; the British Pharmacopœia has introduced a special process in which the freshly precipitated morphine is dissolved in acetic acid. (See foot-note.)*

The local effects of opium are similar in character to those which follow its general operation. An increased action of the part is first observable; then a diminution of its sensibility and contractility; and the latter effect is more speedy, more intense, and of longer continuance, the larger the quantity applied.

In all parts of the world, opium is habitually employed by many with a view to its exhilarating and anodyne influence. This is particularly the case among the Mohammedans and Hindoos, who find in this narcotic the most pleasing substitute for alcoholic drinks, which are interdicted by their religion. In India, Persia, and Turkey, it is consumed in immense quantities; and many nations of the East smoke opium as those of the West smoke tobacco. This is not the place to speak of the fearful effects of such a practice upon both the intellectual and the bodily faculties.

The use of opium as a medicine can be clearly traced back to Diagoras, who was nearly contemporary with Hippocrates; and it was probably employed before his time. It is at present more frequently prescribed than perhaps any other article of the materia medica. Its extensive applicability to the cure of disease will be rendered evident by a view of the indications which it is calculated to fulfil. 1. It is excitant in its primary action. In low or typhoid complaints, requiring a supporting treatment, it exalts the action of the arterial and nervous systems, and, in moderate doses frequently repeated, may be employed with advantage in conjunction or alternation with other stimulants. 2. It relieves pain more speedily and effectually than any other known medicine taken into the stomach. If possessed of no other property than this, it would be entitled to high consideration. Not to mention cancer, and other incurable affections, in which the alleviation afforded by opium is of incalculable value, we have numerous instances of painful diseases which are not only temporarily relieved, but entirely cured, by the remedy; and there is scarcely a complaint in the catalogue of human ailments, in the treatment of which it is not occasionally demanded for the relief of suffering, which, if allowed to continue, might aggravate the disorder, and protract if not prevent a cure. 3. Another very important indication, which, beyond any other narcotic except chloral, it is capable of fulfilling, is the production of sleep. For this purpose it is given in a great variety of diseases; whenever, in fact, morbid vigilance exists, not dependent on acute inflammation of the brain. Among the complaints in which it proves most serviceable in this way is delirium tremens, or the mania of drunkards. Opium produces sleep in two ways: by its direct operation on the brain, and by allaying that morbid nervous irritation upon which wakefulness often depends. In the latter case it may frequently be advantageously combined with camphor, or with Hoffman's anodyne. 4. Opium is powerfully antispasmodic. Only a few medicines are so efficient in relaxing spasm, and in controlling those irregular muscular movements which depend on unhealthy nervous action. Hence its great importance as a remedy in tetanus; colic; spasm of the stomach attending gout, dyspepsia, and cholera; spasm of the ureters in nephritis, and of the biliary ducts during the passage of calculi; and in various convulsive affections. 5. Probably dependent upon a similar influence over the nervous system, is the property which it possesses of allaying general and local irritations, whether exhibited in the nerves or the blood-vessels, provided the action do not amount to positive inflammation; and even in this case it is often prescribed with advantage. Hence its use in composing restlessness, quieting cough, and relieving nausea, tenesmus, and strangury. 6. In suppressing morbid discharges, it answers another indication which fits it for the treatment of a long list of diseases. This effect it is, perhaps, enabled to produce by diminishing the nervous energy upon which secretion and muscular motion depend. Upon this principle it is useful in diarrhœa, when the complaint consists merely in increased secretion into the bowels, without high action or organic derangement; in consumption, chronic catarrh, humoral asthma, and other cases of morbidly increased expectoration; in diabetes; and in certain forms of hemorrhage, particularly that from the uterus, in combination with other remedies. 7. It remains to mention one other indication; that, namely, of producing perspiration, in fulfilling which, opium, conjoined with small doses of emetic medicines, is pre-eminent. We shall speak more fully of this application of the remedy under the head of *Pulvis Ipecacuanhæ et Opii.* It is here sufficient to say that its beneficial effects are especially experienced in rheumatism, the bowel affections, and certain pectoral diseases.

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* *Injectio Morphiæ Hypodermica.* Br. *Hypodermic Injection of Morphia.*

"Take of Hydrochlorate of Morphia *eighty-eight grains;* Solution of Ammonia, Acetic Acid, Distilled Water, of each, *a sufficiency.* Dissolve the Hydrochlorate of Morphia in two ounces of Distilled Water, aiding the solution by a gentle heat; then add Solution of Ammonia, so as to precipitate the Morphia and render the liquid slightly alkaline; allow it to cool, collect the precipitate on a filter, wash it with Distilled Water, and allow it to drain; then transfer the Morphia to a small porcelain dish, with about an ounce of Distilled Water, apply a gentle heat, and carefully add Acetic Acid until the Morphia is dissolved and a very slightly acid solution is formed. Add now sufficient Distilled Water to make the solution measure exactly two fluidounces. Filter and preserve the product in a stopped bottle, excluded from the light." *Br.*

A fluidrachm (3·75 C.c.) of this contains five grains (0·33 Gm.) of the acetate of morphine.

From this great diversity of properties, and the frequent occurrence of those morbid conditions in which opium affords relief, it is often prescribed in the same disease to meet several indications. Thus, in idiopathic fevers we frequently meet with morbid vigilance and great nervous irritation, combined with a low condition of the system. In typhous pneumonia, there is the same depression of the vital powers, combined often with severe neuralgic pains and much nervous irritation. In diarrhœa, besides the indications presented by the spasmodic pain and increased discharge, there is a strong call for the diaphoretic operation of the opium. It is unnecessary to multiply instances. There is hardly a complaint which does not occasionally present a complication of symptoms demanding the use of this remedy.

But a medicine possessed of such extensive powers may do much injury, if improperly directed; and conditions of the system frequently occur, in which, though some one of the symptoms calls for its use, others, on the contrary, are incompatible with it. It is contraindicated by inflammation of the brain, or strong determination of blood to the head, by deficient secretion from inflamed mucous membranes, as in the early stages of bronchitis, and generally by constipation. When, however, the constipation depends upon intestinal spasm, as in colic, it is sometimes relieved by the antispasmodic action of the opium; and the drying effects of the medicine upon mucous membranes may be counteracted by expectorants or laxatives.

Opium may be administered in substance or tincture. In the former state it is given in the shape of a pill, which, as a general rule, should be formed out of powdered opium, as it is thus more readily dissolved in the liquors of the stomach, and therefore operates more speedily and effectually, than when made, as it sometimes is, immediately from the plastic mass. There is no medicine of which the dose is more variable, according to the habits of the patient, the nature of the complaint, or the purpose to be effected. While in catarrh and diarrhœa we often prescribe not more than one-fourth or one-third of a grain (0·016 or 0·02 Gm.), in tetanus and some other acute diseases enormous doses are well borne. In acute peritonitis we have seen the equivalent of seventy-five grains (5 Gm.) given during the twenty-four hours with advantage. In using heroic doses, it is essential that a liquid preparation be administered in divided doses, at short intervals, so as to secure prompt absorption; that the patient be closely watched, and the remedy suspended so soon as narcosis begins. In chronic cases, when the system becomes habituated to the remedy, indefinite doses are sometimes borne. The ordinary medium dose of dried or powdered opium may be set down as one grain (0·065 Gm.).

Opium may often be administered with great advantage by the rectum. In this way it operates most advantageously in obstinate vomiting, painful nephritic and uterine affections, strangury from blisters, and dysenteric tenesmus. It may be employed as a suppository, or in the form of enema made with laudanum and a small quantity of viscid liquid, as flaxseed tea, mucilage of gum arabic, or starch prepared with hot water. Absorption takes place more slowly from the rectum than from the stomach, and a one-half larger dose may be given. In an individual long accustomed to take opium internally, and whose stomach will receive large doses with impunity, it is possible that the rectum may not have lost, in a proportionate degree, its absorbing power or susceptibility, and that serious consequences might result by adhering, in such a case, to the general rule as to the relative quantity to be given in the way of enema or suppository.

In some one of its liquid preparations, opium is often used locally as an addition to collyria in ophthalmia, to injections in gonorrhœa, and to lotions and cataplasms in various complaints of the skin, and external pains, as those of gout and rheumatism. It is also employed in substance, in the form of a plaster or cataplasm made from the powder. But its external use requires some caution, especially when the skin is deprived of the cuticle. Death is said to have resulted from laudanum applied to the epigastrium. (*Ann. de Thérap.*, 1843, p. 5.)

When opium has been taken in an overdose, the stomach must be evacuated as speedily as possible, either by the stomach-pump, or, when this is not attainable, by the more active mechanical emetics, such as mustard flour, sulphate of zinc, or sulphate of copper, conjoined with ipecacuanha. Emetics are preferable to the stomach-pump, when opium has been swallowed in substance; as the capacity of the tube is insufficient to permit the passage of the masses in which the poison is sometimes taken. The operation of the emetic should be promoted by a very free use of warm drinks, by irritating the fauces with a feather, by keeping the patient in motion, and, if the insusceptibility to the action of the remedy is very great, by dashing cold water upon the head and shoulders. Very frequently, before the practitioner has reached the patient, the narcotism will have progressed so far that it is impossible to cause vomiting at once. Owing to the great disturbance of respiration, two poisons are circulating in the blood, namely, the opium and carbonic acid gas. By arousing the patient, and forcing him to supplement the disabled involuntary breathing by voluntary efforts, or, in extreme cases, by artificial respiration, the blood may be so far purified that the nervous centres recover sufficiently their sensitiveness to enable the emetic to act. The great cause of death is failure of respiration; and the keeping the patient awake, and the procedures already spoken of, are for the purpose of preventing this failure. Peremptory orders to breathe should be continually shouted in the ear of the patient. Shaking, forcing to walk, and the galvanic brush, or even flagellations, should be made use of to get the arousing effects of action and pain. Atropine is the most powerful respiratory stimulant known, and should always be used by hypodermic injection in opium poisoning. The dose of the atropine depends upon the amount of the poison swallowed. It is best to commence with from $\frac{1}{20}$ to $\frac{1}{50}$ of a grain of atropine, and repeat as often as necessary. The chief guide is the action upon the respiration, though the influence upon the pupil and circulation should always be considered. The desired effect is the maintenance of the respiration at near the normal rate. When cardiac debility comes on, ammonia in some form may be employed; also alcohol in not too large quantities, for fear of deepening the narcosis; whilst tincture of digitalis should be administered hypodermically. Coffee has been found to be of service in producing wakefulness. It should be given *ad libitum*, and as strong as it can be made. In some rare cases, bleeding, in the early stage of opium poisoning, when evidences of brain congestion have been very pronounced, has been of distinct advantage. Several cases are on record in which life was apparently saved by artificial respiration. As opium does not produce structural derangement, but operates chiefly on the nervous power, the convalescence is usually short and recovery complete.

Off. Prep. Emplastrum Opii, *Br.;* Extractum Opii; Morphiæ Hydrochloras, *Br.;* Pilulæ Opii, *U. S.;* Pilulæ Plumbi cum Opio, *Br.;* Pulvis Cretæ Aromaticus cum Opio, *Br.;* Pulvis Ipecacuanhæ et Opii; Pulvis Kino Compositus, *Br.;* Opium Denarcotisatum, *U. S.;* Opii Pulvis, *U. S.;* Pulvis Opii Comp., *Br.;* Suppositoria Plumbi Composita, *Br.;* Tinctura Camphoræ Composita, *Br.;* Tinctura Opii; Tinctura Opii Ammoniata, *Br.;* Tinctura Opii Camphorata, *U. S.;* Tinctura Opii Deodorata, *U. S.;* Trochisci Glycyrrhizæ et Opii, *U. S.;* Unguentum Gallæ cum Opio, *Br.;* Vinum Opii, *U. S.*

OPIUM DENARCOTISATUM. *U. S.* *Denarcotized Opium.*

(Ō'PĮ-ŬM DĘ-NÄR-CO̧-TĮ-ṢĀ'TŬM.)

"Powdered Opium, containing fourteen per cent. of morphine, *one hundred parts* [or one ounce av.]; Stronger Ether, *one thousand parts* [or fourteen fluidounces]; Sugar of Milk, in fine powder, *a sufficient quantity,* To make *one hundred parts* [or one ounce av.]. Macerate the Powdered Opium with *five hundred parts* [or seven fluidounces] of Stronger Ether, in a well-closed flask, for twenty-four hours, agitating from time to time. Pour off the clear, ethereal solution, and repeat the maceration with two other portions of the Ether, each of *two hundred and fifty parts* [or three and a half fluidounces], first for twelve hours, and the last time for two hours. Collect the residue in a weighed dish, dry it, first by a very gentle heat, and, finally, at a temperature not above 85° C. (185° F.), and mix it thoroughly, by trituration, with enough Sugar of Milk to make the product weigh *one hundred parts* [or one ounce av.]. Instead of taking *one hundred parts* of Powdered Opium, containing *fourteen per cent.* of morphine, a proportionately smaller quantity of Powdered Opium of any higher percentage of morphine may be taken. The proper quantity, in parts by weight, for the above formula, is ascertained by dividing 1400 by the percentage of morphine in the Powdered Opium selected." *U. S.*

"Denarcotized Opium, when assayed by the process mentioned under *Opium,* should yield 14 per cent. of morphine." *U. S.*

This is a new officinal preparation. Denarcotized opium has been in use many years, and it is believed that a standardized and purified powdered opium would prove very serviceable to the profession. The loss sustained through maceration with ether is made up by the addition of sufficient sugar of milk to restore the original weight.

Medical Properties. If the prevalent views concerning the tendency of narcotine and the odorous principles to cause unpleasant after-effects be correct, this new officinal should be a valuable preparation, fully representing the medical properties of the crude drug. The dose is that of powdered opium (page 1076).

ORIGANUM. *U. S.* *Origanum.* [*Wild Marjoram.*]

(O̧-RĬG'Ạ-NŬM.)

"Origanum vulgare. Linné. (*Nat. Ord.* Labiatæ.)" *U. S.*

Origan, Marjolaine sauvage, *Fr.;* Dosten, Wilder Majoran (Meiran), *G.*

Gen. Ch. Strobile four-cornered, spiked, collecting the calyxes. *Corolla* with the upper lip erect and flat, the lower three-parted, with the segments equal. *Willd.*

Two species of Origanum have been used in medicine, *O. Majorana,* or sweet marjoram, and *O. vulgare,* or common marjoram. The former grows wild in Portugal and Andalusia, and is cultivated as a garden herb in other parts of Europe, and in the United States. Some authors, however, consider *O. Majoranoides,* which is a native of Barbary, and closely allied to *O. Majorana,* as the type of the sweet marjoram of our gardens. *Sweet Marjoram* has a pleasant odor, and a warm, aromatic, bitterish taste, which it imparts to water and alcohol. By distillation with water it yields a volatile oil. It is tonic and gently excitant, but is used more as a condiment than as a medicine. In domestic practice, its infusion is employed to hasten the tardy eruption in measles and other exanthematous diseases.

Origanum vulgare. Willd. *Sp. Plant.* iii. 135; *B. & T.* 204. This is a perennial herb, with erect, purplish, downy, four-sided, trichotomous stems, about eighteen inches high, and opposite, ovate, entire, pellucid, punctate, somewhat hairy leaves about an inch long, of a deep yellowish green color. The flowers are of a pinkish purple or rose color, disposed in roundish, panicled spikes, and accompanied with ovate reddish bracts, longer than the calyx. This is tubular and five-toothed, with nearly equal segments. The corolla is funnel-shaped, with the upper lip erect, bifid, and obtuse, the lower trifid, blunt, and spreading. The four stamens are exserted, the stigma bifid and reflexed. The plant is a native of Europe and America. In this country it grows along the roadsides, and in dry stony fields and woods, from Pennsylvania to Virginia, and is in flower from June to October; but it is not very abundant, and is seldom collected for use. It has a peculiar, agreeable, aromatic odor, and a warm, pungent taste. These properties it owes to a volatile oil, which was formerly employed, but has been superseded, in great measure, if not altogether, by the oil of thyme. Origanum is gently tonic and excitant, and has been used in infusion as a diaphoretic and emmenagogue, and externally as a fomentation; but it is at present little employed.

Off. Prep. Vinum Aromaticum, *U.S.*

OS USTUM. *Br.* *Bone Ash.*

(ŏs ŭs'tụm.)

"The residue of Bones, which have been burned to a white ash in contact with air." *Br.*

Os, *Fr.;* Knochen-Asche, *G.;* Ossa, *It.;* Huesos, *Sp.*

Bones are employed in several pharmaceutical processes, and those derived from domestic quadrupeds, especially the ox, are the kind intended.

Properties, etc. Bones are solid, white, and of a lamellated texture, and constitute the skeleton of the superior orders of animals, of which they are the hardest and densest parts. They consist of a cellular gelatinous tissue, the cavities of which are filled with certain earthy salts. When subjected to destructive distillation, in *close* vessels, they are decomposed without alteration of shape, lose about three-sevenths of their weight, become brittle, and are converted into a black substance, containing the earthy salts of the bone, and constituting the species of animal charcoal called *bone-black.* (See *Carbo Animalis.*) The portions which distil over consist of the usual ammoniacal products derived from animal matter, but are especially rich in nitrogenous bases of the pyridine and chinoline series. (See *Ammonii Chloridum.*) Before the distillation is performed, the bones are boiled with water, to separate the fat, which amounts to 5 or 6 per cent.; but gelatin is at the same time extracted, with the effect of rendering the bones less fitted to furnish a good bone-black. In view of this fact, M. Deiss, of Paris, has proposed to extract the fat by bisulphide of carbon, which gives a product of 10 or 12 per cent., without injuring the bones for subsequent conversion into bone-black. (*A. J. P.*, 1856, p. 356.) When calcined in *open* vessels, bones lose more of their weight in consequence of the combustion of the animal matter, and are converted into a white friable substance, consisting of the incombustible part, and commonly called *bone-earth*, or *bone-ash;* and a similar residue is obtained by calcining horns. (See *Cornu Ustum.*) Treated with boiling water, a small portion of the gelatinous matter is dissolved; but, when acted on by water in a *Papin's digester*, the whole of it is taken up, and the earthy salts, deprived of their cement, crumble into powder, and become diffused through the solution. When subjected to dilute hydrochloric acid, the earthy salts are dissolved, and the bone softens without losing its shape, and becomes semi-transparent and flexible. The portion remaining unattacked by the acid is the gelatinous tissue, which may be converted into gelatin by long boiling. This is nutritious, and has been prepared so as to form a wholesome aliment by M. d'Arcet. His process for obtaining it consists in digesting bones in weak hydrochloric acid for seven or eight days, occasionally renewing the acid, plunging them for a few moments in boiling water, and then subjecting them to a strong current of cold water. The pure animal matter, thus procured, is made into cakes, called *portable soup* (*tablettes de bouillon*), by dissolving it in water, concentrating the solution until it gelatinizes, and drying the jelly.

Composition. The bones of different animals, and of the same animal at different ages, vary somewhat in composition. Dry ox-bones, according to Berzelius, consist of bone-gelatin (cartilage of bone) 33·3, bone-phosphate of calcium with a little fluoride of calcium 57·35, carbonate of calcium 3·85, phosphate of magnesium 2·05, and soda with a very little chloride of sodium 3·45 = 100. Human bones differ somewhat in the proportions of their constituents, and in containing traces of iron and manganese. According to Dr. W. Heintz, however, bones exhausted by water, so as to remove the coloring matter of blood, contain not a trace of iron.

Marchand found 1 per cent. of fluoride of calcium in human bone. *Bone-phosphate of calcium* consists, according to Mitscherlich, of two molecules of acid and three of lime. This analysis makes it the normal or tribasic phosphate, $Ca_3(PO_4)_2$, and the same composition has been assigned to it by Dr. Heintz.

Uses. Bones are applied to numerous uses. Burnt to whiteness, they furnish bone-phosphate of calcium, from which phosphorus and all its compounds are either directly or indirectly obtained. Subjected to destructive distillation in close vessels, they yield *impure carbonate of ammonium* with empyreumatic oil, and a carbonaceous residue, called *bone-black.* Calcined, pulverized, and washed, they form the material of which *cupels* are made. As bone-dust, they form an excellent manure. Deprived of their earthy salts by weak acids, they furnish a nutritious article of diet. By proper treatment with water they yield several varieties of gelatin, not only the coarser sorts, called size and glue, but also the finer kinds, which are employed, under the name of isinglass, in making animal jellies, and for the clarifying of wines. The hoof bones of the ox, boiled with water, furnish a peculiar oil, called neat's-foot oil, which was formerly officinal under the name of *Oleum Bubulum.*

Off. Prep. of Bone Ash. Calcis Phosphas, *Br.;* Sodæ Phosphas, *Br.*

OVI VITELLUS. *Br.* *Yolk of Eggs.*

(Ō'VĪ VỊ-TĔL'LỤS.)

"The yolk of the egg of Gallus Banckiva, *var.* Domesticus. Temminck." *Br.*

Ovum, *U. S.* 1870; Ovum Gallinaceum; Œuf, *Fr.;* Ei, *G.;* Ovo, *It.;* Huevo, *Sp.*

The common dunghill fowl is supposed to have come originally from India, where it is found in a wild state. It is now almost everywhere domesticated.

The egg consists of an exterior covering, the shell; a white, semi-opaque membrane, lining the internal surface of the shell; the white; and the yolk.

The shell—*testa ovi* or *putamen ovi*—consists, according to Vauquelin, chiefly of carbonate of calcium, with animal matter, and a minute proportion of phosphate of calcium, carbonate of magnesium, oxide of iron, and sulphur. When exposed to a high degree of heat in the open air, the carbonic acid is driven off, the animal matter consumed, and the lime is left nearly pure. The membrane lining the shell appears to be of an albuminous nature. The white—*albumen ovi*—is a glairy viscid liquid, contained in very delicate membranes, without odor or taste, readily soluble in water, coagulable by the stronger acids, by alcohol, and by a heat of 71·1° C. (160° F.). Exposed in thin layers to a current of air, it becomes solid, retaining its transparency and solubility in water. By coagulation it is rendered sapid, white, opaque, and insoluble. At a temperature of 100° C. (212° F.), one part of it renders one thousand parts of water in which it has been dissolved opaque. It contains, according to Dr. Bostock, in 100 parts, 85 of water, 12 of pure albumen, 2·7 of mucus or uncoagulable matter, and 0·3 of saline substances, including soda with traces of sulphur. The white of egg is precipitated by chloride of tin, chloride of gold, subacetate of lead, sulphate of copper, corrosive sublimate, and tannin. When kept in the fluid state it soon putrefies; but, if carefully dried without coagulation, it may be long preserved unaltered, and may be applied in solution to the same purposes as in its original condition.

The yolk—*vitellus ovi*—is inodorous, of a bland oily taste, and forms an opaque emulsion when agitated with water. By heat it is coagulated into a granular solid, which yields a fixed oil by expression. The researches of Gobley and others have established the constitution of the yolk about as follows: Water, 51·8 per cent.; vitellin, 15·8 per cent.; nuclein, 1·5 per cent.; palmitin, stearin, and olein, 20·3 per cent.; cholesterin, 0·4 per cent.; phosphoglyceric acid, 1·2 per cent.; lecithin, 7·2 per cent.; cerebrin, 0·3 per cent.; coloring matter, 0·5 per cent.; salts, 1·0 per cent. (Koenig, *Nahrungs und Genussmittel,* p. 180.) Chevreul states that there are two coloring principles, one reddish containing iron, the other yellow, and similar to the coloring matter of bile. The former is more difficultly soluble in ether than the latter. (*Neues Repertor.*, 1867, xvi. 697.) Lehmann considers vitellin to be a mixture of albumen and casein, and in the proportion of 13·9 per cent. of casein and 3·7 per cent. of albumen. It is said that the yolk may be kept for a considerable time, without observable change, by adding to it 5 per cent. of sulphate of sodium, in powder or concentrated solution. Granules have been found, with the aid of the microscope, in the yellow of the egg, which are rendered blue by iodine, and have all the other properties of the starch granules. (*Journ. de Pharm.*, Oct. 1868, p. 261.)

To preserve eggs in their entire state, M. Bournouf recommends the following method, which he has found to answer well; affirming that he has eaten eggs which had been kept for two years; and he even thinks that the vitality of the germ may be preserved, in the same manner, for a considerable time. The plan consists simply in covering over each egg completely, by the end of the finger, with an ointment consisting of one part of beeswax dissolved in two parts of heated olive oil. The oil is absorbed by the shell, and each of its pores becomes filled with the wax, so as entirely to exclude the air. (*A. J. P.*, 1866, p. 88.) M. H. Violette, of Louisiana, has found eggs to keep perfectly sound, for six months, by merely covering them well with olive oil by means of the finger. (*Journ. de Pharm.*, Sept. 1867, p. 175.) Mr. Charles Lamont's patented method consists in beating the eggs emptied into a long covered trough, by means of a revolving shaft furnished with metallic disks, drying the mass by a current of heated air, and scraping off the concreted egg in thin scales or granules. It is said that the egg retains its flavor and fitness for cooking unimpaired. (*Chem. News*, Dec. 27, 1867, p. 323.)

Medical Properties and Uses. Eggs are applied to various purposes in medicine and pharmacy. The shells, powdered and levigated, may be used as an antacid in diarrhœa. In common with oyster-shells, they possess the advantage of uniting intimately animal matter with carbonate of calcium, the particles of which are thus more isolated, and more acceptable to the stomach, than the most finely-powdered chalk. The dose is five to ten grains (0·33 to 0·65 Gm.).

The *white* of the egg is used chiefly for the clarification of liquids, which it effects by involving, during its coagulation, the undissolved particles, and rising with them to the surface, or subsiding. It is highly recommended as an antidote for corrosive sublimate and sulphate of copper, with which it forms insoluble and comparatively inert compounds. It is sometimes also used for the suspension of insoluble substances in water, but is inferior for this purpose to the yolk, and even to mucilage of gum arabic. Agitated briskly with a lump of alum it coagulates, at the same time dissolving a portion of the alum, and thus forming the so-called *alum curd*, which is used between folds of gauze over the eye, in some states of ophthalmia.

The *yolk* in its raw state is thought to be laxative, and is a popular remedy in jaundice. If beneficial in this complaint, it is probably in consequence of affording a mild nutritious diet, acceptable to the stomach and easily digested. In dyspepsia it is, from this cause, highly useful. The late Dr. Jos. Parrish, of Philadelphia, found great advantage in that complaint from the habitual use of the yolk of egg, beaten up with water and a little ginger. In pharmacy, the yolk is highly useful as an intermedium between water and insoluble substances, and is to be preferred to the white in preparing emulsions.*

Off. Prep. Mistura Chloroformi, *U. S.;* Mistura Spiritus Vini Gallici, *Br.*

OXYMEL. *Br.* *Oxymel.*

(ŎX'Y̩-MĔL.)

Oxymel Simplex, *P.G.;* Mel Acetatum, Oxymellite simple, Acétomel, *Fr.;* Sauerhonig, *G.*

"Take of Clarified Honey *forty ounces* [avoirdupois]; Acetic Acid *five fluidounces;* Distilled Water *five fluidounces.* Liquefy the honey by heat, and mix with it the Acetic Acid and Water." *Br.*

This mixture of honey and vinegar forms a pleasant addition to gargles, and is sometimes used as a vehicle of expectorant medicines, and to impart flavor to drinks in febrile complaints.

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* *How to know when an egg is fresh.* An egg remains fresh a day or two in summer, from one to six days in winter. The age of eggs may be told by immersion in salt water of a certain strength. Dissolve 4 ounces of table salt in 40 ounces of water, and, when the solution is perfect, introduce the egg. If only one day old, the egg will sink and touch the bottom of the vessel: if two days old, it will sink, but not to the bottom; if three, it will float near the top; if five or more, it will appear at the surface, and project more or less above it, according to the age. (*Ed. Med. Journ.*, Dec. 1873, p. 672.)

OXYMEL SCILLÆ. *Br.* *Oxymel of Squill.*

(ŎX'Y̧-MĔL SÇĬL'LÆ—sĭl'lē.)

"Take of Vinegar of Squill *a pint* [Imperial measure]; Clarified Honey *two pounds* [avoirdupois]. Mix, and evaporate by a water-bath, until the product, when cold, shall have a specific gravity of 1·32." *Br.*

After a long vogue, this preparation fell into such neglect that it was abandoned by the Pharmacopœias. Its reintroduction, however, into the Br. Pharmacopœia indicates that it is still prescribed. It has the virtues of squill, but is in no respect superior to the syrup. It is chiefly used as an expectorant in chronic catarrh, humoral asthma, hooping-cough, and generally in those states of the pulmonary organs in which the bronchial tubes are loaded with a viscid mucus of difficult expectoration. The dose is from one to two fluidrachms (3·9 to 7·5 C.c.). In large doses it is emetic, and as such may sometimes be given with advantage in infantile croup and catarrh.

PAPAVERIS CAPSULÆ. *Br.* *Poppy Capsules.*

(PẠ-PĀ'VẸ-RĬS CĂP'SŮ-LÆ.)

"The nearly ripe dried capsules of the white poppy, Papaver Somniferum. Linn. Cultivated in Britain." *Br.*

Papaver, *U. S.* 1870; Fructus, s. Capita Papaveris, *P.G.;* Capsules (Têtes) de Pavots, *Fr.;* Kapseln des Weissen Mohns, Mohnkapseln, Mohnköpfe, *G.;* Capidel Papavero, *It.;* Cabezas de Amapola, *Sp.*

In England the poppy is cultivated chiefly for its capsules, which are gathered as they ripen, and taken to market enclosed in bags. The Br. Pharmacopœia directs them to be collected before they are quite ripe, as they then contain more of the active milky juice; but, cut at this period, they are apt to lose their juice through the wounded surface, unless carefully kept inverted upon their crown while drying; and, even when thus treated, they are, according to the observations of Buchner, less active than the capsules collected after perfect maturity, while they contain more of useless saccharine and mucilaginous matter. (*Buchner's Repert.*, 3 R., viii. 289 and 326.) M. Meurein states, as the result of his experiments, that the richest are those collected just before the maturity of the seeds, when the capsules have passed from their glaucous green to a yellowish green color. (*Journ. de Pharm.*, 3e sér., xxiii. 341.) They are occasionally imported; but, as no effect is produced by them which cannot be as well obtained from opium, they are little employed.

Dried *poppy capsules* vary in size from the dimensions of a small egg to those of the fist. They differ also in shape according to the variety of the poppy from which they are procured. On the continent two sub-varieties of the white poppy are recognized, the *long*, and the *round* or *depressed*. Of these, according to Aubergier, the long are richest in morphine, and his conclusions are confirmed by Meurein, who also found the largest capsules most efficient. Those commonly kept in our shops are spheroidal, flattened below, and surmounted by a crown-like expansion—the persistent stigma—which is marked by numerous diverging rays that rise somewhat above its upper surface, and appear to be prolongations of partial septa, or partitions, proceeding along the interior circumference of the capsule from the top to the bottom. In the recent state, the seeds, which are very numerous, adhere to these septa; but in the dried capsule they are loose in its cavity. The capsules of the black poppy are smaller and more globular than those of the white, and contain dark instead of light-colored seeds. There appears to be no essential difference in their properties. Both kinds, when fresh, are glaucous, but when dried, as found in the shops, are of a dirty white or purplish brown color, of a consistence somewhat like that of paper, inodorous, and with little taste, unless long chewed, when they are decidedly bitter. They contain principles similar to those of opium, which they yield to water by decoction, and have been employed in France for obtaining morphine.

On the continent of Europe, the poppy is cultivated largely for its seeds, which yield about fifty per cent. of an excellent fixed oil on expression. *Poppy-seed oil* is of a pale golden color, liquid at 5·5° C. (42° F.), easily dried, inodorous, and of a pleasant flavor. It is bleached by exposure in thin layers to the sun. (*P. J. Tr.*, March, 1874, p. 731.)

Medical Properties and Uses. Dried poppy-heads, though analogous to opium in medical properties, are exceedingly feeble. They are nevertheless asserted, in the form of decoction, to have proved fatal in a child. The case, reported by Dr. F. L. Winckler, was that of a babe, in the stomach of which he found a little morphine, but no meconic acid. (*Neues Repertor.*, 1867, xvi. 38.) They are sometimes employed in decoction, as an external emollient and anodyne application; and, in emulsion, syrup, or extract, are often used internally in Europe, to calm irritation, promote rest, and produce generally the narcotic effects of opium.

Off. Prep. Decoctum Papaveris, *Br.;* Extractum Papaveris, *Br.;* Syrupus Papaveris, *Br.*

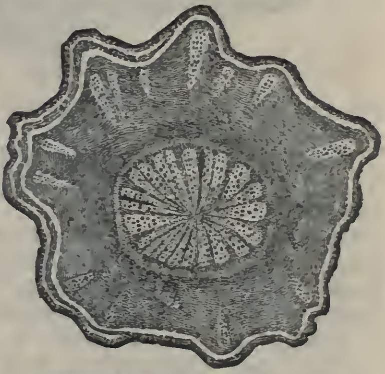
PAREIRA. *U.S.* *Pareira.* [*Pareira Brava.*]

(PA̤-REI′RA̤—pa̤-rā′ra̤.)

"The root of Chondodendron tomentosum. Ruiz et Pavon. (*Nat. Ord.* Menispermaceæ.)" *U.S.* "The dried root of Cissampelos Pareira (Linn.), Brazil." *Br.*

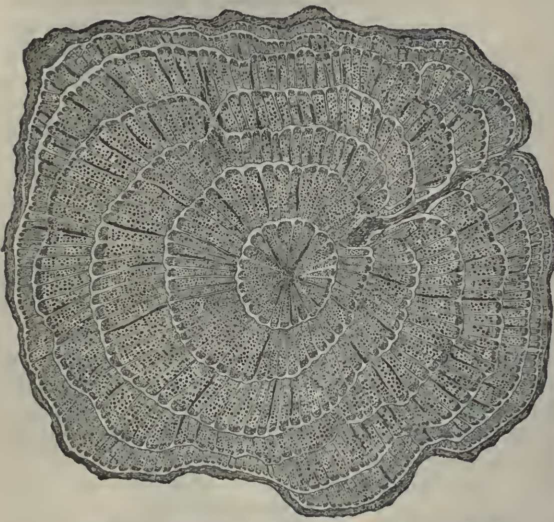
Pareiræ Radix, *Br.;* Pareira Root; Pareira Brava, *Fr., G.*

Under the name of Pareira Brava there are three distinct drugs met with in our market. Of these the rarest is the product of the *Cissampelos Pareira.* Messrs. Allen and Hanburys obtained from Jamaica a considerable quantity of this drug, the bulk of it composed of stems, which are described as being cylindrical, varying from the thickness of a quill to that of the forefinger, with a light brown bark. The roots which we have met in American commerce are rarely more than three-fourths of an inch in diameter, are much contorted, irregularly cylindrical, with a dark brown exterior, which is longitudinally much wrinkled or furrowed. On section they are seen to be composed of a thick corky bark enclosing a woody cylinder composed of a number (10 to 20) of convergent, vascular bundles, separated by wedge-shaped, very porous, medullary rays. There are no concentric layers of wood. The color is a light yellowish fawn tint, the taste a pure bitter. (See cut.) This is the Pareira Brava of the Br. Pharm.


Cissampelos Pareira, transverse section. (Slightly magnified.)

The ordinary pareira brava of our markets is that which was exhibited in 1876 by the Brazilian Government as the product of *Cissampelos Pareira*, but is now generally recognized as being obtained from the *Chondodendron tomentosum.* It consists of great pieces of roots, some of them four inches in diameter and three feet long. They are irregularly cylindrical, often somewhat four-sided, with a thin, brownish, closely adherent bark, often grayish in color, and not so closely wrinkled as in the true pareira brava. On section the root is seen to consist of from three to nine concentric or eccentric rings of growth of a breadth of from one-eighth to one-third of an inch. There is not a distinct continuous series of medullary rays, but each zone is composed of wedge-shaped masses, formed of divergent lines of dense woody tissue arched exteriorly over the porous parenchyma. The stems have a similar structure, but with an obvious pith. (See cut, p. 1084.) This is the pareira brava of the present U. S. Pharm., where it is described as follows. "In subcylndrical, somewhat tortuous pieces, about four to six inches (10 to 15 cm.) long, varying in thickness from three-quarters of an inch to four inches (2 to 10 cm.); externally dark brownish gray, with transverse ridges and fissures and longitudinal furrows; internally pale brown, the fresh cut having a waxy lustre; bark thin; wood porous, in two or more somewhat irregularly concentric circles, and with distinct medullary rays; inodorous and bitter. Pieces having a bright yellow color, or with a grayish, hard, nearly tasteless wood, should be rejected." *U. S.*

Under the name of *Common False Pareira,* Flückiger and Hanbury describe a drug which they state to be the common drug of the Brazilian and English markets. "It consists of a ponderous, woody, tortuous stem and root, occurring in pieces from a few inches to a foot or more in length, and from 1 to 4 inches in thickness, coated with a thin, hard, dark brown bark. The pieces are cylindrical, four-sided, or more or less flattened—sometimes even to the extent of becoming ribbon-like. In transverse section, their structure appears very remarkable. Supposing the piece to be *stem*, a well-defined pith will be found to occupy the centre of the first-formed wood, which is a column about $\frac{1}{4}$ of an inch in diameter. This is succeeded by 10 to 15 or more concentric or oftener eccentric zones, $\frac{1}{10}$ to $\frac{2}{10}$ of an inch wide, each separated from its neighbor by a layer of parenchyme, the outermost being coated with a true bark. In pieces of *true root*, the pith is reduced to a mere point. (*Pharmacographia*, p. 29.)



Chondodendron Tomentosum, transverse section. (Natural size.)

This drug we have not seen. It is stated that in it Wiggers discovered pelosine in 1839. Its botanical source is unknown, but is believed to be a Menospermum.*

CHONDODENDRON. *Gen. Ch. Petals* six, somewhat shorter than the inner sepals. MALE FLOWERS with the filaments of the six stamens coalescent beyond the middle. Loculi of the extrorse anthers distinct and parallel. FEMALE FLOWERS with three carpels, the leaf-like stigmata deflexed. *Drupe* ovoid, with the cicatrix of the style subterminal. *Bentham & Hooker.*

Chondodendron tomentosum. Ruiz and Pavon.—*Cocculus chondodendron.* De C.—*Botryopsis platyphylla.* Miers. This is a climbing, woody vine, which attains often a considerable height, and is remarkable for the size of its leaves. These are about a foot long, broadly ovate or rounded, slightly cordate, with a smooth upper surface, and on the under surface, between the veins, covered with a fine close wool of an ashy hue. The racemose fruits are the size of large grapes, oval and black. This plant inhabits both Brazil and Peru.

CISSAMPELOS. *Gen. Ch.* MALE. *Calyx* four-leaved. *Corolla* none. *Nectary* rotate. *Stamens* four, with connate filaments. FEMALE. *Calyx* one-leafed, ligulate roundish. *Corolla* none. *Styles* three. *Berry* one-seeded.

Cissampelos Pareira. Willd. *Sp. Plant.* iv. 861; Woodv. *Med. Bot.* 3d ed., p. 167, t. 65. This is a climbing plant, with numerous slender, shrubby stems, and roundish, entire leaves, indented at the top, covered with soft hair upon their under surface, and supported upon downy footstalks, inserted into the back of the leaf. The flowers are very small, and disposed in racemes, of which those in the female plant are longer than the leaves. The plant is a native of the West Indies and

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* *White Pareira Brava*, the stems and root of *Abuta rufescens*, is described by Flückiger and Hanbury as consisting "of short pieces of a root half an inch to three inches thick, covered with a rough blackish bark, and also of bits of stem having a pale, striated corky bark cut transversely. The root displays a series of concentric zones of white amylaceous cellular tissue, each marked with narrow wedge-shaped medullary rays of dark porous tissue."

Yellow Pareira Brava is described as consisting "of portions of a hard, woody stem, from one to six inches in diameter, covered with a whitish bark. Internally it is marked by numerous regular concentric zones, is of a bright yellow color and a bitter taste." It contains beberine.

South America. According to Auguste St. Hilaire, true pareira is obtained from another species of the same genus, growing in Brazil, *C. glaberrima*.*

Properties. The root imparts its virtues readily to water. M. Feneulle found in it a soft resin, a yellow bitter principle, a brown substance, a nitrogenous substance, fecula, acid malate of calcium, nitrate of potassium, and various other salts. He considers the yellow bitter substance as the active principle. It is soluble in water and alcohol, and precipitated from its solution by tincture of galls. Wiggers announced, in 1838, the existence in pareira brava of an alkaloid, for which he proposed the name of *pelosine* or *cissampeline*. He procured it by boiling the root with water acidulated with sulphuric acid, precipitating by carbonate of potassium, dissolving the precipitate again in water acidulated with sulphuric acid, treating the solution with animal charcoal, precipitating anew with carbonate of potassium, drying and pulverizing the precipitate, treating it repeatedly with ether, and evaporating the ethereal solution. The alkaloid thus obtained may be rendered entirely pure by dissolving it in dilute acetic acid, precipitating with carbonate of potassium, and washing and drying the precipitate. (*Annal. der Pharm.*, xxvii. 29.) It is probably the chief ingredient of the bitter substance obtained by Feneulle. Peretti of Rome, and Pelletier afterwards, separated from the root an alkaloid, characterized by assuming a beautiful purple color by contact with strong nitric acid. (*Journ. de Pharm.*, xxvi. 162.) In Christison's Dispensatory it is stated to be uncrystallizable, insoluble in water, soluble in ether, alcohol, and the acids, and of an intensely bitter and sweetish taste. Flückiger (*P. J. Tr.*, 1870, p. 192) has found an alkaloid in the root, and, having thoroughly determined its origin, investigated its properties, and fixed its composition at $C_{18}H_{21}NO_3$, shows its identity with *bibirine* of nectandra and the *buxine* of *Buxus sempervirens* obtained by Walz.

Medical Properties and Uses. Pareira brava is said to be tonic, aperient, and diuretic. It was introduced into European practice so long ago as 1688, and at one time enjoyed considerable reputation as a lithontriptic. It has been recommended in calculous affections, chronic inflammation and ulceration of the kidneys and bladder, leucorrhœa, dropsy, rheumatism, and jaundice. The purpose for which it is at present chiefly employed is for the relief of chronic diseases of the urinary passages. Sir Benjamin Brodie found it very useful in chronic inflammation of the bladder, in allaying irritability of that organ, and correcting the disposition to profuse mucous secretion; and it has subsequently come into general use in the same affections. Advantage may often be derived from combining it, in this complaint, with one of the narcotics, as opium or hyoscyamus. In Brazil it is used in the cure of the bites of poisonous serpents; a vinous infusion of the root being taken internally, while the bruised leaves of the plant are applied to the wound. The dose of pareira brava in substance is from thirty grains to a drachm (1·95 to 3·9 Gm.). The infusion, however, is more convenient. (See *Infusum Pareiræ.*) A tincture, made by macerating one part of the root in five parts of alcohol, has been given in the dose of a fluidrachm (3·75 C.c.). The aqueous extract may be given in the dose of from ten to thirty grains (0·65 to 1·95 Gm.). There is now an officinal fluid extract, of which the dose is from half a fluidrachm to a fluidrachm (1·9 to 3·75 C.c.).

Off. Prep. Decoctum Pareiræ, *Br.;* Extractum Pareiræ, *Br.;* Extractum Pareiræ Fluidum, *U. S.;* Extractum Pareiræ Liquidum, *Br.*

PEPO. *U. S.* *Pumpkin Seed.*

(PĔ′PO̤.)

"The seed of Cucurbita Pepo. Linné. (*Nat. Ord.* Cucurbitaceæ.)" *U. S.*

Semences de Potirons, *Fr.;* Kürbissamen, *G.*

The *Cucurbita Pepo*, or *common pumpkin*, is a plant too well known to need description. The seeds are the part used. These are oval, extended into a blunt point at one end, flattish, but somewhat swollen in the middle, with a distinct groove on both sides near the edge from one end to the other, when of full size about 9 lines long by 5 or 6 in breadth where broadest, of a light brownish white color, and a slightly sweetish, somewhat aromatic smell and taste. They consist of a firm brittle coating, and a white oily kernel, consisting of a short, conical radicle and two flat cotyledons, and contain a fixed oil, consisting of the glycerides of palmitic, myristic, and oleic acids, with some free fatty acids, an aromatic principle, chlorophyll, sugar, starch, and, according to Dorner and Wolkowich, an alkaloid, *cucurbitine.* Deprived of their coating, and exhausted by ether, they yield 30 per cent. of fixed oil. (*Annuaire de Thérap.*, 1862, p. 176.) The researches of Dorner and Wolkowich have not received confirmation, and their alkaloid probably has no existence. The seeds yield, according to G. A. Gross (*A. J. P.*, 1865, p. 253), 33½ per cent. of a thick red oil, with little smell, but of a somewhat rank taste. Its sp. gr. at 60° F. is 0·928. Mr. J. C. Lyons used an ounce of it with success in a case of tape-worm (*Ibid.*), but Dr. Wolff has found it inert when pure and free from resin.* Heckel was the first to assert that the active principle is a resin, and in this he has been corroborated by Dr. L. Wolff (Pamphlet, Phila., 1882), who has found the resin efficient in doses of 15 grains (1 Gm.), given in pill, followed in two or three hours by castor oil, and who recommends an alcoholic fluid extract as the best preparation of the drug after the resin.†

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* *Pareira Bark.* Though the root is the officinal part, the bark is probably possessed of similar virtues. A specimen at the International Exhibition at London in 1862 was in flat pieces, from two to four inches broad, about a line thick, extremely fibrous, so tough that it could be bent without breaking, of a very light dirty yellowish color, and covered with a light-colored epidermis.

Medical Properties. It is said that in Italy the seeds of the *Cucurbita maxima,* and in the West Indies those of *C. occidentalis*, have been long used in doses of an ounce and a half as tæniafuges. In the *Dictionary of Materia Medica* by Mérat and De Lens (ii. 493), it is stated that Dr. Hoarau had reported that in the Isle of France the seeds of a small variety of pumpkin were used against the tape-worm, and with never-failing success. In the year 1820, M. Mongeny, a physician of Cuba, published the results of his experience with the flesh of the pumpkin in the same disease. He had discovered the remedy by accident, and found it uniformly successful. He gave to the patient, in the morning, fasting, about three ounces of the fresh pumpkin in the form of a paste, and followed it at the end of an hour by about two ounces of honey, which latter was twice repeated at intervals of an hour. So far as we know, attention was first directed to it in this country by Mr. Richard Soule. (*Bost. Med. and Surg. Journ.*, Oct. 1851.) Since this time the drug has steadily grown in favor, and properly used is one of our most efficient and harmless tæniafuges. The patient should be allowed only a light supper of bread and milk; in the morning early take an ounce to an ounce and a half of the seeds, a cup of tea or coffee an hour later, but no food, at 10 A.M. a brisk cathartic, and two hours later a substantial meal. We have obtained excellent results from the exhibition of the beaten seeds in the form of an electuary strongly flavored with oil of cinnamon or gaultheria.

PEPSINUM SACCHARATUM. *U.S.* *Saccharated Pepsin.*

(PĔP-SĪ′NỤM SĂC-ȻHẠ-RĀ′TỤM.)

"Pepsin, the digestive principle of the gastric juice, obtained from the mucous membrane of the stomach of the hog, and mixed with powdered Sugar of Milk." *U.S.*

Pepsina, *Br.;* Pepsine, *Fr.;* Pepsin, *G.*

Various attempts have been made to concentrate, and bring to a convenient form for administration, the peptic principle of the gastric juice. It must not be supposed that the substances prepared with this object, and sold under the name of pepsin, have any claim to be considered as the pure principle. The one which for a long time was the best in the market, is that prepared by M. Boudault. His process is as follows. The rennet bags of sheep, quite fresh, are opened, turned inside out, and washed by a gentle stream of water; the mucous membrane is then scraped off, bruised in a mortar so as to rupture the cells, and digested for twelve hours in pure water. The infusion thus obtained is precipitated by acetate of lead, and the precipitate, consisting of pepsin and oxide of lead, is mixed with water and decomposed by sulphuretted hydrogen, which throws down the lead, leaving the pepsin in solution. The filtered liquid is evaporated, at about 37·7° C. (100° F.), to a syrupy consistence; after which sufficient perfectly dry starch is added to absorb the semi-liquid matter, and bring it to the state of a dry powder. Lactic acid is sometimes added in small proportion to the liquid before evaporation, and no doubt contributes to its efficiency. An attempt to evaporate to dryness might injure the preparation; and at best a matter would be obtained, strongly disposed to absorb moisture, and consequently to undergo putrefaction. Starch is chosen for the solidification of the syrupy mass, on account of its absorbent property, and because it is not affected by the digestive power of the pepsin. If properly prepared, 15 grains of Boudault's pepsin, with the aid of a little lactic or hydrochloric acid, if the former was not employed in the process, will cause the solution in water of four times its weight of fibrin at the temperature of the human body; and the amount of starch added in the process is proportioned to this result. (*P. J. Tr.*, xvi. 472.) Much care is requisite to use fresh rennet bags, before they have begun to undergo decomposition, and not to allow the temperature used in evaporation to exceed 37·7° C. (100° F.). It is asserted, of the pepsin of Boudault, that it has the reactions of the gastric juice above referred to, and is fully capable of replacing that liquid for the purposes of digestion. It may be given either with or without lactic or hydrochloric acid; the addition being unnecessary when there is already sufficient acid in the stomach. A spurious substance has been sold for it, but may be distinguished by the difference of its reactions, and its power of dissolving fibrin. The genuine pepsin, dissolved in water, is precipitated by acetate of lead, tannic acid, and strong alcohol; and 15 grains of it should, in 12 hours, effect the solution of a drachm and a half of boiled white of egg, or chopped meat, in half a fluidounce of water, at 37·7° C. (100° F.). (Ballard, *Med. Times and Gaz.*, 1857, p. 177.) The spurious substance is destitute of these properties. Another test of the activity of pepsin is its power of coagulating milk; and the rapidity with which it produces this effect, and the quantity required to produce a certain degree of effect, are measures of its efficiency. The process of M. Boudault was essentially adopted in the French Codex. In the Addendum to the British Pharmacopœia, the plan of Prof. Beale, of London, was preferred. In this the opened stomach of a recently killed pig, sheep, or calf is laid upon a board with the inner surface upwards, any adhering portions of food, dirt, or other impurity removed, and the exposed surface slightly washed with cold water; the cleansed mucous membrane is then to be scraped with a blunt knife or other suitable instrument, and the viscid pulp thus obtained is to be immediately spread over the surface of glass or of glazed earthenware and quickly dried at a temperature not exceeding 37·7° C. (100° F.). The dried residue is to be reduced to powder and preserved in a stoppered bottle. This pepsin is a light yellowish brown powder, having a faint, but not disagreeable odor, and a slightly saline taste, without any indication of putrescence. It is very little soluble in water or spirit. "Two grains of it with an ounce of distilled water, to which five minims of hydrochloric acid have been added, form a mixture in which 100 grains of hard boiled eggs, in thin shavings, will dissolve on their being digested together for about 4 hours, at a temperature of 98° F." *Br.*

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* The following plan of Mr. Charles Hand has given great satisfaction in Camden, N. J. Take of the seed sixteen troyounces, alcohol of the sp. gr. ·835, a sufficiency. Bruise the seed with an equal bulk of washed sand until thoroughly comminuted, transfer to a conical percolator, pour in the alcohol till three pints have passed; reserve the first twelve ounces of the percolate, reduce the remainder to four fluidounces by distillation; and, lastly, mix with the reserved liquor, and filter. (*A. J. P.*, 1869, p. 195.)

† He prepares it by extracting the oil from the powdered seeds by means of petroleum benzin, then treating the remaining powder with ether, chloroform, and alcohol, which yields on evaporation a soft greenish brown resin resembling the oleoresin of male fern.

The U. S. Pharmacopœia recognized pepsin for the first time in the revision of 1880, although it has been for some years very largely used by the American profession. Much of the pepsin thus employed was obtained from Europe, and was of very various quality, most of it being heavily loaded with starch and some of it containing little or no pepsin. Several American brands have, however, been put upon the market, which are superior to Boudault's pepsin. Various processes also have been recommended for obtaining pepsin. The most elaborate and valuable investigation of the subject as yet made is that of Prof. E. Scheffer (*A. J. P.*, 1872). He found that various salts, such as the sulphates of sodium and magnesium and the chloride of sodium, precipitate pepsin, and acting upon this discovery devised the following processes. Mucous membrane of the pig's stomach, dissected off and finely chopped, is macerated in water acidulated with hydrochloric acid for several days, with frequent stirring. The strained liquid, if not clear, is clarified by allowing to stand for 24 hours and decanting. Chloride of sodium is then thoroughly mixed with it. After several hours the floating pepsin is skimmed from the surface and put on a cotton cloth to drain, and finally submitted to strong pressure to get rid of saline solution. This pepsin, when air-dried, is very tough, parchment-like or leathery, varying in color from a dim straw-yellow to a brownish yellow. To make his *saccharated pepsin*, Prof. Scheffer adds sugar of milk until a powder is obtained, 10 grains of which will dissolve 120 grains of coagulated albumen. Since his original process, he has increased the strength of saccharated pepsin, and the U. S. Pharmacopœia requires it to be more than four times this strength. *Purified pepsin* he makes by redissolving the pepsin in acidulated water and precipitating as before, immersing the product when perfectly dry in pure water for a short time. A half grain of this dissolved 1500 grains of albumen (*Ibid.*, p. 784). The chemical relations of pepsin are so delicate and wide-spread that it ought to be given by itself, or in combination only with an insoluble substance.

Properties. "Saccharated Pepsin is a white powder of a slight but not disagreeable odor and taste, and a slightly acid reaction. It is not completely soluble in water, leaving floccules of pepsin floating in the solution, which, however, dissolve on the addition of a small quantity of hydrochloric acid. Strong turbidity of the acidulated solution indicates the presence of mucus, which also imparts to the Saccharated Pepsin a disagreeable odor and taste, and will eventually impart to it an ammoniacal odor.

"1 part of Saccharated Pepsin, dissolved in 500 parts of water acidulated with 7·5 parts of hydrochloric acid, should digest at least 50 parts of hard-boiled egg-albumen in five or six hours at a temperature of 38° to 40° C. (100° to 104° F.)." *U. S.*

Pepsin should always be administered in the form of a diluted glycerite (see *Liquor Pepsini*), or of the saccharated pepsin. The wines and elixirs which flood the market are mostly worthless preparations. It is well to combine it with hydrochloric acid, and the powder is often exhibited with advantage in infantile diarrhœa with the subnitrate of bismuth. With these exceptions it is usually preferable to give it by itself.*

Medical Properties and Uses. Pepsin is said to have been first suggested as a remedy by Dr. Corvisart, of Paris (*Journ. de Pharm.*, xxx. 169), and has been very largely used in cases of various character in which the digestive powers of the stomach have failed, for the purpose of supplying the place of the natural digestive ferment. Any influence for good which it possesses is dependent upon its solvent power, which is a measure of its value. The usual dose of pepsin is ten to fifteen grains, and it is plain that the solvent power of such an amount is too trifling to be of much value in sustaining the digestion of an adult. Further, a great portion of the pepsin which has been exhibited has been inert, either originally or from the method of its administration; and in the great majority of cases the good result that has been ascribed to the pepsin has been due, not to it, but to the regulation of the diet and habits of the patient and to the drugs which have been exhibited along with the animal ferment. We have frequently seen pepsin given to adults, and have rarely seen it do very distinct good when prescribed by itself. We believe that its value has been vastly overestimated, that it has been given to adults in ridiculously small doses, and that at least half a drachm (1·95 Gm.) of the commercial article should be given at a dose. It has been found much more certain in its effects in the feeble digestion of infants than of adults, due probably to its being administered in proportionately much larger doses. To a babe six months old, suffering from indigestion and consequent diarrhœa, five grains (0·33 Gm.) of it in acidulated water may be given after each feeding with a rational expectation of benefit.

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* GASTRIC JUICE was many years ago employed by Dr. P. S. Physick, the celebrated surgeon of Philadelphia, with considerable success, as a local application to cancers and sloughing ulcers, with the view of removing the dead bone and flesh, correcting the offensive odor, and yielding a healthful stimulus to the diseased surface. It has also been used with success, by Dr. Ellsworth, of Hartford, Connecticut, for dissolving a portion of tough animal food, which had become impacted in the œsophagus of a lad affected with stricture of that passage. The gastric juice of a pig was used. (*Bost. Med. and Surg. Journ.*, April 17, 1856.) The inner coat of the gizzard of the South American ostrich is said, in the state of powder, to be used in Buenos Ayres as a remedy in dyspepsia (E. S. Wayne, *A. J. P.*, March, 1868, p. 123), and the dried crops and gizzards of chickens and turkeys have long been used in some portions of this country as a domestic remedy. For an account of *Rennet*, see Part II.

PETROLATUM. *U. S.* *Petrolatum.* [*Petroleum Ointment.*]

(PĔT-RỌ-LĀ'TŬM.)

"A semi-solid substance, consisting of hydrocarbons, chiefly of the marsh-gas series [$C_{16}H_{34}$; etc.—$C_{32}H_{34}$; etc.], obtained by distilling off the lighter and more volatile portions from American Petroleum, and purifying the residue. Melting point about 40° C. to 51° C. (104° F. to 125° F.), the first constituting the softer, and the second the firmer variety. When Petrolatum is prescribed or ordered, without specifying its melting point, the low-melting variety, which liquefies at about 40° C. (104° F.), is to be dispensed." *U. S.*

This substance has of late years acquired considerable importance, under various trade names, as a bland neutral body well fitted to take the place of lard as a base for ointments and for other purposes. It is prepared from the residuum left in the stills after a distillation of petroleum in vacuo, or from the residue or sediment deposited in tanks containing crude petroleum, of which large quantities have collected in the storing tanks in the oil districts of Western Pennsylvania. The substances known commercially as *cosmoline* (*Unguentum Petrolei*) and *vaseline* are now made on a large scale from residuums, but more largely from what are termed "reduced oils," that is, crude oils from which the lighter fractions (those included under the heads of benzin, naphtha, illuminating and paraffin oils) have been removed by distillation. This process of reducing would leave an increasing amount of black pyrogenous products in the residuum, were it not that the reducing is carried out under diminished pressure, by what is termed the "vacuum process," in which, moreover, the heat is not applied directly to the still bottoms, but by means of coils of pipe, through which superheated steam is made to pass. These reduced oils can be brought to 337·7° C. (640° F.) fire-test without acquiring the slightest pyrogenous odor. They are then filtered through well-dried bone-black, in chambers kept at a temperature of from 43·3° C. to 54·4° C. (110° F. to 130° F.), or in some cases higher. The first portions of the filtrate are colorless, and then pass from a light straw or amber color to a color red by transmitted light and light green by reflected light. This latter is known as "cylinder stock," and is highly prized as a lubricating oil. The clearer portion of the filtrate is then brought to the proper melting-point, if necessary, by the addition of pure block paraffin, which dissolves perfectly in the warm liquid oil. The storing tank residue is purified in a similar manner. The "B. S. Oil," or "rod wax," as it is technically termed, is placed in a still, heat applied, and after the lighter products have distilled over, and indications of congelation are noticed when a portion of the distillate is allowed to cool, the heat is withdrawn, and the contents of the still, after having cooled, are transferred gradually to a percolator which contains recently heated animal charcoal. These products, which are called, in addition to the names above given, *petrolina*, *deodoroline*, etc., vary considerably in odor and appearance, due to modifications in the method of manufacture, and to difference in the quality of the crude product. Many efforts have been made to economize in the use of animal charcoal, as the large quantity consumed (which is rendered almost worthless) adds largely to the cost of the finished petrolatum. A somewhat different process is used in Germany; the crude product is derived from crude *ozokerite*, obtained from Alsace and Galicia, or American residuum is sometimes used. 1. The oil is heated by steam to about 30° C. (86° F.), mixed, at this temperature, with 10 per cent. of its weight of sulphuric acid of 60° B., stirred for half an hour, and then allowed to stand at rest so that the carbonized portions may separate. 2. When clear, the oil is washed with an aqueous solution of bichromate of potassium, whereby any remaining excess of sulphuric acid is at the same time removed. 3. The residue from the acid treatment is mixed with lime, neutralized, and disposed of to manure-factories. 4. The clear oil from the second step of the process, after being washed, is heated by steam to 80° C. (176° F.), mixed with 10 per cent. of its weight of granular animal charcoal, and then allowed to stand at rest to permit the animal charcoal to settle. 5. After the latter is separated, the liquid portion is filtered through filters heated by steam. 6. The residuary magma of animal charcoal is subjected to hydraulic pressure, the expressed oil filtered, and the solid residue again used in the next operation, a sufficient quantity of fresh animal charcoal being added to make up for any loss or waste. (*Pharm. Centralhalle*, 1881, No. 42; *N. R.*, Feb. 1882.)

Chemical Constitution. Petrolatum consists mainly of the higher members of the paraffin series, but undoubtedly contains also the higher olefines. These may possibly alter in time, and give rise to rancidity, although this is not certainly established. The paraffins, which make up the bulk of it, are not capable of direct oxidation, and are therefore not affected by atmospheric influences. As given in the officinal definition, Petrolatum contains hydrocarbons of the paraffin series, like $C_{16}H_{34}$,$C_{17}H_{36}$,$C_{18}H_{38}$, etc., up probably to $C_{32}H_{66}$, together with hydrocarbons of the olefine series, $C_{16}H_{32}$,$C_{17}H_{34}$, etc. These latter are less concrete than the corresponding paraffin hydrocarbons, and give Petrolatum its oleaginous characters.

Properties. The U. S. Pharmacopœia describes Petrolatum as "a yellowish or yellow, fat-like mass, transparent in thin layers, more or less fluorescent, especially when melted, completely amorphous, tasteless and odorless, or giving off, at most, only a faint petroleum odor when heated, and having a neutral reaction. When gently heated, until the mass is almost entirely melted, the liquid portion has a sp. gr. varying from 0·835 to 0·860. It is insoluble in water; scarcely soluble in alcohol, or in cold absolute alcohol; but soluble in 64 parts of boiling absolute alcohol, and readily soluble in ether, chloroform, disulphide of carbon, oil of turpentine, benzin, benzol, and in fixed or volatile oils. When heated on platinum foil, it is completely volatilized without emitting the acrid vapors of burning fat or resin. If 5 Gm. of Petroleum Ointment be digested, for half an hour, with 5 Gm. of soda and 25 Gm. of water, the aqueous layer separated, and supersaturated with diluted sulphuric acid, no oily substance should separate (abs. of fixed oils or fats of vegetable or animal origin, or of resin). Liquefied Petroleum Ointment agitated with sulphuric acid of sp. gr. 1·540, should not acquire a dark color within two hours (abs. of readily carbonized organic impurities)." *U. S.* As it is found in the market, Petrolatum varies in color, odor, and melting point; the statement that is frequently made by the manufacturers that it is unalterable in the air is incorrect, as we have frequently noticed that exposure to light and air causes it to assume a disagreeable odor resembling that of crude petroleum. It has been observed to have at times irritating properties. This may be due to imperfect removal of the sulphuric acid or similar agents used. It is believed, however, that the presence of these impurities is rare.

Medical Properties. Petrolatum is used exclusively as a bland neutral protective dressing, and as a substitute for fatty materials in ointments. Dr. M. M. Griffith (*N. R.*, May, 1880) claims that the crude semi-solid petroleum (*rod wax*), as it accumulates on the casings, etc., about oil wells, is an invaluable remedy in chronic bronchitis and incipient phthisis. It is readily formed into 3-grain pills, and may be given until it produces eructations. He has used the following formula with advantage. ℞ Petroleum mass, ℥i; Pulv. Cubebæ, Pulv. Doveri, āā ʒvi, to make pill mass (pills 5 grs.). *Huile de Gabian* is a similar product, which has long been famous in France as a remedy in lung diseases.

Paraffin. This name was originally bestowed by Baron von Reichenbach upon a waxy substance obtained through the destructive distillation of wood. He derived it from *parum affinis*, and thus intended to indicate its very neutral character. The name is now popularly applied to a solid white diaphanous substance resembling white wax, which is made by distilling the residuum obtained from the refiners of petroleum and collecting and purifying the distillate. According to Dr. A. W. Miller (*A. J. P.*, 1874, p. 1), distillation begins at 104·4° C. (220° F.), and is terminated at about 298·8° C. (570° F.). The product is a thick, unctuous mass at ordinary temperatures, but it liquefies at about 37·7° C. (100° F.) or a little over. It has the peculiar iridescent color and the characteristic odor of petroleum. The residue of the distillation is a hard, porous, black mass, which is free from odor and presents a close analogy to the ordinary coke of the gas works. In the yards referred to, it is in fact called coke, and is used as fuel to heat the stills. The distillate is next treated with from 4 to 5 per cent. of sulphuric acid. After removal of the excess of acid by carbonate of sodium, the oily mass is introduced into bags made of duck, each of which holds about three or four gallons. A number of these are then placed horizontally in an ordinary screw press, being superimposed on each other and separated by intervening boards. During the summer, it is necessary to use ice in order to lower the temperature and prevent too much loss of paraffin.

The oil expressed during this process has the gravity of 25°; it is known as *heavy paraffin oil.* It can be readily deodorized and freed from unpleasant taste.

The crude paraffin, when taken from the presses, is melted and run into moulds. It is now of a light yellowish or straw color, rather soft, and still having the odor of petroleum. In this state it is sold to the refiners, who further purify it, in order to adapt it to the multitudinous purposes to which it is now applied.

The refiners subject the crude article, which they designate as *wax*, to powerful hydraulic pressure, and thus obtain therefrom a second variety of paraffin oil of about 28° gravity. This is used almost exclusively as a lubricator. The residue is further purified by treating it with a variety of gasolin or benzin of definite density, which is specially prepared for this purpose. Steam is also called into requisition in order to completely deodorize the product.

Paraffin, in its pure condition, is a white, waxy, inodorous, tasteless substance, harder than tallow, softer than wax, with a specific gravity of 0·877. Its melting point is variable, depending somewhat upon its origin. It ranges between 43° C. and 65° C. (109° F. and 151° F.). An ultimate analysis yields, on the average, carbon 85 per cent. and hydrogen 15 per cent. It is insoluble in water, and is indifferent to the most powerful acids, alkalies, and chlorine, and can be distilled unchanged with strong oil of vitriol. Warm alcohol, ether, oil of turpentine, olive oil, benzol, chloroform, and bisulphide of carbon dissolve it readily. It can be mixed in all proportions with wax, stearin, palmitin, and resin. As stearin is less soluble in benzol than paraffin, Vogel proposes this reaction as a method for detecting the adulteration of paraffin with stearin. (*Joy.*)

It would be beyond the scope of this work to give all of the uses of this very valuable substance. The largest quantity is consumed in candles. It is said that meat may be preserved by immersing it in melted paraffin. Lemons may also be preserved in this way. It is used to coat paper to make it impervious to moisture, as a lubricator, for adulterating chocolate and candies, to coat pills, etc.

PHOSPHORUS. *U. S., Br.* *Phosphorus.*

P; 31. (PHŎS′PHO̤-RŬS.) P; 31.

"Phosphorus should be carefully kept under water, in a secure and moderately cool place, protected from light." *U. S.* "A non-metallic element obtained from bones." *Br.*

Phosphore, *Fr.;* Phosphor, *G.;* Fosforo, *It., Sp.*

This non-metallic element was discovered in 1669 by Brandt, an alchemist of Hamburg, who obtained it from evaporated urine by a process which remained a secret until 1737. As thus procured, it was exceedingly scarce and costly. In 1769, the Swedish chemist Gahn discovered it in bones, and shortly afterwards published a process by which it might be extracted from them.

Preparation. Powdered calcined bones (bone phosphate of calcium) are digested for twenty-four hours with two-thirds of their weight of sulphuric acid previously diluted with twelve times its weight of water. The sulphuric acid separates the greater part of the lime from the phosphoric acid, and precipitates as sulphate of calcium; while an acid phosphate of calcium ($CaH_4(PO_4)_2$) remains in solution. The liquid is then strained through a linen cloth to separate the sulphate of calcium, and afterwards submitted to evaporation, which causes a fresh precipitation of sulphate, to be separated by a new straining. The strained solution is evaporated to a syrupy consistence, and then thoroughly mixed with half its weight of powdered charcoal, so as to form a mass, which is dried by being heated to dull redness. At this temperature the acid phosphate is changed into metaphosphate ($Ca(PO_3)_2$) by the loss of two molecules of water. The mass when cool is quickly transferred to a coated earthenware retort, furnished with an adapter of copper, bent downwards at right angles, so as to enter a bottle with a large neck containing water, which should rise about two lines above the orifice of the adapter. The bottle is closed round the adapter with a cork, which is traversed by a small glass tube, to give exit to the gaseous products. The retort is heated in a furnace, furnished with a dome, in the most gradual manner, so as to occupy about four hours in bringing it to a red heat. Afterwards the heat is pushed vigorously, so long as any phosphorus drops into the water; and this takes place generally for from twenty-four to thirty hours. During this part of the process, the metaphosphate is decomposed; its oxygen combining with the charcoal, and the liberated phosphorus distilling over. The calcined bones of the sheep are preferred; as they contain the largest proportion of phosphate of calcium, and are most readily acted on by the acid.

M. Cari-Montrand proposes to obtain phosphorus by passing dry hydrochloric acid gas over a mixture of equal parts of bone-phosphate of calcium and finely powdered charcoal, contained in a porcelain tube, to which a glass tube is attached, dipping under water. Phosphorus and water distil over, carbonic oxide is evolved, and chloride of calcium is left. The following equation explains the reaction: $2Ca_3(PO_4)_2 + 5C_2 + 12HCl = P_4 + 10CO + 6H_2O + (CaCl_2)_6$.

The following improved process for obtaining phosphorus on a large scale is given by Hugo Fleck, of Germany. Clean, broken bones, deprived of fat, are digested in dilute hydrochloric acid, which gives rise to the formation of chloride of calcium, and acid phosphate of calcium, $CaH_4(PO_4)_2$. The bone cartilage, remaining undissolved by the acid, is used for preparing gelatin. The solution is evaporated in pans until its sp. gr. is about 1·4, and then run off to cool, when the acid phosphate crystallizes. This salt, having been separated from the mother-liquor by being pressed between cloths and dried, appears as a white gritty powder with a pearly lustre. The dry salt, warmed, and mixed with a fourth of its weight of charcoal, is distilled from clay cylinders, like gas retorts. Every five cylinders open into one receiver, shaped like a muffle, and contained in a channel through which water flows. The residual bone-phosphate of calcium, in the cylinders, is incinerated upon iron plates to burn away the charcoal, and is thus saved to prepare fresh acid phosphate. By this process 100 lbs. of fresh bones yield from 6 to 7 lbs. of phosphorus, and from 10 to 20 of gelatin; while the process usually pursued gives only 4 or 5 lbs. of phosphorus. (*P. J. Tr.*, Sept. 1856, p. 175.)

Properties. Phosphorus is a semi-transparent solid, without taste, but possessing an alliaceous smell. When perfectly pure it is colorless; but as usually prepared it is yellowish or reddish yellow. It is flexible, and when cut exhibits a waxy lustre. It is said by M. Bœttger to be easily pulverizable by agitation with a solution of urea. (*Journ. de Pharm.*, Juin, 1863, p. 488.) "It melts at 44° C. (111·2° F.), and has the sp. gr. 1·83 at 10° C. (50° F.). It is insoluble in water, soluble in 350 parts of absolute alcohol at 15° C. (59° F.), in 240 parts of boiling absolute alcohol, in 80 parts of absolute ether, in about fifty parts of any fatty oil,* and very abundantly soluble in disulphide of carbon, the latter yielding a solution which must be handled with the greatest care to prevent danger from fire. When exposed to the air it emits white fumes, which are luminous in the dark, and have an odor somewhat resembling that of garlic. On longer exposure to air it takes fire spontaneously. If 3 Gm. of Phosphorus are digested with 24 Gm. of nitric acid and 18 Gm. of distilled water until it is completely dissolved, the solution evaporated until no more nitrous vapors are given off, then diluted with distilled water, so as to weigh about 36 Gm., and hydrosulphuric acid gas be passed through the larger portion of the liquid, heated for half an hour to about 70° C. (158° F.), and afterward until the liquid cools, there should not appear more than a trifling quantity of a lemon-yellow precipitate after the lapse of twenty-four hours (limit of arsenic). On adding test-solution of chloride of barium to the remainder of the liquid, not more than a slight opalescence should make its appearance (limit of sulphur)." *U. S.* Its pulverization may be readily effected by melting it in hot water, and agitating until it is thoroughly cooled; and the powder is obtained finer in saline solutions than in pure water. (Blondlot, *Journ. de Pharm. et de Chim.*, 4e sér., i. 72, 1865.) It takes fire at 37·7° C. (100° F.), melts at 42·2° C. (108° F.), and boils at 287·7° C. (550° F.), air being excluded. During its combustion it combines with the oxygen of the air, and forms phosphoric oxide. On account of its great inflammability, it must be kept under water. When exposed to the air it undergoes a slow combustion, emitting white vapors, which are luminous in the dark. It sometimes contains arsenic, and, therefore, when used in forming medicinal preparations, should be tested for that metal. Dr. C. J. Rademaker obtained out of 100 parts of phosphorus about one part of arsenic. (*A. J. P.*, Nov. 1870.) It also occasionally contains antimony and sulphur. The latter impurity renders it brittle.

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* According to M. A. Vogel, bisulphide of carbon is capable of dissolving eighteen times its weight of phosphorus without losing its fluidity.

When phosphorus is kept in ordinary water it becomes covered with a whitish layer, of the nature of which there are different opinions, it being considered by some a hydrate of phosphorus, by others as an allotropic condition of that element, and by others again as partially crystallized; but all these opinions have apparently been disproved by M. Ernest Baudrimont, who seems to have demonstrated that *white phosphorus* is entirely identical with that principle in its ordinary state, and results from a kind of erosion of the surface, owing to partial oxidation by the free oxygen held in solution by the water. The change never takes place in water entirely deprived of air; and the water when it has taken place holds phosphorous acid in solution. (*Journ. de Pharm. et de Chim.*, 4e sér., iii. 17, 1866.)

Prof. Schroetter, of Vienna, discovered an allotropic form of phosphorus, which he called *red* or *amorphous phosphorus.* It is formed when ordinary phosphorus is kept long at a temperature between 215° C. (419° F.) and 250° C. (482° F.), in atmospheres which have no action on it, or in closed glass tubes. Red phosphorus is much more indifferent than the ordinary substance, and is denser, its sp. gr. being 2·11. It is much less easily acted on by the air than ordinary phosphorus, and is insoluble in bisulphide of carbon, alcohol, and ether, in which ordinary phosphorus is soluble. Solidified from the fused state, it is brittle, and breaks with a conchoidal fracture. Its hardness is considerable. Obtained by distillation in a non-acting gas, it is mixed with ordinary phosphorus, from which it may be freed by bisulphide of carbon, which dissolves the ordinary variety, and leaves the allotropic as a deep red amorphous powder. It may also be purified by shaking it with a solution of chloride of calcium, of a density intermediate between that of red and ordinary phosphorus, and with a little bisulphide of carbon. The red variety will sink to the bottom, and the ordinary float on top of the solution, dissolved in the bisulphide. (*E. Nicklès.*) Red phosphorus when pure is not poisonous. This has been proved beyond a doubt by the experiments of MM. Reynal and Lassaigne, and of MM. L. Orfila and Rigaut. It is applicable to the manufacture of lucifer matches, and forms a much safer material than ordinary phosphorus. It does not take fire by friction at common temperatures, and, therefore, may be transported with the greatest safety. It has been said to be unchangeable in the air; but this is not exactly true, as proved by an observation of Mr. T. B. Groves, who, having set aside some red phosphorus in a bottle that was not air-tight, observed for a year or more no visible change, but found at length that it had become decidedly altered, and ascertained that oxidation had taken place, with the result of forming a large quantity of phosphoric and phosphorous acids, in the proportion of 5 mols. of the former to 2 of the latter. (*P. J. Tr.*, June, 1865, p. 621.) Besides the white and red forms of phosphorus, there is another, called the *black*, first noticed by Thenard, and recently investigated by M. Blondlot, who finds that it is pure phosphorus, and its production owing to some modification in the mode of cooling, when it has been in the liquid state. (*Journ. de Pharm. et de Chim.*, 4e sér., i. 407, 1865.)

Still another modification of phosphorus has recently been made known by M. Hittorf, who obtained it by heating red phosphorus and lead together in a close vessel. The lead on melting dissolved the phosphorus, and on cooling deposited it in the state of crystals, resembling the crystals of arsenic. In this form, phosphorus is a conductor of electricity; and its sp. gr. at 16·6° C. (62° F.) is 2·34. M. Hittorf distinguishes it by the name of *metallic phosphorus*, and ranks it in the same category with red phosphorus, the latter differing simply in being amorphous. (*Chem. News*, March 23, 1866, p. 133.) M. Blondlot has succeeded in crystallizing common phosphorus by means of sublimation, operating in an atmosphere of nitrogen. (*Journ. de Pharm. et de Chim.*, 4e sér., iv. 321.)*

Phosphorus forms with oxygen three oxides: *phosphoric*, P_2O_5, *phosphorous*, P_2O_3, and *hypophosphorous*, P_2O, although the existence of the latter is somewhat dubious. Corresponding to the first of these are three acids, known as *orthophosphoric* (tribasic phosphoric), H_3PO_4, *pyrophosphoric*, $H_4P_2O_7$, and *metaphosphoric*, HPO_3. The first of these is formed by dissolving P_2O_5 in boiling water, or by the action of nitric acid upon phosphorus itself; the second by the heating of the tri-basic phosphoric acid to 213° C. (415·4° F.); and the third by the ignition of the tribasic variety, or by dissolving P_2O_5 in cold water. To the second oxide corresponds *phosphorous acid*, H_3PO_3, although it cannot be formed directly from the oxide. This is a dibasic acid, containing one hydrogen atom not replaceable by metal. To the third oxide corresponds *hypophosphorous acid*, H_3PO_2. This acid is not capable either of being derived directly from the oxide. It is monobasic, containing two hydrogen atoms not replaceable by metal.

Medical Properties. Phosphorus, when given in small doses, is believed by some to act as a general stimulant. With more probability it is believed by most neurologists to act as a nutritive stimulant to the nervous system. Its usefulness in sexual exhaustion, in failure of the mental powers from similar causes, and indeed in all forms of exhaustion of the nerve-centres, when no organic lesion has occurred, seems unquestionable; and it may even be used, with hope of advantage, in cerebral softening. It is sometimes of service in neuralgia, and has been employed, with asserted advantage, in mania, melancholia, and in chronic eczema, psoriasis, and other affections of the skin. When taken in large doses it is a deadly poison. The symptoms usually do not manifest themselves until some hours after the ingestion of the phosphorus. General malaise now becomes very pronounced, and is soon accompanied by nausea, abdominal pain, and vomiting of food, mucus, and bile. On the second and third day the vomiting is apt to cease, but the abdominal tenderness remains, and there is some fever. Jaundice also sets in, both the conjunctiva and the urine betraying its onset. The yellow color rapidly involves the whole surface. Early in the poisoning there is often great anxiety, restlessness, headache, and giddiness, but now delirium appears, wild, erotic, or low and muttering. Severe vomiting of a coffee-ground liquid, free from bile and similar to the black vomit of yellow fever, is now present; the urine is scanty and albuminous, often with tyrosine and leucine in it, or it may finally be suppressed. The temperature falls markedly, and the patient sinks into a coma which ends in death. After death a peculiar fatty degeneration is found affecting almost all the soft tissues. The parts which suffer first are the liver, the gastro-intestinal mucous membrane, and the kidneys. Very often the heart-muscle is also disorganized. The liver is always yellow, its cells engorged with fat globules. At first it undergoes decided enlargement, but if the patient lives long enough it atrophies. Both in its symptoms and in its lesions phosphorus poisoning so closely resembles acute atrophy of the liver that only by detecting it in the matters vomited, in the excretions, or in the tissues of the body, can a positive diagnosis be made. M. Poulet (*Gaz. Méd. de Paris*, Aug. 1872) states that hypophosphorous acid can be detected in the urine by heating the latter with nitric acid to dryness; if the acid be present, as the latter condition is approached there is a sudden outburst of flame.

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* *Liquid Phosphorus.* A claim has been advanced, by Prof. E. J. Houston, to the discovery of another allotropic form of phosphorus characterized by being in the liquid state. Pure phosphorus was boiled repeatedly in strong solution of hydrate of potassa, water being occasionally added to supply that lost by evaporation, and care taken cautiously to stir the liquid during the process. After five or ten minutes, the melted phosphorus is washed by a stream of pure water replacing the alkaline solution, and removing all the hypophosphites as well as liquid and gaseous hydrides of phosphorus that might have been formed. The liquid phosphorus is now in what is believed to be a hitherto unnoticed allotropic modification. Its peculiarity is that of retaining the liquid form indefinitely at temperatures very considerably below the melting point of ordinary phosphorus. A small portion in a test tube solidified at 3·3° C. (38° F.). Another peculiarity is that it is not oxidized on exposure to the air, and consequently does not shine in the dark. (*A. J. P.*, March, 1874, p. 112; from the *Journ. of the Franklin Institute.*)

E. Mitscherlich gives the following as a delicate test for phosphorus. The suspected substance is distilled with sulphuric acid and water from a flask, by means of a tube bent twice at right angles, into a vertical cooling tube, passing through the bottom of a wide glass cylinder filled with water, which is constantly kept cold by passing cold water in at the bottom, while the warm water escapes at the top. Under the cooling tube is placed a vessel to receive the distillate. If phosphorus be present, its vapor, mixed with steam, distils over, and gives rise to a distinct luminous appearance, visible in the dark, at the point where it enters the cold part of the cooling tube. The presence of alcohol and ether prevents the occurrence of the luminous appearance until they have distilled over. Oil of turpentine has the same effect permanently, but is not likely to be present in medico-legal cases. (*Am. Journ. of Med. Sci.*, July, 1856, p. 280; from the *Lancet.*) This test acts equally well in the presence of fatty matters, as has been shown by M. de Vrij. Roussin finds that the presence of free butyric acid prevents the luminous appearance of the phosphorus. After neutralization with potassium carbonate, however, it can be seen. (Sonnenschein, *Gericht. Chem.*, 1881, p. 27.) L. Hofmann gives the following method of detecting phosphorus in the viscera in cases of poisoning. The viscera, mixed with water and a little sulphuric acid, are distilled until two drachms of liquid are obtained; to this a few drops of sulphide of ammonium (ammonium sulphydrate) are to be added, and the liquid is to be evaporated to dryness in a porcelain dish. If phosphorus be present, in the minutest quantity, a drop of solution of ferric chloride will produce a deep violet and brownish, though evanescent, color. (*Chem. News*, Feb. 3, 1865, p. 53.) In addition to Mitscherlich's test, Dusart's is also used. This consists in passing pure hydrogen gas, evolved in a separate vessel, through the solution supposed to contain phosphorus, which solution has been previously warmed to about 50° C. The gas then is allowed to issue from a fine jet and is lighted. If phosphorus be present, the flame shows a green color in the centre.

The treatment of phosphorus poisoning consists simply in administering the antidotes as soon as possible. Oil of turpentine was originally proposed by Andant. After much discussion, it has been finally determined that whilst the pure oil has no effect upon phosphorus, the acid French oil of European commerce forms with it a crystalline, spermaceti-like mass. This is soluble in ether, alcohol, and alkaline solutions, and has received the name of *turpentine-phosphoric acid.* It is said to be eliminated by the kidneys unchanged, and to exert no deleterious influence. Köhler asserts that when German oil has not been rectified for some time, it acts upon phosphorus. He believes that the oil acts partly by oxidizing the poison, and partly by converting it into the harmless turpentine-phosphoric acid. One part of the oil must be given for 0·01 part of the phosphorus. The ordinary American oil of turpentine, as well as the Canada Balsam, appears to be of no antidotal value in phosphorus poisoning.

As was pointed out by MM. Eulenberg and Guttmann, phosphorus in a solution of a soluble salt of copper becomes immediately black, owing to the formation of a phosphide of the metal. Prof. Bamberger asserts that, whilst this change is very rapid, that induced by turpentine is a slow one, and, from an elaborate series of experiments upon animals, he concludes that copper is much the more valuable and certain antidote. In human poisoning, then, sulphate of copper should be given in dilute solution, three grains (0·20 Gm.) every five minutes until vomiting is induced. After this, if the French oil be accessible, it may be given freely in emulsion.

Otherwise, sulphate of copper, with opium to restrain the emesis, should be administered in such doses as the stomach will retain. Sulphate or citrate of magnesium should be used as a quickly-acting purge, and symptoms as they arise should be judiciously treated.

From experiments on dogs poisoned by phosphorus, MM. L. Orfila and Rigaut have shown that putrefaction is remarkably retarded. In a case of chronic poisoning from the copious inhalation of phosphorus vapor, the principal results were a gradual decay of the sexual function, and paralysis, terminating in death at the end of three years. Partial or general paralysis is a not uncommon result. (*Lancet*, July 7, 1866, p. 23.)

The dose of phosphorus is the $\frac{1}{100}$th to the $\frac{1}{75}$th of a grain (0·0006 to 0·0008 Gm.). Much larger doses than these have been given, but have in various cases produced unpleasant symptoms. The usual form for exhibiting phosphorus is in oily solution. The officinal *oleum phosphoratum* is an excellent preparation, which should be administered in aromatized emulsion. The taste of camphor covers that of phosphorus very effectively. M. Tavignot gives pills made from an oleaginous solution of phosphorus. One and a half grains are dissolved, by means of a water-bath, in two drachms of almond oil; the solution is made into a pill mass by mixing it with two drachms of almond oil soap and a sufficient quantity of an inert powder; and the mass is divided into 100 pills. From two to four of the pills may be taken daily. (*Journ. de Pharm.*, Août, 1863, p. 137.) Great caution is necessary in the exhibition of phosphorus, and its effects should be closely watched. It ought never to be given in substance.*

Off. Prep. Acidum Phosphoricum, *U. S.;* Oleum Phosphoratum, *U. S.*, *Br.;* Pilulæ Phosphori, *U. S.*

PHYSOSTIGMA. *U. S.* *Physostigma.* [*Calabar Bean.*]

(PHȲ-SỌ-STĬG′MẠ.)

"The seed of Physostigma venenosum. Balfour. (*Nat. Ord.* Leguminosæ, Papilionaceæ.)" *U. S.* "The seed of Physostigma venenosum (Balfour, *Trans. Royal Soc. Edinb.*, vol. xxii. p. 305), Western Africa." *Br.*

Physostigmatis Faba, *Br.;* Calabar Bean; Faba Calabarica, *P.G.;* Fève de Calabar, *Fr.;* Kalabarbohne, *G.*

Gen. Ch. Inflorescence axillary; on pendulous multifloral racemes; rachis of each raceme zigzag. *Calyx* campanulate, four-cleft at apex, the upper division notched, its segments ciliated. *Corolla* papilionaceous, curved in a crescentic manner. *Stamens* ten, diadelphous. *Pistil* more than one. *Stigma* blunt, covered by a ventricular hood, extending along the upper part of the convexity of the style. *Legume* dark brown and straight, elliptico-oblong, with an apicular curved point, and outer and inner integuments easily separable. *Seeds* two or three, separated by a woolly substance [half surrounded by a deeply-grooved hilum]. *Balfour.*

Physostigma venenosum. Balfour, *Trans. Roy. Soc. Edinb.*, xxii. 305; *Ed. Med. Journ.*, July, 1863, p. 34; *B. & T.* 80. This is a climbing plant, with a ligneous stem, mounting on trees and shrubs, and frequenting especially the banks of streams, into which it often drops its fruit when ripe; and it is said that the people of Calabar derive their supply principally from the borders of the streams down which the fruits are carried. The root is spreading, with numerous fibrils, often having attached to them small succulent tubers. The flowers are in axillary, multiflorous, pendulous racemes. The corolla is papilionaceous, of a pale pink color, with a purplish tinge. The legume when ripe is about seven inches long, and contains two or three seeds. It ripens at all seasons, but is most abundant during the rainy season from June to September. The seeds are the part used. The plant is the only known species. It has been introduced into India and Brazil, and is said to flourish in the latter country.

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* *J. Ashburton Thompson's Solution of Phosphorus.* Take of phosphorus, one grain (0·065 Gm.); absolute alcohol, five fluidrachms (18·4 C.c.). Dissolve the former in the latter by gentle heat, and add to it a previously warmed mixture of one and a half fluidounces (44·2 C.c.) of glycerin, two fluidrachms (7·4 C.c.) of alcohol, and forty minims (2·5 C.c.) of spiritus menthæ piperitæ. One fluidrachm (3·75 C.c.) of this solution contains $\frac{1}{33}$ grain (0·002 Gm.) of phosphorus.

Tinctura Phosphori (*Bellevue Hospital*). Take of clean, transparent phosphorus, thirty-two grains (2·07 Gm.); absolute alcohol, forty-six fluidounces (1360 C.c.). Digest the phosphorus in the alcohol on a water-bath in a flask provided with a reflux condenser, until solution has taken place. Allow the solution to cool, and add to it one fluidounce (29·5 C.c.) of essence of vanilla, and three fluidrachms (11 C.c.) of oil of orange. Finally, make up the bulk with absolute alcohol to forty-eight fluidounces (1416 C.c.). Twelve fluidrachms (44·2 C.c.) of this solution contain one grain (0·065 Gm.) of phosphorus. (*N. R.*, April, 1876.)

Phosphorus Paste, for the destruction of vermin, is made as follows. Triturate six parts of phosphorus and one part of sulphur with six parts of water, until they liquefy. Then mix in two parts of flour of mustard, eight parts of sugar, and twelve parts of rye flour, with the aid of ten additional parts of water, and stir the whole so as to form a soft paste, which must be kept in pots closely stopped. (*A. J. P.*, 1855, p. 473.)

It has been long known that certain poisonous substances were used as an ordeal, to determine the guilt or innocence of accused individuals, among the negroes of Western Africa. One of these, called the ordeal bean of Calabar, from the region where it is used, was brought to the notice of the scientific public by Dr. Daniell, in a paper read before the Ethnological Society of Edinburgh in 1846. Considerable attention was attracted to the subject; and specimens of the bean were obtained by Dr. Christison from the Gold Coast. These were planted in the Botanical Garden at Edinburgh, and produced a perennial creeper. In the year 1859, specimens of the plant were sent from Calabar, which came under the observation of Dr. Balfour, of Edinburgh, who was thus enabled to ascertain its botanical character.

Properties. The seed is about the size of a large horse-bean, being somewhat more than an inch in length by three-fourths of an inch in breadth, with a very firm, hard, brittle, shining integument of a brownish red, pale chocolate, or ash-gray color. The shape is irregularly kidney-form, with a longer convex and a shorter concave edge, two flat sides, and a furrow running longitudinally along its convex margin and ending in an aperture near one of the extremities of the seed. Within the shell is a kernel consisting of two cotyledons, weighing on an average about 46 grains, hard, white, and pulverizable, of a taste like that of the ordinary edible leguminous seeds, without bitterness, acrimony, or aromatic flavor. "Testa granular, chocolate-brown, with a broad, black groove extending over the entire length of the convex edge; embryo with a short, curved radicle, and two large, white, concavo-convex cotyledons; inodorous; taste bean-like. On moistening the embryo with solution of potassa, it becomes pale yellow." *U.S.* The bean yields its virtues to alcohol, and imperfectly to water. The shell constitutes, according to Dr. Edwards, 30 per cent., the kernel 70 per cent., of the bean. Jobst and Hesse (*Journ. de Pharm.*, Mars, 1864, p. 277) first isolated an active principle, which they found exclusively in the cotyledons. They obtained it by exhausting an alcoholic extract of the seeds with water, adding magnesia to neutralization, which is indicated by the liquid becoming brown, then concentrating, and treating with ether. The ethereal solution was shaken with a little weak sulphuric acid. The liquid separated into two layers; the upper, ethereal, containing no alkaloid, and the lower, a solution of the sulphate in water. The latter was separated, treated with magnesia, and afterwards with ether, which yielded the alkaloid on evaporation. The substance thus obtained they proposed to name *physostigmine.* It was brown, amorphous, soluble in ammonia, soda, ether, benzol, and alcohol, and less so in cold water. In 1867, Hesse (*Ann. der Chem. Pharm.*, 141, 82) obtained the same alkaloid in a still purer state, perfectly colorless and tasteless, fusing at 45° C. (113° F.), and decomposing at 100° C. (212° F.) with red coloration. He gives it the formula $C_{15}H_{21}N_3O_2$.

In 1865, Vée and Leven (*Comptes-Rendus*, 60, 1194) obtained, by treating the seeds in nearly the same manner, an alkaloid to which they gave the name *eserine*, which formed colorless tabular crystals of a bitter taste, melting at 90° C. (194° F.), readily soluble in ether, alcohol, or chloroform, but sparingly soluble in water. The identity of this principle with the purified physostigmine of Hesse is assumed by some writers, but is not certainly established. The solution of eserine acts quickly on the pupil, and a drop of a solution containing only 1 part in 1000, placed within the eyelids, causes great and lasting contraction. Of this alkaloid 1·5 milligrammes (·023 gr.), injected under the skin of a guinea-pig, produced palsy of the hind legs in five minutes, and death in half an hour, with dilatation of the pupil at the moment of death. It is said to be capable of destroying life by absorption from the conjunctiva. A peculiarity of the alkaloid is that an aqueous solution of it, or of one of its salts, exposed to the air in the presence of potassa, soda, or lime, becomes red, owing to the absorption of oxygen. The coloring matter is taken up by chloroform. The color is not permanent, but gradually changes to yellow, green, or blue. This test will detect less than the hundred-thousandth part of the alkaloid. The same property is possessed by the alcoholic extract of the bean.*

Harnock and Witkowski in 1876 obtained still another alkaloid, which they named *calabarine.* It is nearly insoluble in ether, and differs in physiological character from physostigmine.

Hesse obtained also a neutral principle, *phytosterin*, by exhausting the cotyledons with petroleum ether. It is closely allied to cholesterin, but its chloroform solution is devoid of rotatory power. Its formula is $C_{26}H_{44}O + H_2O$, and its melting point is 133° C. (271·4 F.).

Calabar bean has been used from time immemorial by the natives of Africa as an ordeal, and, when given by their head men, usually proves fatal to the accused, unless free vomiting occurs. A draught containing 19 seeds pounded and infused in water is said to have killed a man in an hour. In the experiments of Dr. Fraser, it was found that the integuments of the seeds, as well as the shell, are distinctly purgative. It is probable that in the fresh bean they are also emetic, and that the priests or chiefs who administer the ordeal take advantage of this in regulating the effects of the poison to suit their own purposes; sometimes, however, even the pure alkaloid vomits. (*Gubler.*) The effects of the bean upon the lower animals have been laboriously studied, first by Prof. Fraser, of Edinburgh, and since by numerous investigators. The most pronounced symptom is a general progressive failure of muscular power, which affects all portions of the body, and increases until the animal dies of paralytic asphyxia. Along with this symptom occur muscular tremors, diminished reflex action and contraction of the pupil, and some cardiac disturbance. Neither consciousness nor sensibility is affected until death approaches. The symptoms caused by the drug in man are similar to those just described. Dr. Christison took about 12 grains of the kernel, which in fifteen minutes produced giddiness and a feeling of torpidity, followed by great weakness and faintness, paleness of the surface, extreme weakness and irregularity of the pulse, and indisposition or inability to make voluntary muscular effort. There was no pain or other uneasiness, except the feeling of prostration and some nausea, and the intellect was normal. In two hours after the poison was swallowed, drowsiness occurred, but no stupor. Dr. Fraser experienced from smaller doses effects of a similar character, with temporary dimness of vision. The heart appears to be somewhat variously affected, sometimes acting irregularly or tumultuously, and sometimes less frequently. A peculiar epigastric sensation is generally experienced as the first symptom, about five minutes after the taking of the medicine, gradually increasing, and becoming at length almost painful. This continues at intervals for a considerable time, is after a little while attended with dyspnœa, and then dizziness and feebleness of the extremities are experienced. Seventy cases of children are related, who ate more or less of some beans on their arrival from Africa at the wharves of Liverpool, in all of whom vomiting was brought on either by the poison itself, or by emetics administered, except in a single case; and that case was the only one that proved fatal. The nausea and vomiting came on in about 30 minutes; the nervous symptoms, as trembling, dizziness, and loss of muscular power, in less than an hour. In the fatal case four kernels had been eaten.

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* A *sulphate of physostigmine or eserine* is obtained by M. A. Petit in the following manner. A hydro-alcoholic extract of the bean is dissolved in four parts of distilled water, and the solution filtered. To the solution is added one gramme of bicarbonate of potassium for every 20 grammes of extract, and the mixture is shaken with ether in excess. The ether, which takes up nearly all the alkaloid, is, after a few minutes' repose, separated. A little distilled water is then added, and afterwards sulphuric acid drop by drop; the liquid being shaken after each drop, and tested with litmus paper till exactly neutral. After standing, the aqueous solution is separated from the ether, which now contains none of the alkaloid. This ether is then employed as before, and the operation repeated three or four times, so as completely to exhaust the original solution, and the liquid obtained each time is added to the last watery solution. This contains the sulphate of physostigmine nearly pure. To purify this, it should be passed through the same process as the original solution of the extract. The resulting solution may be evaporated to crystallization if desired; but usually the evaporation is carried only so far as to get rid of all the ether present. If enough water be added to the solution to make as many grammes as there were drops of sulphuric acid (H_2SO_4), employed, each gramme will represent one centigramme (·1543 gr.) of the alkaloid. Of a collyrium made of one part of this to nine parts of water, a drop or two will be sufficient to act promptly on the pupil. (*N. R.*, April, 1872, p. 380.)

The results of experiments upon the lower animals prove that the palsy and loss of reflex activity caused by Calabar bean are due to a depressant action upon the motor tract of the spinal cord; the brain, sensory tract of the cord, and the nerve-trunks not being affected by the poison. The muscular twitchings are the result of a direct influence upon the muscles themselves, although the poison acts much more powerfully upon the spinal centres than upon the heart; the latter viscus does not escape its influence. By small doses the force of the individual cardiac beats is greatly increased, although their frequency is diminished and the arterial pressure rises. After large doses there is cardiac depression, with lower arterial pressure. The mode of death in the fatal case spoken of before would seem to indicate that, in man at least, this cardiac depression may be very serious. Upon intestinal peristalsis, and probably also in bronchial movements, the bean acts as upon the heart, in small doses increasing, in large doses paralyzing, functional activity.

When a preparation of Calabar bean is applied locally to the eye, it causes myosis, and also, according to Dr. T. A. Robertson (*Ed. Med. Journ.*, March, 1863), contraction of the ciliary muscle and disturbance of accommodation, by virtue of which distant objects become indistinct, seem nearer, and are apparently magnified, the eye being far-sighted. These effects, even when they result from the drug taken internally, are evidently produced by a direct action of the alkaloid upon the eye, and are probably the result of a paralysis of the peripheral sympathetic fibres, though it may be that at the same time the oculo-motor nerve terminations are stimulated.

Therapeutic Use. From its extraordinary sedative influence on the spine, Calabar bean would seem to be indicated in all cases of abnormal excitement or irritation of the spinal marrow, especially in tetanus and the poisonous effects of strychnine. Facts have not yet been sufficiently accumulated to justify a positive statement as to its therapeutic virtues. Yet reports are somewhat favorable as to its powers in tetanus. The effect of the drug upon intestinal peristalsis has led to its use in "phantom tumor" of the abdomen, constipation, and other affections of the bowels dependent upon muscular atony. It has also been employed with great asserted advantage in chronic bronchitis.

In poisoning by Calabar bean, the stomach should at once be emptied and thoroughly washed out. In 1864, Dr. Kleinwächter employed atropine in a case with success, and by the researches of Bourneville, and especially of Fraser, the antagonism between the two poisons has since been thoroughly established: in severe poisoning by physostigma, atropine should be administered hypodermically, in doses of from one-sixtieth to one-fortieth of a grain (0·001 to 0·0015 Gm.), repeated at intervals according to the exigencies of the case.

The bean may be used in the form of tincture or alcoholic extract. The dose of the kernel would be two or three grains (0·13–0·20 Gm.) to begin with, and increased if necessary. But it is seldom used in this way. A tincture may be made with alcohol, of which five minims shall represent three grains of the bean, and a tincture of this strength is recommended by Dr. Fraser. (See *Tinctura Physostigmatis.*) The same writer obtained about 4 per cent. of extract by exhausting the kernel with alcohol. The dose, therefore, of alcoholic extract should not exceed one twenty-fourth of that of the kernel, or about one-eighth of a grain (0·008 Gm.). In tetanus, Dr. Fraser recommends the alcoholic extract, either in pill or dissolved in diluted alcohol, in the proportion of 32 grains to the fluidounce. He advises that the treatment should be commenced by subcutaneous injection with one-third of a grain (0·02 Gm.), repeated every two hours, until the system is decidedly affected, and then to administer the remedy in three times the dose by the mouth. (*Am. Journ. of Med. Sci.*, Oct. 1868, p. 563.) An alcoholic extract is officinal, of which the dose is from one-sixteenth to one-sixth of a grain (0·004–0·01 Gm.).

For application to the eye, Dr. Robertson employed an alcoholic extract mixed with water so as to make liquid preparations of different strengths, one minim representing half a grain, two grains, or four grains. He found these to begin to affect the power of accommodation in ten minutes, and to produce the full effect in 20 or 30 minutes. They were also wholly unirritating to the eye. They did not, however, keep well. It would seem best to keep the extract perfectly dry, and mix it with a little water when wanted. This extract dissolves freely in glycerin; and a solution of two and a half grains in 100 minims of that liquid perfectly pure has been found to answer in practice. (*P. J. Tr.*, July, 1863, p. 26.) Another method of application is to impregnate paper by immersing it three or four times in a concentrated tincture of the bean, allowing it to dry after each immersion, and placing within the lower lid a piece of the paper thus prepared, about one-eighth of an inch square. Discs of gelatine containing definite quantities of the extract are sometimes used by oculists.

Off. Prep. Extractum Physostigmatis, *U. S.;* Tinctura Physostigmatis, *U. S.*

PHYSOSTIGMINÆ SALICYLAS. *U. S.* *Salicylate of Physostigmine.*

(PHȲ-SỌ-STĬG-MĪ′NÆ SĂL-Ị-CȲ′LĂS.)

$\mathbf{C_{15} H_{21} N_3 O_2 C_7 H_6 O_3}$; **413.** $C_{30} H_{21} N_3 O_4 . C_{14} H_6 O_6$; 413.

"The salicylate of an alkaloid prepared from Physostigma. It should be kept in small, dark amber-colored, well-stopped vials, in a dark place." *U. S.*

This is a new officinal salt; it has been introduced into the Pharmacopœia in preference to the sulphate of the alkaloid (see page 1098) on account of its greater stability. Owing to the greater molecular weight of salicylic acid, the salicylate cannot be as effective as the sulphate in equal quantities, nor is it as soluble in water.

Properties. It is officinally described as in "colorless, shining, acicular, or short, columnar crystals, gradually turning reddish when long exposed to air and light, odorless, having a bitter taste, and a neutral reaction. Soluble in 130 parts of water and in 12 parts of alcohol at 15° C. (59° F.); in 30 parts of boiling water, and very soluble in boiling alcohol. When heated on platinum foil, the salt is completely dissipated. The aqueous or alcoholic solution of the salt, when exposed to light for a short time, turns reddish. On adding bicarbonate of sodium to the aqueous solution, shaking with ether and evaporating the ethereal solution, an amorphous residue is obtained, having an alkaline reaction, and assuming, when dissolved for some time in water, a reddish color, which disappears on the addition of sulphurous acid, but returns again as the latter evaporates. On concentrating the aqueous solution which has been shaken with ether, to a small bulk, and supersaturating with sulphuric acid, a bulky, white precipitate is obtained which responds to the reactions of salicylic acid. (See *Acidum Salicylicum.*)" *U. S.*

Medical Properties. This salt has the medical properties of its base; but we have never known of its administration, and the dose is very uncertain. For use in the eyes, a solution of one or two grains to the fluidounce would probably be of suitable strength; whilst the tentative internal dose should not exceed one-eightieth of a grain.

PHYTOLACCÆ BACCA. *U. S.* *Phytolacca Berry.* [*Poke Berry.*]

(PHȲ-TỌ-LĂC′ÇÆ BĂC′CẠ—fī-tọ-lăk′sē.)

"The fruit of Phytolacca decandra. Linné. (*Nat. Ord.* Phytolaccaceæ.)" *U. S.*
Raisin d'Amérique, *Fr.;* Amerikanische Kermesbeere, *G.*

PHYTOLACCÆ RADIX. *U. S.* *Phytolacca Root.* [*Poke Root.*]

(PHȲ-TỌ′LĂC′ÇÆ RĀ′DĬX.)

"The root of Phytolacca decandra. Linné. (*Nat. Ord.* Phytolaccaceæ.)" *U. S.*
Racine de Phytolaque, *Fr.;* Kermesbeerenwurzel, *G.*

Gen. Ch. *Calyx* none. *Petals* five, calycine. *Berry* superior, ten-celled, ten-seeded. *Willd.*

Phytolacca decandra. Willd. *Sp. Plant.* ii. 822; Bigelow, *Am. Med. Bot.* i. 39; Barton, *Med. Bot.* ii. 213. This is an indigenous plant, with a large perennial root, often five or six inches in diameter, divided into two or three principal branches, soft, fleshy, fibrous, whitish within, and covered with a brownish cuticle. The stems, which are annual, frequently grow to the height of six or eight feet, and divide into numerous spreading branches. They are round, very smooth, green when young, but purple after the berries have ripened. The leaves are scattered, ovate-oblong, entire, pointed, smooth, ribbed beneath, and on short footstalks. The flowers are numerous, small, and in long racemes, which are sometimes erect, sometimes drooping. The corolla consists of five ovate, concave, whitish petals, folding inwards. The germ is green. There are ten stamens, and the same number of pistils. The raceme of flowers becomes a cluster of dark purple, almost black, shining berries, flattened above and below, and divided into ten cells, each containing one seed.

The poke is abundant in all parts of the United States, flourishing along fences, by the borders of woods, and especially in newly cleared and uncultivated fields. The muck thrown up from the ditches of swamps is peculiarly favorable to it; and a bed of muck may almost always be recognized by the luxuriant growth of poke with which it covers itself. It also grows spontaneously in the north of Africa and the south of Europe, where, however, it is supposed to have been introduced from America. Its flowers begin to appear in July, and the fruit ripens in autumn. The magnitude of the poke-weed, its large rich leaves, and its beautiful clusters of purple berries, often mingled upon the same branch with the green unripe fruit, and the flowers still in bloom, render it one of the most striking of our native plants. The young shoots are much used as food early in the spring, boiled in the manner of spinage. The ashes of the stems and leaves contain a very large proportion of potassa, yielding, according to Braconnot, not less than 4·2 per cent. of the pure caustic alkali. In the plant the potassa is neutralized by an acid closely resembling the malic, though differing from it in some respects. The leaves, berries, and root are used, but the two latter only are mentioned in the Pharmacopœia. The root is most active. It should be dug up late in November, cut into thin transverse slices, and dried with a moderate heat. As its virtues are diminished by keeping, a new supply should be procured every year. The berries should be collected when perfectly ripe, and the leaves about the middle of summer, when the footstalks begin to redden.

The *berries* contain a succulent pulp, and yield upon pressure a large quantity of fine purplish red juice. They have a sweetish, nauseous, slightly acrid taste, with little odor. They are officinally described as "a depressed-globular, dark purple, compound berry, about one-third of an inch (8 mm.) in diameter, composed of ten carpels, each containing one lenticular, black seed." *U. S.* The coloring principle is evanescent, and cannot be applied to useful purposes in dyeing, from the difficulty of fixing it. Alkalies render it yellow; but the original color is restored by acids. The juice contains saccharine matter, and, after fermenting, yields alcohol by distillation.

The *dried root* is branched, of a light yellowish brown color externally, very much wrinkled, and, when in transverse slices, exhibits on the cut surface numerous concentric rings, formed by the projecting ends of fibres, between which the intervening matter has shrunk in drying. The structure internally in the older roots is firm and almost ligneous; the color yellowish white, alternating with darker circular layers. The fracture is fibrous, the wood-bundles in several distinct, concentric circles. There is no smell. The taste is slightly sweetish, and at first mild, but followed by a sense of acrimony. The active matter is imparted to boiling water and alcohol. From the analysis of Mr. Edward Donnelly, the root appears to contain tannic acid, starch, gum, sugar, resin, fixed oil, and lignin, besides various inorganic substances. (*A. J. P*, xv. 169.)

Claussen (*Pharmacist*, 1879, p. 466) prepared from the seeds of *Phytolacca decandra*, by extraction with alcohol, evaporation to dryness, and taking up with chloroform or ether, after washing the residue with petroleum ether, a neutral principle in silky lustrous crystals, insoluble in water, soluble in alcohol, ether, and chloroform, which he named *phytolaccin.*

A. Terail (*Comptes-Rendus.* 91, 856) obtained from the berries an acid (*phytolaccic acid*) as an uncrystallizable yellowish brown mass of gummy consistency. It was soluble in water and alcohol, slightly soluble only in ether, of acid reaction, and gelatinizing with hydrochloric and sulphuric acids.

Medical Properties and Uses. Poke is emetic, purgative, and somewhat narcotic. As an emetic it is very slow in its operation, frequently not beginning to vomit in less than one or two hours after it has been taken, and then continuing to act for a long time upon both the stomach and bowels. The vomiting produced by it is said not to be attended with much pain or spasm; but narcotic effects have been observed by some physicians, such as drowsiness, vertigo, and dimness of vision. In overdoses it produces excessive vomiting and purging, attended with great prostration of strength, and sometimes with convulsions. A case is recorded in the *Stethoscope* for March, 1852, ii. 134, by Dr. Geo. F. Terrill, of Hanover County, Va., in which death was produced in a woman by eating a double handful of the berries. Free purgation followed upon the first day, after which coma set in, with great prostration, though death did not occur until after the sixth day. Dr. A. W. Griggs, of West Point, Georgia, has reported the case of a child, six years old, who, after having swallowed two or three fluidrachms of a tincture of the root, was seized in less than an hour with tonic spasm of the muscles, the extremities being stiff, the hands clinched, the feet extended and toes flexed, and the trunk in a condition of opisthotonus. Under the application of cups to the head and spine, cold to the scalp, and a sinapism over the spine, the spasms were relieved, and recovery took place. (*Atlanta Med. and Surg. Journ.*, July, 1866.) If there was no other cause to which these symptoms could be ascribed, poke root must be considered as having before unsuspected powers; for, though considered narcotic, we have seen no proof from any other source that it is a spinal irritant. Poke root has been proposed as a substitute for ipecacuanha; but the slowness and long continuance of its action, and its tendency to purge, wholly unfit it for the purpose. In small doses it acts as an alterative, and has been highly recommended in the treatment of chronic rheumatism. Dr. C. S. Fenner, of Memphis, Tennessee, has found it highly useful, as an internal remedy, in granular conjunctivitis, especially in preventing the relapses to which the affection is so liable. A case has been recorded by Dr. Alexander, of Tennessee, in which an obstinate and painful tumor on the face, having some of the characters of cancer, disappeared in the course of three months under the use for that time of a fluid extract of phytolacca, given for the cure of chronic rheumatism, which also was greatly relieved by the remedy. Dilute carbolic acid with glycerin was used as a local measure. (*M. and S. Reporter*, May 14, 1870, p. 422.) Dr. Biggers, of La Grande, Oregon, states that he has found the fluid extract of phytolacca an excellent remedy in inflamed and painful mammæ, having frequently employed the remedy, and invariably with success. (*N. R.*, July, 1873, p. 403.) The dose of the powdered root, as an emetic, is from ten to thirty grains (0·65–1·95 Gm.); as an alterative, from one to five grains (0·065–0·33 Gm.). A saturated tincture of the berries may be given in rheumatic cases, in the dose of a fluidrachm (3·75 C.c.), three times a day. Dr. Fenner uses a saturated decoction, of which he gives a wineglassful (60 C.c.) every two or three hours. A strong infusion of the leaves or root has been recommended in piles. An ointment, prepared by mixing a drachm of the powdered root or leaves with an ounce of lard, has been used with advantage in psora, tinea capitis, and some other forms of cutaneous disease. Dr. H. G. Carey, of Dayton, Ohio, has cured three cases of sycosis, and one of favus, by the local use of a decoction of the root. (*Va. Med. Journ.*, Aug. 1856, p. 144.) It occasions at first a sense of heat and smarting in the part to which it is applied. An extract made by evaporating the expressed juice of the recent leaves has been used for the same purposes, and acquired at one time considerable repute as a remedy in cancer.

PICROTOXINUM. *U. S.* *Picrotoxin.*

$C_9H_{10}O_4$; 182. (PĬC-RO̦-TŎX-Ī'NU̦M.) $C_{18}H_{10}O_8$; 182.

"A neutral principle prepared from the seeds of Anamirta paniculata. Colebrooke. (*Nat. Ord.* Menispermaceæ.)" *U. S.*

This is a new officinal. A full account of the method of obtaining this principle will be found in Part II., under the heading of *Cocculus Indicus.* We append here the officinal description and tests. "Colorless, flexible, shining, prismatic crystals, permanent in the air, odorless, having a very bitter taste, and a neutral reaction. Soluble in 150 parts of water and in 10 parts of alcohol at 15° C. (59° F.); in 25 parts of boiling water, and in 3 parts of boiling alcohol; also soluble in acids and in solutions of the alkalies. When heated to about 200° C. (392° F.), the crystals melt, forming a yellow liquid; when heated on platinum foil, they char and are finally completely dissipated. Concentrated sulphuric acid dissolves Picrotoxin with a golden-yellow color, which turns violet-red on the addition of a trace of bichromate of potassium. When mixed with 3 times its weight of nitrate of potassium, moistened with sulphuric acid, and then treated with strong solution of soda in excess, Picrotoxin assumes a brick-red color of short duration. The aqueous solution should remain unaffected by solutions of salts of mercury or platinum, tannic acid, iodide of mercury and potassium, or other reagents for alkaloids (abs. of and difference from alkaloids)." *U. S.*

Medical Properties. The physiological action of this drug does not indicate that it is of practical value, and we know of no reason why it should have been introduced into the Pharmacopœia. Planat reports sixteen cases of true epilepsy cured by a saturated tincture of cocculus, given in doses of 2 drops (0·10 C.c.), twice a day, increased until 30 drops (1·5 C.c.) were given; but we suppose few physicians will be credulous enough to believe his report. For a further account of the physiological and medicinal properties of picrotoxin, see *Cocculus Indicus*, Part II.

PILOCARPINÆ HYDROCHLORAS. *U. S.* *Hydrochlorate of Pilocarpine.*

(PĪ-LO̤-CÄR-PĪ′NÆ HȲ-DRO̤-ÇHLŌ′RĂS.)

$C_{11} H_{16} N_2 O_2 . HCl$; 244·4. $C_{22} H_{16} N_2 O_4 . HCl$; 244·4.

"The hydrochlorate of an alkaloid prepared from Pilocarpus. It should be kept in small, well-stopped vials." *U. S.*

This is a new officinal alkaloidal salt. It is usually obtained by the process given under Pilocarpus for the alkaloid (see page 1105). Although the nitrate is more frequently found in commerce at present, the hydrochlorate has been preferred for introduction into the Pharmacopœia, principally because of its more ready solubility in water. Schuchardt notices (*N. R.*, May, 1881) that 100 parts of boiling water dissolve 66 parts of the hydrochlorate of pilocarpine, and water at 15° C. (59° F.) dissolves nearly the same amount; of alcohol of sp. gr. 0·820 it requires 7 parts for solution at 15° C. (59° F.), while the same alcohol, boiling, easily dissolves 2½ parts of the salt. According to the same authority, nitrate of pilocarpine is soluble at 15° C. (59° F.) in 8 parts of water. At 100° C. (212° F.) it has the same solubility as the hydrochlorate. It requires 130 parts of alcohol of sp. gr. 0·820 at 15° C. (59° F.), and 40 parts of boiling alcohol to dissolve it.

The hydrochlorate of pilocarpine is officinally described as in "minute, white crystals, deliquescent, odorless, having a faintly bitter taste, and a neutral reaction. Very soluble in water and in alcohol, but almost insoluble in ether or chloroform. When heated on platinum foil, the crystals melt, and are finally completely dissipated. With concentrated sulphuric acid, the crystals yield a yellow color, with nitric acid (sp. gr. 1·400), a faintly greenish violet tint, with sulphuric acid and chromate of potassium, an emerald-green color. If an aqueous solution of the salt is slightly acidulated, the addition of water of ammonia produces no precipitate. Solution of soda produces a cloudiness only in a concentrated solution. The aqueous solution yields, with test-solution of nitrate of silver, a white precipitate insoluble in nitric acid, but soluble in ammonia." *U. S.*

Medical Properties and Uses. Pilocarpine is superior to jaborandi in the certainty of its action, in being less disagreeable, and probably less apt to nauseate. Weber, Bardenhewer, and Auschmann agree that 0·3 of a grain of it is equal to seventy-five grains of the best leaves; but this is probably an overestimate of its powers. The hydrochlorate may be used hypodermically in watery solution; the commencing dose is an eighth of a grain (0·008 Gm.), although much larger doses are sometimes necessary. A solution of the salt is sometimes used by oculists as a myotic.

PILOCARPUS. *U. S.* *Pilocarpus.* [*Jaborandi.*]

(PĪ-LO-CÄR′PUS.)

"The leaflets of Pilocarpus pennatifolius. Lemaire. (*Nat. Ord.* Rutaceæ, Xanthoxyleæ.)" *U. S.*

Gen. Ch. Calyx short, subentire or four- to five-dentate. *Petals* four to five, triangular, ovate, coriaceous, very open, reflexed, valvate or slightly imbricate. *Disk* annular, aggregated with the ovary or almost obliterated. *Stamens* four to five, inserted below the disk, with subulate filaments. *Ovary* four- to five-lobed, immersed in the disk, smooth, four- to five-locular. *Styles* simple or six-parted to the base. *Stigmata* five-lobed, distinct, loculicidally two-valved, one-seeded, with the endocarp loose. *Seeds* ovate, exalbuminous, with membranaceous testa; radicle shorter than, and retracted between, the thick cotyledons. Bentham & Hooker.

The words *jaborandi*, *iaborandi*, and *jamborandi* are used in Brazil in a generic sense to designate various pungent, sudorific plants. Among the chief of these are *Piper nodosum*, *P. citrifolium*, and *P. reticulatum*. Under the same title Dr. Coutinho (*Journ. de Pharm.*, 4e sér., xx. 51) has introduced into Europe a drug which is composed of the leaves of one or more species of rue. There has been a good deal of discussion as to the exact botanical relations of these leaves, although all are agreed that they belong to a Pilocarpus. Martius is said (*A. J. P.*, 1875, p. 73), in his *Flora Brasiliensis*, to divide the pinnate-leaved species of the genus into those with smooth and those with hairy leaves. In the original specimens of Dr. Coutinho, and also in other specimens received from the doctor's family by Surgeon F. V. Greene, U.S.N., some of the leaves are hairy, although most of them are smooth. Either, then, there are two species represented, or, as Dr. Greene surmises (*Phila. Med. Times*, vi.), the hairiness is not a specific character. In *P. selloanus*, Engl., a smooth-leaved species, the peduncles and pedicels are long and slender; whilst in *P. pennatifolius*, and also in the jaborandi plant, they are shorter and thicker.

Properties. The following description of the drug is adapted from that of Dr. F. V. Greene, U.S.N., who had unquestionable specimens of the original jaborandi of Coutinho. The package contained several stems branched at an angle of about 20°; these branches being furnished with alternate leaves, which are impari-pinnate, with from two to five opposite leaflets (Planchon has met with leaves having as many as seven, nine, and more rarely eleven leaflets), articulated to the rachis by short petiolules, thickened at the base. The leaflets, which are coriaceous in texture, vary considerably in size and outline. As a rule, they may be considered as oblong-lanceolate, and are entire, emarginate, with an unequal base. The midrib rises very little above the upper surface of the leaflet, but is very prominent and sharp on the lower. The veins, which are rather more prominent on the lower surface, leave the midrib at an angle of about 60°, pursue a parallel course across the leaflet, and finally turn up and anastomose within about a quarter of an inch of the margin. The leaflets are pellucidly punctate; the dots are the receptacles of secretion, are numerously and irregularly distributed over the whole surface, and are plainly visible when the leaflet is held up to the light. The fruit consists of five carpels, of which not more than two or three are usually developed to maturity; when ripe the carpels dehisce into two valves, and then remind one strongly of miniature cockle-shells with the valves open exposing the animals. The black, shining, reniform seeds (one for each carpel) have a lancet-shaped hilum, a sharp ridge on the back near the apex, and a smooth, pale yellow endocarp surrounding it. The officinal description of the drug is as follows. "About four inches (10 cm.) long, short-stalked, oval or ovate-oblong, entire and slightly revolute at the margin, obtuse and emarginate, unequal at the base; coriaceous, pellucid-punctate, mostly smooth; when bruised, slightly aromatic; somewhat pungent and bitter." *U. S.*

Chemical Constituents. An alkaloid was isolated in 1875 from jaborandi, almost simultaneously by A. W. Gerrard and M. Hardy. To this the name of *pilocarpine* was given. Gerrard at the same time stated that there were at least two alkaloids in the leaves, and this view was afterwards confirmed when *jaborine* was discovered. He also obtained a volatile oil, tannic acid, a peculiar volatile acid, and chloride of potassium. *Pilocarpine* may be prepared as follows. The leaves of *P. pennatifolius* are exhausted with 80 per cent. alcohol containing 8 grammes of hydrochloric acid in a litre, the tincture is distilled and evaporated to the consistence of a liquid extract, and this is mixed with a small quantity of water, and filtered. The filtrate is treated with a slight excess of ammonia, and then with a large quantity of chloroform. The chloroform solution is agitated with water, to which hydrochloric acid is added, drop by drop, in sufficient quantity to neutralize the alkaloid, the hydrochlorate of which is obtained in long needles on evaporating the aqueous solution, while foreign principles remain dissolved in the chloroform. By dissolving the crystals in water, treating the solution with ammonia and chloroform, and evaporating the latter solution, pilocarpine is obtained as a soft viscous mass, which is only slightly soluble in water, but is freely soluble in alcohol, ether, and chloroform. Harnack and Meyer, in 1880, obtained the second alkaloid, *jaborine.* Their process depends upon these facts: 1, that jaborine is less soluble in water than pilocarpine; 2, that it is more soluble in ether than pilocarpine; and, 3, that jaborine platino-chloride is more soluble in alcohol than the pilocarpine salt. (See *A. J. P.*, Feb. 1881.) Kingzett assigns to pilocarpine the formula $C_{23}H_{34}N_4O_4 + 4H_2O$. Harnack and Meyer, on the other hand, give it as $C_{11}H_{16}N_2O_2$. The latter has been generally accepted, and is now recognized by the U. S. Pharmacopœia. These investigators state that jaborine is easily formed from pilocarpine, and may be produced by simply heating the latter alkaloid. They also showed that *pilocarpine* has physiological effects analogous to those of *nicotine*, whilst *jaborine* resembles *atropine* in its effects. Pilocarpine combines with acids, and a number of the salts are to be had in commerce. The nitrate has probably been used most frequently, although the hydrochlorate is now officinal. Gerrard tested the solubilities of several of the salts as follows. The *nitrate* is soluble in water, sparingly in cold but freely in boiling alcohol; it is insoluble in chloroform, benzol, carbon bisulphide, and ether. The *phosphate* is soluble in water, sparingly in cold, more freely in boiling alcohol, from which on cooling it crystallizes in lustrous tables; it is insoluble in ether, chloroform, benzol, and carbon bisulphide. The *chloride* is freely soluble in water, alcohol, and chloroform; insoluble in ether, benzol, and carbon bisulphide. The *acetate* is soluble in water, alcohol, chloroform, benzol, and ether; insoluble in carbon bisulphide. The *hydrobromate* is soluble in water, alcohol, and chloroform; insoluble in ether and carbon bisulphide.

Medical Properties and Uses. When an infusion of from sixty to ninety grains of jaborandi is given to an adult, in about ten minutes the face and neck become deeply flushed, and free perspiration and salivation commence. After a hypodermic injection of the alkaloid, the symptoms may set in in six minutes. The sweating begins on the face; both it and the salivation are excessively profuse, and last from three to five hours. There is frequently nausea, and sometimes vomiting. The pulse is usually more or less quickened, as is also usually the respiration. After the sweating has ceased, the patient is left more or less exhausted. The nasal and lachrymal secretions are also very generally increased under the action of the drug, and M. Gubler has noted diarrhœa, which in the experiments of Ringer and others has not been present. There is sometimes contraction of the pupils, and even disturbance of vision. These effects of the drug are in the adult fairly constant; but subjects have been occasionally found who were not susceptible to the action of the remedy, and, very curiously, in Dr. Ringer's experiments children were found to be very insusceptible, although doses of sixty grains were employed. Schwann and subsequent observers have noticed in the lower animals that very violent intestinal peristalsis is produced by the drug.

The sweat produced by jaborandi is often enormous in quantity (nine to fifteen ounces by estimation). It is stated to be at first acid, then neutral, and finally often clearly alkaline, as is also the saliva. Not only the watery, but also the solid portions are increased, and the elimination of urea is said especially to be affected. Usually, but not always, when the drug acts very moderately upon the skin, the salivary glands are but slightly affected, and *vice versa.* The cause of the excessive secretion is a direct action upon either the gland cells or the peripheral nerve-endings, but probably upon the former. In the first stages of sweating the bodily temperature sometimes rises, but it usually falls after the perspiration.

When applied to the eye, pilocarpine produces great contraction of the pupil, tension of the accommodative apparatus, and an approximation of the nearest and farthest points of distinct vision by a peripheral action. It is stated to produce less irritation than Calabar bean.

Jaborandi is so powerful and certain in its diaphoretic action that it has already taken rank as the most reliable and influential of the remedies of its class; indeed, so great is its power that it has greatly extended the use of diaphoretics. In dropsies it has been widely employed, and certainly is a most efficient remedy. Great value has been ascribed to it in facilitating the removal of local watery effusions, such as occur in pleurisy and pulmonic œdema. In uræmia it is the most efficient remedy at our command. In acute or chronic Bright's disease it is of great value, sufficing often in the one case to bring about convalescence, and in the other greatly to prolong life and make it comfortable. The sweats may be repeated daily, bi-weekly, or weekly. Recently, the plan of giving very small doses at short intervals as a diuretic has been strongly commended. The dose of jaborandi is twenty to sixty grains (1·3 to 3·9 Gm.), diffused in water, or given in the form of a fluid extract.

It has been proved by elaborate experimentation that in many of their actions upon the human system pilocarpine and atropine are directly antagonistic; and in poisoning by jaborandi or its alkaloid, atropine has the power to arrest the excessive secretion and save life. The power of pilocarpine in atropine poisoning is more doubtful; but Dr. Purjesz, of Buda-Pesth, reports (*Centralb. Prak. Augenheilk.*, 1880) a case in which two and a half grains of the sulphate of atropine are said to have been taken, and relief, with final recovery, was secured by hypodermic injections of 0·4 grain of pilocarpine every ten minutes until 6·4 grains had been administered.

Off. Prep. Extractum Pilocarpi Fluidum, *U. S.*

PILULÆ. *Pills.*

(PĬL′U-LÆ.)

Pilules, *Fr.;* Pillen, *G.*

These are globular masses of a size convenient for swallowing. They are well adapted for the administration of medicines which are unpleasant to the taste or smell, or insoluble in water, and which do not require to be given in large doses. Deliquescent substances should not be made into pills; and those which are efflorescent should be previously deprived of their water of crystallization. Care should be taken not to combine materials, the mutual reaction of which may result in a change of form.

Some substances have a consistence which enables them to be made immediately into pills. Such are the softer extracts and certain gum-resins; and the addition of a little water to the former, and of a few drops of spirit to the latter, will give them the requisite softness and plasticity, if previously wanting. Substances which are very soft, or in the liquid state, are formed into the pilular mass by incorporation with dry and inert powders, such as wheat flour, starch, and powdered gum arabic, or with crumb of bread. Powders must be mixed with soft, solid bodies, as extracts, confections, soap, etc., or with tenacious liquids, as syrup, molasses, honey, mucilage, or glycerin; and the last-mentioned substance has been especially recommended in connection with a little alcohol. Heavy metallic powders are most conveniently made into pills with the former; light vegetable powders with the latter. Mucilage is very often used; but pills made with it are apt when kept to become hard and of difficult solubility in the liquids of the stomach, and, if metallic substances are mixed with it, the mass does not work well. A mixture of syrup and powdered gum arabic is not subject to the same inconveniences, and is an excellent material for the formation of pills. Honey evaporated to about half its bulk has been highly recommended. Confection of rose and glucose are among the best excipients, when the pills are to be kept long. For the same purpose of keeping the pills soft, the addition of a small portion of some fixed oil or deliquescent salt has been recommended; but glycerin is still better. Glycerin incorporated with one twenty-fifth of its weight of powdered tragacanth is said to cause pills to remain soluble for almost any length of time. The new officinal mucilage of tragacanth is an excellent excipient. Mr. Martindale prepares a mass by heating together with constant stirring to 115·5° C. (240° F.) five parts by weight of glycerin and one of flour, or, when a very firm mass is required, equal parts of flour and glycerin. ((*P. J. Tr.*, 3d ser., i. 412.) It has been objected that pills made with glycerin could not be handsomely gilt or silvered, the lustre of the metal disappearing. This is true, however, only of very recent pills, or of those in which an excess of glycerin has been used. Many powders require only water. Such are all those which contain ingredients capable of forming an adhesive or viscid solution with that liquid. Care should always be taken that the matter added be not incompatible with the main constituents of the pill.

The materials should be accurately mixed together, and beaten in a mortar till formed into a perfectly uniform and plastic mass. This should be of such a consistence that the pills may preserve their form, without being so hard as to resist the solvent power of the gastric liquors. As pills frequently become very hard by time, it is often convenient to keep the mass in a state fit to be divided when wanted for use. This may be done by wrapping it in waxed paper, putting it in covered pots, and occasionally moistening it as it becomes dry; or, more effectually, by keeping it in glass or well-glazed jars, accurately closed with rubber cloth.

The mass, having been duly prepared, is made into pills by rolling it with a spatula, or with a flat, smooth piece of hard wood, into a cylinder of precisely the same thickness throughout, and of a length corresponding to the number of pills required. It is then divided as equally as possible by the hand, or more accurately by a machine made for the purpose.* The pills receive a spherical form by being rolled between the fingers. M. Miahle describes a little instrument for rolling pills, composed of two circular plates, one about 12, the other 6 inches in diameter; the former having a ledge at the border one-third of an inch high, the latter with a similar ledge, varying, according to the size of the pills, from less than a line to nearly two lines, and with a strap on the back by which it can be fitted to the hand. This is to be moved in a rotatory manner upon the larger plate, holding the divided portions of the pill mass. (*Journ. de Pharm.*, 3e sér., xvii. 218.) Similar pill-rollers made of wood are now in use. In order to prevent the adhesion of pills to one another, or to the sides of the vessel in which they may be placed, it is customary to agitate them with some dry powder, which gives them an external coating, that serves also to conceal their taste. For this purpose carbonate of magnesium, rice flour, or starch may be used. Carbonate of magnesium is sometimes incompatible with one of the ingredients of the pills; and liquorice root is sometimes preferable, though it occasionally becomes mouldy with very damp pills. The powder of lycopodium, which has been long in use in Europe, is now considerably employed in this country, and is perhaps one of the best substances for the purpose. It is the custom in some sections of the country, particularly on the Pacific coast, to give the pill a coating of gold or silver leaf. This is done by agitating the pills, prepared without dusting powder, and with their surface still damp, along with gold or silver leaf, in a hollow spherical wooden box, made by turning two hemispheres out of hard wood, fitting each other, and provided with a short handle.

It was proposed by M. Garot to cover pills with gelatin, which answers the purpose of concealing their taste and odor and counteracting deliquescence or chemical change from exposure to the air, but it sometimes interferes with their solubility in the stomach. This method of coating is largely used at the present time, and one of the best machines that have been devised for gelatin-coating pills is that of H. Maynard, of Chicago. This consists of a circular plate in which are affixed twenty fine needles; the pills are rolled into depressions, and are easily impaled on the points of the needles; they are then dipped into a solution of gelatin, gently rotated, and allowed to cool.

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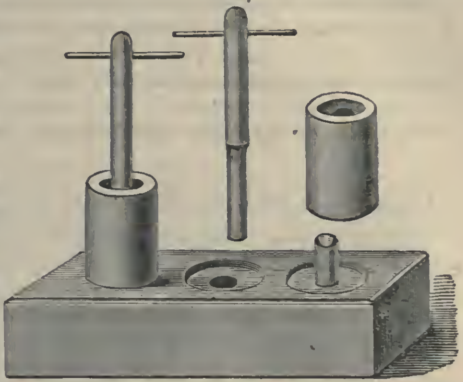
* The common pill-machine is too well known to require description. In *A. J. P.* (xxiv. 315) the reader will find the description of a rotatory pill-machine, calculated to prepare large numbers of pills in a short time; and in the same journal (xxvi. 118) of another, which is considered an improvement on the first. (See also *A. J. P.*, Jan. 1869.)

Another plan for attaining the same objects, less effectual but more convenient than the above, is to introduce the pills into a spherical box, to drop on them enough syrup simply to moisten their surface, then to give a rotatory movement to the box until the pills are uniformly covered, and finally to add by degrees either powdered French chalk, elm bark, or similar substance, shaking the box with each addition, and continuing the process until nothing more will adhere to the pills. The investing material may be rendered agreeable to the taste and smell by aromatic additions, if deemed advisable. M. Calloud found that a good powder for coating pills, because little disposed to attract moisture, was made by boiling one part of flaxseed and three parts of white sugar with sufficient water till a thick mucilage is formed, evaporating this carefully to dryness, and then pulverizing. (*Ibid.*, xxiii. 301.) The same writer has since suggested, as still more effective, a powder made by forming a mucilage with one part of tragacanth and two parts of water, pressing this through linen, mixing it with twenty parts of sugar of milk, spreading the paste thus made in thin layers to dry, and then powdering. The pills may be simply moistened with water, and then shaken in the powder. M. Lhermite proposes first to agitate the pills in a mortar with a little concentrated solution of gum, and afterwards to put them into a box containing dry and very finely powdered sugar, to which a rotatory motion is given. If the coating be not sufficiently thick, the process may be repeated. (*Ibid.*, xxv. 460.) The sugar-coating of pills is now conducted upon a great scale by manufacturers, who send large quantities both of popular and of officinal pills into the market thus protected. The process employed is similar to that of the confectioners in coating almonds. After having been thoroughly dried, the pills are put into a hemispherical tinned copper basin, which is suspended from the ceiling, and moved quickly backward and forward with an eccentric motion, so as to cause a constant attrition among the pills. First a little very thick syrup, or syrup of gum, is introduced in order to give a thin coating to their surface; and afterwards very finely powdered and very dry white sugar is sifted or thrown over them, the motion being constantly maintained. The sugar is fixed by the moist surface of the pills, and the coating made compact and smooth by the attrition. The process is aided by a gentle heat, but the heat must be guarded, lest the pills be much softened, and thus lose their shape, and even discolor the coating. Dexterous manipulation is necessary in order that the process may succeed thoroughly. For practical remarks on the sugar-coating of pills, see an essay by Mr. H. C. Archibald in *A. J. P.*, 1867, p. 199. On a larger scale a copper pill-coater of peculiar construction, heated by steam pipes, is now used. Still another method, proposed by Mr. E. K. Durden, is to cover the pills with collodion, which completely conceals the taste. The solution employed by Mr. Durden had the sp. gr. 0·810; and two dippings gave a sufficient coating. (*A. J. P.*, xxi. 183.) It is, however, yet to be determined whether a coating of collodion would yield readily to the solvent powers of the gastric juice. M. Blancard covers pills with a solution of Tolu balsam in ether; but Mr. H. C. Baildon objects to this, that it takes too long to dry, and suggests as a substitute a solution of a drachm of the balsam in three drachms of chloroform, which dries sufficiently in twenty minutes. (*A. J. P.*, xxix. 350.) If old and solid Tolu balsam be selected, it will be less liable to the objection of drying slowly. This balsam is officinally employed in coating the U. S. pills of iodide of iron. A solution of mastic in ether has also been used for coating pills; and the white of egg has been recommended for the same purpose. (*Ibid.*, March, 1862, p. 137.)

Pills which are to be kept long should be well dried, and put into bottles with loosely-fitting stoppers to prevent moulding. Though the U. S. Pharmacopœia, in almost every instance, orders the mass to be divided into pills, yet it should be understood rather as indicating the number of pills to be made from a certain quantity of the mass, when particular directions are not given by the physician, than as requiring the division to be made immediately after the materials have been mixed. It will be found convenient by the apothecary to retain a portion of the mass undivided, especially when it is desirable to keep the pills soft.

Compressed pills are made directly from the medicinal substance without the aid of an excipient. The drug, if not already in powder, is reduced to such, and then forced into pill shape by means of a powerful press. For certain substances which naturally exist in powder, such as bisulphate of quininé, bromide and iodide of potassium, and which have some cohesiveness, the process is a good one. The cut shows an apparatus contrived by Prof. J. P. Remington for compressing pills; it is made of cast steel; the base has two countersunk depressions with a short post in the centre of each; a lenticular depression is made in the upper surface of each post. A steel cylinder having a central aperture of the diameter of the post is placed in the depression, the proper quantity of powder is introduced, and the plunger, which has a corresponding lenticular depression on its lower surface, is placed on the powder and is struck with a mallet a quick blow; the powder is compressed, and the pill adheres to the cylinder; by removing the cylinder and holding it over a box and tapping the plunger again lightly, the pill is forced out and falls into a box.



The Pills formerly officinal which have been omitted in the present U. S. and Br. Pharmacopœias are the *Pills of Sulphate of Quinine*, U. S.; *Compound Pills of Squill, Compound Pills of Soap, Compound Pills of Aloes*, Lond., Dub.; the *Pills of Calomel and Opium*, Ed.; the *Pills of Sulphate of Iron*, Ed.; the *Opiate Pills of Lead*, Ed.; *Pills of Rhubarb and Iron*, Ed., and the *Compound Pills of Storax*, Lond., Ed.

PILULÆ ALOES. *U. S.* *Pills of Aloes.*

(PĬL′Ụ́-LÆ ĂL′Ọ-ĒṢ.)

Pilula Aloes Barbadensis, Pilula Aloes Socotrinæ, *Br.;* Pill of Barbadoes Aloes, Pill of Socotrine Aloes; Pilules d'Aloès, *Fr.:* Aloepillen, *G.*

"Purified Aloes, in fine powder, *two hundred grains* (13 Gm.); Soap, in fine powder, *two hundred grains* (13 Gm.), To make *one hundred pills.* Beat them together with water so as to form a mass, and divide it into *one hundred pills.*" *U. S.*

"Take of Barbadoes Aloes, in powder, *two ounces* [avoirdupois]; Hard Soap, in powder, *one ounce* [avoird.]; Oil of Caraway *one fluidrachm;* Confection of Roses, *one ounce* [avoird.]. Beat all together until thoroughly mixed." *Br.*

The British process for pill of Socotrine Aloes is the samé, except that Socotrine is substituted for Barbadoes Aloes, and the volatile Oil of Nutmeg for that of Caraway.

The soap, in this formula, not only serves to impart a proper consistence to the aloes, but is thought to qualify its operation, and diminish its liability to irritate the rectum. Five of the U. S. Pills, containing ten grains (0·65 Gm.) of aloes, may be given with a view to their purgative effect; but the preparation is usually employed as a laxative in habitual costiveness; one, two, or three pills, before dinner, or at bedtime. The British pill is of very nearly the same strength.

PILULÆ ALOES ET ASAFŒTIDÆ. *U. S., Br.* *Pills of Aloes and Asafetida.*

(PĬL′Ụ́-LÆ ĂL′Ọ-ĒṢ ĔT ĂS-Ạ-FŒT′Ị-DÆ—ăs-ạ-fĕt′ị-dē.)

Pilules d'Aloès et Asefétide, *Fr.;* Aloe- und Asafœtida-Pillen, *G.*

"Purified Aloes, in fine powder, *four hundred grains* (26 Gm.); Asafetida, *four* *hundred grains* (26 Gm.); Soap, in fine powder, *four hundred grains* (26 Gm.), To make *three hundred pills.* Beat them together with water so as to form a mass, and divide it into *three hundred pills.*" *U. S.*

"Take of Socotrine Aloes, in powder, Assafetida, Hard Soap, in powder, Confection of Roses, of each, *an ounce.* Beat all together until thoroughly mixed." *Br.*

These pills are peculiarly adapted, by the stimulant and carminative properties of the asafetida, to cases of costiveness attended with flatulence and debility of the digestive organs. Each pill contains about four grains (0·26 Gm.) of the mass. From two to five may be given for a dose.

PILULÆ ALOES ET FERRI. *U. S. Pills of Aloes and Iron.*

(PĬL'Ū-LÆ ĂL'O̤-ĒS̤ ĔT FĔR'RĪ.)

Pilula Aloes et Ferri, *Br.;* Pilulæ Aloeticæ Ferratæ, s. Pilulæ Italicæ Nigræ, *P.G.;* Pilules d'Aloès et de Fer, *Fr.;* Aloe- und Eisenpillen, Italienische Pillen, *G.*

"Purified Aloes, in fine powder, *one hundred grains* (6·5 Gm.); Dried Sulphate of Iron, *one hundred grains* (6·5 Gm.); Aromatic Powder, *one hundred grains* (6·5 Gm.); Confection of Rose, *a sufficient quantity,* To make *one hundred pills.* Beat the powders together with Confection of Rose so as to form a mass, and divide it into *one hundred pills.*" *U. S.*

"Take of Sulphate of Iron *one ounce and a half;* Barbadoes Aloes, in powder, *two ounces;* Compound Powder of Cinnamon, *three ounces;* Confection of Roses, *four ounces.* Reduce the Sulphate of Iron to powder, rub it with the Aloes and Compound Powder of Cinnamon, and adding the Confection make the whole into a uniform mass." *Br.*

This is a new officinal pill. It differs from the preparation of the same name in the British Pharmacopœia in the substitution of aromatic powder for the compound powder of cinnamon. It is essentially an old preparation of the Edinburgh Pharmacopœia, which, having been omitted in the original British, has been resumed in the present edition. It is said that the laxative power of aloes is increased, and its tendency to irritate the rectum diminished, by combination with sulphate of iron. This pill is especially adapted to amenorrhœa with debility of the stomach and constipation. The dose is from one to three pills.

PILULÆ ALOES ET MASTICHES. *U. S. Pills of Aloes and Mastic.*

(PĬL'Ū-LÆ ĂL'O̤-ĒS̤ ĔT MĂS'TI̤-ÇHĒS̤.)

Lady Webster's Dinner Pills, *E.;* Pilules d'Aloès et de Mastic, *Fr.;* Aloe- und Mastix-Pillen, *G.*

"Purified Aloes, in fine powder, *two hundred grains* (13 Gm.); Mastic, in fine powder, *fifty grains* (3·25 Gm.); Red Rose, in fine powder, *fifty grains* (3·25 Gm.), To make *one hundred pills.* Beat them together with water so as to form a mass, and divide it into *one hundred pills.*" *U. S.*

Each of these pills contains about four grains of the mass, including the water employed, and nearly two grains (0·13 Gm.) of aloes. They are in imitation of Lady Webster's dinner pills, and one of them may be given as a laxative at bedtime, or before a meal. The mastic has probably little other effect than to impair the solubility of the aloes, and thus give it a still greater tendency to act on the lower bowels.*

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* The following is the formula for the aloetic pills, usually called *dinner pills* or *Lady Webster's pills.* They are the *Pilulæ Stomachicæ* of the fifth edition of the Paris Codex, 1758. Take of the best aloes six drachms; mastic and red roses, each, two drachms; syrup of wormwood sufficient to form a mass, to be divided into pills of three grains each. Common syrup may be substituted for syrup of wormwood. One or two of these pills, taken shortly before a meal, will usually produce one free evacuation.

The Philadelphia College of Pharmacy has adopted the following formulas for the compound aloetic preparations commonly called *Hooper's* and *Anderson's pills.*

"*Hooper's Female Pills.* ℞ Aloës Barbadensis ℥viij, Ferri Sulphatis Exsiccati ℥ij, ʒiss, *vel* Ferri Sulphatis Crystal. ℥iv, Extracti Hellebori ℥ij, Myrrhæ ℥ij, Saponis ℥ij, Canellæ in pulv. tritæ ʒj, Zingiberis in pulv. trit. ʒj.—Beat them well together into a mass with water, and divide into pills, each containing two and a half grains." (*Journ. of the Phila. Coll. of Pharm.*, v. 25.)

PILULÆ ALOES ET MYRRHÆ. *U. S., Br.* *Pills of Aloes and Myrrh.*

(PĬL′Ů-LÆ ĂL′Ọ-ĒȘ ĔT MЎR′RHÆ.)

Rufus's Pills, *E.;* Pilules d'Aloès et de Myrrhe, Pilules de Rufus, *Fr.;* Rufus'sche Pillen, *G.*

"Purified Aloes, in fine powder, *two hundred grains* (13 Gm.); Myrrh, in fine powder, *one hundred grains* (6·5 Gm.); Aromatic Powder, *fifty grains* (3·25 Gm.); Syrup, *a sufficient quantity*, To make *one hundred pills.* Beat them together so as to form a mass, and divide it into *one hundred pills.*" *U. S.*

"Take of Socotrine Aloes *two ounces;* Myrrh *one ounce;* Saffron, dried, *half an ounce;* Confection of Roses *two ounces and a half.* Triturate the Aloes, Myrrh, and Saffron together, and sift; then add the Confection of Roses, and beat them together into a uniform mass." *Br.*

This composition has been long in use, under the name of *Rufus's Pills.* It is employed, as a warm stimulant cathartic, in general debility attended with constipation, and in retention or suppression of the menses. From three to six pills, or from ten to twenty grains (0·65–1·3 Gm.) of the mass, may be given for a dose.

PILULÆ ANTIMONII COMPOSITÆ. *U. S.* *Compound Pills of Antimony.* [*Plummer's Pills.*]

(PĬL′Ů-LÆ ĂN-TỊ-MŌ′NỊ-Ī CỌM-PŎȘ′Ị-TÆ.)

Pilula Hydrargyri Subchloridi Composita, *Br.;* Pilula Calomelanos Composita, *Br.* 1864; Compound Pill of Subchloride of Mercury, Compound Calomel Pill; Pilules altérantes composées, Pilules antidartreuses, Pilules de Plummer, *Fr.;* Plummer'sche Pillen, *G.*

"Sulphurated Antimony, *fifty grains* (3·25 Gm.); Mild Chloride of Mercury, *fifty grains* (3·25 Gm.); Guaiac, in fine powder, *one hundred grains* (6·5 Gm.); Mucilage of Tragacanth, *a sufficient quantity*, To make *one hundred pills.* Mix the powders, beat them together with Mucilage of Tragacanth so as to form a mass, and divide it into *one hundred pills.*" *U. S.*

"Take of Subchloride of Mercury, Sulphurated Antimony, of each, *one ounce* [avoirdupois]; Guaiacum Resin, in powder, *two ounces* [avoird.]; Castor Oil *one fluidounce*, or *a sufficiency.* Triturate the Subchloride of Mercury with the Antimony, then add the Guaiacum Resin and Castor Oil, and beat the whole into a uniform mass." *Br.*

We prefer the title "compound calomel pill," of the former British Pharmacopœia, as not liable to any mistake, and most expressive of the quality of the medicine. The antimonial employed, though under a different name, is identical with the old U. S. precipitated sulphide. According to Vogel, a reaction takes place between the calomel and sulphurated antimony, resulting in the production of chloride of antimony and sulphide of mercury. The preparation was originally introduced to the notice of the profession by Dr. Plummer, who found it useful as an alterative, and upon whose authority it was at one time much employed under the name of *Plummer's Pills.* The combination is well adapted to the treatment of chronic rheumatism, and of scaly and other eruptive diseases of the skin, especially when accompanied with a syphilitic taint. Six grains (0·4 Gm.) of the U. S. preparation, and five (0·33 Gm.) of the British, contain about one grain (0·065 Gm.) of calomel, and each U. S. pill about half a grain (0·03 Gm.). One to two pills or more may be given morning and evening.

PILULÆ ASAFŒTIDÆ. *U. S.* *Pills of Asafetida.*

(PĬL′Ů-LÆ ĂS-Ạ-FŒT′Ị-DÆ—ăs-ạ-fĕt′ị-dē.)

Pilules d'Asefétide, *Fr.;* Asafœtida-Pillen, *G.*

"Asafetida, *three hundred grains* (19·5 Gm.); Soap, in fine powder, *one hundred grains* (6·5 Gm.), To make *one hundred pills.* Beat them together with water so as to form a mass, and divide it into *one hundred pills.*" *U. S.*

"*Anderson's Scots Pills.* ℞ Aloës Barbadensis ℥xxiv, Saponis ℥iv, Colocynthidis ℥j, Gambogiæ ℥j, Olei Anisi f℥ss. Let the aloes, colocynth, and gamboge be reduced to a very fine powder; then beat them and the soap with water into a mass, of a proper consistence to divide into pills, each containing three grains."

Each of these pills contains three grains (0·20 Gm.) of the gum-resin. They are a convenient form for administering asafetida, the unpleasant odor and taste of which render it very offensive in the liquid state.

PILULA CAMBOGIÆ COMPOSITA. *Br.* *Compound Pill of Gamboge.*

(PĬL′Ủ-LẠ CẠM-BŌ′Ģ-Ị-Æ CỌM-PŎŞ′Ị-TẠ.)

"Take of Gamboge, in powder, Barbadoes Aloes, in powder, Compound Powder of Cinnamon, of each, *one ounce;* Hard Soap, in powder, *two ounces;* Syrup, *a sufficiency.* Mix the Powders together, add the Syrup, and beat the whole into a uniform mass." *Br.*

This is an active purgative pill, and may be given in the dose of from five to fifteen grains (0·33–1 Gm.). The formula is that of Dr. George Fordyce simplified.

PILULÆ CATHARTICÆ COMPOSITÆ. *U. S.* *Compound Cathartic Pills.*

(PĬL′Ủ-LÆ CẠ-THÄR′TỊ-ÇÆ CỌM-PŎŞ′Ị-TÆ.)

Antibilious Pills. *E.;* Pilules cathartiques composées, *Fr.;* Abführpillen, *G.*

"Compound Extract of Colocynth, *one hundred and thirty grains* (8·4 Gm.); Abstract of Jalap, *one hundred grains* (6·5 Gm.); Mild Chloride of Mercury, *one hundred grains* (6·5 Gm.); Gamboge, in fine powder, *twenty-five grains* (1·6 Gm.), To make *one hundred pills.* Mix the powders intimately; then with water form a mass, and divide it into *one hundred pills.*" *U. S.*

This cathartic compound was first made officinal in the second edition of the U. S. Pharmacopœia. It was intended to combine smallness of bulk with efficiency and comparative mildness of purgative action, and a peculiar tendency to the biliary organs. Such an officinal preparation was much wanted in this country, in which bilious fevers, and other complaints attended with congestion of the liver and portal circle generally, so much abound. The object of smallness of bulk is accomplished by employing extracts and the more energetic cathartics; that of a peculiar tendency to the liver, by the use of calomel; and that of efficiency with mildness of operation, by the union of several powerful purgatives. It is a fact, abundantly proved by experience, that drastic cathartics become milder by combination, without losing any of their purgative power. Nor is it difficult, in this case, to reconcile the result of observation with physiological principles. Cathartic medicines act on different parts of the alimentary canal and organs secreting into it. In small doses, both the irritation which they occasion and their purgative effect are proportionally lessened. If several are administered at the same time, each in a diminished dose, it is obvious that the combined purgative effect of all will be experienced; while the irritation, being feeble in each part affected, and diffused over a large space, will be less sensible to the patient, and will more readily subside. In the compound cathartic pills, most of the active purgatives in common use are associated together in proportions corresponding with their respective doses, so that an excess of any one ingredient is guarded against, and violent irritation from this cause prevented. The present officinal process does not differ from that of U. S. P. 1870, except in the substitution of the abstract of jalap for the extract, the latter being no longer officinal. This, however, does not alter the composition of the pill. It is highly important, for the efficiency of these pills, that they be prepared in exact compliance with the directions, and that the *compound extract of colocynth* and the *abstract of jalap* used be of good quality. When they fail, the result is generally ascribable to the substitution of jalap for the abstract, or to the use of a compound extract of colocynth made with nearly inert scammony, inferior aloes, and insufficient colocynth, and altogether badly prepared. (See a paper by G. H. Chas. Klie, *A. J. P.*, April, 1878.)

Three of the pills, containing 10⅔ grains (0·69 Gm.) of the mass, are a medium dose for an adult. In this quantity are four grains (0·26 Gm.) of compound extract of colocynth, three (0·20 Gm.) of abstract of jalap, three (0·20 Gm.) of calomel, and two-thirds of a grain (0·04 Gm.) of gamboge. A single pill will generally be found to operate as a mild laxative. In a full dose, the preparation acts vigorously on the bowels, producing bilious stools, generally without much pain or disorder of the stomach. It may be employed in most instances where a brisk cathartic is required, but is particularly applicable to the early stages of bilious fevers, to hepatitis, jaundice, and all those derangements of the alimentary canal, or of the general health, which depend on congestion of the portal circle.

PILULA COLOCYNTHIDIS COMPOSITA. *Br.* *Compound Pill of Colocynth.*

(PĬL'Ụ̇-LẠ CŎL-Ọ-CȲN'THỊ-DĬS CỌM-PŎŞ'Ị-TẠ.)

Pilules de Coloquinte composées, Pilules cochées mineures, *Fr.;* Coloquinten-Pillen, *G.*

"Take of Colocynth Pulp, in powder, *one ounce;* Barbadoes Aloes, in powder, Scammony, in powder, of each, *two ounces;* Sulphate of Potash, in powder, *a quarter of an ounce;* Oil of Cloves *two fluidrachms;* Distilled Water *a sufficiency.* Mix the Powders, add the Oil of Cloves, and beat into a mass with the aid of the Water." *Br.* The ounce employed is the avoirdupois ounce.

This is not, like the late London pills of the same name, merely another form of the compound extract of colocynth, though containing essentially the same materials; one great difference being that colocynth and aloes are used in substance in the pill, instead of in the state of extract. The present British preparation is that of the late Edinburgh Pharmacopœia slightly altered. Sulphate of potassium is used to promote the more complete division of the aloes and scammony. The preparation is actively cathartic in the dose of from five to twenty grains (0·33–1·3 Gm.).

PILULA COLOCYNTHIDIS ET HYOSCYAMI. *Br.* *Pill of Colocynth and Hyoscyamus.*

(PĬL'Ụ̇-LẠ CŎL-Ọ-CȲN'THỊ-DĬS ĔT HȲ-ỌS-CȲ'Ạ-MĪ.)

"Take of Compound Pill of Colocynth *two ounces;* Extract of Hyoscyamus *one ounce.* Beat them into a uniform mass." *Br.*

This is an old officinal of the Edinburgh College. It is asserted that the compound pill and compound extract of colocynth are almost entirely deprived of their griping tendency by combination, as above, with extract of hyoscyamus, without losing any of their purgative power. The dose is from five to twenty grains (0·33–1·3 Gm.).

PILULA CONII COMPOSITA. *Br.* *Compound Pill of Hemlock.*

(PĬL'Ụ̇-LẠ CỌ-NĪ'Ī CỌM-PŎŞ'Ị-TẠ.)

"Take of Extract of Hemlock *two ounces and a half;* Ipecacuanha, in powder, *half an ounce;* Treacle *a sufficiency.* Mix the Extract of Hemlock and Ipecacuanha, and add sufficient Treacle to form a pill-mass." *Br.*

This is an old formula of the London College, discarded in the formation of the original British Pharmacopœia, but admitted into the present edition. The pill is an anodyne and expectorant combination, useful in chronic bronchial disease. The dose is from five to ten grains (0·33–0·65 Gm.).

PILULÆ FERRI COMPOSITÆ. *U. S.* *Compound Pills of Iron.*

(PĬL'Ụ̇-LÆ FĔR'RĪ CỌM-PŎŞ'Ị-TÆ.)

Pilules de Griffith, Pilules de Fer et de Myrrhe composées, *Fr.;* Griffith'sche Pillen, *G.*

"Myrrh, in fine powder, *one hundred and fifty grains* (9·75 Gm.); Carbonate of Sodium, *seventy-five grains* (4·85 Gm.); Sulphate of Iron, *seventy-five grains* (4·85 Gm.); Syrup, *a sufficient quantity,* To make *one hundred pills.* Rub the Myrrh, first with the Carbonate of Sodium and afterward with the Sulphate of Iron, until they are thoroughly mixed; then beat them with Syrup so as to form a mass, and divide it into *one hundred pills.*" *U. S.*

This preparation is closely analogous to the Mistura Ferri Composita in properties and composition. It is a good emmenagogue and antihectic tonic. As its peculiar advantages depend upon the presence of ferrous carbonate, which speedily changes into the ferric salt on exposure, it is proper that only so much of the mass should be prepared as may be wanted for immediate use. It is said that the iron will be better preserved in the ferrous state, if, instead of mixing the ingredients as directed in the Pharmacopœia, the operator should first dissolve the sulphate of iron, finely powdered, in the syrup, with a moderate heat, then add the carbonate of sodium, stirring till they are thoroughly mixed, and lastly incorporate the myrrh. From two to six pills may be given at a dose three times a day. They are sometimes called *Griffith's pills.* They closely resemble *Blaud's ferruginous pills*, celebrated in France as a remedy in chlorosis, prepared from equal weights of sulphate of iron and carbonate of potassium, made into a pilular mass with mucilage of tragacanth and powdered liquorice root. The pills contain, as the result of double decomposition, ferrous carbonate and sulphate of potassium. MM. Van de Velde and Van Melckebeke prefer the bicarbonate of sodium to the potassium salt. (*Journ. de Pharm.*, 4e sér., xvi.)

PILULÆ FERRI IODIDI. *U. S.* *Pills of Iodide of Iron.*

(PĬL′Ū-LÆ FĔR′RĪ Ī-ŎD′Į-DĪ.)

Pilula Ferri Iodidi, *Br.;* Pilules d'Iodure de Fer, P. de Blancard, *Fr.;* Eisenjodür-Pillen, *G.*

"Reduced Iron, *sixty grains* (4 Gm.); Iodine, *eighty grains* (5·2 Gm.); Glycyrrhiza, in No. 60 powder, *fifty grains* (3·25 Gm.); Sugar, in fine powder, *fifty grains* (3·25 Gm.); Extract of Glycyrrhiza, in fine powder, *twelve grains* (0·75 Gm.); Acacia, in fine powder, *twelve grains* (0·75 Gm.); Water, Balsam of Tolu, Stronger Ether, each, *a sufficient quantity*, To make *one hundred pills.* To the Reduced Iron, contained in a porcelain capsule, add about *two fluidrachms*, or about *eight grammes* of Water, and gradually add the Iodine, constantly triturating, until the mixture ceases to have a reddish tint. Then add the remaining powders, previously mixed, and evaporate the excess of moisture, on the water-bath, constantly stirring, until the mass has acquired a pilular consistence. Lastly, divide it into *one hundred pills.* Dissolve *one part* of Balsam of Tolu in *one part* of Stronger Ether, shake the pills with a sufficient quantity of this solution until they are uniformly coated, and put them on a plate to dry, occasionally stirring them until the drying is completed. Keep the pills in a well-stopped bottle. Pills of Iodide of Iron should be devoid of the smell of iodine, and distilled water rubbed with them and filtered, should not impart more than a light blue tint to gelatinized starch (abs. of more than traces of free iodine)." *U. S.*

This process differs from that formerly officinal in the use of reduced iron, in the place of iron wire and reduced iron of the formula of U. S. 1870. The simplification of the process does not change the relative strength.

"Take of Fine Iron Wire *forty grains;* Iodine *eighty grains;* Refined Sugar, in powder, *seventy grains;* Liquorice Root, in powder, *one hundred and forty grains;* Distilled Water *fifty minims.* Agitate the Iron with the Iodine and Water in a strong stoppered ounce phial, until the froth becomes white. Pour the fluid upon the Sugar in a mortar, triturate briskly, and gradually add the Liquorice." *Br.*

The pills of iodide of iron were introduced into the U. S. Pharmacopœia at the revision of 1850. The present officinal pills are formed on the plan proposed by Prof. Procter, in imitation of *Blancard's pills* (*A. J. P.*, May, 1860), and are much superior to those made by the U. S. process of 1850, or by that of the British Pharmacopœia. M. Magnes-Lahens especially recommends the following formula. "Take of Pure Iodine 4·10 grammes; Powdered Iron 1·90 grammes; Powdered Sugar 2·50 grammes; Powdered Gum Arabic 2·50 grammes; Distilled Water 2·50 grammes. Put in an iron dish the Water and the powdered Iron, add the Iodine gradually, and facilitate the reaction by stirring with a spatula of iron and by warming a little; when the reaction is complete, add the Gum and the Sugar, then heat to about 50° C. (122° F.), stirring until the mass ceases to drop when a little is taken up on the spatula. If necessary, five grammes of powdered liquorice root may be incorporated into the mass, which is then to be rolled into one hundred pills." (*A. J. P.*, 1873, p. 498.) The iodine and iron unite directly to form ferrous iodide in solution, which is protected against the oxidizing influence of the air by the sugar and excess of reduced iron, while the liquorice and gum serve to give due consistence and plasticity to the pilular mass. The pills are still further protected from the air by the impervious coating of balsam of Tolu, which readily yields to the softening and solvent properties of the gastric liquids. The great disadvantage of the pill of iodide of iron, as ordinarily prepared, is that it will not keep; crumbling by time and exposure, and evolving iodine in consequence of the oxidation of the iron. The preparation, made according to the U. S. formula of 1870, stood the test of time; and we have seen pills which, four years after their preparation, exhibited no signs of change. Each pill contains about a grain (0·065 Gm.) of iodide of iron and one-fifth of a grain (0·012 Gm.) of reduced iron. The therapeutic uses of this preparation are the same as those of iodide of iron. (See *Ferri Iodidum.*)

PILULÆ GALBANI COMPOSITÆ. *U. S.* *Compound Pills of Galbanum.*

(PĬL'Ụ̇-LÆ GĂL'BẠ-NĪ CỌM-PŎṢ'Ị-TÆ.)

Pilula Assafœtidæ Composita, *Br.;* Compound Pill of Assafetida; Pilules de Galbanum composées, *Fr.;* Galbanum-Pillen, *G.*

"Galbanum, *one hundred and fifty grains* (9·75 Gm.); Myrrh, *one hundred and fifty grains* (9·75 Gm.); Asafetida, *fifty grains* (3·25 Gm.); Syrup, *a sufficient quantity*, To make *one hundred pills.* Beat them together so as to form a mass, and divide it into *one hundred pills.*" *U. S.*

"Take of Assafetida, Galbanum, Myrrh, of each, *two ounces;* Treacle, by weight, *one ounce.* Heat all together by means of a water-bath, and stir the mass until it assumes a uniform consistence." *Br.*

This compound is given as an antispasmodic and emmenagogue in chlorosis and hysteria. The dose is 2 to 4 pills, or from five to twenty grains (0·33–1·3 Gm.).

PILULA IPECACUANHÆ CUM SCILLA. *Br.* *Pill of Ipecacuanha with Squill.*

(PĬL'Ụ̇-LẠ ĬP-Ẹ-CĂC-Ụ̇-ĂN'HÆ CŬM SCĬL'LẠ—sĭl'lạ.)

"Take of Compound Powder of Ipecacuanha *three ounces;* Squill, in powder, Ammoniacum, in powder, of each, *one ounce;* Treacle *a sufficiency.* Mix the Powders and beat into a mass with the Treacle." *Br.*

This is a good combination of expectorants, along with a little opium to allay irritation and restlessness, well adapted to chronic catarrh, with either deficient or greatly excessive expectoration, and to the advanced stages of the acute disease offering similar indications. The dose is from five to ten grains (0·33–0·65 Gm.).

PILULÆ OPII. *U. S.* *Pills of Opium.*

(PĬL'Ụ̇-LÆ Ō'PỊ-Ī.)

Pilules d'Opium, *Fr.;* Opiumpillen, *G.*

"Powdered Opium, *one hundred grains* (6·5 Gm.); Soap, in fine powder, *twenty-five grains* (1·62 Gm.), To make *one hundred pills.* Beat them together with water so as to form a mass, and divide it into *one hundred pills.*" *U. S.*

This process is designed merely to furnish a convenient formula for putting opium into the pilular form, preferable to the mode sometimes practised of making the pills directly from the unpowdered mass of opium as found in commerce. The soap answers no other purpose than to give a due consistence, and is therefore in small proportion.

As hard old opium pills are sometimes preferred, in cases of irritable stomach, in consequence of their slow solution, it is proper for the pharmacist to keep some in this state to meet the prescription of the physician.

Of the pills above directed, each contains one grain (0·065 Gm.) of powdered opium, and one is a full dose if made of officinal powdered opium.

PILULÆ PHOSPHORI. *U. S., Br.* *Pills of Phosphorus.*

(PĬL′Ú-LÆ PHŎS′PHỌ-RĪ.)

Pilula Phosphori, *Br.;* Phosphorus Pill.

"Phosphorus, *one grain* (0·06 Gm.); Althæa, in No. 60 powder, *eighty grains* (5·2 Gm.); Acacia, in fine powder, *twenty grains* (1·3 Gm.); Glycerin, *forty grains* (2·6 Gm.) [or thirty-five minims]; Water, *twenty grains* (1·3 Gm.) [or nineteen minims]; Purified Chloroform, *fifty grains* (3·2 Gm.) [or thirty-six minims]; Balsam of Tolu, Stronger Ether, each, *a sufficient quantity*, To make *one hundred pills.* Dissolve the Phosphorus in the Chloroform, in a test-tube [heating gently]. Mix the Althæa and the Acacia, in a mortar, with the pestle, add the solution of Phosphorus, then the Glycerin and the Water, and quickly form a mass, to be divided into *one hundred pills.* Dissolve *one part* of Balsam of Tolu in *one part* of Stronger Ether, shake the pills with a sufficient quantity of the solution until they are uniformly coated, and put them on a plate to dry, occasionally stirring until the drying is completed. Keep the pills in a well-stopped bottle." *U. S.*

"Take of Phosphorus *two grains;* Balsam of Tolu *one hundred and twenty grains;* Yellow Wax *sixty grains.* Put the Phosphorus and Balsam of Tolu in a Wedgwood mortar about half-full of hot water, and when the Phosphorus has melted and the Balsam has become sufficiently soft, rub them together beneath the surface of the water until no particles of phosphorus are visible, the temperature of the water being maintained at or near to 140°. Add now the Wax, and as it softens mix it thoroughly with the other ingredients. Allow the mass to cool without being exposed to the air, and keep it in a bottle immersed in cold water. It may be softened with a few drops of rectified spirit when made into pills." *Br.*

This is a new officinal pill. The increasing use of phosphorus in the free state made the introduction of phosphorus pills a necessity; the problem of preventing the oxidation of the phosphorus is believed to be solved by dissolving it in an excess of warm chloroform; this is accomplished in a stoppered test-tube, for it has been shown that no oxidation takes place in the presence of chloroform vapor. It is necessary to form the mass quickly, so that the chloroform may not all evaporate and leave the phosphorus exposed to the action of the air. If the pills are intended for immediate use, it is not necessary to coat them with Tolu. Chloroform is preferred to carbon disulphide, for, although the latter is a better solvent, it is difficult to rid the mass of the disgusting odor. (See *A. J. P.*, 1875, pp. 253, 254, 335, 501; 1876, p. 56; 1877, p. 135; 1878, p. 584; and *N. R.*, 1876, pp. 189, 332; 1877, p. 32.)

Of the British mass, three drachms contain two grains of the drug, and the dose is therefore from 1 to 2 grains (0·07 to 0·13 Gm.), equivalent to from $\frac{1}{90}$th to $\frac{1}{45}$th of a grain (0·0015 to 0·003 Gm.) of phosphorus. Each officinal pill contains the $\frac{1}{100}$th of a grain (0·0006 Gm.) of phosphorus.

PILULA PLUMBI CUM OPIO. *Br.* *Pill of Lead and Opium.*

(PĬL′Ú-LẠ PLŬM′BĪ CŬM Ō′PỊ-Ō.)

"Take of Acetate of Lead, in fine powder, *thirty-six grains;* Opium, in powder, *six grains;* Confection of Roses *six grains.* Beat them into a uniform mass." *Br.*

This pill would be better left to extemporaneous prescription; the requisite proportion of opium to the acetate varying in different cases. The tannic acid of the confection of roses decomposes a portion of the acetate; but the resulting tannate of lead is not inert. The mass contains six parts of the acetate of lead in eight, and may be given in the dose of two or three grains (0·13 to 0·20 Gm.) to begin with.

PILULA QUINIÆ. *Br.* *Pill of Quinia.*

(PĬL′Ú-LẠ QUĪ′NỊ-Æ.)

"Take of Sulphate of Quinia *sixty grains;* Confection of Hips *twenty grains.* Mix them to a uniform mass." *Br.*

The U. S. Committee of Revision did not deem it necessary to have an officinal pill of sulphate of quinine, as the quantity desired by physicians in each pill necessarily varies.[*]

PILULÆ RHEI. *U. S.* *Pills of Rhubarb.*

(PĬL'Ŭ̇-LÆ RHĒ'Ī.)

Pilules de Rhubarbe, *Fr.;* Rhabarberpillen, *G.*

"Rhubarb, in fine powder, *three hundred grains* (19·5 Gm.); Soap, in fine powder, *one hundred grains* (6·5 Gm.), To make *one hundred pills.* Beat them together with water so as to form a mass, and divide it into *one hundred pills.*" *U. S.*

Rhubarb is so often given in the pilular form, that it is convenient both for the physician and the apothecary to have an officinal formula indicating the mode of preparing the pills, as well as the quantity of rhubarb to be contained in each. Soap has stood the test of long experience as a good excipient for rhubarb. If made in quantity the pills should be kept in loosely-stopped bottles. We have found rhubarb pills, made with compound tincture of cardamom, without other ingredient, to answer an excellent purpose. Each officinal pill contains three grains (0·20 Gm.) of rhubarb.

PILULÆ RHEI COMPOSITÆ. *U. S.* *Compound Pills of Rhubarb.*

(PĬL'Ŭ̇-LÆ RHĒ'Ī CỌM-PŎṢ'Ị-TÆ.)

Pilula Rhei Composita, *Br.;* Pilules de Rhubarbe composées, *Fr.;* Rhabarber und Aloepillen, *G.*

"Rhubarb, in No. 60 powder, *two hundred grains* (13 Gm.); Purified Aloes, in fine powder, *one hundred and fifty grains* (9·75 Gm.); Myrrh, in fine powder, *one hundred grains* (6·5 Gm.); Oil of Peppermint, *ten grains* (0·65 Gm.), To make *one hundred pills.* Beat them together with water so as to form a mass, and divide it into *one hundred pills.*" *U. S.*

"Take of Rhubarb Root, in powder, *three ounces;* Socotrine Aloes, in powder, *two ounces and a quarter;* Myrrh, in powder. Hard Soap, in powder, of each, *one ounce and a half;* Oil of Peppermint, *one fluidrachm and a half;* Treacle, by weight, *four ounces.* Mix the Powders with the Oil, then add the Treacle, and beat the whole into a uniform mass." *Br.*

This is a warm tonic laxative, useful in costiveness with debility of stomach. If made in quantity the pills should be kept in loosely-stopped bottles. From two to four pills, or from ten to twenty grains (0·65–1·3 Gm.) of the mass, may be taken twice a day.

PILULA SAPONIS COMPOSITA. *Br.* *Compound Pill of Soap.*

(PĬL'Ŭ̇-LẠ SẠ-PŌ'NĬS CỌM-PŎṢ'Ị-TẠ.)

"Take of Opium, in powder, *half an ounce;* Hard Soap, in powder, *two ounces;* Distilled Water *a sufficiency.* Mix the Opium and Soap, and beat into a mass with the Water." *Br.*

This pill is no longer officinal. The process of U. S. P. 1870 will be found in the foot-note.[†] This preparation is useful by affording the opportunity of conveniently administering opium, in a pilular and readily soluble form, in small fractions of a grain. The name was probably intended to conceal the nature of the preparation from the patient. One grain (0·065 Gm.) of opium is contained in five grains (0·33 Gm.) of the mass.

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[*] Mr. H. P. Reynolds prepares small and soluble sulphate of quinine pills by the following formula. Take of Sulphate of Quinine six hundred grains; Tartaric Acid one hundred grains; Glycerin, pure (exactly) seventy-five minims. Rub the sulphate of quinine and acid together in a mortar to a fine powder, add the glycerin and continue the trituration until the powder becomes adherent; beat into a proper form for handling, and divide; to whiten the pills, roll in starch powder. (*A. J. P.*, Sept. 1874.)

[†] *Pilula Saponis Composita,* U. S. P. 1870. "Take of Opium, in fine powder, *sixty grains;* Soap, in fine powder, *half a troyounce.* Beat them together with water so as to form a pilular mass." *U. S.* 1870.

PILULA SCAMMONII COMPOSITA. *Br.* *Compound Scammony Pill.*

(PĬL'U̇-LẠ SCẠM-MŌ'NỊ-Ī CỌM-PŎŞ'Ị-TẠ.)

Pilules de Scammonée composées, *Fr.;* Scammoniumpillen, *G.*

"Take of Resin of Scammony, Resin of Jalap, Curd Soap, in powder, of each, *one ounce;* Strong Tincture of Ginger, *one fluidounce;* Rectified Spirit, *two fluidounces.* Add the spirit and tincture to the soap and resins, and dissolve with the aid of a gentle heat; then evaporate the spirit by the heat of a water-bath until the mass has acquired a suitable consistence for forming pills." *Br.*

These pills are actively purgative in doses of from five to fifteen grains (0·33 to 1 Gm.).

PILULA SCILLÆ COMPOSITA. *Br.* *Compound Squill Pill.*

(PĬL'U̇-LẠ SCĬL'LÆ CỌM-PŎŞ'Ị-TẠ—sĭl'le.)

Pilules de Scille composées, *Fr.;* Meerzwiebelpillen, *G.*

This preparation was dropped at the last revision of the Pharmacopœia. See process for U. S. P. 1870 in the foot-note.*

"Take of Squill, in powder, *one ounce and a quarter;* Ginger, in powder, Ammoniacum, in powder, Hard Soap, in powder, of each, *one ounce;* Treacle, by weight, *two ounces,* or *a sufficiency.* Mix the Powders, add the Treacle, and beat into a uniform mass." *Br.*

This is a stimulating expectorant compound, depending for its virtues chiefly on the squill, and applicable to the treatment of chronic affections of the bronchial mucous membrane. From five to ten grains (0·33–0·65 Gm.) may be given three or four times a day. The preparation should be made when wanted for immediate use, as the squill which it contains is liable to be injured by keeping.

PIMENTA. *U. S., Br.* *Pimenta.* [*Allspice.*]

(PỊ-MĔN'TẠ.)

"The nearly ripe fruit of Eugenia Pimenta. De Candolle. (*Nat. Ord.* Myrtaceæ.)" *U. S.* "The dried unripe berries of the Allspice tree, Eugenia Pimenta (D. C.), West Indies." *Br.*

Semen Amonii, Piper Jamaicense; Pimento, Allspice, Jamaica Pepper; Piment de la Jamaïque, Toute-épice, Piment, Poivre de la Jamaïque, *Fr.;* Englisches Gewürz, Neugewürz, Nelkenpfeffer, *G.;* Pimenti, *It.;* Pimienta de la Jamaica, *Sp.*

Gen. Ch. *Calyx* five-cleft, superior. *Petals* five. *Berry* two- to five-celled, many-seeded. *Willd.*

Myrtus Pimenta. Willd. *Sp. Plant.* ii. 973; Woodv. *Med. Bot.* p. 541, t. 194.—*Eugenia Pimenta.* De Cand. *Prodrom.* iii. 285; Lindley, *Flor. Med.* p. 76.—*Pimenta acris.* Wight. *B. & T.* 110. This is a beautiful tree, about thirty feet high, with a straight trunk, much branched above, and covered with a very smooth gray bark. Its dense and ever-verdant foliage gives it at all times a refreshing appearance. The leaves, which are petiolate, vary in shape and size, but are usually about four inches long, elliptical, entire, blunt or obtusely pointed, veined, and of a deep shining green color. The flowers are small, without show, and disposed in panicles upon trichotomous stalks, which usually terminate the branches. The fruit is a spherical berry, crowned with the persistent calyx, and when ripe is smooth, shining, and of a black or dark purple color. The tree exhales an aromatic fragrance, especially during the summer months, when in flower.

It is a native of the West Indies, Mexico, and South America, and is abundant in Jamaica, whence its fruit received the name of *Jamaica pepper.*† At present commerce is supplied to a great extent from Jamaica; the total imports in 1881 were

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* "Take of Squill, in fine powder, *twelve grains;* Ginger, in fine powder, Ammoniac, in fine powder, each, *twenty-four grains;* Soap, in fine powder, *thirty-six grains;* Syrup *a sufficient quantity.* Mix the powders together; then beat them with Syrup so as to form a pilular mass, to be divided into twenty-four pills." *U. S.* 1870.

† *Pimienta de Tabasco. Tabago,* or *Mexican Allspice,* is larger and somewhat less aromatic than the *Jamaica,* or true allspice.

1,774,344 pounds. The berries are the officinal part. They are gathered after having attained their full size, but while yet green, and are carefully dried in the sun. When sufficiently dry, they are put into bags and casks for exportation.

Properties. The berries, as they reach us, are of different sizes, usually about as large as a small pea, round, wrinkled, crowned with the short, four-parted calyx or its remnants and a short style, brownish or brownish gray, and when broken present two cells, each containing a black hemispherical or reniform seed. They have a fragrant odor, thought to resemble that of a mixture of cinnamon, cloves, and nutmeg. Hence the name of *allspice*, by which they are best known in this country. Their taste is warm, aromatic, pungent, and slightly astringent. They impart their flavor to water, and all their virtues to alcohol. The infusion is of a brown color, and reddens litmus paper. They yield a volatile oil by distillation. (See *Oleum Pimentæ.*) Bonastre obtained from them a volatile oil, a green fixed oil, a fatty substance in yellowish flakes, tannin, gum, resin, uncrystallizable sugar, coloring matter, malic and gallic acids, saline matters, moisture, and lignin. The green oil has the burning aromatic taste of pimenta, and is supposed to be the acrid principle. Upon this, therefore, together with the volatile oil, the medical properties of the berries depend; and, as these two principles exist most largely in the shell or cortical portion, this part is most efficient. According to Bonastre, the shell contains 10 per cent. of the volatile and 8 of the fixed oil, the seeds only 5 per cent. of the former and 2·5 of the latter. Berzelius considers the green fixed oil of Bonastre as a mixture of volatile oil, resin, fixed oil, and perhaps a little chlorophyll. Dragendorff in 1871 announced the existence of an alkaloid in allspice. It is present in exceedingly small quantity, and has somewhat the odor of conine.

Medical Properties and Uses. Pimenta is a warm aromatic stimulant, used in medicine chiefly as an adjuvant to tonics and purgatives, the taste of which it serves to cover; while it increases their warmth, and renders them more acceptable to the stomach. It is particularly useful in cases attended with much flatulence. It is, however, much more largely employed as a condiment than as a medicine. The dose is from ten to forty grains (0·65–2·6 Gm.). A tincture of pimenta has been recommended as a local application in chilblains.

Off. Prep. Aqua Pimentæ, *Br.;* Oleum Pimentæ; Syrupus Rhamni, *Br.*

PIPER. *U.S.* *Pepper.* [*Black Pepper.*]

(PĪ′PẸR.)

"The unripe fruit of Piper nigrum. Linné. (*Nat. Ord.* Piperaceæ.)" *U. S.* "The dried unripe berries of Piper nigrum. Linn. Imported from the East Indies." *Br.*

Piper Nigrum, *Br.;* Poivre noir (commun), Poivre, *Fr.;* Schwarzer Pfeffer, *G.;* Gemeine Peper, *Dutch;* Pepe nero, *It.;* Pimienta negra, *Sp.;* Fifil uswud, *Arab.;* Lada, *Malay;* Maricha, *Jav.;* Sahan, *Palembang.*

PIPER. See *Cubeba.*

Piper nigrum. Willd. *Sp. Plant.* i. 159; Carson, *Illust. of Med. Bot.* ii. 38, pl. 83; *B. & T.* 245. The pepper vine is a perennial plant, with a round, smooth, woody, articulated stem, swelling near the joints, branched, and from eight to twelve feet or more in length. The leaves are entire, broad-ovate, acuminate, seven-nerved, coriaceous, very smooth, of a dark green color, and attached by strong sheath-like footstalks to the joints of the branches. The flowers are small, whitish, sessile, covering thickly a cylindrical spadix, and succeeded by globular berries, which are red when ripe.

The plant grows wild in Cochin-China and various parts of India. It is cultivated on the coast of Malabar, in the peninsula of Malacca, in Siam, Sumatra, Java, Borneo, the Philippines, and many other places in the East. The best pepper is said to be produced in Malabar; but Europe and America derive their chief supplies from Sumatra and Java. It appears to have been introduced into the West Indies; as a specimen of black pepper was seen by the author, at the International Exhibition in London, in 1862, among the products of Trinidad. The plant is propagated by cuttings, and is supported by props, or trees planted for the purpose, upon which it is trained. In three or four years from the period of planting, it begins to bear fruit. The plant sometimes begins to bear as early as the first year after planting, increases in its yield to the fifth or sixth year, when it produces eight or ten pounds, and begins to lose its productiveness about the fifteenth year. The berries are gathered so soon as one is seen to turn red,—*i.e.*, before they are all perfectly ripe,—and, upon being dried, become black and wrinkled.

White pepper is the ripe berry, deprived of its skin by maceration in water and subsequent friction, and afterwards dried in the sun. It has less of the peculiar virtues of the spice than the black pepper, and is seldom employed.

Properties. The dried berries are about as large as a small pea, externally blackish, reticulated, and wrinkled, internally whitish, hollow, and with an undeveloped embryo, of an aromatic smell, and a hot, pungent, almost fiery taste.* They yield their virtues partially to water, entirely to alcohol and ether. Pelletier found them to contain a peculiar alkaloid called *piperine*, an acrid concrete oil or soft resin of a green color, a balsamic volatile oil, isomeric with oil of turpentine, a colored gummy substance, an extractive matter like that found in leguminous plants capable of being precipitated by infusion of galls, starch, a portion of bassorin, tartaric and malic acids, lignin, and various salts. (See *Piperina.*)

The taste and medicinal activity of pepper depend mainly on the concrete oil or resin, and on the volatile oil. The concrete oil is of a deep green color, very acrid, and soluble in alcohol and ether. The volatile oil is limpid, colorless, becoming yellow by age, of a strong odor, and of a taste less acrid than that of pepper itself. Its formula is $C_{10}H_{16}$, and it forms a liquid, but not a concrete compound with hydrochloric acid.

Medical Properties and Uses. Black pepper is a warm carminative stimulant, capable of producing general arterial excitement, but acting with greater proportional energy on the part to which it is applied. From the time of Hippocrates it has been employed as a condiment and medicine. Its chief medicinal application is to excite the languid stomach and correct flatulence. It was long since occasionally administered for the cure of intermittents; but its employment for this purpose had passed from the profession to the vulgar, till a few years since revived by an Italian physician, to be again consigned to forgetfulness. Piperine has also been employed in the same complaint, and has even been thought superior to sulphate of quinine; but experience has not confirmed this favorable opinion. That, in its impure state, when mixed with a portion of the acrid principle, it will occasionally cure intermittents, there can be no doubt; but it is not comparable to the preparations of bark, and is certainly less active than the officinal oleoresin of pepper. In intermittent fever, pepper may be found a useful adjuvant to the more powerful febrifuge. The dose of pepper is from five to twenty grains (0·33–1·3 Gm.). It may be given whole or in powder, but is more energetic in the latter state. Piperine has been given in doses varying from one to six or eight grains (0·065–0·4 or 0·52 Gm.).

Piper longum, which was at one time officinal, differs from its congeners in having its lower leaves cordate, petiolate, seven-nerved, its upper oblong-cordate, sessile, and five-nerved; its flowers in dense, short, terminal, and nearly cylindrical spikes; and its fruit, consisting of very small one-seeded berries or grains, embedded in a pulpy matter. It is a native of Southeastern Asia, and is produced abundantly in Bengal and other parts of Hindostan. The fruit is green when immature, and becomes red as it ripens. It is gathered in the former state, as it is then hotter than when perfectly ripe. The whole spike is taken from the plant, and dried in the sun. *Long pepper*, as the fruit is called, is cylindrical, an inch or more in length, indented on its surface, of a dark gray color, a weak aromatic odor, and a pungent fiery taste. M. Dulong found its chemical composition to be closely analogous to that of black pepper. Like that, it contains *piperine*, a concrete oil or soft resin upon which its burning acrimony depends, and a volatile oil to which it probably owes its odor. Its medical virtues are essentially the same as those of black pepper; but it is considered inferior to that spice, and is seldom used.

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* The powder of pepper is frequently adulterated with various substances, which can be detected by the microscope. (See *P. J. Tr.*, June, 1860; also Hassall, *Food and its Adulterations.*) The characteristic starch granule is said to be compound, preserving the form of the cell containing it. (Bouchardet, *Ann. de Thérap.*, 1874.)

West African or *Ashantee Pepper* is the berry of *P. Clusii*, which grows abundantly in tropical Africa. It does not come into Western commerce, although much used in Africa. The berry is described as resembling cubebs, but less rugose, and with a more slender pedicel, and having the odor and taste of black pepper. Stenhouse found piperine in this variety of pepper.

Off. Prep. Confectio Piperis, *Br.;* Oleoresina Piperis, *U. S.;* Pulvis Opii Compositus, *Br.*

PIPERINA. *U. S.* *Piperine.*

$C_{17}H_{19}NO_3$; 285. (PĪ-PẸ-RĪ'NẠ.) $C_{34}H_{19}NO_6$; 285.

"A proximate principle of feebly alkaloidal power, prepared from Pepper, and occurring also in other plants of the *Nat. Ord.* Piperaceæ." *U. S.*

Piperine was discovered by Professor Œrsted, of Copenhagen, who considered it to be the active principle of pepper. Pelletier, however, denied its medical activity, and ascribed all the effects, supposed to have been obtained from it, to a portion of the acrid concrete oil with which it is mixed when not very carefully prepared. It is obtained by treating pepper with alcohol, evaporating the tincture to the consistence of an extract, submitting the extract to the action of an alkaline solution by which the oleaginous matter is converted into soap, washing the undissolved portion with cold water, separating the liquid by filtration, treating the matter left on the filter with alcohol, and allowing the solution thus obtained to evaporate spontaneously, or by a gentle heat. Crystals of piperine are deposited, and may be purified by alternate solution in alcohol or ether, and crystallization. R. Buchheim believes that black pepper contains two substances of analogous constitution, piperine and *chavicine;* he obtained these two principles by washing the alcoholic extract of black pepper with water and treating it with ether. The residue was treated with a little potassa to remove an acid resin, dissolved in alcohol, decolorized with animal charcoal, and repeatedly crystallized from petroleum benzin. The piperine thus obtained was in nearly colorless quadrangular prisms, which in alcoholic solution had a peppery taste. The ethereal solution was agitated with a little potassa solution to remove chlorophyll, fatty acids, and resin, the ether distilled off, and the residue dissolved in alcohol, treated with animal charcoal, and evaporated. By repeatedly dissolving it in a little ether, the piperine was nearly entirely removed, and a little petroleum benzin separated the last portions of fat. The chavicine remaining behind was a yellowish brown mass of the consistence of turpentine and an extremely acrid pepper taste. Its alcoholic solution, boiled with potassa, yielded an alkaline distillate, which proved to be piperidine, while the residue in the retort, after dissolving in water and acidulating with hydrochloric acid, yielded *chavicic acid* as an amorphous resinous mass. Piperine may be regarded as a piperidine, N,H,C_5H_{10}, in which one H is replaced by piperic acid, thus: $N,C_{12}H_9O_3,C_5H_{10}$; and chavicine may in like manner be viewed as a piperidine in which one H is replaced by chavicic acid. Neither chavicine nor piperine yields salts with acids. (*Buch. N. R.; A. J. P.*, Oct. 1876.) Rügheimer (*A. J. P.*, Aug. 1882, p. 397) has recently regenerated the alkaloid piperine by the union of piperidine and the chloride of the radical of piperic acid, thus making piperine artificially. The properties of this artificial alkaloid are identical with those of the natural piperine.

Properties. When perfectly pure, piperine is in colorless transparent crystals, without taste, with no perceptible action on litmus paper, and fusible at 128° C. to 129·5° C. (262·4° to 265° F.) (Rügheimer, *A. J. P.*, Aug. 1882, p. 397), capable of being sublimed under favorable circumstances in perfect crystals (Waddington, *P. J. Tr.*, March, 1868, p. 415), insoluble in cold water, slightly soluble in boiling water which deposits it upon cooling, soluble in alcohol, ether, and acetic acid, and still more readily in chloroform, benzol, and petroleum spirit, decomposed by the concentrated mineral acids, with sulphuric becoming of a blood-red color, with nitric, first of a greenish yellow, then orange, and ultimately red. Christison, however, states, in his Dispensatory, that the whitest crystals he had been able to obtain were still acrid, and emitted an irritating vapor when thrown on heated iron. As ordinarily procured, the crystals are yellow. Piperine is a weak alkaloid of the formula $C_{17}H_{19}NO_3$. When boiled with strong potash or heated with soda-lime it is converted into *piperic acid*, $C_{10}H_{12}O_4$, and *piperidine*, $C_5H_{11}N$. This latter is a powerful volatile alkaloid, soluble in all proportions in water and alcohol, and forming crystalline salts with acids.

It is officinally described as in "colorless or pale yellowish, shining, four-sided prisms, permanent in the air, odorless and almost tasteless when first put in the mouth, but on prolonged contact producing a sharp and biting sensation. It has a neutral reaction, is almost insoluble in water, but soluble in 30 parts of alcohol at 15° C. (59° F.), in 1 part of boiling alcohol, and but slightly soluble in ether. When heated to about 128° C. (about 262° F.), Piperine melts, yielding a clear, yellowish liquid, which, on cooling, congeals to a resinous mass. When heated on platinum foil, it takes fire and is consumed without residue. Concentrated sulphuric acid dissolves Piperine with a dark, blood-red color, which disappears on dilution with water. When treated with cold nitric acid, Piperine turns rapidly greenish yellow, orange, and red, and gradually dissolves with a reddish color. On adding to this solution an excess of solution of potassa, the color is at first pale yellow, but on boiling it deepens to blood-red, while, at the same time, vapors of an alkaline reaction and of a peculiar odor (piperidine) are given off." *U. S.*

Medical Properties. (See *Piper*, p. 1119.)

PIX BURGUNDICA. *U. S., Br.* *Burgundy Pitch.*

(PĬX BỤR-GŬN′DỊ-CẠ.)

"The prepared, resinous exudation of Abies excelsa. De Candolle. (*Nat. Ord.* Coniferæ.)" *U. S.* "A resinous exudation from the stem of the Spruce Fir, Abies excelsa. D. C. Melted and strained; imported from Switzerland." *Br.*

Poix de Bourgogne, Poix jaune, Poix blanche, *Fr.;* Burgundisches Pech, Burgunder Harz, Wasserharz, *G.*

The genus Pinus of Linnæus has been divided into three genera, viz., *Pinus*, *Abies*, and *Larix;* the first including the pines, the second the firs and spruces, and the third the larches; and the division is recognized in this work.

Gen. Ch. MALE FLOWERS. *Catkins* solitary, not racemose; *Scales* staminiferous at the apex. *Stamens* two, with one-celled anthers. FEMALES. *Catkins* simple. *Ovaries* two. *Stigmas* glandular. *Cone* with imbricated scales, which are thin at the apex, and rounded. *Cotyledons* digitate-partite. *Leaves* solitary in each sheath. *De Cand.*

Abies excelsa. De Candolle.—*A. communis.* Loudon's *Encyc. of Plants.*—*Pinus Abies.* Willd. *Sp. Plant.* iv. 506; Woodv. *Med. Bot.* p. 4, t. 2.—*Pinus picea.* Du Roi. *B. & T.* 261. The *Norway spruce* is a lofty tree, rising sometimes one hundred and fifty feet in height, with a trunk from three to five feet in diameter. The leaves, standing thickly upon the branches, are short, obscurely four-cornered, often curved, of a dusky green color, and shining on the upper surface. The male aments are purple and axillary, the female of the same color, but usually terminal. The fruit is in pendent, purple, nearly cylindrical strobiles, the scales of which are oval, pointed, and ragged at the edges.

This tree is a native of Europe and Northern Asia. Though designated as the source of Burgundy pitch, it furnishes but a part of the substance sold under that name. Tingley asserts that the real Burgundy pitch is obtained from the *Abies picea*, or European silver fir tree. According to Geiger, who is probably correct, it is procured from both species. To obtain the *pitch*, portions of the bark are removed so as to lay bare the wood, or perpendicular grooved channels are cut, and the flakes of concrete resinous matter, which form upon the surface of the wound, having been detached by iron instruments, are melted with water in large boilers, and then strained through coarse cloths. It is called Burgundy pitch from the province of that name in the east of France, although whether it was ever produced in that province is uncertain. It is chiefly collected in Finland, the Schwarzwald, Austria, and to some extent in the Bernese Alpine region.

From various species of pine, in different parts of Europe, a similar product is obtained and sold by the same name. It is prepared by removing the juice which concretes upon the bark of the tree, or upon the surface of incisions, called *galipot* by the French, and purifying it by melting, and straining either through cloth or a layer of straw. A *factitious Burgundy pitch* is made by melting together common pitch, rosin, and turpentine, and agitating the mixture with water, which gives it the requisite yellowish color. Its odor is different from that of the genuine. Mr. Hanbury gives, as a test of true Burgundy pitch, that it is almost entirely soluble in twice its weight of glacial acetic acid, while the factitious article similarly treated forms a turbid mixture, which quickly separates into a thick oily liquid above, and a bright solution below.

As brought to this country, Burgundy pitch is generally mixed with impurities, which require that it should be melted and strained before being used. In its pure state it is "hard, yet gradually taking the form of the vessel in which it is kept; brittle, with a shining, conchoidal fracture, opaque or translucent, reddish brown or grayish brown, aromatic and somewhat empyreumatic, not bitter." *U. S.* It is very fusible, and at the heat of the body softens and becomes adhesive. It differs from turpentine in containing a smaller proportion of volatile oil. According to Guibourt, it can be distinguished from factitious pitches by its complete lack of bitterness, and its being only partially soluble in alcohol.

Medical Properties and Uses. Applied to the skin, in the shape of a plaster, Burgundy pitch acts as a gentle rubefacient, producing a slight inflammation without separating the cuticle. Sometimes it excites a papillary or vesicular eruption; and we have known it to act as a violent irritant, giving rise to severe pain, swelling, and redness, followed by vesication and even ulceration. It is used chiefly in chronic rheumatic pains, and in chronic affections of the chest or abdomen, which call for a gentle but long-continued revulsion to the skin.

Off. Prep. Emplastrum Ferri, *U. S.;* Emplastrum Picis, *Br.;* Emplastrum Picis Burgundicæ, *U. S.;* Emplastrum Picis cum Cantharide, *U. S.*

PIX CANADENSIS. *U. S.* *Canada Pitch.* [*Hemlock Pitch.*]

(PĬX CĂN-A-DĔN′SIS.)

"The prepared resinous exudation of Abies Canadensis. Michaux. (*Nat. Ord.* Coniferæ.)" *U. S.*

Abies. See *Pix Burgundica.*

Abies Canadensis. Michaux, *N. Am. Sylv.* iii. 185.—*Pinus Canadensis.* Willd. *Sp. Plant.* iv. 505; *B. & T.* 264. This is the *hemlock* or *hemlock spruce* of the United States and Canada. When of full growth it is often seventy or eighty feet high, with a trunk two or three feet in diameter, and of nearly uniform dimensions for two-thirds of its length. The branches are slender, and dependent at their extremities. The leaves are very numerous, six or eight lines long, flat, denticulate, and irregularly arranged in two rows. The strobiles are ovate, little longer than the leaves, terminal, and pendulous.

The tree is abundant in Canada, Nova Scotia, and the more northern parts of New England, and is found in the elevated and mountainous regions of the Middle States. Its bark abounds in the astringent principle, and is much used for tanning in the northern parts of the United States. An extract is made from the bark for tanning, which is prepared by evaporation in vacuo, and is said by Mr. N. Spencer Thomas, who prepares it, to have a close resemblance to extract of rhatany, and is proposed by him as a medicine applicable to similar purposes. It no doubt contains tannic acid largely. (*A. J. P.*, May, 1866, p. 214.) The tree contains much less juice than some other of the Pinaceæ; and very little flows from incisions made into its trunk. But in the trees which have attained their full growth, and are about or have begun to decay, the juice exudes spontaneously, and hardens upon the bark, in consequence of the partial evaporation or oxidation of its volatile oil. The bark thus encrusted is stripped from the tree, broken into pieces, and boiled in water. The pitch melts, rises to the surface, is skimmed off, and is still further purified by a second boiling in water. It is brought to Philadelphia from the north of Pennsylvania, in dark colored brittle masses, which, on being broken, exhibit numerous minute fragments of bark interspersed through their substance. From these it is purified in the shops, by melting and straining through linen or canvas. (Ellis, *Journ. of Phila. Coll. of Pharm.*, ii. 18.) Another mode of collecting it is to make incisions into the body of the tree, and to remove the juice as it exudes. (Stearns, *A. J. P.*, 1860, p. 29.)

Hemlock pitch is hard, brittle, quite opaque, of a dark reddish brown color, becoming still darker by exposure to the air, of a weak peculiar odor, and scarcely any taste. It softens and becomes adhesive with a moderate heat, and even at ordinary temperatures takes the form of the vessel containing it, and melts at 198° F. Its constituents are resin and a minute proportion of volatile oil. It is commonly known by the incorrect name of *hemlock gum.*

Medical Properties and Uses. Canada pitch is a gentle rubefacient, closely analogous to Burgundy pitch in its properties, and employed for precisely the same purposes. It is, however, more readily softened by heat, and is sometimes almost too soft for convenient application at the temperature of the body. A volatile oil obtained from Abies Canadensis, and called *oil of spruce*, or *oil of hemlock*, has been employed to produce abortion, with the effect of endangering the life of the female. (J. S. Paige, *N. Y. Journ. of Med.*, viii. 184.)

Off. Prep. Emplastrum Picis Canadensis, *U. S.*

PIX LIQUIDA. *U. S., Br.* *Tar.*

(PĬX LĬQ′UI̤-DA̤—lĭk′we̤-da̤.)

"An empyreumatic oleoresin obtained by the destructive distillation of the wood of Pinus palustris, Miller, and of other species of Pinus. (*Nat. Ord.* Coniferæ.)" *U. S.* "A bituminous liquid, obtained from the wood of Pinus sylvestris (Linn.) and other Pines, by destructive distillation." *Br.*

Resina Empyreumatica Liquida; Goudron végétal, Goudron, *Fr.;* Theer, *G.;* Pece liquida, *It.;* Alquitran, *Sp.*

The tar used in this country is prepared from the wood of various species of pine, particularly *Pinus palustris* of the Southern States. (See *Terebinthina.*) The dead wood is usually selected, because, when vegetation ceases, the resinous matter becomes concentrated in the interior layers. The wood is cut into billets of a convenient size, which are placed together so as to form a large stack or pile, and then covered with earth as in the process for making charcoal. The stack is built upon a small circular mound of earth previously prepared, the summit of which gradually declines from the circumference to the centre, where a cavity is formed, communicating by a conduit with a shallow ditch surrounding the mound. Fire is applied through an opening in the top of the pile, and a slow combustion is maintained, so that the resinous matter may be melted by the heat. This runs into the cavity in the centre of the mound, and passes thence by the conduit into the ditch, whence it is transferred into barrels. Immense quantities of tar are thus prepared in North Carolina and the southeastern parts of Virginia, sufficient, after supplying our own consumption, to afford a large surplus for exportation. Considerable quantities of tar have been prepared also in the lower parts of New Jersey, in some portions of New England, and in Pennsylvania west of the Alleghany Mountains, from the *Pinus rigida*, or pitch pine, and perhaps from some other species.

Properties. Tar has an acid reaction, a peculiar empyreumatic odor, a bitterish, resinous, somewhat acrid taste, a color almost black, and a tenacious consistence intermediate between that of a liquid and a solid. By age it becomes granular and opaque. It consists of resinous matter, united with acetic acid, oil of turpentine, and various volatile empyreumatic products, and colored with charcoal. By distillation it yields an acid liquor called *pyroligneous acid* (see *Acidum Aceticum*), and an empyreumatic oil called *oil of tar;* and what is left behind is *pitch.* The empyreumatic oil was first examined by Dr. Reichenbach, of Moravia, who found a variety of substances, to which he gave the names of *paraffin*, *eupion*, *creasote*, *picamar*, *capnomor*, and *pittacal.* It has been found by more careful study of wood-tar that it contains a great variety of compounds, including the hydrocarbons *toluol*, C_7H_8, *xylol*, C_8H_{10}, *mesitylene* and *pseudocumol*, C_9H_{12}; phenols like common *phenol*, C_6H_6O, *cresol*, C_7H_8O, *guaiacol*, $C_7H_8O_2$, *creasol*, $C_8H_{10}O_2$, *phlorol*, $C_8H_{10}O$, and *methylcreasol*, $C_9H_{12}O_2$, the last four constituting the mixture known as creasote; and, lastly, *paraffin* in variable quantity, depending upon the temperature of distillation, *naphthalene*, $C_{10}H_8$, *pyrene*, $C_{16}H_{10}$, *chrysene*, $C_{18}H_{12}$, and *retene*, $C_{18}H_{18}$. *Pyrocatechin*, $C_6H_4(OH)_2$, is also obtained, either in the pyroligneous acid, as it is soluble in water, or in the tarry mixture. It crystallizes readily, fuses at 104° C. (219·2° F.), and sublimes at a temperature slightly above this. Tar yields a small proportion of its constituents to water, which is thus rendered medicinal, and is employed under the name of *tar-water*. It is dissolved by alcohol, ether, and the volatile and fixed oils, and by a solution of potassa or soda.

The pitch, left after the evaporation of tar, was formerly officinal, with the British Colleges, under the names of *Pix nigra*, *Pix arida*, or simply *Pix*, but has been omitted in the present British Pharmacopœia. It has a shining fracture, softens and becomes adhesive with a moderate heat, melts in boiling water, and consists of the resin of the pine unaltered, and of various empyreumatic resinous products which have received the name of *pyretin*. (Berzelius, *Trait. de Chim.*, vi. 641 and 680.) It appears to be very gently stimulant or tonic, and has been used internally in ichthyosis and other cutaneous diseases, and recently with great advantage in piles. The dose is from ten grains to a drachm (0·65 to 3·9 Gm.) given in pills. Pitch is also used externally in the form of ointment.

Medical Properties and Uses. The medical properties of tar are similar to those of the turpentines, but it is much less irritant. It is occasionally used with advantage in chronic catarrhal affections, and in complaints of the urinary passages. Little benefit can be expected from it in genuine phthisis, in the treatment of which it was formerly recommended. In reference to the administration of tar, it has always been considered desirable to have it in a soluble state, so that it may be brought with facility into a liquid form if thought desirable. Besides, tar in the stomach will probably be found efficacious in proportion to its solubility. This desired end was attained when it was discovered that tar was capable of forming a definite, solid compound with sugar, which was very soluble in water. Saccharated tar contains 4 per cent. of pure tar, resembles sugar in appearance, having a sweet taste and the odor of tar, and may be given in substance or solution as deemed desirable. (*P. J. Tr.*, Sept. 1871.) (See *Syrupus Picis Liquidæ.*)* But glycerin is a more convenient vehicle; and Glycerite of Tar was an officinal preparation in 1870. Its vapor, inhaled into the lungs, has been found serviceable in numerous cases of bronchial disease. Its effects are most conveniently obtained by placing tar or the oil of tar in a tin dish containing hot water, and heating this; the fumes may be inhaled by inverting a funnel over the dish, to which a rubber tube is attached. Externally applied it is a decided stimulant, and in the state of ointment is a very efficient remedy in tinea capitis or scaldhead, and in some cases of psoriasis, in chronic eczema, and other affections of the skin.† Some prefer a mixture with glycerin in the form of the formerly officinal Glycerite of Tar.

It may be used in the form of tar-water (see *Infusum Picis Liquidæ*), or in substance made into pills with wheat flour, or mixed with sugar in the form of an electuary. The dose is from half a drachm to a drachm (1·9–3·75 C.c.), and may be repeated so as to amount to three or four drachms (11·25–15 C.c.) daily.

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* *Wine of Tar*, J. B. Moore. Pure Tar, ℥xvi, troy; Glycerin, Sherry Wine, Honey, āā f℥viii; Acetic Acid, f℥i; Boiling Water, Ovi. Mix the glycerin, sherry wine, honey, acetic acid, and boiling water together, in a stone jug or other suitable vessel of the capacity of a gallon. To the mixture add the tar, and shake the whole vigorously for several minutes. The vessel is then to be tightly stopped and placed upon a stove or in a water-bath, resting upon folds of paper, and the mixture digested, for an hour or two, at a temperature of from 150° to 160° F. During the digestion, the mixture should be frequently well shaken. When the digestion is completed, the mixture is to be set aside to macerate, in a warm place, for a few days, it being well shaken occasionally during the process. Lastly, strain through muslin, and filter the strained liquid through paper.

† *Liquor Picis Alkalinus.* Dr. L. D. Bulkley, of New York, gives the following formula for this preparation, which was originally devised by his father. Tar, ʒij; Caustic Potash, ʒj; Water, fʒv. Mix and dissolve for external use. This mixes with water in all proportions, and only moderately discolors the skin. It dries rapidly and leaves very little stickiness. (*Med. News and Library*, June, 1873; from *Archives of Sci. and Pract. Med.*, Feb. 1873.)

Pulverulent tar is prepared by M. Magnes Lahens, by mixing, in an earthen-ware vessel, two parts of finely divided charcoal and one part of liquid tar. The resulting mixture resembles small grains of gunpowder, does not soil the vessel or the fingers, and yields readily to water the tar which it contains; the most favorable temperature for solution being about 20° C. (68° F.). M. Magnes Lahens recommends a syrup prepared from the powder as follows. Take of pulverulent tar 50 Gm., water 180 Gm., granulated sugar 320 Gm. Mix the tar and sugar in a mortar, then add the water, and heat the mixture by a water-bath at 60° C. (140° F.). Then remove from the bath, shake until the sugar is all dissolved, and strain when hot, and afterwards again when cold. A tablespoonful of the syrup, added to a tumbler of water, yields a tar-water resembling that of the French Codex. The pulverulent tar may also be used for pills, and for fumigation by throwing a few grains on a heated shovel. (*P. J. Tr.*, April, 1872, p. 850.)

Off. Prep. Syrupus Picis Liquidæ, *U. S.;* Unguentum Picis Liquidæ, *U. S.*

PLUMBUM. *Lead.*

Pb; 206·5. (PLŬM'BŬM.) Pb; 103·25.

Plomb, *Fr.;* Blei, *G.;* Lood, *Dutch;* Piombo, *It.;* Plomo, *Sp.;* Chumbo, *Port.*

Lead is not officinal in its metallic state, but enters into a number of important medicinal preparations. It occurs in nature as an oxide, as a sulphide called *galena*, and in saline combination, forming the native sulphate, phosphate, carbonate, chromate, molybdate, tungstate, and arseniate of lead. The oxide is rare, but galena is exceedingly abundant, and is the ore from which nearly all the lead of commerce is extracted. The process of extraction consists either in melting the ore in contact with charcoal, or, in the case of pure galenas, by what is termed the *air reduction* process. In this case the galena is first roasted, when it is in part changed into oxide, PbO, and sulphate, $PbSO_4$. The doors of the furnace are then closed, and the unchanged sulphide reacts with both the oxide and the sulphate as follows:

$$2PbO + PbS = 3Pb. + SO_2,\ PbSO_4 + PbS = 2Pb. + 2SO_2,$$

whereby all the lead is obtained in the metallic state. The richest and most extensive mines of galena are found in this country. The lead region of the United States extends in length from the Wisconsin in the north to the Red River of Arkansas in the south, and in breadth about one hundred and fifty miles.

Properties. Lead is a soft, bluish gray, and very malleable metal, presenting a bright surface when newly melted or cut. It has a perceptible taste, and a peculiar smell when rubbed. It undergoes but little change in the air, but is acted on by the combined influence of air and rain-water, which give rise to a hydrate, which is afterwards changed, in part, into carbonate, by absorbing carbonic acid from the atmosphere; and if in water, the carbonate is imparted to it in the state of bicarbonate, which dissolves and renders the liquid poisonous. This chemical effect on the metal is greater in proportion as the water is purer. (See page 219.) Aqueous vapor passed through leaden pipes has a similar corroding effect, which is greater as the lead is purer. (*A. J. P.*, Nov. 1863, p. 507.) Spring and river water act on lead differently; the lead becoming slowly oxidized, and covering itself with a black coating of suboxide, which adheres strongly to the metal, and thus in some measure protects the water. (Langlois, *Journ. de Pharm. et de Chim.*, 4e sér., ii. 29.) M. Stalmann has satisfied himself, by experiment, that an extremely minute quantity of ammonia or of nitric acid will very much promote the action of water upon lead; a millionth of ammonia being sufficient for the purpose. (*Ibid.*, iv. 467.) Metallic lead seems to be liable to the attacks of certain insects, which bore into and sometimes through it, not using it as food, but apparently in search of secure places of retreat for future development. A knowledge of this fact may sometimes be important. (*A. J. P.*, Jan. 1865, p. 72.) Its sp. gr. is 11·4, melting point 334° C. (633·2° F.), and atomic weight 206·5. Exposed to a stream of oxygen on ignited charcoal, it burns with a blue flame, throwing off dense yellow fumes. The best solvent of lead is nitric acid; but the presence of sulphuric acid destroys, and that of hydrochloric acid lessens, its solvent power, on account of the insolubility of the sulphate and chloride of lead. Lead forms a suboxide, Pb_2O, a monoxide, PbO, a sesquioxide, Pb_2O_3, a dioxide, PbO_2, and a compound of these last two, which has a varying composition, but is usually Pb_3O_4. The *monoxide*, called in commerce *massicot*, or *litharge*, may be obtained by calcining, in a platinum crucible, the subnitrate of lead, formed by precipitating a solution of the nitrate by ammonium. On a large scale it is manufactured by exposing melted lead to the action of the air. Its surface becomes encrusted with a gray pellicle, which, being scraped off, is quickly succeeded by another; and the whole of the metal, being in this way successively presented to the air, becomes converted into a greenish gray powder, consisting of monoxide and metallic lead. This, by exposure to a moderate heat, absorbs more oxygen, and is converted wholly into monoxide. This oxide has a yellow color, and is the only oxide of lead capable of forming salts with the acids. It consists of one atom of lead 206·5, and one of oxygen 16 = 222·5. *Litharge* is very much used in pharmacy, and is officinal in all the Pharmacopœias. (See *Plumbi Oxidum.*) The *sesquioxide*, discovered by Winckelblech, is unimportant. The *dioxide*, called also *puce* oxide from its *flea*-brown color, may be obtained by treating red lead with nitric acid. The acid takes up the monoxide and leaves the dioxide, which may be purified by washing with boiling water. A more productive process is to precipitate four parts of acetate of lead by three of carbonate of sodium, and then to pass into the thin pasty mass of carbonate of lead a stream of chlorine, which converts the monoxide of the carbonate into the brown dioxide. (*F. Wöhler.*) Solution of chlorinated soda may be conveniently employed to furnish the necessary chlorine. (F. F. Mayer, *A. J. P.*, 1856, p. 410.) Dioxide of lead is a tasteless powder, of a dark brown color. When heated to redness it loses half its oxygen and becomes monoxide. It consists of one atom of lead 206·5, and two of oxygen 32 = 238·5. The *red oxide*, Pb_3O_4, called in commerce *minium*, or *red lead*, is described under another head. (See *Plumbi Oxidum Rubrum.*) Lead combines with iodine, forming the officinal iodide of lead. The acetate, carbonate, and nitrate are also officinal.

The best tests of lead are sulphuretted hydrogen, and a solution of iodide of potassium. The former produces a black precipitate of sulphide of lead, the latter, a yellow one of iodide of lead.

Medical Properties and Uses. The effects of lead in its various combinations are those of a sedative and astringent. It is used internally for reducing the action of the heart and arteries, and for restraining inordinate discharges; and externally as an abater of inflammation. When introduced into the system in a gradual manner with the food or drinks, or by working in the metal, or when taken in small and frequently repeated doses, it acts injuriously on the nervous system, producing a peculiar colic, called *lead colic*, sometimes apoplectic symptoms, and occasionally palsy, which is almost always partial, and affects for the most part the upper extremities. Amaurosis has sometimes been traced to the poisonous action of lead. In some instances salivation occurs; and, according to Dr. Henry Burton, the constitutional effects of the metal are indicated by a narrow lead-blue line at the edge of the gum, round two or more of the teeth, as a constant and early sign. According to Mialhe, lead gains access to the circulation by means of the chlorides of the alkalifiable metals in the alimentary canal, which form with the lead a soluble double chloride of lead and potassium, or of lead and sodium. The treatment necessary in lead colic is given under *Carbonate of Lead.* Lead palsy is usually attended with dyspepsia, constipation, tendency to colic, lassitude, and gloominess of mind, and is best treated, after the elimination of the lead, by tonics, aperients, exercise, and avoidance of the cause of the disease. The acute poisonous effects of the lead preparations are to be combated by emetics if free vomiting has not previously occurred, by purges of sulphate of magnesia or sulphate of soda, and by opium. These sulphates are supposed to act as antidotes by forming sulphate of lead. It is probable that they lessen the poisonous effects of the soluble salts of lead; but the sulphate, though insoluble in water, may be to some extent soluble in the gastric juice; and, as to its external use in the form of ointment, it has been found by Flandin to prove poisonous to the inferior animals. Dr. Geo. B. Wood found alum an excellent remedy for the acute poisonous effects of lead.

For the purpose of eliminating lead from the system, warm sulphuretted baths are useful, formed by dissolving four ounces of sulphide of potassium in thirty gallons of water, in a wooden tub. These baths cause discoloration of the skin, from the formation of sulphide of lead, and should be repeated every few days, until this effect ceases to be produced. During each bath, the patient should be well washed with soap and water with the aid of a flesh-brush, in order to remove the discoloration. By proceeding in this way, the lead on the skin, or in its pores, is rendered insoluble and inert, and at the same time removed. Dr. Melsens praises iodide of potassium as a means of separating lead from the tissues, acting by rendering the metal soluble, and separating it principally by the urine. (See *Potassii Iodidum.*)

Orfila has determined, by experiments on dogs, the appearance exhibited by the mucous membrane of the stomach after the use of small doses of the salts of lead. After the action of such doses for two hours, dull white points are visible on the membrane, sometimes in rows and sometimes disseminated, and evidently consisting of the metal, united with the organic tissue. If the animal be allowed to live for four days, the same spots may be seen with the magnifier; and if sulphuretted hydrogen be applied to the surface, they are instantly blackened. (*Archives Gén.*, 3e sér., iv. 244.)

According to M. Gendrin, sulphuric acid, prepared like lemonade, and used both internally and externally, is a prophylactic against the poisonous effects of lead, especially the lead colic. It may be supposed to act by forming the comparatively inert sulphate of lead with the poison. Mr. Benson, a manager of white lead works at Birmingham, has tried this acid, and finds it a preventive of lead colic in his establishment, where it was exceedingly prevalent before its employment. He uses it as an addition to ginger beer, to which bicarbonate of soda is also added to render it brisk, but not in sufficient quantity to neutralize the whole of the acid. On the other hand, the powers of sulphuric acid in preventing the poisonous effects of lead are positively denied by Dr. A. Grisolle, Dr. Melsens, and other authorities. Dr. Grisolle recommends that workmen employed in lead manufactories should use frequent baths, avoid intemperance, and always eat before they enter upon their work in the morning. He supposes that in a great majority of cases the metal is introduced into the system through the stomach by means of the saliva or food.

According to MM. Sandras and Bouchardat, the hydrated sesquisulphide of iron acts as an antidote to the salts of lead; and its efficacy has been confirmed by its effects in a case reported by M. Lepage. (*Ann. de Thérap.*, 1857, p. 224.) After acute poisoning by lead, the metal has been found in the liver and brain. Indeed, it may be detected in most of the organs, a long time after the ingestion of the poison.

The following table embraces all the officinal preparations of lead.

- Plumbi Oxidum; Lithargyrum, *Br.* 1864. *Oxide of Lead. Litharge.*
  - Emplastrum Cerati Saponis, *Br. Soap. Cerate Plaster.*
  - Emplastrum Plumbi; Emplastrum Lithargyri, *Br.* 1864. *Lead Plaster. Litharge Plaster.*
    - Emplastrum Asafœtidæ, *U. S. Asafetida Plaster.*
    - Emplastrum Ferri. *Iron Plaster.*
    - Emplastrum Galbani, *U. S.*, *Br. Galbanum Plaster.*
    - Emplastrum Hydrargyri. *Mercurial Plaster.*
    - Emplastrum Opii, *U. S.*, *Br. Opium Plaster.*
    - Emplastrum Resinæ. *Resin Plaster. Adhesive Plaster.*
      - Emplastrum Aconiti, *U. S. Aconite Plaster;* Emplastrum Arnicæ, *U. S. Arnica Plaster;* Emplastrum Belladonnæ. *Belladonna Plaster.*
  - Emplastrum Saponis. *Soap Plaster.*
    - Emplastrum Calefaciens, *Br. Warm Plaster.*
  - Liquor Plumbi Subacetatis. *Solution of Subacetate of Lead. Goulard's Extract.*
    - Liquor Plumbi Subacetatis Dilutus. *Dilute Solution of Subacetate of Lead. Lead-water.*

Ceratum Plumbi Subacetatis, *U. S.;* Unguentum Plumbi Subacetatis Compositum, *Br. Cerate of Subacetate of Lead, U. S. Compound Ointment of Subacetate of Lead, Br. Goulard's Cerate.*
Plumbi Acetatis. *Acetate of Lead. Sugar of Lead.*
    Pilula Plumbi cum Opio, *Br. Pills of Lead and Opium.*
    Suppositoria Plumbi Composita, *Br. Compound Lead Suppositories.*
    Unguentum Plumbi Acetatis, *Br. Ointment of Acetate of Lead.*
Plumbi Carbonas. *Carbonate of Lead.*
    Unguentum Plumbi Carbonatis. *Ointment of Carbonate of Lead.*
Plumbi Nitras. *Nitrate of Lead.*
Plumbi Iodidum. *Iodide of Lead.*
    Emplastrum Plumbi Iodidi, *Br. Iodide of Lead Plaster.*
    Unguentum Plumbi Iodidi, *Br. Ointment of Iodide of Lead.*

PLUMBI ACETAS. *U. S., Br.* *Acetate of Lead.* [*Sugar of Lead.*]

(PLŬM'BĪ Ạ-CĒ'TẠS.)

$Pb(C_2H_3O_2)_2.3H_2O$; 378·5. $PbO, C_4H_3O_3.3HO$; 189·25.

Plumbi Aceticum, *P.G.;* Acetas Plumbicus, Saccharum Saturni, Cerussa Acetata; Acétate de Plomb, Sucre de Plomb, Sel de Saturne, *Fr.;* Essigsaures Bleioxyd, Bleizucker, *G.;* Zucchero di Saturno, *It.;* Azucar de Plomo, *Sp.*

"Acetate of Lead should be kept in well-stopped bottles." *U. S.* In the British Pharmacopœia the following process is given for preparing this salt. "Take of Oxide of Lead, in fine powder, *twenty-four ounces* [avoirdupois]; Acetic Acid *two pints* [Imperial measure], or *a sufficiency;* Distilled Water *one pint* [Imp. meas.]. Mix the Acetic Acid and the Water, add the Oxide of Lead, and dissolve with the aid of a gentle heat. Filter, evaporate till a pellicle forms, and set aside to crystallize, first adding a little Acetic Acid should the fluid not have a distinctly acid reaction. Drain and dry the crystals on filtering paper, without heat." *Br.*

Preparation. Acetate of lead is obtained by two methods. By one method, thin plates of lead are placed in shallow vessels filled with distilled vinegar, in such a manner as to have a part of each plate rising above the vinegar; and these are turned from time to time, so as to bring different portions of the metallic surface in contact with the air. The metal, in the presence of the oxygen of the air, dissolves in the vinegar to saturation, and the solution is evaporated to the point of crystallization. This process is a slow one, but furnishes a salt which is perfectly neutral. The other method consists in dissolving, by the assistance of heat, litharge, or the protoxide of lead obtained by calcination, in an excess of distilled vinegar or of purified pyroligneous acid, contained in leaden boilers. The oxide is quickly dissolved, and, when the acid has become saturated, the solution is transferred to other vessels to cool and crystallize. The crystals having formed, the mother-waters are decanted, and, by evaporation, made to yield a new crop. These are generally yellow, but may be rendered white by repeated solutions and crystallizations.

Acetate of lead is extensively manufactured in Germany, Holland, France, and England, as well as in the United States. It is principally consumed in the arts of dyeing and calico-printing, in which it is employed to form with alum the acetate of alumina, to act as a mordant.

Properties. "Colorless, shining, transparent, prismatic crystals or scales, efflorescent and attracting carbonic acid on exposure to air, having a faintly acetous odor, a sweetish, astringent, afterward metallic taste, and a faintly acid reaction. Soluble in 1·8 parts of water and in 8 parts of alcohol at 15° C. (59° F.); in 0·5 part of boiling water, and in 1 part of boiling alcohol. The solutions exhibit generally a slight turbidity, which is removed by the addition of a few drops of acetic acid. When heated, the salt melts, then begins to lose water and acetic acid, and, at a higher temperature, it is decomposed. The aqueous solution yields a black precipitate with hydrosulphuric acid, a white one with diluted sulphuric acid, and a yellow one with test-solution of iodide of potassium. On heating the salt with sulphuric acid, acetous vapors are evolved. The aqueous solution, when completely precipitated by hydrosulphuric acid, should yield a filtrate which leaves no residue on evaporation (abs. of zinc, alkalies, or alkaline earths). On precipitating a 10 per cent. aqueous solution with diluted sulphuric acid, the filtrate, when supersaturated with ammonia, should not exhibit a blue tint (abs. of copper)." *U. S.* Exposed to the air, it effloresces slowly. In pure distilled water, free from carbonic acid, it ought to dissolve entirely, and form a clear solution. The commercial acetate is sometimes impure from the presence of sulphate and carbonate of lead. In purchasing it the apothecary should select large crystalline masses. Mr. John Mackay analyzed a specimen of this salt, derived from the London market, which contained nearly 30 per cent. of sulphate of lead. (*P. J. Tr.*, Jan. 1856, p. 316.) Sulphuric acid, when added to a solution of acetate of lead, produces instantly a precipitate of sulphate of lead; and the disengaged acetic acid gives rise to vapors having the smell of vinegar. The salt, when heated, first fuses and parts with its water of crystallization, and afterwards is decomposed, yielding acetic acid and pyroacetic spirit (acetone), and leaving a residue of charcoal and reduced lead. An important property of sugar of lead is its power of dissolving a large quantity of monoxide of lead. (See *Liquor Plumbi Subacetatis.*) It consists of one atom of lead, which has replaced the two hydrogen atoms furnished by two molecules of acetic acid, $C_2H_3O_2.H$, so that its formula becomes $Pb(C_2H_3O_2)_2$, and this in crystallizing takes $3H_2O$. Its mol. wt. is therefore 378·5.

Incompatibles and Tests. Acetate of lead is decomposed by all acids, and by those soluble salts the acids of which produce with protoxide of lead insoluble or sparingly soluble compounds. Acids of this character are sulphuric, hydrochloric, citric, and tartaric. It is also decomposed by lime-water, and by ammonia, potassa, and soda; the last two, if added in excess, dissolving the precipitate at first formed. It is decomposed by hard water, in consequence of the sulphate of lime and common salt which such water usually contains. "Thirty-eight grains dissolved in water require for complete precipitation 200 grain-measures of the *volumetric solution of oxalic acid.*" *Br.*

Medical Properties and Uses. Acetate of lead, in medicinal doses, is a powerful astringent and sedative; in overdoses, an irritant poison, which has in a number of cases caused death. Burning epigastric pain, vomiting of a white curdy matter (chloride of lead), and diarrhœa or constipation with black stools (sulphide of lead), and finally collapse, are the characteristic symptoms. Its antidote is any soluble sulphate, common salt, soap, or an alkali. In medicinal doses acetate of lead is a powerful sedative astringent. The class of diseases in which it has been most frequently used are hemorrhages, particularly from the lungs, stomach, intestines, and uterus. Its effect in restraining the discharge of blood is admitted to be very powerful. It has been employed by Dr. Burkart with supposed benefit in pneumonia, especially in cases occurring in the aged, in which bleeding or antimony cannot be borne. It has also been used with advantage in certain forms of dysentery and diarrhœa, and has been recommended in particular stages of cholera infantum. Combined with opium, it is well suited to the treatment of the diarrhœa occurring in phthisis. It sometimes proves a valuable remedy in checking vomiting. Dr. Irvine, of Charleston, recommended it to compose the irritability of the stomach in yellow fever. Dr. Geo. B. Wood employed it in several cases of yellow fever, at the beginning of the second stage, with apparently good effect. The dose recommended is two grains every two hours, given steadily until thirty-six grains have been taken. Certain German physicians have strongly recommended it in aneurism of the aorta, and Dupuytren, on their report of its efficacy, tried it in several cases, and with marked effect in diminishing the size of the aneurismal tumor. Dr. Geo. B. Wood imitated the practice in aneurism of the aorta, and employed it in several cases of enlarged heart, with encouraging results. In the treatment of the latter disease, the testimony of M. Brachet, of Lyons, is strongly in favor of the remedy. The solution is frequently used as a collyrium; and, applied by means of cloths, or mixed with crumb of bread, it forms a good application to superficial inflammation. It is sometimes advantageous to associate opium with the solution, in which case the meconate of morphine of the opium is decomposed, with the result of forming acetate of morphine in solution, and meconate of lead which precipitates. A convenient lotion, containing an excess of acetate of lead, may be formed by adding four grains of the acetate and four of opium to a fluidounce of water.

The practitioner should bear in mind that, when long continued in small doses, this medicine may produce—1, an affection of the alimentary canal, attended with severe pain and obstinate constipation, called *colica pictonum*, or *lead colic;* 2, a chronic affection of the muscles, especially of the extensors of the upper extremities, characterized by an excessive wasting of these organs, and denominated *lead palsy*. Both these affections are apt to be produced in artisans who work in lead. The approach of these constitutional symptoms is indicated by a lead-blue line at the edge of the gums.

The dose of acetate of lead is from one to three grains (0·065–0·20 Gm.) in the form of pill, repeated every two or three hours. It is generally given combined with opium. The solution for external use may be made by dissolving from two to three drachms in a pint of water; and, if it be wanted clear, a fluidrachm of vinegar or of dilute acetic acid may be added, which immediately dissolves the carbonate of lead, to which its turbidity is owing. When the skin is denuded of the cuticle, the solution should be weaker. The usual strength of the solution as a collyrium is from one to two grains (0·065 to 0·13 Gm.) to the fluidounce (30 C.c.) of *distilled* water.

Off. Prep. Liquor Plumbi Subacetatis; Pilula Plumbi cum Opio, *Br.;* Suppositoria Plumbi Composita, *Br.;* Unguentum Plumbi Acetatis, *Br.*

PLUMBI CARBONAS. *U.S.* *Carbonate of Lead.* [*White Lead.*]

(PLŬM'BĪ CĂR-BŌ'NĂS.)

$(PbCO_3)_2.\ Pb(HO)_2$; 773·5. $2PbO, CO_2.\ PbO, HO$; 386·75.

Cerussa, *P.G.;* Plumbum Carbonicum, Carbonas Plumbicus, Ceruse; Céruse, Carbonate de Plomb, Blanc de Plomb, Blanc de Céruse, *Fr.;* Bleiweiss, *G.;* Cerussa, *Lat.*, *It.:* Albayalde, *Sp.*

Preparation. Carbonate of lead is prepared by two principal methods. By one method it is obtained by passing a stream of carbonic acid through a solution of subacetate of lead. The acid combines with the lead hydrate of the basic salt, and precipitates as carbonate of lead, while a neutral acetate remains in solution. This, by being boiled with a fresh portion of protoxide, is again brought to the state of basic salt, when it is treated with carbonic acid as before. In this way the same portion of acetate repeatedly serves the purpose of being converted into subacetate, and of being decomposed by carbonic acid. The carbonate obtained is washed, dried with a gentle heat, and thrown into commerce. This process, which produces white lead of the first quality, was invented by Thenard, about the year 1802, and is that which is usually pursued in France and Sweden, and known as the "Clichy process." A modification of the process of Thenard, known as Benson's, is now pursued by some manufacturers in England. It consists in mixing litharge with a hundredth part of acetate of lead, and subjecting the mixture, previously moistened with very little water, to a stream of carbonic acid.

The other method, which consists in exposing lead to the vapors of vinegar, originated in Holland, whence the name "Dutch process," and is usually pursued in England and the United States; but in England, with some modifications which are not well known. We shall describe this process as pursued by our own manufacturers. The lead is cast into thin sheets, made by pouring the melted lead over an oblong sheet-iron shovel, with a flat bottom, and raised edges on its sides, which is held in a slanting direction over the melting-pot. As many of these sheets are then loosely rolled up as may be sufficient to form a cylinder five or six inches in diameter, and seven or eight high, which is placed in an earthen pot containing about half a pint of vinegar, and having within, a few inches from the bottom, three equidistant projecting knobs in the earthen-ware, on which the cylinder of lead is supported, in order to keep it from contact with the vinegar. The pots thus prepared are placed side by side, in horizontal layers, in a building roughly constructed of boards, with interstices between them. The first layer is covered with boards, on which a stratum of tan or of refuse straw from the stables is strewed; and fresh layers of pots, boards, and tan or straw are successively placed until the building is filled. The sides are also enclosed with straw. The layers of pots contained in one building, called a stack, are allowed to remain undisturbed for about six weeks, at the end of which time they are unpacked, and the cylinder of sheet-lead in each pot, though still retaining its shape, is found almost entirely converted into a flaky, white, friable substance, which is the white lead. This is separated from the lead yet remaining in the metallic state, ground in water, whereby it is washed and reduced to fine powder, and finally dried in long shallow reservoirs, heated by steam.

Pelouze has succeeded in explaining these several processes on the same general principles. In Thenard's process, it is admitted that the same portion of acetate of lead repeatedly unites with protoxide, and gives it up again to carbonic acid to form the carbonate. In the modified English process, referred to above, he supposes that the one per cent. of acetate of lead combines with sufficient litharge to convert it into subacetate, which immediately returns to the state of neutral acetate, by yielding up its excess of base to form the carbonate with the carbonic acid. The acetate is now ready to combine with a fresh portion of litharge, to be transferred to the carbonic acid as before; and thus the small proportion of acetate, by combining with successive portions of the litharge, finally causes the whole of the latter to unite with the carbonic acid. In the Dutch process, Pelouze has rendered it almost certain that none of the oxygen or carbonic acid of the carbonate is derived from the vinegar. In this process he supposes that the heat, generated by the fermentation of the tan or straw, volatilizes the vinegar, the acetic acid of which, with the assistance of the oxygen of the air, forms with the lead a small portion of subacetate. This, by reacting with the carbonic acid, resulting from the decomposition of the tan or straw, or derived from the atmosphere, forms carbonate of lead, and is brought to the state of neutral acetate. The neutral acetate returns again to the state of subacetate, and, by alternately combining with and yielding up the protoxide, causes the whole of the lead to be finally converted into carbonate.

The temperature of the stacks of pots in the Dutch process is about 45° C. (113° F.). If it falls below 35° C. (95° F.), a part of the lead escapes corrosion, and if it rises above 50° C. (122° F.), the product is yellow. The form of acetic acid usually employed in this process is vinegar; but the variable nature of that liquid as to strength and purity is an objection to its use; and, accordingly, other forms of the acid have been substituted with advantage; as, for example, the purified acetic acid from wood in a diluted state. Another method, which yields a white lead of excellent covering power, is the process patented in England by Dale and Milner. This consists in carefully grinding between millstones a mixture of litharge or any insoluble basic lead salt with water and bicarbonate of sodium. Milner has improved upon this method by grinding a mixture of 4 parts of finely divided litharge with 1 part of common salt and 16 parts of water. After about 4½ hours the reaction is complete. The mixture of basic lead chloride and caustic soda is then transferred to a leaden vessel, well stirred with a wooden pestle, and a current of carbon dioxide passed through it until the liquid is neutral. If the carbon dioxide be passed in too long, the product is spoiled. (*Roscoe and Schorlemmer*, vol. ii., 1, p. 293.)

Properties. "A heavy, white, opaque powder or pulverulent mass, permanent in the air, odorless, tasteless, and insoluble in water or alcohol. When strongly heated, the salt turns yellow, without charring, and, if heated in contact with charcoal, is reduced to metallic lead. The salt dissolves in diluted nitric acid with effervescence, and without leaving more than a trifling residue. This solution yields a black precipitate with hydrosulphuric acid, a white one with diluted sulphuric acid, and a yellow one with test-solution of iodide of potassium. On completely precipitating the solution with hydrosulphuric acid, the filtrate should not leave more than a trifling residue on evaporation (limit of zinc, alkalies, or alkaline earths)." *U. S.* It is sometimes adulterated with the sulphates of barium, calcium, and lead, particularly the first. A mixture of equal parts of white lead and barium sulphate is known as *Venetian white*, whilst *Hamburg white* is a mixture of 1 part of white lead and 2 parts of barium sulphate, and *Dutch white* of 1 part to 3 of barium sulphate. M. Louyet has examined samples of French white lead, containing considerably more than half their weight of sulphate of barium. These sulphates, if present, are left undissolved by nitric acid. Chalk or whiting is another adulteration. This may be detected by adding to the nitric solution of the white lead an excess of potassa, which will redissolve the monoxide of lead first thrown down, but leave a white powder of lime. The British Pharmacopœia gives among the tests, that "the acetic solution when treated with excess of sulphuretted hydrogen, boiled and filtered, gives no precipitate with oxalate of ammonia." *Br.* Neutral carbonate of lead consists of one atom of lead 206·5, one of carbon 12, and three of oxygen 48 = 266·5. Commercial white lead is a compound of the carbonate and hydrate of lead. Its formula is generally taken as $(PbCO_3)_2 + Pb(OH)_2$. According to Stein, white lead, when submitted to simple calcination, loses 14·5 per cent. of its weight; and a mode of determining its purity is thus afforded. (*Journ. de Pharm.*, Janv. 1859, p. 78.) But the fact seems to be, from the observations of Mr. Wm. Baker, that commercial white lead contains variable proportions of the hydrated oxide, from a mere trace to the amount of 1 mol. to 3 mols. of the neutral carbonate. (*Chem. News*, Aug. 10, 1861, p. 74.)

Medical Properties and Uses. White lead is ranked in the Materia Medica as an astringent and sedative. It is employed externally only, being used, in the form of ointment, as an application to ulcers, and to inflamed and excoriated surfaces. It is recommended in scalds and burns by Prof. Gross; and Mr. Alfred Freer has found it very useful in erysipelas, eczema, carbuncle, etc. (*P. J. Tr.*, Aug. 1859, p. 138.) The white lead is first brought to the consistence of cream by linseed oil, as in making common white paint, and then brushed over the inflamed surface. Its external use, however, is viewed by many practitioners as dangerous, on account of the risk of absorption; but the occurrence of bad effects is rare. A case, however, of colica pictonum from the white lead treatment of a severe scald is reported by Dr. G. A. Kunkler, of Madison, Iowa. (See *N. A. Medico-Chir. Rev.*, July, 1857, p. 605.)

Being extensively manufactured for the purposes of the arts, the carbonate of lead is that preparation which, by slow absorption, most frequently produces the peculiar spasmodic colic called *colica pictonum.* This disease is characterized by pain about the region of the navel, and by obstinate constipation attended with a frequent desire to evacuate the bowels, and is supposed to depend upon a spasmodic constriction of the intestinal tube, particularly of the colon. The principal indications in the treatment are, first to relax the spasm, and then to evacuate the bowels by the gentlest means. Opium and mild aperients, used alternately, are, accordingly, the best remedies, and among the latter castor oil and sulphate of magnesia are to be preferred. Indeed, the latter appears peculiarly adapted to the case; for, while it acts as an aperient, it operates to some extent as a counterpoison, by forming sulphate of lead with any soluble compound of the metal which it may meet with in the bowels. By some practitioners alum is deemed almost a specific in colica pictonum. It has often been advantageously used in lead poisoning; and iodide of potassium and the alkaline bromides have been recommended as eliminative means. In relation to the bromides, see *Journal de Pharmacie*, Oct. 1861, p. 313.

Pharm. Uses. In preparing Liquor Gutta-Perchæ, *U. S.*

Off. Prep. Unguentum Plumbi Carbonatis.

PLUMBI IODIDUM. *U. S., Br.* *Iodide of Lead.*

PbI_2; 459·7. (PLŬM'BĪ Ī-ŎD'Ị-DŬM.) PbI; 229 85.

Plumbum Iodatum, *P.G.;* Ioduretum Plumbicum; Iodure de Plomb, *Fr.;* Jodblei, *G.*

"Take of Nitrate of Lead, Iodide of Potassium, each, *four ounces* [avoir.]; Distilled Water *a sufficiency.* Dissolve the Nitrate of Lead, by the aid of heat, in a pint and a half, and the Iodide of Potassium in half a pint of the Water, and mix the solutions. Collect the precipitate on a filter, wash it with Distilled Water, and dry it at a gentle heat." *Br.*

No process is given in the U. S. P. 1880 for Iodide of Lead. The process of U. S. P. 1870 was identical with the British given above.

The nitrate of lead gives up its metal to the iodine, receiving the potassium; the operation taking place between one mol. of the lead nitrate and two mols. of the potassium iodide. The nitrate of potassium thus formed remains in solution, while the iodide of lead is precipitated, $Pb2NO_3 + 2KI = 2KNO_3 + PbI$. The theoretical quantities of nitrate of lead and iodide of potassium are 330·5 of the former and 331·2 of the latter, or almost precisely equal quantities. The proportions should be as nearly as possible those of exact saturation. An excess of the iodide of potassium, independently of the waste, has the disadvantage of holding a portion of the iodide of lead in solution; while, according to Christison, an excess of lead over the iodine disposes to the formation of the lemon-yellow insoluble oxyiodide of lead. By the use of equal quantities of the two salts, these disadvantages are avoided. As iodide of lead is slightly soluble in cold water, it is desirable to use as little of the solvent as will answer; and hence the comparatively small proportion of water employed.

In the former London process acetate of lead was employed instead of the nitrate; but M. Depaire, of Brussels, ascertained that in this process a considerable amount of iodine remains in solution after the precipitation of the iodide of lead; and M. F. Boudet states that the quantity of the iodide resulting from the process is 10 per cent. less than theory would indicate. By the addition of nitric acid to the solution, after precipitation, an additional quantity of iodide of lead is obtained. M. Boudet ascribes this result to the formation of a portion of soluble iodide of potassium and lead, whenever iodide of lead and acetate of potassium are in contact. By substituting nitrate for acetate of lead, he found that a quantity of iodide of lead was obtained, as near that required by theory as the solubility of the iodide of lead permits. (*Journ. de Pharm.*, 3e sér., xi. 274.)

From the above remarks it would appear that the above process is on the whole to be preferred to that in which the acetate of lead is used, and especially as the nitrate is more easily obtained pure. Some interesting experiments have been made by M. T. Huraut, of Paris, on the different methods of preparing iodide of lead. It may be obtained by the reaction between any of the soluble iodides and the soluble salts of lead. It resulted from his observations that of the two salts of lead employed, the nitrate was to be preferred, and of the various iodides, though iodide of potassium yielded a very handsome product, yet iodide of calcium afforded one not inferior in quality, and somewhat greater in quantity. Upon a small scale, as the process is performed by the apothecary, the difference would be of little or no consequence; but it might be important to the manufacturer. (See *A. J. P.*, xxi. 228.)

As obtained by the above process, iodide of lead is in the form of "a heavy, bright citron-yellow powder, permanent in the air, odorless and tasteless, and of a neutral reaction. Soluble in about 2000 parts of water at 15° C. (59° F.), and in about 200 parts of boiling water; very slightly soluble in alcohol, but readily dissolved by aqueous solutions of the acetates of alkalies and by solution of chloride of ammonium. When strongly heated, the salt fuses, and, at a higher temperature, it is decomposed, emitting violet vapors of iodine, and leaving a citron-yellow residue. On triturating 1 part of the salt with 2 parts of chloride of ammonium in a porcelain mortar, and adding 2 parts of water, a colorless liquid should result (abs. of and difference from chromate). This liquid, diluted with water, affords a white precipitate with diluted sulphuric acid, and a black one with hydrosulphuric acid. If all the lead has been precipitated from a portion of the solution by the last-named reagent, the filtrate should leave no residue on evaporation and gentle ignition (abs. of zinc, alkalies or alkaline earths)." *U. S.* According to Soubeiran, it is soluble in 1235 parts of cold water, and 194 of boiling water, which, on cooling, deposits it in minute, shining, golden-yellow, crystalline scales. It is freely soluble in a concentrated solution of acetate of sodium (Donato Tommasi, *P. J. Tr.*, 3d series, ii. 805). It should be kept excluded from the light. It is stated by Engelhardt that iodine is separated from iodide of lead by the perchlorides of iron and copper; while the other metallic chlorides have no such effect, producing compounds of iodides of the metal employed with chlorides of lead. (*Chem. Gaz.*, Jan. 15, 1856, p. 24.)

Medical Properties and Uses. This compound is supposed to have the resolvent properties of iodine, combined with those which are peculiar to lead, and was at one time recommended in tuberculous diseases, in which, however, it has proved wholly inefficient. It is said to have been usefully employed in the discussion of scrofulous tumors and other indolent swellings, and in the cure of obstinate ulcers; and for these purposes has been used both internally and locally in the form of an ointment. According to Dr. Cogswell, if given for some time in small doses, it produces the effects of lead, but not those of iodine, upon the system. (*Christison's Dispensatory.*) The dose is from half a grain to three or four grains (0·03–0·20 or 0·26 Gm.). Dr. O'Shaughnessy states that ten grains (0·65 Gm.) are borne without inconvenience.

Off. Prep. Emplastrum Plumbi Iodidi, *Br.;* Unguentum Plumbi Iodidi, *U. S., Br.*

PLUMBI NITRAS. *U. S., Br.* *Nitrate of Lead.*

$Pb(NO_3)_2$; 330·5. (PLŬM'BĪ NĪ'TRĂS.) PbO, NO^5; 165·25.

Plumbum Nitricum, Nitras (Azotas) Plumbicus, *Lat.;* Nitrate de Plomb, *Fr.;* Salpetersaures Bleioxyd, Bleisalpeter, *G.;* Nitrato di Piombo, *It.;* Nitrato de Plomo, *Sp.*

Neither the U. S. or Br. Pharmacopœias give a formula for the preparation of this salt. It may be readily prepared by the process of the old Dublin Pharmacopœia. "Take of Litharge, in fine powder, *five ounces* [avoirdupois]; Pure Nitric Acid *two fluidounces;* Distilled Water *three pints* [Imp. meas.]; Dilute Nitric Acid *a sufficient quantity.* To the Litharge, placed in a porcelain dish, add the Acid with a pint and a half of the Water, and, applying a sand heat, and occasionally stirring the mixture, evaporate the whole to dryness. Upon the residue boil the remainder of the Water, clear the solution by filtration, and, having acidulated it by the addition of a few drops of the Dilute Nitric Acid, evaporate until a pellicle begins to form. The heat being now withdrawn, crystals will form on the cooling of the solution, which should be dried on blotting-paper in a warm atmosphere, and preserved in a close bottle."

Properties. In this process the nitric acid unites directly with the oxide of lead to form the nitrate. This nitrate is officinally described as in "colorless, transparent, or white, nearly opaque, octahedral crystals, permanent in the air, odorless, having a sweetish, astringent, afterward metallic taste, and an acid reaction. Soluble in 2 parts of water at 15° C. (59° F.), and in 0·8 part of boiling water; almost insoluble in alcohol. When strongly heated, the salt decrepitates, emits nitrous vapors, and finally leaves a residue of oxide of lead. The aqueous solution yields a black precipitate with hydrosulphuric acid, a white one with diluted sulphuric acid, and a yellow one with test-solution of iodide of potassium. When completely precipitated with hydrosulphuric acid, the solution should yield a filtrate which leaves no residue on evaporation (abs. of zinc, alkalies or alkaline earths). On precipitating a 10 per cent. solution of the salt with diluted sulphuric acid, the filtrate, when supersaturated with ammonia, should not exhibit a blue tint (abs. of copper)." *U. S.* It is composed of one atom of lead 206·5, combined with two nitric acid groups, $(NO_3)_2.124 = 330{\cdot}5$, without water of crystallization.

Medical Properties. The effects of this salt upon the system are the same as those of the other soluble salts of lead; but, though formerly employed, it is now quite out of use as an internal remedy. Externally it is occasionally applied to excoriated surfaces; and a solution made in the proportion of ten grains to an ounce of water, and colored probably with alkanet, has been used on the continent of Europe, as a secret remedy, in sore nipples, chapped hands, cracked lips, etc. It has recently been found useful in the correction of fetid odors, dependent on the presence of sulphuretted hydrogen or ammonium sulphydrate, which it decomposes. It is employed for this purpose in solution, which may be sprinkled in apartments, or applied to putrescent ulcers, or mixed with offensive discharges, the odor of which it is desirable to correct. It will not prevent the putrefaction of animal substances, and has no power of destroying the germs or virus of contagion. *Ledoyen's disinfecting fluid* is a solution of nitrate of lead in the proportion of a drachm to an ounce. Should the salt be used internally, the dose would be from the fourth to the half of a grain (0·016 to 0·03 Gm.).

Dr. Ogier Ward has found a solution extremely useful as an injection and lotion in cases of fetid discharges from the uterus and vagina, in gleety discharges from the urethra, in sloughing and indolent ulcers, and in chronic impetiginous affections of the skin. He prepares the solution extemporaneously by dissolving a scruple of carbonate of lead in sufficient diluted nitric acid for solution, and adding a pint of distilled water. The application is to be made twice or three times daily. (*Prov. Med. and Surg. Journ.*, Oct. 15, 1851.) By Moerlonge and Vanzette remarkable efficiency is ascribed to nitrate of lead in the cure of that very painful and obstinate affection, onychia maligna; and their statements have been confirmed by other practitioners. It is applied by sprinkling the powder on the surface, and, according to Dr. J. Scott, of Belfast, Ireland, a complete cure may be relied on in from fourteen to thirty days. (*Dublin Journ. of Med. Sci.*, Feb. 1874, p. 145.) A solution of the salt in glycerin, in the proportion of ten grains (0·65 Gm.) to the fluidounce (30 C.c.), is spoken of by Prof. J. G. Wilson in the highest terms as a remedy for excoriated and fissured nipples, applied locally to the affected parts, after suckling; care being taken to wash the parts well before the next application of the child, for fear of lead poisoning. (*M. and S. Reporter*, Aug. 21, 1869, p. 164.)

Off. Prep. Plumbi Iodidum, *Br.*

PLUMBI OXIDUM. *U. S., Br.* *Oxide of Lead.* [*Litharge.*]

PbO ; 222·5. (PLŬM′BĪ ŎX′Ị-DŬM.) PbO; 111·25.

Lithargyrum, Plumbum Oxydatum, Plumbi Oxidum Semivitreum; Oxide de Plomb fondu, Litharge, Protoxide de Plomb, *Fr.;* Bleiglätte, Bleioxyd, *G.;* Litargirio, *It.;* Almartaga, *Sp.*

When oxide of lead is rendered semi-crystalline by incomplete fusion it becomes the *semivitrified oxide*, or litharge. Almost all the litharge of commerce is obtained, as a secondary product, in the process for extracting silver from argentiferous galenas. After extracting the argentiferous lead from the ore, the alloy is calcined in the open air; whereby the lead becomes oxidized, and by fusion passes into the state of litharge, while the silver remains unchanged. The following is an outline of the process. The lead containing the silver is placed upon an oval slightly excavated dish, about three feet long and twenty inches wide, called a *test*, made by beating pulverized bone-ash, formed into a paste with water, into a mould, the sides of which consist of an elliptical band of iron, and the bottom of strips of sheet-iron, placed at short distances apart. The test is of such a size as exactly to fit an opening in the floor of a reverberatory furnace, where it is placed and adjusted to the level of the floor. On one side of the test the fireplace is situated, and exactly opposite, the chimney; while at one extremity of it the pipe of a strong bellows is placed, and at the other a vertical hole is made, communicating with a gutter leading from the test. The furnace is now lighted, and shortly afterwards the bellows are put in motion. The lead fuses and combines with oxygen, and the resulting oxide, melting also, forms a stratum which floats on the surface, and which is driven, by the blast of the bellows, along the gutter and through the vertical hole into a recipient below, where, upon solidifying, it crystallizes in small scales, which form the litharge. In proportion as the lead is oxidized and blown off the test, fresh portions are added so as to keep it always sufficiently full. The process is continued for eight or ten days, after which no more lead is added. The operation is now confined to the metal remaining on the test; and, the oxidation proceeding, a period at last arrives when the whole of the lead has run off as litharge, and the silver, known to be pure by its brilliant appearance in the fused state, alone remains. This is then removed, and the process repeated on a fresh portion of argentiferous lead.

Properties. "A heavy, yellowish or reddish yellow powder, or minute scales, permanent in the air, odorless, tasteless, and insoluble in water or alcohol. When heated in contact with charcoal, it is reduced to metallic lead. Oxide of Lead should be soluble in diluted nitric acid, without leaving more than a trifling residue, and with but little effervescence (limit of carbonate). The diluted and filtered solution yields a black precipitate with hydrosulphuric acid, a white one with diluted sulphuric acid, and a yellow one with test-solution of iodide of potassium. If the lead be completely precipitated with hydrosulphuric acid, the resulting filtrate should not leave more than a trace of residue on evaporation (limit of zinc, alkalies or alkaline earths)." *U. S.* It slowly attracts carbonic acid from the air, and contains more of this acid the longer it has been exposed. It is on this account that it commonly effervesces slightly with the dilute acids. It has the property of decolorizing wines, when agitated with them. When heated with the fats and oils, in connection with water, it saponifies them. (See *Emplastrum Plumbi.*) Heated with charcoal, it is reduced to the metallic state. In dilute nitric acid it should be almost entirely soluble; and the solution is affected by potassa in the same manner as that of the carbonate. (See *Plumbi Carbonas.*) As it occurs in commerce, it usually contains iron, copper, and a little silver and silica. It may be purified from iron and copper by digestion in dilute sulphuric acid. The English litharge is most esteemed; that from Germany being generally contaminated with iron and copper. In choosing litharge, samples should be selected which are free from copper, and from fragments of vegetable matter. Copper is detected, if upon adding ferrocyanide of potassium to a nitric solution of the litharge, a brown instead of a white precipitate is produced. Two varieties of litharge are distinguished in commerce, named from their color, and dependent on differences in the process employed. Sometimes it has a pale yellow color and silvery appearance, and is then denominated *silver litharge* or *yellow litharge;* at other times it is of a red color, and is known under the name of *gold litharge* or *red litharge.* The latter has been said to owe its color to the presence of a portion of red lead; but M. Leblanc has shown that the two varieties of litharge differ in color, structure, and density only, and not in chemical composition. In this respect litharge is essentially identical with the oxide of lead. (See *Plumbum.*) The carbonic acid which it contains is variable; but its average amount is about 4 per cent. Peroxide of lead and red lead in litharge may be detected by heating it in a test-tube with chloride of sodium and bisulphate of potassium, and introducing a slip of paper colored blue by indigo. If either of these oxides be present, the paper will be bleached by the chlorine evolved. (*Journ. de Pharm.*, Mars, 1860, p. 237.)

Litharge is never used internally, but is employed in several pharmaceutical operations, and forms an ingredient in various external applications, used for abating inflammation, and for other purposes. By reaction with olive oil it forms the *Emplastrum Plumbi*, which is the basis of many of the *Plasters.* (See *Emplastra.*) In the arts it is employed in the glazing of pottery, in painting to render oils drying, and as an ingredient in flint glass.

Pharm. Uses. In preparing Digitalinum. *Br.*

Off. Prep. Emplastrum Cerati Saponis, *Br.;* Emplastrum Lithargyri, *Br.*, 1864; Emplastrum Plumbi; Liquor Plumbi Subacetatis; Plumbi Acetas, *Br.*

PLUMBI OXIDUM RUBRUM. *Red Oxide of Lead.*

$Pb_3\,O_4$; 683·5. (PLŬM'BĪ ŎX'Ị-DŬM RŪ'BRŬM.) $Pb_3\,O_4$, 342·8.

Red Lead, Minium; Deutoxide de Plomb, Oxide rouge de Plomb, Minium, *Fr.;* Mennige, *G.;* Minio, *It.*, *Sp.*

Preparation. Red lead is prepared on the large scale in a furnace, with the floor slightly concave and the roof arched, presenting a general resemblance to a baker's oven. The lead is placed on the floor, and gradually raised to a red heat, whereby it melts and becomes covered with a pellicle of monoxide, which is removed by means of a long iron scraper; and the pellicles, as they successively form, are scraped off until the whole of the metal has been converted into them. The product is subjected to further calcination, with occasional stirring, for some time, in order to oxidize any particles of metallic lead. It is thus rendered yellow, and constitutes the *monoxide of lead*, or *massicot.* This is taken out of the furnace, thrown upon a level pavement, and cooled by being sprinkled with water. It is next reduced to fine powder by trituration and levigation, and dried; and in this state is introduced into large, shallow, square tin boxes, which are placed in another furnace, closed from the air, and heated nearly to redness; the heat being allowed gradually to fall during a period of from twenty-four to thirty hours. At the end of that time the monoxide of lead will have combined with an additional quantity of oxygen, and become the red oxide. This is taken out, and, having been passed through a fine wire sieve, is packed in barrels for the purposes of commerce.

The above is an outline of the French process for making red lead. In England and the United States, the calcination of the monoxide is not performed in tin boxes, but by returning it to the furnace in which it was first calcined. To save the first calcination, litharge is generally used for making the red lead of commerce, which consequently is liable to contain the impurities of that substance, consisting of iron, copper, and a little silver and silica. Copper is hurtful in red lead when used for making glass, to which it communicates color. In order to have red lead of good quality, it should be made in large quantities at a time. It is also important that it be slowly cooled; for, as the absorption of oxygen by which it is formed takes place during a particular interval of temperature only, it is necessary that the heat, within that interval, should be maintained sufficiently long to allow all the monoxide to absorb its appropriate quantity of oxygen. Red lead is also prepared by exposing litharge to a high temperature with nitrate or carbonate of potassium or sodium.

Properties. Red lead is in the form of a heavy, scaly powder, of a bright red color, with a slight shade of orange. Its sp. gr. is about 9. When exposed to heat it gives off oxygen, and is reduced to the state of monoxide. It is sometimes adulterated with red oxide of iron and red bole, substances which may be detected by treating the red lead with nitric acid, and testing the nitric solution with tincture of galls. This reagent will produce a black precipitate, in consequence of the iron being dissolved by the nitric acid. If brick-dust be present, it will be left undissolved upon boiling the suspected specimen in water, with sugar and a small quantity of nitric acid. When free from impurities it is wholly reduced on charcoal by means of the blowpipe, giving a globule of metallic lead. It is completely soluble in highly fuming nitrous acid. When treated with nitric acid it is resolved into monoxide which dissolves and dioxide which remains in the form of a dark brown powder.

The red lead of commerce may be considered as a mixture of what may be called the true red oxide, and variable proportions of monoxide. That this is its nature is rendered probable by the action of cold dilute acetic acid, not used in excess, which takes up a variable quantity of monoxide, leaving a portion unchanged in color, which may be deemed the pure red oxide. This latter, when analyzed by nitric acid, has been proved, by the coincident results of Dalton, Dumas, and Phillips, to consist of three atoms of lead, and four of oxygen, equal to $2PbO,PbO_2$ (Dumas), or PbO,Pb_2O_3 (Winckelblech). Mulder gives $Pb_4O_5 = 3PbO,PbO_2$, or $2PbO,Pb_2O_3$, as the usual composition of red lead.

Red lead enters into no officinal preparation. In the arts it is used chiefly as a paint, and in the manufacture of flint glass.

PODOPHYLLUM. *U.S.* *Podophyllum.* [*May-apple.*]

(PŎD-Ọ-PHȲL′LŬM.)

"The rhizome and rootlets of Podophyllum peltatum. Linné. (*Nat. Ord.* Berberidaceæ.)" *U.S.* "The dried rhizome of Podophyllum peltatum. Linn. Imported from North America." *Br.*

Podophylli Radix, *Br.;* Podophyllum Root, Mandrake Root; Rhizome de Podophyllum, *Fr.;* Fussblattwurzel, *G.*

Gen. Ch. Calyx three-leaved. *Corolla* nine-petalled. *Berry* one-celled, crowned with the stigma. *Willd.*

Podophyllum peltatum. Willd. *Sp. Plant.* ii. 1141; Barton, *Med. Bot.* ii. 9; Carson, *Illust. of Med. Bot.* i. 18, pl. 11; *B. & T.* 17. The may-apple, sometimes also called *mandrake*, is an indigenous herbaceous plant, and the only species of the genus. The root (rhizome) is perennial, creeping, usually several feet in length, about one-quarter of an inch thick, brown externally, smooth, jointed, and furnished with radicles at the joints. The stem is about a foot high, erect, round, smooth, divided at top into two petioles, and supporting at the fork a solitary one-flowered peduncle. Each petiole bears a large, peltate, palmate leaf, with six or seven wedge-shaped lobes, irregularly incised at the extremity, yellowish green on their upper surface, paler and slightly pubescent beneath. The flower is nodding. The calyx is composed of three oval, obtuse, concave, deciduous leaves. The corolla has from six to nine white, fragrant petals, which are obovate, obtuse, concave, with delicate transparent veins. The stamens are from thirteen to twenty, shorter than the petals, with oblong, yellow anthers, of twice the length of the filaments. The stigma is sessile, and rendered irregular on its surface by numerous folds or convolutions. The fruit is a large oval berry, crowned with the persistent stigma, and containing a sweetish fleshy pulp, in which about twelve ovate seeds are embedded. It is, when ripe, of a lemon-yellow color, diversified by round brownish spots.

The plant is extensively diffused through the United States, growing luxuriantly in moist shady woods, and in low marshy grounds. It is propagated by its creeping root, and is often found in large patches. The flowers appear about the end of May and beginning of June; and the fruit ripens in the latter part of September. The leaves are said to be poisonous. The fruit has a subacid, sweetish, peculiar taste, agreeable to some palates, and may be eaten freely with impunity. From its color and shape, it is sometimes called *wild lemon*. The root is the officinal portion, and is said to be most efficient when collected after the falling of the leaves. It shrinks considerably in drying.

Properties. The dried root is much wrinkled lengthwise, is yellowish or reddish brown externally, and furnished with fibres of a similar but somewhat paler color. It was determined, by an experiment of Mr. Wm. Saunders, that these fibres contain as much active matter as the rhizome itself. The fracture is short and irregular, and the internal color whitish. The microscopic examination of the section shows the rhizome to be composed of loose parenchymatous tissue, with sixteen or more yellowish vascular bundles arranged in a circle, and a cortical layer of a double row of thick-walled yellowish cells surmounted by the epidermis. It is officinally described as "about one-fifth of an inch (5 mm.) thick, horizontal, nearly cylindrical, consisting of joints about two inches (5 cm.) long, somewhat enlarged at the end which has a circular scar on the upper side, a tuft of about ten nearly simple, fragile rootlets on the lower side, and is sometimes branched laterally; smooth or somewhat wrinkled, orange-brown, internally white and mealy, with a circle of small wood-bundles; pith large; inodorous; sweetish, somewhat bitter and acrid." The powder is light yellowish gray, resembling that of jalap. The root in its aggregate state is nearly inodorous, but in powder has a sweetish not unpleasant smell. The taste is at first sweetish, afterwards bitter, nauseous, and slightly acrid. Both the decoction and tincture are bitter; but alcohol is said to be the best solvent of the active matter. A bitter substance was extracted from the root by William Hodgson, Jr., of Philadelphia, by boiling it with quicklime in water, straining the decoction, precipitating the lime with sulphate of zinc, evaporating the clear solution to the consistence of an extract, treating this with cold alcohol of 0·817, filtering and evaporating the alcoholic solution, and treating the residue with boiling distilled water, which deposited the substance referred to on cooling. (*Journ. of the Phila. Coll. of Pharm.*, iii. 273.) Though the alcoholic solution of this substance is very bitter, it has upon trial been found not to be the purgative principle of the root. Analyzed by Mr. John R. Lewis, podophyllum yielded albumen, gum, starch, extractive, lignin, gallic acid, fixed oil, traces of volatile oil, salts of potassa and lime, and two resinous principles, one soluble in alcohol and ether, and the other soluble in alcohol only. Both resins were found to possess the active properties of the root. Six grains operated as a drastic cathartic, with some emetic effect. (*A. J. P.*, xix. 165.) Prof. F. F. Mayer, of New York (*A. J. P.*, 1863, p. 97), stated as the result of his investigations, that the rhizome of the may-apple contained both *berberine* and a colorless alkaloid, a resin, a free acid, a neutral odorous substance volatilizable in white scales, and *saponin*. Prof. J. M. Maisch, after a short examination in 1863 of the mother-liquors from the preparation of the resin, stated also (*A. J. P.*, 1863, p. 303) that an alkaloid seemed to be present, but on fuller examination at a later date (*A. J. P.*, 1879, p. 590) states that he is unable to find any traces of any alkaloid whatever, although Mayer's reagent (potassio-mercuric iodide) at times gave slight traces of turbidity. In this final conclusion Prof. Maisch comes into accord with Dr. F. Power, who (*A. J. P.*, 1878, p. 370) had shown the resin of podophyllum to be destitute of the principles announced by Mayer. Podwissotsky also confirms this view. The resin is a light brownish yellow powder, of greenish tint, devoid of crystalline appearance, becoming darker if heated above 32° C., and having an acrid, bitter taste. Dr. V. Podwissotsky, 1882 (*Pharm. Zeitschrift für Russland*, vol. xx. p. 777), made a careful examination of the root and resin, and announces the active principle to be solely a neutral crystalline principle, *picropodophyllin*. This principle is associated with an inactive resin-acid, *picropodophyllic acid*, and the combination of the two he names *podophyllotoxin*. Picropodophyllin is in colorless, silky, extremely delicate needles, very soluble in chloroform, readily soluble in 95 per cent. alcohol, but very slightly in 75 per cent. alcohol. It is soluble in ether, and crystallizes from a warm saturated solution on cooling. It is insoluble in water, turpentine, or benzin. Podophyllotoxin is a bitter, white resinous powder, soluble in weak alcohol and hot water. It may be precipitated from its alcoholic solution by water in large quantity. (*P. J. Tr.*, 1882, p. 1011.) He also obtained *podophylloquercetin*, the coloring principle, which is closely allied to quercetin, and is the cause of the varying color of resin of podophyllum. The processes for preparing these principles will be found in the foot-note.[*] Dr. Manlius

[*] *Podophyllotoxin.* This is better prepared from the root than from the crude podophyllin. The coarsely powdered root is extracted with chloroform, either by maceration or percolation. The chloroform must be as free from alcohol as possible, otherwise considerable quantities of podophylloquercetin, etc., are dissolved, which complicate the purification of the podophyllotoxin, and for the same reason the root should be exhausted cold, not on the water-bath. The chloroform is distilled from the liquid until the residue has attained a syrupy consistence, when it is slowly poured into two volumes of pure absolute ether: or ether may be added in small quantities at a time with frequent stirring, until, on further addition, no more precipitation takes place. Podophyllotoxin and fatty matter are dissolved by the ether-chloroform mixture, whilst podophyllic acid separates in flocks. An insufficiency of ether may therefore result in the non-precipitation of some of the podophyllic acid, but an excess cannot be injurious. On no account should ether that is contaminated with alcohol be used, as it retains podophyllic acid in solution, which cannot afterwards be removed. To ascertain if that substance has been completely precipitated, ether is gently poured on to the ether-chloroform solution, when the appearance of flocks indicates the presence of podophyllic acid.

The ether-chloroform solution is poured off on to a filter and allowed to drop into about twenty times its volume of petroleum spirit. From each drop as it falls into the petroleum spirit a white powder separates, whilst fixed oil and crystalline fat dissolve. If an insufficient quantity of petroleum spirit has been used, the deposited powder adheres together or forms small lumps which easily retain fatty matter, and even a part of the powder itself may pass into solution if too much ether-chloroform mixture be present. The more the powder is contaminated with podophyllic acid the more liable will it be to form agglutinated lumps. If this is the case, the podophyllotoxin must be subjected to a purification, it being first completely precipitated by the addition of more petroleum spirit.

The precipitated podophyllotoxin is dried at a temperature not exceeding 35° C., and dissolved in the smallest possible quantity of chloroform. This chloroformic solution is filtered into petroleum spirit, adding a few drops of water so as to moisten the precipitate as it falls. It should be allowed to settle, and then collected and dried at a low temperature. If properly prepared it should form a white or pale yellow powder, and may be preserved in ordinary glass bottles, as it is not decomposed by light.

Podophyllotoxin may also be prepared from podophyllin by the same method, but it must be borne in mind that podophyllin contains decomposition products formed during the process of manufacture, from which the podophyllotoxin is not easily freed. Pure podophyllotoxin must be very easily soluble in chloroform, and the solution must remain clear on the addition of ether, but deposit white flocks when mixed with petroleum spirit. Perchloride of iron should not color the alcoholic solution green. It is not completely soluble in aqueous solution of ammonia; the alkali should remove the picropodophyllic acid only, and if too much ammonia has not been used, a gelatinous mass is obtained in consequence of the separation of picropodophyllin. If to this mass ether is added, gently warmed and shaken, the picropodophyllin dissolves in the ether and may be obtained in acicular crystals by evaporating the ethereal solution.

Picropodophyllin. This body may be prepared from podophyllum resin or root. In either case, however, the podophyllotoxin must be first extracted, but not necessarily in a state of purity; it may be obtained by exhausting the resin or root with chloroform, evaporating the chloroformic solution to complete dryness, and thoroughly extracting with boiling petroleum spirit. The residual brown powder is impure podophyllotoxin. It is dissolved in a small quantity of alcohol, freshly slaked lime added in considerable excess, and the whole dried in the water-bath. The dry mass is then powdered and exhausted by repeatedly boiling with absolute, or at least very strong, alcohol, and filtering through a heated funnel. On cooling, the concentrated alcoholic solution deposits the picropodophyllin in long, snow-white, silky crystals. They are collected, washed with 50 per cent. spirit containing a little ammonia, to remove the last traces of picropodophyllic acid as well as coloring matter, etc., and finally dried at a low temperature, during which the crystals aggregate to felted, silky masses. The filtrate and washings may be concentrated to obtain the picropodophyllin still in solution. All the solutions of picropodophyllin have an intensely bitter taste.

Picropodophyllic Acid may be obtained from podophyllotoxin by treatment with ammonia. Owing to the decomposing action of the alkali, it is very difficult to obtain picropodophyllic acid quite pure, especially in sufficient quantity for chemical analysis.

Smith recommends that the resin should be prepared by forming an alcoholic tincture of the root, evaporating the tincture till most of the alcohol is driven off, and throwing the residue into water, by which the resin is precipitated. The concentration should not be carried too far; as otherwise the resin separates in clots, which cannot be easily washed. According to Dr. Smith, the resin, when pure, is white, and purges actively. It is called *podophyllin.* (*A. J. P.*, xxiv. 306.) For a more complete account of what is known of the resins of podophyllum, the reader is referred to the article on *Resina Podophylli.*

The leaves of the *Podophyllum peltatum* were chemically examined by Mr. Thomas J. Husband, Jr., who obtained from them a resinous matter and a portion of the alkaloid berberine, which is found in the root. This resinous matter consisted of two distinct resins, "one soluble in ether and alcohol, the other in alcohol, and both in caustic alkalies and chloroform. Mr. Husband states that the resin obtained from the leaves is similar in its chemical relations to podophyllin, but proved, when taken internally, to be without its purgative properties; eight grains being taken without other effect than slight headache." (*A. J. P.*, 1869, p. 200.)

Medical Properties and Uses. Podophyllum is a slow but active and certain cathartic, producing copious liquid discharges. In some cases it has given rise to nausea and even vomiting, but the same result is occasionally experienced from every active cathartic. Its operation resembles that of jalap, but is rather slower, and is thought by some to be more drastic. It is generally thought by the profession to be an efficient cholagogue, and the experiments of Prof. Rutherford upon dogs certainly confirm this belief. It is very much employed in various parts of the country in bilious fevers and hepatic congestions, and as a general cathartic. In minute doses, frequently repeated, podophyllum has been thought to diminish the frequency of the pulse, and to relieve cough, and, for these effects, has been given in hæmoptysis, catarrh, and other pulmonary affections, but this employment of it is of doubtful advantage.

The dose of the powdered root, as a purgative, is about twenty grains (1·3 Gm.). An extract is prepared from it possessing all its virtues in a smaller bulk (see *Extractum Podophylli*), but the officinal resin is almost exclusively used under the name of *podophyllin.* In its purest state the dose as a laxative is from one-eighth to one-quarter of a grain (0·008–0·017 Gm.); as a purgative, from one-quarter to one-half grain (0·017–0·037 Gm.).

Off. Prep. Abstractum Podophylli, *U. S.;* Extractum Podophylli, *U. S.;* Extractum Podophylli Fluidum, *U. S.;* Podophylli Resina, *Br.;* Resina Podophylli, *U. S.*

Podophyllic Acid separates out on the addition of ether to the chloroformic solution of the crude podophyllotoxin; it may be washed with ether and purified by repeated treatment with chloroform and ether.

Both the fatty substances present may be isolated from the petroleum spirit solutions obtained in preparing podophyllotoxin. The residue left after distilling off the solvent crystallizes on standing.

Podophylloquercetin can be best obtained from podophyllin that has been prepared without the use of alum. After exhausting with chloroform and petroleum spirit, the podophyllin is dried and extracted with ether, which removes podophylloquercetin with but little impurity. The residue, after evaporating the ethereal solution, is treated with acetate of lead, with which podophylloquercetin forms a compound soluble in acetic acid. This compound is decomposed in the usual manner, the podophylloquercetin being taken up with ether. On evaporating the solution, it is finally obtained in the form of a yellow powder, gradually turning green on exposure to air. Ether precipitates it from ammoniacal solution in minute yellow crystals. It may also be obtained by sublimation in yellow shining crystals. (*Pharm. Zeitschrift für Russland*, vol. xx. p. 777; *P. J. Tr.*, 1882, p. 1011.)

According to Podwissotsky, picropodophyllin is so insoluble in its crystalline form that it has little action upon the system, but administered in solution in warm oil it is active. In the root and in the officinal resin it is in the form of podophyllotoxin, and is rendered soluble by picropodophyllic acid; if an alkali or soap be added to podophyllin, it is affirmed, the active part passes through the intestine unchanged. One-sixteenth of a grain (0·004 Gm.) of podophyllotoxin was usually sufficient to kill a cat; of picropodophyllin more than five-sixths of a grain (0·05 Gm.) was never required to kill; a solution of picropodophyllin in picropodophyllic acid acted like podophyllotoxin. The dose of the latter principle for the adult man is set down as from one-fourth to one-half a grain (0·017 to 0·035 Gm.). If this be correct, podophyllotoxin is practically no stronger than the officinal resin.

POTASSIUM. *Potassium.*

K; 39. (PỌ-TĂS′SỊ-ŬM.) K; 39.

Potassium, *Fr.;* Kalium, Kalimetall, *G.;* Potassio, *It.;* Potasio, *Sp.*

Potassium is a peculiar metal, forming the radical of potassa, and of a number of other medicinal preparations. It was discovered in 1807 by Sir H. Davy, who obtained it by decomposing fused hydrate of potassa by a voltaic current. It was afterwards procured in larger quantity by Gay-Lussac and Thenard, by bringing the fused alkali in contact with white-hot iron, which attracted the oxygen and set free the metal. The best process is that of Brunner, as modified by Wöhler, which consists in decomposing potassa in the state of carbonate, mixed with charcoal. The mixture of carbonate and charcoal is obtained by heating cream of tartar to redness in a covered crucible. For an account of some improvements in Brunner's process by MM. Mareska and Donny, see *A. J. P.* (xxv. 70).

Potassium is solid, softer and more ductile than wax, easily cut with a knife, and of a silver-white color. A newly-cut surface is brilliant; but the metal quickly tarnishes by combining with the oxygen of the air, and assumes the appearance of lead. It possesses a remarkably strong affinity for oxygen, and is capable of taking that element from almost every other substance. On account of this property it must be kept in liquids, such as naphtha, which are devoid of oxygen. On the same account, when exposed with a fresh-cut surface to the air, it becomes luminous through a slow combustion, like phosphorus in the dark. (*Chem. News*, Feb. 28, 1868, p. 108.) Its sp. gr. is 0·865, melting point 62·5° C. (144·5° F.), atomic weight 39, and symbol K. When thrown upon water it floats, takes fire, and burns with a rose-colored flame, combining with oxygen, and generating potassa which dissolves in the water. It forms numerous combinations, uniting with most of the non-metallic elements, and with several of the metals. It combines in two proportions with oxygen, forming a monoxide (K_2O) of a gray, and a tetroxide (K_2O_4) of a yellowish brown color. It also unites with chlorine, and forms officinal compounds with iodine, bromine, cyanogen, ferrocyanogen, and sulphur, under the names of iodide, bromide, cyanide, and ferrocyanide of potassium, and sulphurated potassa. Its monoxide is a strong salifiable base existing in nature always in combination, and forming with acids a numerous and important class of salts. Of these, the acetate, bichromate, hypophosphite, carbonate, bicarbonate, chlorate, citrate, hydrate (caustic potassa), nitrate, permanganate, sulphate, sulphite, tartrate, and bitartrate are officinal, and will be described under their respective titles.

POTASSA. *U. S.* *Potassa.*

KHO; 56. (PỌ-TĂS′SẠ.) KO, HO; 56.

Potassa Caustica, *Br.;* Kali Purum; Caustic Potassa, Hydrate of Potassa, Potassium Hydrate; Kali Causticum Fusum, *P.G.;* Potassæ (Potassii) Hydras, Kali Hydricum Fusum, Oxydum Potassicum, Lapis Causticus Chirurgorum; Caustic Potash; Potasse caustique, *Fr.;* Kalium-Hydrat, Kaustisches Kali, *G.*

"Take of Solution of Potash *two pints* [Imperial measure]. Boil down the Solution of Potash rapidly in a silver or clean iron vessel, until there remains a fluid of oily consistence, a drop of which when removed on a warm glass rod solidifies on cooling. Pour this into proper moulds, and when it has solidified, and while it is still warm, put it into stoppered bottles." *Br.* A process for Potassa is no longer in the U. S. Pharmacopœia: that of 1870 is identical with the British.

The concrete alkali, obtained from these processes, is the hydrate of potassa, sufficiently pure for medicinal purposes. The solution of the alkali freed from carbonic acid having been obtained by another formula (see *Liquor Potassæ*), the formation of the present preparation requires merely the evaporation of this solution until the whole of its uncombined water is driven off. The evaporation must be performed in metallic vessels, as those of glass or earthen-ware are acted on by the alkali; and it should be completed as quickly as possible, in order to abridge the period during which the solution would be liable to absorb carbonic acid from the atmosphere. When poured out on a metallic plate or dish, the cake, just as it concretes, may be marked with a knife in the directions in which it is to be divided, and when cold it readily breaks in those directions. A better plan, however, is to run the fused alkali into suitable moulds, as directed in the former U. S. and British formulas. These should be made of silver or iron and have a cylindrical shape, which is the most convenient form of the alkali for surgical use. Green glass bottles with ground stoppers are best adapted for preserving this preparation, as white flint glass is attacked by the alkali. "Potassa should be kept in well-stopped bottles made of hard glass." *U. S.*

Properties. It is officinally described as "a white, hard and dry solid, generally in form of pencils, very deliquescent, odorless, or having a faint odor of lye, of a very acrid and caustic taste, and a strongly alkaline reaction. Soluble in 0·5 part of water, and in 2 parts of alcohol at 15° C. (59° F.); very soluble in boiling water and in boiling alcohol. When heated nearly to a red heat, it melts, forming an oily liquid. At a strong red heat, it is slowly volatilized unchanged. Its aqueous solution dropped into solution of tartaric acid, produces a white, crystalline precipitate which is redissolved by an excess of solution of potassa. An aqueous solution of potassa should be colorless (abs. of organic matter), and, after being supersaturated with nitric acid, should not be more than slightly clouded on the addition of test-solution of nitrate of silver (limit of chloride), or of chloride of barium (limit of sulphate). Dropped into an acid, it should not produce more than a faint effervescence of isolated bubbles (limit of carbonate). If 1 part of potassa be dissolved in 2 parts of water, and the solution dropped into 4 parts of alcohol, not more than a slight precipitate (limit of silica), or a small amount of a dense aqueous layer (limit of carbonate), should be separated. To neutralize 2·8 Gm. of Potassa should require not less than 45 C.c. of the volumetric solution of oxalic acid (corresponding to at least 90 per cent. of absolute hydrate of potassium)." *U. S.* It is important that the requirements of the Pharmacopœia be complied with, and that potassium hydrate should not contain more than 10 per cent. of impurity. The *white stick caustic potassa* of commerce usually contains from 15 to 28 per cent. of water, which seems to be a necessary impurity, for if a certain quantity of water is not present it is impossible to mould the stick. By heating this so as to drive off the water a purified hydrate in cakes may be obtained. On account of its deliquescent property, and its strong attraction for carbonic acid, it requires to be kept in very accurately stopped bottles. As formerly obtained by the U. S., London, and Edinburgh formulas, from solution of potassa derived from an impure carbonate, it contained various impurities, which, however, did not interfere with its medicinal value; such as chloride and tetroxide of potassium, ferric oxide, lime, silica, alumina, sulphate of potassium, and a portion of the alkali still in a carbonated state. Officinal potassa may be rendered nearly pure by digestion in alcohol, which takes up only the alkaline hydrate, evaporating the solution to dryness, and fusing the dry mass obtained. *Hydrate of Potassa*, when thus procured, is called *alcoholic potassa.* It is generally in flat white pieces, which are dry, hard, brittle, and extremely caustic. Its other properties are similar to those of the impure hydrate above described. According to Mr. H. Wurtz, of New York, commercial alcoholic potassa usually contains a trace of silicate of potassium, which appears to be taken up by the alcohol. The source of this is the carbonate of potassium employed, which may be freed from this impurity by evaporating its aqueous solution, in a sheet-iron dish, to dryness, and adding, from time to time, lumps of carbonate of ammonium. The silicate is thus converted into the carbonate; and, on dissolving the residue, the silica appears in flakes, which may be separated by filtration. Potassa may be distinguished from the other fixed alkalies (soda and lithia) by affording, when in solution, a crystalline precipitate (cream of tartar) with an excess of tartaric acid, and a yellow one with platinic chloride.* Potassa imparts to the flame of burning alcohol in which it is dissolved a reddish tint; soda colors it yellow even in the presence of potassa; and thus a method is afforded of detecting an admixture of the latter with the former alkali. According to Bunsen, when the flame is viewed through a glass having a cobalt-blue color, only the color imparted by potassa is seen, that peculiar to soda not being able to penetrate through blue glass. (*Journ. de Pharm.*, Oct. 1860,

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* For a method of analyzing commercial potash so as to determine the percentage and character of impurities, see *A. J. P.*, xlvii. 464.

p. 319.) Potassa is known chemically as potassium hydrate, KOH, and is composed of one atom of potassium 39, united with one hydroxyl group, OH, 17 = 56.

Medical Properties and Uses. This is the old *causticum commune acerrimum*, or *strongest common caustic.* It is a powerful escharotic, quickly destroying the life of the part with which it comes in contact, and extending its action to a considerable depth beneath the surface. In this latter respect it differs from nitrate of silver or lunar caustic, to which it is, therefore, preferred in forming issues and opening abscesses. The most convenient mode of employing the caustic for the formation of an issue, is to apply to the skin a piece of linen spread with adhesive plaster, having a circular opening in its centre corresponding with the intended size of the issue, and then to rub upon the skin, within the opening, a piece of the caustic previously moistened at one end. The application is to be continued till the life of the part is destroyed, when the caustic should be carefully washed off with a wet sponge or wet tow, or neutralized by vinegar. In forming from it solutions of potassa of definite strength, whether for medicinal or pharmaceutical use, an allowance should be made for the percentage of water it always contains. (See *Liquor Potassa.*) A solution of one drachm and a half of caustic potassa in two fluidounces of distilled water was highly recommended by the late Dr. Hartshorne, of Philadelphia, as an application to the spine in tetanus. It may be applied by means of a sponge attached to the end of a stick, which should be drawn quickly along the back from the nape of the neck to the sacrum. It produces a powerful rubefacient effect.*

Off. Prep. Liquor Potassæ, *U. S.;* Potassa cum Calce, *U. S.;* Potassæ Permanganas, *Br.*

POTASSA CUM CALCE. *U. S.* *Potassa with Lime.*

(PO-TĂS-SA CŬM CĂL′CĒ.)

Pulvis Causticus cum Calce, Pulvis Causticus Viennensis; Vienna Caustic, Vienna Paste; Caustique (Poudre) de Vienne, *Fr.;* Wiener Aetzpulver, *G.*

"Potassa, *fifty parts;* Lime, *fifty parts*, To make *one hundred parts.* Rub them together so as to form a powder, and keep it in a well-stopped bottle." *U. S.*

This preparation is "a grayish white powder, deliquescent, having a strongly alkaline reaction, and responding to the tests for calcium and potassium. It should be soluble in hydrochloric acid without leaving more than a small residue." *U. S.* It should not effervesce on the addition of an acid. It is prepared for use by being made up into a paste with a little alcohol. The paste is applied to the part to be cauterized for ten or fifteen minutes, and is conveniently limited in its operation by a piece of adhesive plaster, in the manner explained under potassa. The former Edinburgh preparation, made by evaporating the solution of potassa to one-third, and adding lime enough to bring it to the state of a firm paste, was often called *causticum commune mitius*, or *milder common caustic.* Potassa with lime is a more manageable caustic than the officinal potassa, on account of the presence of the lime, which renders it milder, slower in its operation, and less deliquescent, and causes it to spread less beyond the part intended to be affected. Dr. Filhos has improved this caustic by forming it in sticks. To prepare it thus, the potassa is perfectly fused in an iron spoon, and one-third of its weight of quicklime is added in divided portions; the whole being stirred with an iron rod. The fused mass is then run into lead tubes, closed at one end, about three inches long, and from a quarter to half an inch in diameter in the clear. The sticks are kept, still enclosed in the lead tubes with the open end downwards, in thick glass tubes, containing some powdered quicklime, and closed with a cork, between which and the stick some cotton is put to steady the caustic. When employed, as much of the caustic is uncovered at the end, by scraping off the lead, as it is proposed to use. This form of caustic is particularly recommended for cauterizing the neck of the uterus. M. E. Robiquet has modified the caustic, by fusing the potassa and lime at a higher heat, running the fused mass into iron moulds, and quickly coating the sticks, when cold, with melted gutta-percha. The higher heat employed renders the caustic harder and more homogeneous.*

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* At the suggestion of Dr. Maunoury, of Chartres, M. E. Robiquet has prepared a paste consisting of gutta-percha and caustic potassa, which offers many advantages of manipulation, in the application of the latter substance. It is prepared by simply melting together equal weights of the two substances. The resulting paste can be moulded into any form that may be thought desirable, either of cylinders, plates, or lozenges, and retains its form indefinitely, even when introduced into cavities. All that is necessary, before applying it, is to dip it into alcohol for a few seconds. The resulting eschars are very precise in their form. (*Journ. de Pharm.*, xxx. 275.)

POTASSA SULPHURATA. *U. S., Br.* *Sulphurated Potassa.*

(PỌ-TĂS′SẠ SŬL-PHŪ-RĀ′TẠ.)

Potassii Sulphuretum, *U. S.* 1870; Sulphuret of Potassium, Sulphurated Potash; Kalium Sulfuratum, *P.G.;* Sulfure de Potasse, Foie de Soufre, *Fr.;* Kalischwefelleber, *G.*

"Sublimed Sulphur, *one part;* Carbonate of Potassium, *two parts.* Rub the Carbonate of Potassium, previously dried, with the Sulphur, and heat the mixture gradually, in a covered crucible, until it ceases to swell and is completely melted. Then pour the liquid on a marble slab, and, when it has solidified and become cold, break it into pieces, and keep them in a well-stopped bottle of hard glass." *U. S.*

"Take of Carbonate of Potash, in powder, *ten ounces;* Sublimed Sulphur *five ounces.* Mix the Carbonate of Potash and the Sulphur in a warm mortar, and, having introduced them into a Cornish or Hessian crucible, let this be heated, first gradually, until effervescence has ceased, and finally to dull redness, so as to produce perfect fusion. Let the liquid contents of the crucible be then poured out on a clean flagstone, and covered quickly with an inverted porcelain basin, so as to exclude the air as completely as possible while solidification is taking place. The solid product thus obtained should, when cold, be broken into fragments, and immediately enclosed in a green-glass bottle, furnished with an air-tight stopper." *Br.*

These processes are essentially the same, except that a greater heat is used in the Br. process, which somewhat modifies the result. When carbonate of potassium is melted with half its weight of sulphur, as in the U. S. process, the carbonic acid is expelled. The composition varies with the heat employed. If the heat do not exceed 185° C. (365° F.), the resulting preparation will contain hyposulphite of potassium; if above 300° C. (572° F.), sulphate of potassium. (*Fordos and Gélis.*) The reaction for the preparation at the lower temperature is $3K_2CO_3 + (S_2)_4 = 2K_2S_3 + K_2S_2O_3 + 3CO_2$, which at the higher temperature is changed as follows, $4K_2S_2O_3 = 3K_2SO_4 + K_2S_5$. The pentasulphide of potassium formed is decomposed at this high temperature into sulphur, which burns off, and K_2S_3. The U. S. preparation, therefore, which is made at the temperature of fusion, probably contains hyposulphite of potassium, and may be represented by the formula $2K_2S_3 + K_2S_2O_3$; three mols. of CO_2 escaping: while the British, being prepared at a red heat, contains sulphate of potassium, the reaction probably being $4K_2CO_3 + (S_2)_5 = K_2SO_4 + 3K_2S_3 + 4CO_2$.

The Pharmacopœias use the carbonate of potassium from pearlash; but in the process of M. Henry, which is stated to be the best yet devised, the pure carbonate of potassium is employed. His formula is as follows. Mix two parts of pure salt of tartar with one of roll sulphur reduced to powder, and put the mixture into flat-bottomed matrasses, which should be only two-thirds filled. These are placed on a sand-bath, and the fire is applied so as, at first, to produce only a gentle heat, which is afterwards increased. Care must be taken that the necks of the matrasses do not become obstructed. The heat is continued, until the matter is brought to the state of tranquil fusion, when it is allowed to cool. The mass obtained, which is compact, smooth, and of a fine yellow color, is broken into pieces, and preserved in well-stopped bottles.

Properties. Sulphurated potassa, when properly prepared, is a hard, brittle substance, having a nauseous, alkaline, and bitter taste. Its color is liver-brown, and hence its name of *hepar sulphuris*, or *liver of sulphur*. The color of the surface of a fresh fracture is brownish yellow. It is inodorous when dry, but emits a slightly fetid smell when moist, owing to the extrication of a little sulphuretted hydrogen gas. It is soluble in water, forming an orange-yellow liquid, and exhaling the smell of sulphuretted hydrogen. It is officinally described as in "irregular pieces of a liver-brown color when freshly prepared, turning gradually to greenish yellow or brownish yellow, having a faint, disagreeable odor, a bitter, alkaline, repulsive taste, and an alkaline reaction. Soluble in about 2 parts of water 15° C. (59° F.), with the exception of a small residue; partly soluble in alcohol, the latter leaving undissolved the accompanying impurities. The aqueous solution has an orange-yellow color and exhales the odor of hydrosulphuric acid. The latter is abundantly evolved on the addition of hydrochloric acid, while, at the same time, sulphur is deposited. If a solution of the salt be boiled with an excess of hydrochloric acid, until no more hydrosulphuric acid is given off, the cold filtrate, after being neutralized with soda, yields a white, crystalline precipitate with a saturated solution of bitartrate of sodium. On triturating together 10 parts of Sulphurated Potassa and 12·69 parts of crystallized sulphate of copper with 60 parts of water, and filtering, the filtrate should remain unaffected by hydrosulphuric acid (presence of at least 56 per cent. of true sulphide of potassium)." *U. S.* By exposure to the air it attracts oxygen, and the sulphide of potassium is gradually changed into sulphate of potassium, when the preparation becomes inodorous, and white on the surface. The solution is decomposed by the mineral acids, which extricate sulphuretted hydrogen, and precipitate the excess of sulphur. It is also incompatible with solutions of most of the metals, which are precipitated as sulphides. When boiled with an excess of hydrochloric acid and filtered, it gives a yellow precipitate with platinic chloride, and a white one with chloride of barium. The preparation of the Br. Pharmacopœia yields about three-fourths of its weight to alcohol; the portion dissolved being sulphide of potassium, and the undissolved portion sulphate of potassium.

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* M. Piedagnel states that by mixing the Vienna powder with hydrochlorate of morphine, in the proportion of three parts of the former to one of the latter, a caustic is obtained which will produce an eschar without causing pain. He first mixes them intimately in the dry state, and then with alcohol, chloroform, or water, making a paste, which may be applied by means of adhesive plaster. (*Journ. de Pharm.*, 3e sér., xxxiii. 469.)

Medical Properties and Uses. Sulphurated potassa is a local irritant, and, in small and repeated doses, is said to increase the frequency of the pulse, heat of the skin, and different secretions, especially the mucous. Occasionally it vomits and purges. It acts, moreover, as an antacid, and produces the alterative effects of sulphur. By some it is maintained to be sedative, and directly to reduce the action of the heart. It probably does so, when taken in considerable quantities, by the development of sulphuretted hydrogen. In overdoses it acts, according to Orfila, as a violent poison, corroding the stomach, and depressing the powers of the nervous system. Acetate of lead or acetate of zinc may be used as an antidote; but the latter is preferable, as less likely to act injuriously in an overdose, and having besides emetic properties. The complaints in which it has been most advantageously employed are chronic rheumatism and gout, and various cutaneous affections. It has been given also in painters' colic, asthma, and chronic catarrh, and acquired a short-lived reputation as a remedy in croup, after the publication of the essay to which the prize offered by Napoleon for the best dissertation on that disease was awarded. It is said, in some cases of cancer, to have assisted the palliative operation of hemlock. In consequence of forming insoluble sulphides with the metallic salts, it has been proposed as an antidote for some mineral poisons; but Orfila has shown that it does not prevent their effects. Dissolved in water, it has proved efficacious as an external application in cutaneous diseases, and in scabies is an almost certain remedy. It may be used for this purpose in the form of lotion, bath, or ointment. For a lotion it may be dissolved in water in the proportion of from fifteen to thirty grains to the fluidounce (1–1·95 Gm. to 30 C.c.), and for a bath the same quantity or rather more may be added to a gallon of water. A very small proportion of hydrochloric or sulphuric acid may in either case be added to the solution. The ointment is made by mixing half a drachm of the sulphide with an ounce of lard. The odor is very favorably modified, whether in solution or the state of ointment, by incorporating with it a little oil of anise. The dose of sulphide of potassium is from two to ten grains (0·13–0·65 Gm.), repeated several times a day, and given in pill with liquorice, or in solution with syrup. In infantile croup, from one to four grains (0·065–0·26 Gm.) were given every three or four hours.

Off. Prep. Unguentum Potassæ Sulphuratæ, *Br.*

POTASSII ACETAS. *U. S.* *Acetate of Potassium.*

$KC_2H_3O_2$; 98. (PỌ-TĂS'SỊ-Ī Ạ-CĒ'TĂS.) KO, $C_4H_3O_3$; 98.

Potassæ Acetas, *Br.;* Kali Aceticum. *P.G.;* Sal Diureticum, Acetas Potassicus, s. Kalicus, Terra Foliata Tartari; Acetate of Potash (Potassa), Diuretic Salt; Acétate de Potasse, *Fr.;* Essigsaures Kali, *G.*

"Take of Carbonate of Potash *twenty ounces* [avoirdupois]; Acetic Acid [sp. gr. 1·044] *two pints* [Imperial measure], or *a sufficiency.* To the Acetic Acid, placed in a thin porcelain basin, add gradually the Carbonate of Potash, filter, acidulate, if necessary, with a few additional drops of the Acid, and, having evaporated to dryness, raise the heat cautiously so as to liquefy the product. Allow the basin to cool, and, when the salt has solidified, and while it is still warm, break it in fragments, and put it into stoppered bottles." *Br.*

The substitution in the U. S. Pharmacopœia of 1870* of the bicarbonate of potassium for the carbonate used in the British formula, was an improvement, as it insured a purer product. The form of acid for generating the salt is officinal acetic acid, and a colorless solution is obtained. This is evaporated to dryness, but the British Pharmacopœia directs the dry salt to be melted, so that it may be obtained as a solid mass on cooling. When fusion is resorted to, great care must be taken not to use too high a heat; as otherwise part of the acetic acid will be decomposed, and the resulting salt will be discolored. For drying the acetate of potassium, Dr. Christison considers the heat of a vapor-bath too low, and that of a sand-bath apt to become too high. He therefore recommends the use of a bath of chloride of calcium when operating on a small scale. In conducting the evaporation, it is best to have the solution always slightly acid; for if the alkali predominate, it will react upon the acetic acid when the solution is concentrated, and give rise to discoloration. On account of the liability to discoloration, great care must be observed also to avoid the contamination of iron. Some manufacturers use silver dishes.

Acetate of potassium may also be obtained by double decomposition between acetate of lead and sulphate of potassium. When thus procured, it is very white and pure, but liable to the objection, for medical use, that it may possibly contain a little lead. Another method by double decomposition is between acetate of calcium and sulphate of potassium. "Acetate of Potassium should be kept in well-stopped bottles." *U. S.*

Properties. It is officinally described as in "white, foliaceous, satiny, crystalline masses, or a white granular powder, very deliquescent, odorless, having a warming, mildly pungent and saline taste, and a neutral or faintly alkaline reaction. Soluble in 0·4 part of water and in 2·5 parts of alcohol at 15° C. (59° F.); very soluble in boiling water and in boiling alcohol. When strongly heated, the salt melts; at a higher temperature it evolves empyreumatic, inflammable vapors, and leaves a blackened residue of an alkaline reaction. The aqueous solution yields a white crystalline precipitate on the addition of a saturated solution of bitartrate of sodium. On adding sulphuric acid to the salt and heating, vapor of acetic acid is evolved. A cold solution of the salt is rendered deep red by ferric chloride, and, on boiling, a red precipitate is formed." *U. S.* When unskilfully prepared, it is apt to be more or less colored. Its state of aggregation differs with the manner in which it is procured. As obtained by evaporating the solution to dryness, agreeably to the directions of the U. S. Pharmacopœia of 1870, it is in the form of soft fibrous masses. As usually prepared and found in the shops, it has a foliated texture, which is given to it by fusion and cooling. On account of this appearance, it was formerly called *foliated earth of tartar.* It must always be preserved in well-stopped bottles.

Tests. The most usual impurities contained in it are silica, sulphate, tartrate, and chloride of potassium, and the salts of lead and copper. "A two per cent. aqueous solution of the salt, acidulated with acetic acid, should not yield more than a faint opalescence on the addition of test-solution of nitrate of silver (limit of chloride), or of chloride of barium (limit of sulphate). If a solution of the salt, acidulated with nitric acid, is evaporated to dryness, the residue should be completely soluble in water (abs. of silica), and the solution should remain unaffected by hydrosulphuric acid or sulphide of ammonium (abs. of metals), and should yield no precipitate, or at most only a trace, on the addition of test-solution of carbonate of sodium (limit of alkaline earths). Fragments of the salt added to acetic acid should produce no effervescence (abs. of carbonate), and, when sprinkled upon colorless, concentrated sulphuric acid, should not impart any color to the latter (abs. of organic impurities). If 4·9 Gm. of Acetate of Potassium are ignited until gases cease to be evolved, the alkaline residue should require, for complete neutralization, not less than 49 C.c. of the volumetric solution of oxalic acid (corresponding to at least 98 per cent. of absolute acetate of potassium)." *U. S.* Since the introduction of the cheap method of obtaining pure acetic acid from wood, this salt has scarcely been subjected to adulteration. Acetate of potassium is incompatible with the mineral acids, which expel the acetic acid; with the sulphates of sodium and magnesium; with corrosive sublimate and nitrate of silver; and with several other earthy and metallic salts. This salt exists in the juices of many plants, and especially in the sap of trees, and is the principal source of the carbonate of potassium existing in the ashes of wood. It consists of one atom of potassium 39 combined with one acetic acid group, $C_2H_3O_2$, $59 = 98$ mol. wt.

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* "Take of Acetic Acid *a pint*: Bicarbonate of Potassium *a sufficient quantity.* Add the Bicarbonate gradually to the Acid until it is neutralized; then filter the solution, and evaporate cautiously, by means of a sand-bath, until a dry salt remains." *U. S.* 1870.

Medical Properties and Uses. In doses of from a scruple to a drachm (1·3–3·9 Gm.) acetate of potassium acts as a diuretic, and as a mild cathartic when given to the extent of three or four drachms (11·65–15·5 Gm.). It is employed in dropsies, but is not as useful as the bitartrate. Dr. J. A. Easton, of Glasgow, has found it useful in several skin diseases, such as psoriasis, eczema, and lepra, in doses of half a drachm (1·95 Gm.) three times a day. The alkaline treatment of acute rheumatism originated by Dr. Golding Bird is very well carried out by this salt, half an ounce to an ounce (15·5–31·1 Gm.), in dilute solution, being given during the twenty-four hours. Acetate of potassium, like the other alkaline salts containing a vegetable acid, may be given in the uric acid diathesis, to render the urine alkaline; for the experiments of Wöhler and others have shown that the acid of these salts undergoes decomposition in the system, leaving the alkali free to act as a carbonate. Vegetable salts of potash increase the oxidation of tissue, and are therefore very useful as depuratives when the system is oppressed by retained effete material.

Off. Prep. Tinctura Ferri Acetatis, *Br.*

POTASSII BICARBONAS. *U. S.* *Bicarbonate of Potassium.*

$KHCO_3$; 100. (PỌ-TĂS′SỊ-Ī BĪ-CÄR-BŌ′NĂS.) KO, HO, $2CO_2$; 100.

Potassæ Bicarbonas, *Br.;* Kali Bicarbonicum, *P.G.;* Kali Carbonicum Acidulum; Bicarbonas Potassicus, s. Kalicus; Bicarbonate of Potash; Bicarbonate de Potasse, *Fr.;* Doppelt-Kohlensaures Kali, *G.*

The process of U. S. P. 1870* for this salt was abandoned at the last revision.

"Take of Carbonate of Potash *one pound* [avoirdupois]; Distilled Water *two pints* [Imperial measure]; Hydrochloric Acid *one pint and a half* [Imp. meas.]; Water *three pints* [Imp. meas.]; White Marble, in fragments, *one pound* [avoird.], or *a sufficiency*. Dissolve the Carbonate of Potash in the Distilled Water, and filter the solution into a three-pint bottle, capable of being tightly closed by a cork traversed by a glass tube sufficiently long to pass to the bottom of the fluid. Introduce the Marble into another bottle, in the bottom of which a few small holes have been drilled, and the mouth of which is closed by a cork, also traversed by a glass tube, and place the bottle in a jar, of the same height as itself, but of rather larger diameter. Connect the two glass tubes, air-tight, by a caoutchouc tube. The cork of the bottle containing the Carbonate of Potash having been placed loosely, and that of the bottle containing the Marble tightly, in its mouth, pour into the jar surrounding the latter bottle the Hydrochloric Acid, previously diluted with the Water. When carbonic acid gas has passed through the potash solution for two minutes so as to expel the whole of the air of the apparatus, fix the cork tightly in the neck of the bottle, and let the process go on for a week. At the end of this time numerous crystals of Bicarbonate of Potash will have formed, which are to be removed, shaken with twice their bulk of cold Distilled Water, and, after decantation of the water, drained, and dried on filtering paper by exposure to the air. The mother-liquor, filtered, if necessary, and concentrated to one-half, at a temperature not exceeding 110°, will yield more crystals. The tube immersed in the solution of Carbonate of Potash, which should have as large a diameter as possible, may require the occasional removal of the crystals formed within it, in order that the process may not be interrupted." *Br.*

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* "Take of Carbonate of Potassium *forty-eight troyounces;* Distilled Water *ten pints.* Dissolve the Carbonate of Potassium in the Distilled Water, and pass Carbonic Acid through the solution till it is fully saturated. Then filter the liquid, and evaporate that crystals may form, taking care that the heat does not exceed 160°. Lastly, pour off the supernatant liquid, and dry the crystals upon bibulous paper. Carbonic acid may be obtained from marble by the addition of dilute sulphuric acid." *U. S.* 1870.

In this process the neutral carbonate of potassium is changed into the acid carbonate (bicarbonate), according to the reaction : $K_2CO_3 + CO_2 + H_2O = (KHCO_3)_2$. This change is effected by passing a stream of carbon dioxide gas through a solution of the carbonate, so long as it is absorbed. In the U. S. formula of 1870 the distilled water taken is about three times the weight of the carbonate. As the bicarbonate of potassium requires four times its weight of water to dissolve it, the quantity of water ordered in this formula would seem not to be sufficient to dissolve the new salt; unless it be assumed that the solution becomes heated in consequence of the reaction. The solution of the whole of the new salt is not intended in the British process, which proceeds on the plan of forming crystals of bicarbonate at once in the original solution, without concentration by heat. The filtration directed in the U. S. formula of 1870 is ordered on the presumption that the whole of the bicarbonate formed is dissolved; and is intended to separate silica, which is always deposited during the progress of the saturation, when carbonate of potassium from pearlash is employed. On a small scale the saturation of the carbonate is best conducted in a Wolfe's apparatus of three bottles; the first containing water to wash the carbonic acid gas, the two others, solutions of the carbonate. The bottles should be connected by means of wide tubes, to prevent their being obstructed by the crystals formed. On a large scale the saturation is performed in strong vessels, into which the carbonic acid is driven under pressure. Sulphuric acid is always used by the manufacturing chemist for generating the carbonic acid; but in small operations, hydrochloric acid, diluted with twice its bulk of water, is more convenient; inasmuch as it generates with the marble or chalk a soluble salt (chloride of calcium), which does not interfere with the extrication of the carbonic acid, as the insoluble sulphate of calcium does. In the British process dilute hydrochloric acid is used for the extrication of the carbonic acid, which is effected in a self-regulating generator of that gas.

Mr. Brande gives the following proportions for the preparation of bicarbonate of potassium on a larger scale: "100 lbs. of purified carbonate of potassium are dissolved in 17 gallons of water, which, when saturated with carbonic acid, yield from 35 to 40 lbs. of crystallized bicarbonate; 50 lbs. of carbonate of potassium are then added to the mother-liquor, with a sufficient quantity of water to make up 17 gallons, and the operation repeated." Wöhler states that charcoal, when mixed with the carbonate, facilitates by its porosity, in a remarkable degree, the formation of the bicarbonate. Thus, he found that, when crude tartar was charred in a covered crucible, and the carbonaceous mass, after having been slightly moistened with water, was subjected to a stream of carbonic acid, the gas was absorbed with great rapidity, and heated the mass so considerably as to render it necessary to surround the vessel with cold water, to prevent the decomposition of the bicarbonate formed. When the temperature diminished, the saturation was known to be completed. The mass was lixiviated in the smallest quantity of water at the temperature of from 29·4° C. to 37·7° C. (85° F. to 100° F.), and the solution, after filtration and cooling, deposited the greater part of the bicarbonate in fine crystals. (See *A. J. P.*, x. 82.)

M. Behrens has proposed to obtain bicarbonate of potassium by partially saturating the carbonate, dissolved in an equal weight of water, with acetic acid gradually added. Up to a certain point, no carbonic acid is extricated, and a precipitate takes place of pure bicarbonate of potassium, equal to half the weight of the carbonate employed. After the bicarbonate is separated, the saturation may be completed, and acetate of potassium obtained. (*Journ. de Pharm.*, 3e sér., iv. 464.) L. Pesci dissolves purified caustic potassa in 80 per cent. alcohol, and passes a stream of carbonic acid through the solution until it is saturated. The white precipitate is collected and washed with alcohol; it is free from chlorides and nitrates. (*Ber. d. Chem. Ges.*, 1876, p. 83.)

According to Berzelius, the cheapest method of obtaining the bicarbonate of potassium is to suspend a concentrated solution of the purified carbonate, contained in a stone-ware dish, within a cask, over a liquid undergoing the vinous fermentation. The alkali is thus surrounded by an atmosphere of carbonic acid, and, by absorbing it, crystallizes into bicarbonate in the course of five or six weeks. Distillers and brewers may prepare this salt with great facility by suspending the alkaline solution in the fermenting tun. The salt in powder called *potash sal aëratus*, made principally in New England, is prepared in this way. In composition it is between a carbonate and a bicarbonate.

Properties. Bicarbonate of potassium is officinally described as in "colorless, transparent, monoclinic prisms, permanent in dry air, odorless, having a saline and slightly alkaline taste, and a feebly alkaline reaction. Soluble in 3·2 parts of water at 15° C. (59° F.), and decomposed by boiling water; almost insoluble in alcohol. At a red heat, the salt loses 31 per cent. of its weight. The aqueous solution, on being heated, disengages carbonic acid gas, and finally contains carbonate of potassium. It effervesces on the addition of acids, and, with tartaric acid in excess, it produces a white, crystalline precipitate. When supersaturated with nitric acid, the aqueous solution should yield no precipitate with test-solution of chloride of barium (abs. of sulphate), and at most only a slight cloudiness with test-solution of nitrate of silver (limit of chloride). If 1 Gm. of the salt be dissolved in 200 C.c. of cold water, and the solution be carefully mixed, without agitation, with a solution of 1·22 Gm. of chloride of barium in 200 C.c. of cold water, no precipitate or opalescence should make its appearance within ten minutes (limit of carbonate). To neutralize 5·0 Gm. of Bicarbonate of Potassium should require 50 C.c. of the volumetric solution of oxalic acid (corresponding to 100 per cent. of pure Bicarbonate of Potassium)." *U. S.* When heated to redness it loses carbonic acid and returns to the state of carbonate, which, when thus obtained, is free from silica, and otherwise very pure. This method was adopted in the U. S. Pharmacopœia of 1870 for obtaining the pure carbonate. When a perfect bicarbonate, its solution, unless heated, does not precipitate a solution of sulphate of magnesium. This negative indication, however, cannot be depended upon as showing the absence of carbonate; for, according to Dr. Christison, no precipitate will be occasioned even when 50 per cent. of this impurity is present. Bicarbonate of potassium does not decompose calomel. When dissolved in 40 parts of water, it produces a white haze merely with a solution of corrosive sublimate; but if it contain so much as a hundredth part of carbonate, a brick-red precipitate is immediately produced. (*Christison.*) Another way of detecting the presence of carbonate is to add starch sugar to a heated solution of the suspected bicarbonate. If any carbonate be present, the mixture turns yellow or brown. (*Chevallier.*) The officinal test (Hirsch's) given above is, however, more reliable, and admits but traces of carbonate. Bicarbonate of potassium consists of one atom of potassium 39, and one of hydrogen 1, in combination with one carbonic acid group, CO_3, 60 = 100. "Fifty grains exposed to a low red heat, leave 34·5 grains of a white residue, which requires for exact saturation 500 grain-measures of the *volumetric solution of oxalic acid;*" and "20 grains neutralize 14 grains of citric acid, or 15 grains of tartaric acid." *Br.*

Medical Properties. The medical properties of this salt are similar to those of the carbonate, to which it is preferable from its milder taste, and greater acceptability to the stomach. The dose is from twenty grains to a drachm (1·3–3·9 Gm.).

It is, however, much more disagreeable than the vegetable salts, which are now universally used when a decided effect upon the system is desired; the bicarbonate and carbonate being almost exclusively employed as antacids.

Off. Prep. Liquor Magnesii Citratis, *U. S.;* Liquor Potassæ, *U. S.;* Liquor Potassii Arsenitis, *U. S.;* Liquor Potassii Citratis, *U. S.;* Liquor Potassæ Effervescens, *Br.;* Mistura Potassii Citratis, *U. S.*

POTASSII BICHROMAS. *U. S.* *Bichromate of Potassium.*

$K_2 Cr_2 O_7$; 294·8. (PO̤-TĂS′SI̤-Ī BĪ-CHRŌ′MĂS.) KO, $2CrO_3$; 147·4.

Potassæ Bichromas, *Br.;* Red Chromate of Potash (Potassa); Kali Bichromicum, Kali Chromicum Rubrum; Bichrômate de Potasse, *Fr.;* Zweifach Chromsaures Kali, Doppeltchromsaures-Kali, *G.*

This salt is most conveniently prepared from the neutral or yellow *chromate of potassium*, by acidulating its solution with sulphuric acid, and setting it aside for a day or two. In the action which follows we may suppose two reactions to take place: $(K_2CrO_4)_2 + H_2SO_4 = K_2SO_4 + (KHCrO_4)_2$, $(KHCrO_4)_2 = K_2Cr_2O_7 + H_2O$. Here the sulphuric acid, taking half the base from the two molecules of neutral chromate, changes them into two molecules of an acid chromate. This, however, is unstable, and the two molecules condense to form one of the dichromate with the elimination of one molecule of water. The yellow chromate is obtained by igniting four parts of powdered chrome-iron ore (FeO,Cr_2O_3) with one part of nitre, and lixiviating the resulting mass with water. The solution, by evaporation, yields the yellow salt in crystals. In this process, the nitric acid of the nitre furnishes oxygen to convert the sesquioxide of chromium into chromic acid, which then unites with the potassa of the same salt. The iron, in the mean time, is sesquioxidized and rendered insoluble. Sometimes impure carbonate of potassium (pearlash) is substituted for part of the nitre in the calcination. Omitting the nitre entirely, Stromeyer, of Norway, in performing the ignition, has used lime along with the pearlash, with economical results. When lime is employed, chromate of calcium is formed, which is extracted by lixiviation, and decomposed by a soluble salt of potassium. When desired, the bichromate may be obtained directly from the solution of chromate of potassium, derived from the treatment of the ore by acidulating it with sulphuric acid, without first crystallizing it.

Bichromate of potassium is in the form of "large, orange-red, transparent, four-sided, tabular prisms, permanent in the air, odorless, having a bitter, disagreeable, metallic taste, and an acid reaction. Soluble in 10 parts of water at 15° C. (59° F.), and in 1·5 parts of boiling water; insoluble in alcohol. The salt fuses, below a red heat, forming a dark brown liquid, without loss of weight. At a white heat it evolves oxygen, and leaves a residue of neutral chromate of potassium and green chromic oxide, from which the former may be washed out by water. The aqueous solution yields a white, crystalline precipitate on the addition of a saturated solution of bitartrate of sodium. On heating the powdered salt with hydrochloric acid, chlorine vapor is given off. A one per cent. solution of the salt, acidulated with nitric acid, should not be precipitated nor be rendered cloudy on the addition of test-solution of chloride of barium (abs. of sulphate)." *U. S.*

In the year 1880 there were received at the port of New York 5885 packages of bichromate of potash, valued at $418,850, while in the year 1881 there were entered at the same port only 1501 packages, valued at $118,445.

Medical Properties. Bichromate of potassium is an irritant caustic. It was first used internally in 1850, by M. Robin, as an alterative in secondary syphilis, in doses of one-fifth of a grain (0·012 Gm.), given in pill form; and Prof. Heyfelder, of Erlangen, and M. Vicente afterwards employed it in the same disease with asserted encouraging results. It is said to cause salivation, but is at present never used internally. Its saturated solution was recommended, in 1827, by Dr. Cumin, as a caustic application to tubercular elevations, excrescences, and warts, and in 1850 by M. Puche in syphilitic vegetations. It causes the morbid parts to shrivel and fall off. Dissolved in water, in the proportion of five grains gradually increased to a drachm to the fluidounce, it has been found useful in affections of the mucous membranes requiring astringents; and a solution has also been used with advantage for correcting the fetor of sloughing wounds.*

In overdoses it operates as a violent irritative and corrosive poison, producing severe vomiting, frequent dark hemorrhagic dejections, violent abdominal pains, etc. More than one fatal case is on record. Soap, an alkaline carbonate, or magnesia, is the antidote. Bichromate of potassium is manufactured largely for the use of calico-printers. The workmen engaged in making it are liable to painful ulcerations of the hands; and, in consequence of the acrid vapors evolved, violent irritation of the nostrils is apt to be experienced, with severe pricking sensations and excessive sneezing, followed in time by destruction of the mucous membrane and even the septum itself. It is asserted that this result may be avoided by breathing through the mouth exclusively; the profuse secretion of saliva produced carrying off the poisonous particles. (*B. and F. Med.-Chir. Rev.*, Oct. 1863.) For a full account of the manufacture of the chromium salts, for dyes and pigments, see *P. J. Tr.* (xv. 32).

Pharm. Uses. A solution of this salt, under the title of *volumetric solution of bichromate of potassium*, is used as a test in the U. S. and British Pharmacopœias.

POTASSII BITARTRAS. *U. S.* *Bitartrate of Potassium.* [*Cream of Tartar.*]

$KHC_4H_4O_6$; 188. (PỌ-TĂS'SỊ-Ī BĪ-TÄR'TRĂS.) KO, HO, $C_8H_4O_{10}$; 188.

Potassæ Tartras Acida, *Br.;* Acid Tartrate of Potash, Supertartrate of Potassa, Crystals of Tartar, Cream of Tartar; Tartarus Depuratus, *P.G.;* Kali Bitartaricum, Bitartras Potassicus, s. Kalicus, Cremor Tartari; Tartrate acide de Potasse, Crême de Tartre, Bitartrate de Potasse, Pierre de Vin, *Fr.;* Doppeltweinsaures Kali, Weinsteinrahm, Weinstein, *G.;* Cremore di Tartaro, *It.;* Cremor de Tartaro, *Sp.*

During the fermentation of wines, especially those that are tart, a peculiar matter is deposited in the casks, forming a crystalline crust, called *crude tartar*, or *argol.* That deposited from red wines is of a reddish color, and called *red tartar;* while that derived from white wines is of a dirty-white color, and denominated *white tartar.* Both kinds consist of potassa, united with an excess of tartaric acid, forming acid-tartrate of potassium, rendered impure by tartrate of calcium, more or less coloring matter, and other matters which are deposited during the clarification of the wine. The deposition of the tartar is thus explained. The acid-tartrate exists naturally in the juice of the grape, held in solution by saccharine matter. When the juice is submitted to fermentation in the process for converting it into wine, the sugar disappears, and is replaced by alcohol, in which the salt is insoluble. It is from this substance that acid-tartrate of potassium is obtained by a process of purification. Although the amount of crude tartar produced in the United States is small, compared with the quantity imported from Europe, yet the amount from American wines is rapidly increasing, whilst the importation of cream of tartar has practically ceased (1882). Ten years ago over 6,000,000 pounds were imported annually. The importation of half-refined cream of tartar has been reduced rapidly from 2,000,000 pounds to 300,000 pounds annually.

The process for purifying crude tartar is founded upon the greater solubility of acid-tartrate of potassium in hot than in cold water. The tartar, previously pulverized, is boiled with water in copper boilers. The solution, when saturated, is transferred to earthen pans, where it deposits on cooling a crystalline layer, nearly free from color. This is redissolved in boiling water; and the solution, having been mixed with 4 or 5 per cent. of pipe-clay, is evaporated to a pellicle. The clay precipitates with the coloring matter; and the clear solution, as it cools, deposits white crystals in crusts, which, upon being exposed to the air on linen for several days, acquire an increased degree of whiteness. These constitute the *crystals of tartar* of pharmacy. The salt, as met with in the shops, is generally, for greater convenience, in the form of powder, to which the name *cream of tartar* properly belongs.

Wittstein proposes to free cream of tartar from lime by dilute hydrochloric acid, which dissolves the lime preferably, and, if not used in excess, will take up very little of the potassa salt. For remarks on this subject by Tenner, of Berne, see *A. J. P.*, Jan. 1862, p. 39.

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* *Mueller's Fluid* is used for preserving anatomical specimens. It consists of 2 to 2·5 parts of potassium bichromate, 1 part of sodium sulphate, and 100 parts of water.

Properties. Bitartrate of potassium occurs in commerce in white crystalline crusts, or masses of aggregated crystals, which are always powdered before being sold to pharmacists. It is officinally described as in "colorless or slightly opaque, rhombic crystals, or a white, somewhat gritty powder, permanent in the air, odorless, having a pleasant, acidulous taste, and an acid reaction. Soluble in 210 parts of water at 15° C. (59° F.), and in 15 parts of boiling water; very slightly soluble in alcohol. When heated, the salt chars and evolves inflammable vapors having the odor of burnt sugar. On moderate ignition, it leaves a blackened residue of an alkaline reaction, which strongly effervesces with acids. The salt is dissolved by warm solution of potassa, and is again precipitated on the addition of hydrochloric acid. Its aqueous solution, rendered neutral by potassa, produces, with test-solution of nitrate of silver, a white precipitate, becoming black by boiling." *U. S.* With salifiable bases which form soluble tartrates, it gives rise to double salts, consisting of neutral tartrate of potassium, and the tartrate of the base added. Several of these are important medicines. Cream of tartar, though sparingly soluble in water, becomes abundantly so by the addition of borax or boracic acid.* (See *Sodii Boras.*)

"The aqueous solution of the salt, acidulated with nitric acid, should not be rendered turbid by test-solution of chloride of barium (abs. of sulphate), or nitrate of silver (abs. of chloride). A solution of the salt in water of ammonia should remain unaffected by sulphide of ammonium (abs. of metals). If 1 Gm. of Bitartrate of Potassium be digested with 5 C.c. of diluted acetic acid for half an hour, then diluted with distilled water to 500 C.c., the solution agitated and filtered, and 25 C.c. of the filtrate treated with 5 C.c. of test-solution of oxalate of ammonium, the liquid should not become cloudy in less than one minute, nor distinctly turbid in less than one minute and a half (absence of more than 6 per cent. of tartrate of calcium.)" *U. S.*

The cream of tartar of commerce is not pure bitartrate of potassium. It usually contains from 2 to 7 per cent. of tartrate of calcium, an amount admissible in samples for medicinal use. But it sometimes contains from 8 to 13 per cent. of tartrate of calcium. It is often purposely mixed with various substances, such as sand, clay, gypsum, flour, chalk, alum, and sulphate of potassium. Sand, clay, and gypsum may be detected by their insolubility in a hot solution of potassa; flour, by striking a blue color with iodine; chalk, by its effervescing with dilute acids; alum (an unlikely sophistication), by its astringent taste; and any soluble sulphate, by causing a precipitate with chloride of barium, not entirely soluble in nitric acid. The action of the last-mentioned test is explained by the fact that the tartrate of barium is soluble and the sulphate insoluble in nitric acid. Another sophistication of cream of tartar is said to be with sugar of milk, but this cannot often happen, because of the cost of the latter. The best security against fraud is to purchase the crystals and have them powdered. According to the Br. Pharmacopœia, 188 grains ignited till gas ceases to be evolved, leave an alkaline residue (carbonate of potassium) which requires for exact neutralization 1000 grain-measures of the *volumetric solution of oxalic acid.* This Pharmacopœia admits a slight impurity of lime, probably in the form of tartrate.

Composition. Cream of tartar consists of one molecule of tartaric acid, $C_4H_4O_6.H_2$, in which one of the two replaceable hydrogen atoms has been replaced by an atom of potassium. Its mol. wt. is therefore $39 + 1 + 148 = 188$.

Medical Properties and Uses. Bitartrate of potassium is cathartic, diuretic, and refrigerant. In small doses it acts as a cooling aperient and in large ones as a hydragogue cathartic, producing copious watery stools; and, from this latter property, as well as its tendency to excite the action of the kidneys, it is much used in dropsical affections. It is frequently prescribed in combination with senna, sulphur, or jalap. (See *Confectio Sulphuris* and *Pulvis Jalapæ Compositus.*) Its solution in boiling water, sweetened with sugar and allowed to cool, forms an acid, not unpleasant, refrigerant drink, advantageously used in some febrile affections, and frequently employed as a domestic remedy. The beverage called *imperial* (*potus imperialis*) is a drink of this kind, made by dissolving half an ounce of the salt in three pints of boiling water, and adding to the solution four ounces of white sugar, and half an ounce of fresh lemon-peel. *Cream of tartar whey* is prepared by adding about two drachms of the bitartrate to a pint of milk. It may be given, diluted with water, in dropsical complaints. The dose of cream of tartar is a drachm or two (3·9–7·8 Gm.) as an aperient; and from half an ounce to an ounce (15·5–31·1 Gm.) as a hydragogue cathartic, mixed with molasses, or suspended in water. As a diuretic in dropsical cases, it may be given in the dose of a drachm and a half or two drachms (5·9–7·8 Gm.), several times a day. It is believed to escape from the system unchanged, and hence is not available when an alkaline influence upon the blood or renal secretion is desired.

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* *Soluble Tartar. Tartarus boraxatus, s. Kali tartaricum boraxatum, s. Cremor tartari solubilis.* Borax, 2 parts; distilled water, 20 parts. Dissolve and add 5 parts purified cream of tartar. Agitate to dissolve, filter, evaporate to dryness, and powder.

In pharmacy, cream of tartar is employed to obtain the neutral tartrate of potassium (soluble tartar), tartrate of potassium and sodium (Rochelle salt), tartrate of antimony and potassium (tartar emetic), and tartrate of iron and potassium (tartarized iron). Deflagrated with nitre, or incinerated alone, it is converted into a pure form of carbonate of potassium, called salt of tartar. In the laboratory it is used to procure potassa in a pure state, and for making black and white flux. *Black flux* is prepared by deflagrating cream of tartar with half its weight of nitre; and *white flux*, by deflagrating it with twice its weight of the same salt.

Off. Prep. Acidum Tartaricum, *Br.;* Antimonii et Potassii Tartras, *U. S.;* Antimonium Tartaratum, *Br.;* Confectio Sulphuris, *Br.;* Ferri et Potassii Tartras, *U. S.;* Ferrum Tartaratum, *Br.;* Potassii et Sodii Tartras, *U.S.;* Potassæ Tartras, *Br.;* Potassii Tartras, *U.S.;* Pulvis Jalapæ Compositus; Soda Tartarata, *Br.*

POTASSII BROMIDUM. *U. S., Br.* *Bromide of Potassium.*

KBr; 118·8. (PỌ-TĂS′SỊ-Ī BRŌ′MỊ-DŬM.) KBr; 118·8.)

Kalium Bromatum, *P.G.;* Bromuretum Potassicum, s. Kalicum; Bromure de Potassium, *Fr.;* Bromkalium, *G.*

"Take of Solution of Potash *two pints* [Imperial measure]; Bromine *four fluidounces* [Imp. meas.], or *a sufficiency;* Wood Charcoal, in fine powder, *two ounces* [avoirdupois]; Boiling Distilled Water *one pint and a half* [Imp. meas.]. Put the Solution of Potash into a glass or porcelain vessel, and add the Bromine in successive portions, with constant agitation, until the mixture has acquired a permanent brown tint. Evaporate to dryness; reduce the residue to a fine powder, and mix this intimately with the Charcoal. Throw the mixture in small quantities at a time into a red-hot iron crucible, and, when the whole has been brought to a state of fusion, remove the crucible from the fire and pour out its contents. When the fused mass has cooled dissolve it in the Water, filter the solution through paper, and set it aside to crystallize. Drain the crystals, and dry them with a gentle heat. More crystals may be obtained by evaporating the mother-liquor and cooling. The salt should be kept in a stoppered bottle." *Br.*

In the first step of the U. S. process of 1870,[*] a solution of ferrous bromide was formed; and this, by the addition of the solution of carbonate of potassium, was decomposed so as to produce ferrous carbonate, which precipitated, and bromide of potassium, which remained in solution. By straining, the precipitated carbonate was separated, and from the strained liquor bromide of potassium was obtained by due evaporation. In the Br. process, by reaction between potassa and bromine, the bromide and bromate of potassium are produced in solution, and, having been obtained dry by evaporation, are exposed with the powder of charcoal to a red heat, whereby the bromate of potassium is converted into bromide of potassium by the separation of its oxygen. The remainder of the process consists in obtaining the bromide in crystals by solution in boiling water, which deposits it on cooling. "Bromide of Potassium should be kept in well-stopped bottles." *U. S.*

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[*] "Take of Bromine *two troyounces;* Iron, in the form of Filings, *a troyounce;* Pure Carbonate of Potassium *two troyounces and sixty grains;* Distilled Water *four pints.* Add the Iron, and afterwards the Bromine, to a pint and a half of the Distilled Water, stirring the mixture frequently with a glass rod for half an hour. Apply a gentle heat, and, when the liquid assumes a greenish color, add gradually the Pure Carbonate of Potassium, previously dissolved in a pint and a half of the Distilled Water, until it ceases to produce a precipitate. Continue the heat for half an hour, and then filter. Wash the precipitate with the remainder of the Distilled Water, boiling hot, and again filter. Mix the filtered liquids, and evaporate that crystals may form. Lastly, pour off the mother-water, and, having dried the crystals on bibulous paper, keep them in a well-stopped bottle." *U. S.* 1870.

Properties. Bromide of potassium is in "colorless, translucent, cubical crystals, permanent in dry air, odorless, having a pungent, saline taste, and a neutral reaction. Soluble in 1·6 parts of water and in 200 parts of alcohol at 15° C. (59° F.); in 1 part of boiling water, and in 16 parts of boiling alcohol. The commercial salt generally appears in white, opaque or semi-transparent crystals, having a faintly alkaline reaction; but single crystals laid upon moistened red litmus paper should not at once produce a violet-blue stain (abs. of more than about 0·1 per cent. of alkali). At a dull red heat the salt melts without losing weight. At a full red heat it is slowly volatilized without decomposition. The aqueous solution of the salt yields a white, crystalline precipitate on the addition of a saturated solution of bitartrate of sodium. If disulphide of carbon be poured into a solution of the salt, then chlorine water added drop by drop, and the whole agitated, the disulphide will acquire a yellow or yellowish brown color without a violet tint." *U. S.* According to Mr. Chas. D. Chase, the commercial salt often is decidedly alkaline, and will precipitate the alkaloids from the solution of their salts; a serious mishap from such cause is very conceivable.

Tests. To determine the percentage of chloride in an impure bromide the process of M. Baudrimont, as improved by M. Falières, may be used. It is founded upon the fact that chlorides precipitate more silver than the bromides; for an explanation of the rationale of the steps of the process the reader is referred to *P. J. Tr.*, 1872, p. 542. Prepare a titrated solution of 0·852 gramme of nitrate of silver in 100 cubic centimetres of distilled water. It is necessary, by means of ferric chloride, salts of barium, and strong sulphuric acid in excess, to insure that there are present no other salts, such as iodide, carbonate or sulphate of potassium, or nitrate of sodium, which shall interfere with the results. Then dissolve one grain of the bromide in thirty or forty grammes of water in a stoppered bottle, and add 1·427 grammes of nitrate of silver in solution. When the precipitate has subsided, add, drop by drop, from a Gay-Lussac burette the titrated solution. If the bromide be pure, no precipitate forms; otherwise the number of cubic centimetres required to completely precipitate it equals the percentage of the chloride. An iodide of an alkaline metal may be detected by adding to the solution of the bromide the chloride of palladium, which will precipitate all the iodine in the form of iodide of palladium, while the bromide of that metal will remain in solution. (*Ibid.*) According to MM. Bobieure and Herbelin, bromide of potassium containing iodide may be purified by boiling with bromine water and evaporating, the liberated iodine and the excess of bromine being driven off during the evaporation. (*Journ. de Pharm.*, 4e sér., x. 166.) The U. S. Pharmacopœia permits the presence of 3 per cent. of chloride, in potassium bromide, but insists on the absence of iodide and bromate. "If diluted sulphuric acid be dropped upon crushed crystals of the salt, they should not at once assume a yellow color (abs. of bromate). If 1 Gm. of the salt be dissolved in 10 C.c. of water, some gelatinized starch added, and then a few drops of chlorine water be carefully poured on top, no blue zone should make its appearance at the line of contact of the two liquids (abs. of iodide). On adding to 1 Gm. of the salt, dissolved in 20 C.c. of water, 5 or 6 drops of test-solution of nitrate of barium, no immediate cloudiness or precipitate should make its appearance (limit of sulphate). If 3 Gm. of the well-dried salt be dissolved in distilled water to make 100 C.c., and 10 C.c. of this solution be treated with a few drops of test-solution of bichromate of potassium, and then volumetric solution of nitrate of silver be added, not more than 25·7 C.c. of the latter should be consumed before the red color ceases to disappear on stirring (abs. of more than 3 per cent. of chloride). 1 Gm. of the powdered and dried salt, when completely precipitated by nitrate of silver, yields, if perfectly pure, 1·579 Gm. of dry bromide of silver." *U. S.*

Medical Properties. When given to either cold- or warm-blooded animals in repeated doses of sufficient amount, bromide of potassium produces a condition of universal depression, with failure of the circulation, progressively increasing paralysis, lowering of temperature, and finally death from asphyxia or exhaustion. In man the remedy causes similar results—the series of phenomena being known as *bromism.* The symptoms are muscular weakness, general mental and bodily sluggishness, loss of memory, often marked sleepiness, depression of spirits deepening into complete apathy, lowering of temperature, and finally a universal depression of function, the patient lying in bed scarcely more than a feeble automaton. Fetor of breath is usually well marked, and an eruption of acne may be the first indication of the constitutional action of the drug. In some cases the effects of the drug upon the skin are most marked, and the pustules, under its continuous exhibition, become furuncular or go on to ulceration. It seems to be proved that the bromide affects the whole nervous system, but that the portions most susceptible to its influence are those tissues of the spinal cord whose function it is to receive the impulse from without and the peripheral ends of the afferent or sensitive nerves. Its action upon the circulation has not been clearly determined, but it is somewhat probable that in small doses it contracts, in large ones relaxes, the capillaries; in sufficient amount it lessens the force of the heart's beats. It is probably eliminated with all the secretions, having been found in the sweat, saliva, urine, and intestinal mucus. When taken largely for some time it accumulates in the system, and has been found in the urine a month after the ingestion of the last dose. It has been employed in almost all diseases to which human flesh is heir. But experience has shown that it is chiefly valuable as a means of quieting non-inflammatory excitement of the reflex centres of the cord, of the peripheral afferent nerves, of the genital function, and of the cerebrum. It is especially valuable in epilepsy, very often affording relief and in a few cases bringing about a cure. It is necessary to maintain its decided action for years. In various forms of convulsions, such as hysterical, infantile, and puerperal, it is often of great service. In tetanus and strychnine poisoning, if given with sufficient boldness, it seems to be an excellent remedy. In general nervous excitement,—or unrest,—in delirium tremens, in nymphomania, satyriasis, and other forms of genital irritation without inflammation, and in semi-impotence from over-irritability of the sexual organs, it is of great service. Given with opium it will often avert the secondary nausea which that narcotic produces in some persons. In reflex vomiting, as that of pregnancy, it is often of advantage. According to Dr. J. T. Rothrock, it is of service in preventing the so-called urethral fever produced in some very susceptible males by the passage of a catheter or bougie. The bromide of potassium was formerly used as an alterative and resolvent in syphilis, scrofula, bronchocele, and other affections; but this employment of it has passed entirely out of vogue.

Bromide of potassium may be given, dissolved in water, in doses of twenty grains to a drachm (1·3–3·9 Gm.) three times a day. In some cases much larger amounts are required. In severe strychnine poisoning a half-ounce (15·5 Gm.), properly diluted, may be exhibited at once; and in tetanus there is little use in giving less than the same amount in the twenty-hour hours. The *ointment* may be made by mixing from a scruple to two drachms (1·3–7·8 Gm.) of the bromide with an ounce (31·1 Gm.) of lard. Of this from half a drachm to a drachm (1·95–3·9 Gm.) may be rubbed on a scrofulous tumor, or other part where its local action is desired, once in twenty-four hours. Sometimes bromine is added to this ointment in the proportion of thirty minims to the ounce of lard.

POTASSII CARBONAS. *U. S.* *Carbonate of Potassium.*

$(K_2CO_3)_2 . 3H_2O$; 330. (PỌ-TĂS′SỊ-Ī CĂR-BŌ′NĂS.) $2(KO, CO_2), 3HO$; 165.

Potassæ Carbonas, *Br.;* Carbonate of Potassa from Pearlash; Kali Carbonicum, Carbonas Potassicus, s. Kalicus; Carbonate de Potasse, *Fr.;* Kohlensaureskali, *G.*

The British Pharmacopœia defines this salt as "KO,CO_2, with about 16 per cent. of water of crystallization," and states that it is "obtained from common commercial pearl-ash, by treating it with its own weight of distilled water and evaporating the solution to dryness, while kept briskly agitated."

The U. S. Pharmacopœia has omitted to give a process for this salt; that of the U. S. P. 1870 will be found in the foot-note.*

The object of the process is to purify the impure carbonate of potassium, or pearlash. This generally contains certain insoluble impurities, as well as small portions of sulphate, silicate, and chloride of potassium, as explained under another head. (See *Potassii Carbonas Impura.*) By dissolving it in a due proportion of water, and filtering the solution, the insoluble impurities are disposed of, as well as the greater part of the foreign salts, which, being much less soluble than the carbonate of potassium, are excluded by the superior affinity of this salt for the water. The proper way of conducting the purification is to mix the impure carbonate with an equal weight of *cold water*, and to allow the mixture to stand for a day or two, stirring it frequently to promote the action of the water. The clear liquor obtained by decantation or filtration is then evaporated to dryness. The former officinal process was conducted very much in this way, cold water being employed, and about equal weights of alkali and water being used. The prolonged contact of the water with the salt, and the occasional stirring of the mixture, formerly ordered by the Dublin College, were useful directions. In no case should the undissolved residue be washed with a fresh portion of water, as by such a proceeding the foreign salts, which it is the object of the process to separate, would be dissolved. Iron vessels are directed, because this metal is not acted on by the alkali, while glass is attacked by it. In granulating the salt by stirring, it is better, when the solution is brought nearly to dryness, to keep it on the fire at a reduced heat until the process is finished, than to remove it the moment it thickens.

According to Berzelius, a more productive process for purifying pearlash, though the resulting salt is not so pure as when obtained in the way just described, is to dissolve the pearlash in more than its weight of water, to evaporate the solution till it has the sp. gr. 1·52, and then to put it in a cool place, that the foreign salts, principally sulphate and chloride of potassium, may crystallize. The solution is then decanted, and evaporated to dryness.

To get rid of the silica, Rieckher proposes to evaporate the solution, exempt from sulphate, to dryness, to moisten the residue with solution of carbonate of ammonium, and again evaporate. The silica separates, and passes into the insoluble state at the temperature necessary for evaporation. By again dissolving and evaporating, the carbonate is obtained free from this impurity. (*Chem. Centralb.*, 1863, p. 158.) "Carbonate of Potassium should be kept in well-stopped bottles." *U. S.*

Properties. "A white, crystalline or granular powder, very deliquescent, odorless, having a strongly alkaline taste, and an alkaline reaction. Soluble in 1 part of water at 15° C. (59°. F.), and in 0·7 part of boiling water; insoluble in alcohol. At a red heat the salt loses between 15 and 18 per cent. of its weight, and at a bright red heat it melts. The aqueous solution strongly effervesces on the addition of acids, and, with an excess of tartaric acid, produces a white, crystalline precipitate." *U. S.* It is extremely deliquescent; and hence a portion of it, exposed to the air for some time, attracts so much water as to dissolve completely into an oily liquid, called by the older chemists *oleum tartari per deliquium.* On account of this property, carbonate of potassium should be kept in bottles with accurately-ground stoppers. The usual impurities are earthy matters, sulphate and chloride of potassium, and silica in the state of silicate of potassium.

Tests. "If a solution of the salt be supersaturated with nitric acid, and evaporated to dryness, a residue remains which should be soluble in water without leaving more than a trifling amount of insoluble matter (silica, etc.). This solution should not produce more than a cloudiness on the addition of test-solution of carbonate of sodium (limit of alkaline earths). An aqueous solution of the salt, supersaturated with nitric acid, should not be rendered more than slightly turbid by test-solution of nitrate of silver (limit of chloride) or of chloride of barium (limit of sulphate). To neutralize

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* "Take of Impure Carbonate of Potassium [pearlash] *thirty-six troyounces;* Water *two pints and a half.* Dissolve the Impure Carbonate in the Water, and filter the solution; then pour it into an iron vessel, and evaporate over a gentle fire until it thickens. Lastly, remove it from the fire, and stir constantly with an iron spatula so as to form a granular salt." *U. S.* 1870.

3·45 Gm. of Carbonate of Potassium should require not less than 40·5 C.c. of the volumetric solution of oxalic acid (corresponding to at least 81 per cent. of pure, anhydrous carbonate of potassium)." *U. S.* Its aqueous solution, saturated by an acid, slowly deposits a slight flocculent precipitate of hydrated silica. It is incompatible with acids and acidulous salts, chloride and acetate of ammonium, lime-water, chloride of calcium, sulphate of magnesium, alum, tartar emetic, nitrate of silver, ammoniated copper and ammoniated iron, sulphate of iron, tincture of chloride of iron, calomel and corrosive sublimate, acetate and subacetate of lead, and sulphate of zinc. It is not decomposed by tartrate of iron and potassium. According to the Br. Pharmacopœia, "83 grains require for neutralization at least 980 grain-measures of the *volumetric solution of oxalic acid;*" and "20 grains neutralize 17 grains of citric acid, or 18 grains of tartaric acid." A solution of the salt, on exposure to the air, or on the addition of an acid, deposits flocculi consisting of hydrated silica, resulting from the decomposition of potassium silicate, which is always present as an impurity. The spontaneous deposition of silica is owing to the absorption of carbonic acid.

Composition. Carbonate of potassium, after exposure to a red heat, is anhydrous, consisting of two atoms of potassium 78, and one carbonic acid group, CO_3, $60 = 138$. Obtained by the officinal formulas, it is hydrate, containing two mols. of carbonate and three of water, making thus a mol. wt. of 138×2 or $276 + 18 \times 3$ or $54 = 330$. When exposed to the air, carbonate of potassium absorbs sufficient water, before losing its solid form, to give it three mols.; with more it begins to deliquesce. (Dr. Pohl, *A. J. P.*, 1861, p. 532.)

Medical Properties and Uses. Purified pearlash is the form of carbonate of potassium usually employed in this country, where it is frequently, though incorrectly, called *salt of tartar;* the latter name being strictly applicable to the purer carbonate obtained by decomposing cream of tartar. It is occasionally used as an antacid in dyspepsia, a diuretic in dropsy, and an antilithic in gravel attended with red deposits in the urine; but the purpose to which it was most commonly applied in former years was the formation of the *neutral mixture* and *effervescing draught.* It is also used with advantage in some cases of jaundice, in which it probably operates by entering the circulation, and directly exciting the hepatic function. The dose is from ten to thirty grains (0·65–1·95 Gm.), given in some aromatic water sweetened with sugar. In large quantities it acts as a corrosive poison, and is capable of producing death in a few hours; but an adult female, who swallowed about three ounces in very concentrated solution, ultimately recovered, after a long and very painful convalescence. (Dr. Espagne, *Arch. Gén.*, Fév. 1867, p. 233.) The antidotes are the fixed oils and the vegetable acids.

As a local remedy in cutaneous affections, carbonate of potassium is used in the form of bath, of lotion, and of ointment. From eight to sixteen ounces may be used for a single bath, the quantity being gradually increased. Lotions may be made by dissolving two or three drachms in a pint of water; and ointments, by rubbing from ten grains to a drachm with an ounce of lard.

Off. Prep. Decoctum Aloes Compositum, *Br.;* Enema Aloes, *Br.;* Liquor Arsenicalis, *Br.;* Liquor Potassæ, *Br.;* Mistura Ferri Composita; Potassa Sulphurata, *Br.;* Potassæ Acetas, *Br.;* Potassæ Bicarbonas, *Br.;* Potassæ Chloras, Potassæ Citras, *Br.;* Potassæ Tartras, *Br.;* Unguentum Sulphuris Alkalinum, *U. S.*

POTASSII CARBONAS IMPURA. *U. S.* 1870. *Impure Carbonate of Potassium.*

(PỌ-TĂS′SỊ-Ī CÄR-BŌ′NĂS ỊM-PŪ′RẠ.)

Pearlash, Pearlashes, Impure Potassa; Potasse du Commerce, *Fr.;* Rohe Pottasche, *G.;* Potasch, *Dutch;* Potaske, *Dan.;* Potaska, *Swed.;* Potassa del Commercio, *It.;* Cenizas claveladas, *Sp.*

The alkali potassa is the hydrate of the metal potassium. (See *Potassium.*) It exists in various states of purity. In its most impure state, it is the common potash of commerce. This, subjected to calcination, is rendered purer, and is then called *pearlash*, the form of the alkali designated by the name at the head of this article.

Natural State and Preparation. Potash and pearlash of commerce are procured largely from the ashes of wood by lixiviation, and the subsequent evaporation of the solution obtained. The alkali exists in the wood, principally in the state of acetate, and, being of a fixed and incombustible nature, is left behind after the incineration. The wood is burnt on the ground, in a place sheltered from the wind. The ashes consist of a soluble and an insoluble portion. The soluble part is made up of carbonate of potassium, together with sulphate, phosphate, and silicate of potassium, and the chlorides of potassium and sodium; the insoluble portion, of carbonate and phosphate of calcium, aluminium, oxidized iron and manganese, and a little carbonaceous matter that has escaped combustion. The ashes are lixiviated in barrels with the addition of a portion of lime, and the soluble substances above mentioned are taken up. The lixivium is then evaporated in large iron kettles, which for several days are kept constantly full. The evaporation is continued until the mass has become of a black color, and of the consistence of brown sugar. It is now subjected to as powerful a heat as can be produced by the best wood fire for a number of hours, by which it is fused. During the fusion, the combustible impurities are for the most part burnt out, and a gaseous matter is emitted, which agitates the more fluid part. When the fusion is complete, the liquid becomes quiescent, and looks like melted iron. It is now transferred, by means of large iron ladles, to iron pots, where it congeals in cakes. These are broken up and packed in tight barrels, and constitute the *potash* of commerce. (*Dr. G. A. Rogers*, in *Silliman's Journal.*)

If it is intended to make *pearlash*, the process is varied. In this case the black matter of the consistence of brown sugar, called *black salts* by our manufacturers, instead of being fused, is transferred from the kettles to a large oven-shaped furnace, so constructed that the flame may play over the alkaline mass, which in the mean time is stirred by means of an iron rod. The ignition is in this way continued, until the combustible impurities are burnt out, and the mass, from being black, becomes of a dirty bluish white color. (*Rogers.*)

The ashes of plants amount generally to not more than a few parts in the hundred; and of these a portion only consists of potassa. The different parts of the same vegetable, and, for a stronger reason, different plants, furnish variable quantities of ashes. Ligneous plants yield less than herbaceous, the trunk less than the branches, and the branches less than the leaves. The bark yields more ashes than the wood; and the leaves of trees which drop their foliage in winter more than the leaves of evergreens. The following table gives the quantity of potassa contained in the ashes of one thousand parts of the under-named plants.

Pine	0·45	Wheat straw	4·18	Dry oak leaves	24·0
Poplar	0·75	Flax	5·0	Common nettle	25·0
Birch	1·29	Rush	5·08	Black elder	25·5
Beech	1·45	Common thistle	5·37	Vetch	27·5
Oak	2·03	Vine branches	5·5	Poke	45·6
Oak bark	2·08	Barley straw	5·8	Wheat stalks	47·0
Box	2·26	Beech bark	6·0	Stems of potatoes	55·0
Willow	2·85	Fern	6·2	Wormwood	73·0
Linden	3·27	Indian corn stalks	17·5	Fumitory	79·0
Elm	3·9	Sunflower stalks	19·4	Angelica	96·2
Maple	3·9				

Commercial History. Potash and pearlash are made in those countries in which forests abound. Accordingly, the alkali is extensively manufactured in Canada and the United States, and constitutes an important export of this country. It is also produced in considerable quantities in the northern countries of Europe, especially in Russia, and on the shores of the Baltic. It is of different qualities as it occurs in commerce, and is distinguished by the country or place of manufacture, as *American*, *Russian*, *Dantzic potash, etc.*

Within recent years the residues of beet-root molasses, after fermentation of the sugar and distillation of the spirit, have served as a source of potash. It is thus obtained in large quantity in Germany and France.

The *suint* of sheep's wool constitutes another source of potashes. Sulphate of potassium, either the crude salt from the Stassfurt deposits or that obtained from the crude potassium chloride of the same locality, is also converted into carbonate by a process analogous to Leblanc's soda process.

Potash has been extracted from feldspar by Prof. Fuchs, by igniting it with lime, which renders the alkali slowly soluble in water. Dr. E. Meyer, of Berlin, has found that the extraction is facilitated by digesting the united mass with water under a pressure of seven or eight atmospheres. (*P. J. Tr.*, June, 1857, p. 607.) Other minerals have recently become the sources of potassa salts, especially a deposit of mixed chlorides of potassium and magnesium, overlying a bed of common salt, at Stassfurt, near Magdeburg, in Prussia.

The extent of the potash industry may be seen from the following figures, taken from the report of the Vienna Exposition of 1869.

Yearly Product of Potashes, in Kilos. From wood-ashes, 20,000,000; from beet-root, 12,000,000; from suint of sheep, 1,000,000; from sulphate of potassium, 15,000,000.

These figures clearly show that the potash industry is undergoing a most remarkable change. Thirty years ago the whole of the potash salts were obtained from wood-ashes, and the export of Russian potashes amounted in 1864 to more than 11,000,000 kilos., whilst in 1873 it amounted to only 5,500,000 kilos. The export of American potashes also diminished from 1,900,000 kilos. during 1863, to 388,000 kilos. during 1873. (*Roscoe & Schorlemmer*, vol. ii. p. 94.)

Properties. *Potash* is in the form of fused masses, of a stony appearance and hardness, and caustic burning taste. Its color is variegated; but reddish and dark brown are the predominant hues. When exposed to the air, it absorbs moisture and deliquesces, and, if sufficiently long exposed, finally becomes liquid. *Pearlash* is of a white color, with usually a tinge of blue. As it occurs in commerce, it is in tight casks, containing about three hundred and fifty pounds, in which it forms one entire, hard, concrete mass. In the shops it is found in coarse powder, intermingled with lumps as dug out of the casks, presenting an opaque granular appearance, like table salt or Havana sugar. It is deliquescent, and has a burning alkaline taste. It is soluble in water, with the exception of impurities. The soluble matter in 100 grains of the salt of medium quality will neutralize about 58 grains of officinal sulphuric acid. It differs from potash principally in containing fewer combustible impurities, and in being less caustic and deliquescent. The coloring matter of both these forms of alkali is derived from carbonaceous impurities, and small portions of iron and manganese.

Composition. The basis of both potash and pearlash is carbonate of potassium; but this is associated with certain salts, and with insoluble impurities. Several varieties of potash found in commerce were analyzed by Vauquelin, whose principal results are contained in the following table. The quantity examined of each kind was 1152 parts.

KINDS OF POTASH.	Caustic Hydrate of Potassa.	Sulphate of Potassa.	Chloride of Potassium.	Insoluble Residue.	Carbonic Acid and water.
American potash	857	154	20	2	119
Russian potash	772	65	5	56	254
Pearlash	754	80	4	6	308
Dantzic potash	603	152	14	79	304

These results, calculated for 100 parts, show that the American potash contains 74 per cent. of pure hydrated alkali, and the Russian 67 per cent. Pearlash, it is seen, is more rich in carbonic acid than potash; and this result of analysis corresponds with the qualities of the two substances as prepared in the United States; potash being known to be far more caustic than pearlash. Besides the impurities shown by the table, phosphate and silicate of potassium and chloride of sodium are present. According to Mr. Stevenson Macadam, the potashes of commerce contain iodine and a trace of bromine, which shows that the forest trees from which the alkali is obtained must contain a very minute proportion of these non-metallic elements.

As the potash of commerce is valuable in the arts in proportion to the quantity of real alkali which it contains, it is important to possess an easy method of ascertaining its quality in that respect. The process by which this is accomplished is called *alkalimetry.* One of the best methods is by the use of a decinormal solution of oxalic acid (6·3 Gm. in a litre). A 50 C.c. burette, graduated to fifths, and a beaker will be required.

Prof. H. B. Parsons gives the following practical points about estimating the amount of hydrate or carbonate. "100 C.c. of the decinormal solution will neutralize one one-hundredth of the molecular weight, in grammes, of any alkaline hydrate or bicarbonate, or one two-hundredths of the molecular weight of any alkaline normal carbonate or oxide. The reason for weighing out $\frac{1}{200}$ of the molecular weight for normal carbonates is because the oxalic acid in one litre is only sufficient to saturate one atom of K in any hydrate or carbonate; the normal carbonates and the oxides of the alkalies contain *two* atoms of K, Na, etc., and, consequently, require twice the volume of acid solution for neutralization. Hence it is proper to weigh out of carbonates or oxides $\frac{1}{100}$ of $\frac{1}{2}$ their molecular weights when estimating their purity volumetrically. If the proper quantities are weighed and titrated, each C.c. of acid used shows one per cent. of the substance sought. In practice, weigh out the amount of alkaline hydrate theoretically equivalent to 100 C.c. of the acid used, add about 20 drops of cochineal tincture, and drop the acid, from a burette, into the aqueous solution of alkali, until the purple color changes to the straw-yellow or amber color due to slight excess of acid. The number of C.c. of acid employed shows the percentage of pure salt. Beginners are often troubled to know the 'end-reaction,' because they do not know the exact shade of color showing the change from alkaline to acid reaction. To obviate this difficulty, select two beakers of the same size as those used in titration, place in each 100 C.c. pure water and 20 drops of cochineal tincture. To one solution add a single drop of acid, and to the other add a single drop of alkali. By comparing the solutions titrated with these standard colors, it soon becomes easy to catch the neutral point. To secure greater accuracy, it is best to make several titrations, and take the average as the true result. By dissolving the weighed amount of alkali in a definite measure of water, and taking aliquot parts, very little extra trouble is experienced. For instance, it is required to determine the per cent. of pure K_2CO_3 in a commercial sample. Weigh accurately ·690 grammes ($\frac{1}{100}$ of $\frac{1}{2}$ of 138) and add water to make 100 C.c. Then, by means of the burette, measure out into separate beakers four portions of 20 C.c. each. Rinse the burette thoroughly with water, then with a little of the standard oxalic acid, and fill with the standard acid. Having added the same amount of cochineal tincture to each solution, carefully run in the acid until the neutral point is obtained; the number of C.c. of acid used is, respectively, 19·7, 19·6, 19·6, 19·5; the average being 19·6. This average multiplied by five gives the percentage, 98. In the case of compounds which are variable mixtures of several salts, it is customary to state the results as all oxide, or hydrate, or carbonate. Potassii carbonas impura, U. S. P. 1870 (Pearlash), is a variable mixture of hydrate and carbonate, with more or less sulphate, chloride, and silicate of potassium, with traces of organic matter, silica, iron, calcium, etc. The results do not show how much of the salt sought is actually present in that particular condition, but they do show to how much the mixture is equivalent; that is, how much of the required salt may be made from the mixture. If it is required to know how much potassic hydrate may be made from pearlash, weigh out ·561 grammes, and if how much oxide, weigh out ·471 grammes, and titrate with decinormal acid. The percentages thus obtained show the value of the pearlash for the purposes named. It will be noticed that alkalimetry gives no clue as to the nature of the impurities present in alkaline salts; these must be determined by qualitative and quantitative analysis." (*N. R.*, Oct. 1878.)

This method of testing the potash of commerce indicates its alkaline strength, assuming this to be dependent solely on potassa; but soda, a cheaper alkali, may be present as an adulteration, and its proportion is important to be known. To solve this problem, M. O. Henry proposes that the saturating power of a given weight should be first determined in relation to sulphuric acid, and afterwards the proportion of carbonate of potassium in an equal weight, by first converting it into an acetate, and then precipitating the potassa by perchlorate of sodium, the reacting salts being in alcoholic solution. The precipitated perchlorate of potassium indicates the proportion of carbonate of potassium. The amount of the latter determines how much of the sulphuric acid was expended in saturating the potassa; and the soda is indicated by the amount of this alkali equivalent to the remainder of the acid. (*Journ. de Pharm.*, vii. 214.) Another method of detecting soda in the potash of commerce, proposed by Pagenstecher, is to convert the suspected alkali into a sulphate, and to wash the sulphate formed with a saturated solution of sulphate of potassium. If the whole of the saline matter be sulphate of potassium, the washing will cause no loss of weight; but if part of it be sulphate of sodium, this will be washed away, on account of its solubility in a saturated solution of sulphate of potassium. (*Ibid.*, Mars, 1848, p. 239.) Frémy has proposed the metantimoniate of potassium as a test for soda in potash. In applying this test, the potash is converted into a neutral chloride of potassium, and treated with a recent solution of the metantimoniate. If the alkali examined contain 2 or 3 per cent. of soda, a precipitate will be almost instantly formed. If a less proportion of soda be present, time and agitation will be necessary to effect the precipitation. Frémy states that by this test he can detect the half of 1 per cent. of soda in commercial potash. (*Philos. Mag.*, Oct. 1848, p. 325.) Good potash should not contain a proportion of chlorides indicating more than 2 per cent. of chlorine by the test of nitrate of silver. If a larger proportion is shown, adulteration with common salt may be suspected. A standard solution of the silver salt may be made, a known measure of which shall be just sufficient to precipitate all the chlorine in a given weight of good potash, after having been supersaturated with nitric acid. If a further addition of the test causes a precipitate, the presence of too much chlorine is shown.

Pearlash, from its impurity, is never used as a medicine. Purified to a certain extent, it takes the name of carbonate of potassium. (See *Potassii Carbonas.*)

POTASSII CHLORAS. *U. S.* *Chlorate of Potassium.*

$KClO_3$; 122·4. (PỌ-TĂS′SỊ-Ī ȻHLŌ′RĂS.) KO, ClO_5; 122·4.

"Chlorate of Potassium should be kept in well-stopped bottles, and should not be triturated with readily oxidizable or combustible substances." *U. S.*

Potassæ Chloras, *Br.;* Chlorate of Potash; Kali Chloricum, *P.G.;* Kali Oxymuriaticum, Kali Muriaticum Oxygenatum, Chloras Potassicus, s. Kalicus; Hyperoxymuriate of Potassa; Chlorate de Potasse, *Fr.;* Chlorsaures Kali, *G.*

In the U. S. Pharmacopœia, no process is given for Chlorate of Potassium; in the British, it is ranked among the Preparations, with the formula KO,ClO_5.

The salt may be conveniently obtained by the process of Graham, which consists in mixing carbonate of potassium with an equivalent quantity of hydrate of lime, before submitting it to the action of chlorine. The gas is absorbed with avidity, and the mass becomes hot, while water is given off. The lime converts the carbonate into caustic potassa, and the reaction then takes place between six mols. of potassa and six atoms of chlorine, with the result of forming five mols. of chloride of potassium, and one of chlorate of potassium, while three mols. of water are eliminated. ($6KOH + (Cl_2)_3 = 5KCl + KClO_3 + 3H_2O$.) The products are, therefore, carbonate of calcium, chloride of potassium, and chlorate of potassium. The chloride and chlorate are separated from the carbonate by solution in hot water, and the chlorate from the chloride by priority of crystallization. The Br. Pharmacopœia has adopted this process, with the following directions. "Take of Carbonate of Potash *twenty ounces* [avoirdupois]; Slaked Lime *fifty-three ounces* [avoird.]; Distilled Water *a sufficiency;* Black Oxide of Manganese *eighty ounces* [avoird.]; Hydrochloric Acid *twenty-four pints* [Imperial measure]. Mix the Lime with the Carbonate of Potash, and triturate them with a few ounces of the Water so as to make the mixture slightly moist. Place the Oxide of Manganese in a large retort or flask, and, having poured upon it the Hydrochloric Acid, diluted with six pints [Imp. meas.] of water, apply a gentle sand heat, and conduct the Chlorine as it comes over, first through a bottle containing six [fluid]ounces of Water, and then into a large carboy containing the mixture of Carbonate of Potash and Slaked Lime.

When the whole of the chlorine has come over, remove the contents of the carboy, and boil them for twenty minutes with seven pints [Imp. meas.] of the Water; filter and evaporate till a film forms on the surface, and set aside to cool and crystallize. The crystals thus obtained are to be purified by dissolving them in three times their weight of boiling Distilled Water, and again allowing the solution to crystallize."

In the first process, a large proportion of the potassa is lost by being converted into chloride of potassium. In the process now generally employed for the commercial manufacture of chlorate of potash this is obviated as follows. Chlorine is passed into a solution of milk of lime having a specific gravity of 1·04 until the liquid is nearly saturated. The clear solution is evaporated until it has a specific gravity of 1·18, and then potassium chloride added, and the mixture boiled down until a specific gravity of 1·28 is attained. On cooling, crystals of potassium chlorate separate out. The reactions here are, $6Ca(OH)_2 + (Cl_2)_6 = 5CaCl_2 + Ca(ClO_3)_2 + 6H_2O$ and $Ca(ClO_3)_2 + 2KCl = CaCl_2 + 2KClO_3$. *Pechiney's* improvement on this process is to separate the greater part of the *chloride* of calcium from the *chlorate* of calcium before adding the chloride of potassium. For details, see *N. R.*, Feb. 1882.

The chlorate of potassium of commerce is also prepared by the reaction of solutions of chloride of potassium and hypochlorite of calcium, with the assistance of heat. The chlorate of potassium crystallizes during the refrigeration of the liquor, and chloride of calcium remains in solution ($2KCl + 3(Ca(OCl)_2 + CaCl_2) = 2KClO_3 + 6CaCl_2$). The importations of chlorate of potash at the port of New York for the year 1880 were valued at $66,822, and for the year 1881, at $84,944.

Properties. Chlorate of potassium is in "colorless, monoclinic prisms or plates, of a pearly lustre, permanent in the air, odorless, having a cooling, saline taste, and a neutral reaction. Soluble in 16·5 parts of water at 15° C. (59° F.), and in 2 parts of boiling water; only slightly soluble in alcohol. When heated, the salt melts and afterward gives off an abundance of oxygen, finally leaving a residue of a neutral reaction, amounting to 60·8 per cent. of the original weight, and completely soluble in water. The aqueous solution of this residue yields a white, crystalline precipitate, with a saturated solution of bitartrate of sodium, and, with test-solution of nitrate of silver, a white precipitate insoluble in nitric acid, but soluble in ammonia. A one per cent. aqueous solution of the salt should yield no precipitate with test-solution of chloride of barium (sulphate), or of oxalate of ammonium (calcium), and, at most, only a faint cloudiness with test-solution of nitrate of silver (limit of chloride)." *U. S.*

Chlorate of potassium is characterized also by becoming first yellow, and then red by admixture with a little sulphuric acid, and by the action of that acid evolving chlorine tetroxide (Cl_2O_4), known by its yellow color, and its explosive property when heated; by its bleaching power when mixed first with hydrochloric acid and then with water; and by its property of exploding violently when triturated with a small portion of sulphur or phosphorus, or even kermes mineral. Chlorate of potassium consists of one atom of potassium in combination with the chloric acid group, ClO_3, 39 + 35·5 + 48 = 122·5.

This salt is an excellent test of manganese existing in organic matter. If a small portion of such matter, containing even a trace of manganese, be thrown on the surface of the *pure* melted salt in a test-glass, after the combustion has ceased, the cooled saline mass will be found to have a rose or pinkish tint, caused by the formation of permanganate of potassium. (*Neues Repert.*, vi. 247.) A similar discoloration of the salt, produced by the use of pure charcoal in the same manner, will evince the presence of manganese in the chlorate as an impurity.

Medical Properties. Owing to the assertions of Dr. O'Shaughnessy, that under the use of the chlorate of potassium all the blood of the body becomes florid, it was long supposed that the salt acts upon the system as an oxidizing agent. Dr. Isambert, however, has found the statements of O'Shaughnessy incorrect, and as the chlorate does not naturally part with its oxygen at the temperature of the body, and as it is eliminated from the kidneys unchanged, it is evident that it has not the specific action claimed for it. It is more irritant than most of the other salts of potash, and probably acts less powerfully as a cardiac depressant than do most of them. It is a very efficient remedy in the follicular and even the gangrenous stomatitis of childhood, and in mercurial ptyalism, acting, however, only by its local influence, it being continually eliminated with the saliva and coming in perpetual contact with the mucous membrane of the mouth. It is much employed in scarlatina and diphtheria, but has no specific action in these affections, being useful only by its direct influence upon the mucous membrane affected. In scurvy, phthisis, and the various dyscrasiæ in which it was once employed, it is of little or no service.

Externally, chlorate of potassium in solution has been used in several diseases. Mr. Moore, of London, has found it very useful as an application to indolent and scrofulous ulcers and phagedæna, to ulcerations of the nose, mouth, and tongue, and for cleansing cancerous sores (*Journ. de Pharm.*, Mars, 1864, p. 269); and its solution is now frequently employed as a local application in gonorrhœa, leucorrhœa, ulceration of the os uteri, chronic cystitis, etc. Its saturated solution given with laudanum, twice daily, is an excellent remedy for hemorrhoids. The internal dose is from ten to twenty grains (0·7–1·3 Gm.) every three or four hours, given in sufficient gum water, sweetened water, or lemonade to dissolve it. When administered as a prophylactic in salivation, a smaller dose will answer. Taken to the extent of five drachms (19·4 Gm.) in twenty-four hours, it has been found to produce diuresis, abundant salivation, and a strong saltish taste. Such a dose as this is, however, dangerous even for the adult. In several cases the chlorate has caused death* by its irritant properties, and in many cases of fatal albuminuria in diphtheria it is probable that the salt has greatly aided in the result. It is liable to produce gastroenteritis, and also acute Bright's disease, its irritant properties being felt most at its points of entrance to and exit from the system. When used as a wash or injection, from a drachm to half an ounce (3·9–15·5 Gm.) of the salt may be dissolved in a pint (472 C.c.) of water. A solution in glycerin, in the proportion of one part of the salt to ten parts of the menstruum, has been especially recommended as a dressing for ill-conditioned wounds and ulcers. The remedy has also been applied in the form of very fine powder dusted on the surface.

Off. Prep. Potassæ Permanganas, *Br.;* Trochisci Potassæ Chloratis, *Br.;* Trochisci Potassii Chloratis, *U. S.*

POTASSII CITRAS. *U. S.* *Citrate of Potassium.*

$K_3 C_6 H_5 O_7 . H_2 O$; 324. (PỌ-TĂS'SỊ-Ī CĪ'TRĂS.) $3KO, C_{12} H_5 O_{11} . 2HO$; 324.

"Citrate of Potassium should be kept in well-stopped bottles." *U. S.*

Potassæ Citras, *Br.;* Kali Citricum, Citras Potassicus, s. Kalicus; Citrate of Potash; Citrate de Potasse, *Fr.;* Citronsaures Kali, *G.*

"Take of Carbonate of Potash *eight ounces* [avoirdupois], or *a sufficiency;* Citric Acid, in crystals, *six ounces* [avoird.], or *a sufficiency;* Distilled Water *two pints* [Imperial measure]. Dissolve the Citric Acid in the Water, add the Carbonate of Potash gradually, and, if the solution be not neutral, make it so by the cautious addition of the Acid or the Carbonate of Potash. Then filter, and evaporate to dryness, stirring constantly, after a pellicle has begun to form, till the salt granulates. Triturate in a dry, warm mortar, and preserve the powder in stoppered bottles." *Br.*

Citrate of potassium was known formerly by the name of *salt of Riverius.* In the U. S. formula of 1870,† mutually saturating proportions of the acid and bicarbonate were intended to be employed; the latter ingredient being preferred to the carbonate on account of its greater purity. The potassium of the bicarbonate unites with the citric acid, to form the citrate of potassium, and the carbonic acid escapes, producing effervescence. The resulting solution is directed to be evaporated to dryness, as affording the most convenient form for use. The granulation ordered has a tendency to retard the deliquescence of the citrate. The British process differs only in the use of the carbonate instead of bicarbonate, and by providing more carefully for an exact neutralization.

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* Cases. *Amer. Med. Times,* April, 1861, one ounce; *A. J. P.,* 1878, p. 113, half an ounce; *Lond. Med. Record,* 1[illegible]9, p. 424.

† "Take of Citric Acid *ten troyounces:* Bicarbonate of Potassium *fourteen troyounces;* Water *a sufficient quantity.* Dissolve the Citric Acid in a pint of water, add the Bicarbonate of Potassium gradually, and, when effervescence has ceased, filter the solution and evaporate to dryness, stirring constantly, after a pellicle has begun to form, until the salt granulates. Keep it in a well-stopped bottle." *U. S.*

Properties. Citrate of potassium is crystallizable, but, as usually seen, is in the form of "a white, granular powder, deliquescent on exposure to air, odorless, having a slightly cooling, faintly alkaline taste, and a neutral or faintly alkaline reaction. Soluble in 0·6 part of water at 15° C. (59° F.), and very soluble in boiling water; very slightly soluble in alcohol. When heated to about 200° C. (392° F.), the salt loses nearly 5·5 per cent. of water. At a higher temperature it chars, and, if kept at a red heat, until gases cease to be evolved, it is converted into a blackened mass of an alkaline reaction, which strongly effervesces with acids. The aqueous solution of the salt yields a white, crystalline precipitate on the addition of a saturated solution of bitartrate of sodium. It remains clear on the addition of chloride of calcium until it is boiled, when a white, granular precipitate is produced. The aqueous solution of the salt should not effervesce on the addition of an acid (abs. of carbonate), and the solution, acidulated with nitric acid, should remain unaffected by test-solution of chloride of barium (abs. of sulphate), or of nitrate of silver (chloride). A concentrated solution should not deposit a white crystalline precipitate on the addition of acetic acid (tartrate). If 5·4 Gm. of Citrate of Potassium are ignited until gases cease to be evolved, the alkaline residue should require for complete neutralization not less than 50 C.c. of the volumetric solution of oxalic acid (corresponding to 100 per cent. of the pure Citrate of Potassium)." *U. S.*

The British Pharmacopœia gives the following tests of its character. Heated with sulphuric acid it forms a brown fluid, and gives off inflammable vapors with the odor of acetic acid. Its solution, mixed with a solution of chloride of calcium, remains clear till it is boiled, when a white precipitate is formed readily soluble in acetic acid. This is one of the characteristics of citric acid, which unites with lime to form the insoluble citrate only when heated. Acidulated with hydrochloric acid, the solution gives a yellow precipitate with platinic chloride; showing that the base of the salt is potassa. "One hundred and two grains, heated to redness till gases cease to be evolved, leave an alkaline residue [carbonate of potassium], which requires for exact neutralization 1000 grain-measures of the *volumetric solution of oxalic acid.*" *Br.*

As citric acid is tribasic, this salt consists of three atoms of potassium combined with the citric acid radical $C_6H_5O_7$, and with this one mol. of water; its formula being $K_3C_6H_5O_7,H_2O$.[*]

Medical Properties. Citrate of potassium is a grateful refrigerant diaphoretic, and has long been used in the fevers of this country, in the extemporaneous forms of neutral mixture and effervescing draught. As these require time and a somewhat careful manipulation in their preparation, it has been found more convenient to keep the citrate of potassium ready made, and dissolve it in water when wanted for use. This solution will no doubt produce the essential diaphoretic and refrigerant effects of the neutral mixture or effervescing draught, but is less agreeable to the stomach and palate, because destitute of the carbonic acid contained in these preparations. The citrate of potassium dissolved in an excess of lemon-juice affords the most agreeable method of securing the influence of an alkaline salt of potash upon the system, as in rheumatism, uric acid diathesis, etc. The usual dose of the citrate is from twenty to twenty-five grains (1·3–1·565 Gm.). When a decided effect upon the system is desired, as much as an ounce (31·1 Gm.) of it may be given in the twenty-four hours.

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[*] *Citrate of Sodium and Potassium.* Mr. T. Push, of Dessau, Germany, has made a complete series of citrates, corresponding to the officinal tartrates, with a view of finding a stable compound. He ascertained that the double citrate of sodium and potassium is an extremely stable compound, even when exposed to the air for a long time. He prepares the salt by dissolving 100 parts of citric acid in water, adding 108 parts of pure potassium carbonate, and 221 parts of crystallized sodium carbonate, filtering, evaporating, and crystallizing. The crystals are allowed to drain, and the mother-liquor is further concentrated, until, on cooling, it solidifies to a crystalline mass, which is used in the condition of powder. (*Arch. d. Pharm.*, July, 1877, 47: *N. R.*, Sept. 1877.)

POTASSII CYANIDUM. *U.S.* *Cyanide of Potassium.*

KCN; 65. (PỌ-TĂS′SỊ-Ī CȲ-ĂN′Ị-DŬM.) KC_2N; 65.

"Cyanide of Potassium should be kept in well-stopped bottles." *U. S.*

Potassii Cyanuretum, *U. S.* 1850; Cyanuret of Potassium; Kalium Cyanatum, Cyanuretum Potassicum, s. Kalicum; Cyanure de Potassium, *Fr.;* Cyankalium, *G.*

The process of U. S. P. 1870* is that of F. & E. Rodgers, though generally known under the name of Liebig. It furnishes a large product, a considerable part of which is the impurity, cyanate of potassium. The reaction takes place between one mol. of ferrocyanide of potassium and one of carbonate of potassium. The iron is set free, the carbonic acid evolved, and five mols. of cyanide of potassium and one of cyanate of potassium are formed. The iron occupies the lower part of the fused liquid; and, if the latter be carefully poured out to solidify, the portion contaminated with the iron may be left behind. The reaction is explained by the following equation: $K_4Fe(CN)_6 + K_2CO_3 = 5KCN + KOCN + CO_2 + Fe$. MM. Fordos and Gélis, in an able paper contained in the *Journ. de Pharmacie* for Aug. 1857, have pointed out numerous causes which concur in rendering the salt, as obtained by the use of carbonate of potassium, impure. The commercial cyanide, which is obtained by this process, was found by these writers to be very impure, only containing from 36 to 55 per cent. of the pure salt. The cyanate of potassium may be readily detected by saturating the product with an acid, which will cause an effervescence of carbonic acid, and the generation of a salt of ammonium. According to Dr. Schwarz, it may be freed from cyanate and carbonate of potassium by treating the impure cyanide with bisulphide of carbon, which dissolves it, and may be recovered in great measure by distillation. (*Chem. News*, No. 190, p. 41.)

In the process in which the ferrocyanide of potassium is ignited alone (U. S. process 1840), the salt is first deprived of its water of crystallization by exposure to a moderate heat, and then calcined at a red heat for two hours, in order to decompose the cyanide of iron. The reaction which takes place is as follows: $K_4Fe(CN)_6 = 4KCN + FeC_2 + N_2$. The product of the calcination is a black, porous mass, consisting of cyanide of potassium, mixed with carbide of iron and charcoal. As the cyanide is very prone to absorb oxygen, especially when hot, whereby it is decomposed, atmospheric air is excluded from the retort while it is cooling, by luting its orifice. When the whole is cold, the black mass is reduced to coarse powder, and exhausted by cold distilled water, which dissolves the cyanide of potassium, and leaves the carbide of iron and charcoal behind. The filtered liquor, therefore, is an aqueous solution of cyanide of potassium, which is obtained in a solid state by a rapid evaporation to dryness. During the evaporation, a small portion of the cyanide is decomposed, attended with the evolution of ammonia, and the production of formiate of potassium. A portion of this salt, therefore, contaminates the cyanide, as obtained by this process; but the quantity is too small to interfere with its medicinal action. The decomposition here referred to takes place between one mol. of cyanide of potassium and two of water, and is represented by the following equation: $KCN + (H_2O)_2 = NH_3 + HCOOK$. This decomposition is avoided by exhausting the black mass with boiling alcohol of 60 per cent. (sp. gr. 0·896) instead of with water. The alcoholic solution, by evaporation to a pellicle, lets fall the salt upon cooling, as a crystalline precipitate, perfectly white and pure.

According to the process of the French Codex, which is that of Robiquet, this cyanide is obtained in the dry way, without the use of any solvent. The calcination is performed in a coated stone-ware retort, half filled with the ferrocyanide, to which a tube is attached for collecting the gaseous products. When these cease to be disengaged, the heat is gradually raised to a very high temperature, at which it is kept for a quarter of an hour; after which the tube is closed with luting, and the whole left undisturbed until quite cold. When the calcination is thus conducted, the retort, upon being broken, will be found to contain a black matter, covered with a fused layer of pure cyanide of potassium, resembling white enamel. This is detached by means of a knife, and immediately transferred to a bottle, with an accurately fitting stopper. The black matter, under the name of *black cyanide of potassium*, is also kept for medicinal use; but the dose of this cannot be accurately fixed, on account of its containing, at different times, more or less impurity.

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* *Cyanide of Potassium.* "Take of Ferrocyanide of Potassium, dried, *eight troyounces;* Pure Carbonate of Potassium, dried, *three troyounces.* Mix the salts intimately, and throw the mixture into a deep iron crucible previously heated to redness. Maintain the temperature until effervescence ceases, and the fused mass concretes, of a pure white color, upon a warm glass rod dipped into it. Then pour out the liquid carefully into a shallow dish to solidify, ceasing to pour before the salt becomes contaminated with the precipitated iron. Break up the mass while yet warm, and keep the pieces in a well-stopped bottle." *U. S.* 1870.

According to MM. Fordos and Gélis, the French Codex process should supersede the carbonate of potassium process; as it gives a product far purer, and in larger proportion to the materials employed, estimated by the pure product. The same process is preferred by Mr. Donovan, who has modified it by substituting, for the stone-ware retort, an iron mercury bottle, which, when cold, must be cut in two by a chisel and hammer to get out the product. The same recommendation of iron in preference to stone-ware vessels is made by Fordos and Gélis, who found that the latter, at the high heat employed, were acted on. The process of Wiggers consists in disengaging hydrocyanic acid from a mixture of ferrocyanide of potassium and sulphuric acid, and passing it into a cooled receiver containing an alcoholic solution of hydrate of potassa. The contents of the receiver ultimately form a solid magma of the cyanide, which is drained, washed several times with strong alcohol, pressed between folds of bibulous paper, and dried as quickly as possible. Cyanide of potassium may be formed by passing a current of strongly heated nitrogen over charcoal, impregnated with carbonate of potassium, and heated to a white heat.

Properties. Cyanide of potassium is in "white, opaque, amorphous pieces, or a white, granular powder, deliquescent in damp air, odorless when perfectly dry, but generally of a peculiar, characteristic odor, having a sharp, somewhat alkaline and bitter-almond taste, and a strongly alkaline reaction. The commercial salt is soluble in 2 parts of water at 15° C. (59° F.), and in 1 part of boiling water; it is but sparingly soluble in alcohol. When heated to a low red heat, the salt fuses. Its aqueous solution yields a white, crystalline precipitate on the addition of a saturated solution of bitartrate of sodium. When exposed to the air, the solution exhales the odor of hydrocyanic acid, and, when added to test-solution of nitrate of silver, it yields a white precipitate which is wholly soluble in excess of cyanide of potassium and also in water of ammonia. An aqueous solution of the salt should not produce more than a slight effervescence on the addition of an acid (limit of carbonate). If 0·65 Gm. of Cyanide of Potassium be dissolved in 12 C.c. of water, and volumetric solution of nitrate of silver be gradually added, the precipitate first formed should dissolve on stirring and a permanent precipitate should not appear until at least 45 C.c. of the volumetric solution have been used (corresponding to at least 90 per cent. of pure Cyanide of Potassium)." *U. S.* If yellow, it contains iron. Its solution effervesces with acids. The salt and its solution, when exposed to the air, exhale the odor of hydrocyanic acid, and become weaker; but the change takes place slowly. Orfila found that the salt, after fourteen days' exposure, by which it was almost entirely liquefied, still possessed energetic poisonous properties. He thinks, therefore, that the bad effects of opening the containing bottle, in dispensing the medicine, have been exaggerated. Unfortunately, the salt varies in quality independently of the effects of time and exposure. Dr. David Stewart, of Baltimore, examined six samples of this cyanide, on sale, and found them to vary considerably in purity. Besides water, the usual impurities are hydrate, carbonate, cyanate, and formiate of potassium. They sometimes amount to half the weight of the cyanide, consisting principally of the carbonate. From the extensive use at present made of cyanide of potassium in electro-metallurgy and photography, it is of importance to have a reliable test of its purity. Such a test has been discovered by MM. Fordos and Gélis, founded on the fact that one mol. of iodine rapidly reacts with one of the cyanide, so as to form a colorless compound, consisting of one mol. of iodide of potassium, and one of iodide of cyanogen: $KCN + I_2 = KI + CNI$. Accordingly, a tincture of iodine of known strength is gradually added to an aqueous solution of a given weight of the cyanide to be tested, until it assumes a permanent yellowish tinge; and the amount of iodine expended indicates the proportion of cyanide in the specimen. A necessary preliminary step, before using the tincture, is to add sufficient carbonic acid water to the solution of the cyanide, to convert any hydrate or carbonate of potassium present into bicarbonate, in which state neither has any action on the iodine. (*Chem. Gaz.*, Oct. 15, 1852, p. 387.) This test is applicable to other cyanogen compounds which are soluble. Mr. Thornton J. Herapath's test for commercial cyanide of potassium is a standard solution of ammonio-sulphate of copper, the blue color of which is destroyed by a solution of the cyanide. The copper solution is added to one of the cyanide of known strength, until a faint blue coloration is produced; and the richness of the sample in pure cyanide is in proportion to the quantity of the copper solution required. (*Chemist*, April, 1856, and Feb. 1857.) Applying this test to five samples, Mr. Herapath found the proportion of pure cyanide to vary from 41 to 65 per cent. Cyanide of potassium yields with nitrate of silver a precipitate of cyanide of silver, wholly soluble in ammonia and boiling nitric acid. It consists of one atomic group of cyanogen 26, and one of potassium 39 = 65.

The importations of potassium cyanide at the port of New York for the year 1880 were valued at $72,399, and for the year 1881, at $178,931.

Medical Properties. Cyanide of potassium acts precisely like hydrocyanic acid as a poison and as a medicine. (See *Acidum Hydrocyanicum Dilutum.*) Five grains of it have repeatedly taken life, and hydrocyanic acid has been detected in the blood of a person who had been fatally poisoned by the cyanide. (Venghauss, *Arch. der Pharm.*, clii. 138.) The grounds on which this cyanide was proposed as a substitute for hydrocyanic acid by Robiquet and Villermé were its uniformity as a chemical product, and its less liability to undergo decomposition. The dose is the eighth of a grain (0·008 Gm.), dissolved in half a fluidounce of distilled water, to which may be added half a fluidrachm of syrup of lemons, if the prescriber wish to set the hydrocyanic acid free. The spurious cyanide, formed by calcining dried muscular flesh with potash, consists principally of carbonate of potassium, and is but slightly poisonous. (*Orfila.*) A solution of cyanide of potassium, made with from one to four grains (0·065–0·26 Gm.) to the fluidounce (30 C.c.) of water, has been recommended in neuralgic and other local pains, applied by means of pieces of linen. Mr. Guthrie found that a solution of from three to six grains (0·2–0·4 Gm.) to the fluidounce (30 C.c.) of distilled water, answered admirably, applied by drops every other day, for removing the olive-colored stains of the conjunctiva caused by nitrate of silver.

POTASSII ET SODII TARTRAS. *U.S.* *Tartrate of Potassium and Sodium.* [*Rochelle Salt.*]

(PỌ-TĂS′SỊ-Ī ĔT SŌ′DỊ-Ī TÄR′TRĂS.)

KNa $C_4 H_4 O_6 . 4H_2 O$; 282. KO, NaO, $C_8 H_4 O_{10} . 8HO$; 282.

Soda Tartarata, *Br.;* Sodæ et Potassæ Tartras, *Br.* 1864, *U. S.* 1850; Tartarus Natronatus, *P.G.;* Natro-kali Tartaricum; Tartarated Soda; Sal Polychrestum Seignetti, Tartras Potassico-sodicus; Sel de Seignetti, Soude Tartarisée, *Fr.;* Seignettesalz, *G.*

"Take of Acid Tartrate of Potash, in powder, *sixteen ounces* [avoirdupois], or *a sufficiency;* Carbonate of Soda *twelve ounces* [avoird.], or *a sufficiency;* Boiling Distilled Water *four pints* [Imperial measure]. Dissolve the Carbonate of Soda in the Water, add gradually the Acid Tartrate of Potash, and, if after being boiled for a few minutes the liquid has an acid or alkaline reaction, add a little Carbonate of Soda or Acid Tartrate of Potash till a neutral solution is obtained. Boil and filter; concentrate the liquor till a pellicle forms on the surface, and set it aside to crystallize. More crystals may be obtained by again evaporating as before." *Br.**

This is a double salt, consisting of a molecule of tartaric acid, $C_4H_4O_6.H_2$, in which one of the basic hydrogen atoms is replaced by potassium and the other by sodium.

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* "Take of Carbonate of Sodium *twelve troyounces;* Bitartrate of Potassium, in fine powder, *sixteen troyounces;* Boiling Water *five pints.* Dissolve the Carbonate of Sodium in the Water, and gradually add the Bitartrate of Potassium. Filter the solution, and evaporate until a pellicle begins to form; then set it aside to crystallize. Pour off the mother-water, and dry the crystals on bibulous paper. Lastly, evaporate the mother-water, that it may furnish more crystals." *U. S.* 1870.

The theory of its formation is very simple, being merely the replacement of the hydrogen in the bitartrate of potassium by the sodium of the carbonate of sodium, the carbonic acid of which escapes with effervescence. The quantities of the materials for mutual saturation are 286 parts of carbonate and 376 of bitartrate, or one mol. of crystallized sodium carbonate to two mols. of the acid tartrate. This gives the ratio of 3 to 3·95. The proportion adopted in the U. S. 1870 and Br. Pharmacopœias is as 3 to 4, which is very near the theoretical quantities. As the salts employed are apt to vary in composition and purity, the carbonate from the presence of more or less water of crystallization, and the bitartrate from containing tartrate of calcium, it is perhaps best in all cases, after indicating the nearest average proportion as a general guide, to present to the operator the alternative of using the cream of tartar to the point of exact saturation.

Properties. Tartrate of potassium and sodium is in the form of "colorless, transparent, rhombic crystals, slightly efflorescent in dry air, or a white powder, odorless, having a cooling, mildly saline and slightly bitter taste, and a neutral reaction. Soluble in 2·5 parts of water at 15° C. (59° F.), and very soluble in boiling water; almost insoluble in alcohol. When rapidly heated to about 75° C. (167° F.), the salt melts in its water of crystallization; at a higher temperature it dries, then chars, evolves inflammable vapors having the odor of burnt sugar, and, on moderate ignition, leaves a blackened residue of an alkaline reaction, strongly effervescing with acids, and imparting to a non-luminous flame an intense yellow color, which appears red when observed through a blue glass. A concentrated aqueous solution of the salt yields a white, crystalline precipitate on the addition of acetic acid. With test-solution of nitrate of silver it yields a white precipitate which becomes black on boiling." *U. S.* As it is sometimes largely adulterated with sulphate of sodium (F. Mahla, *A. J. P.*, 1868, p. 548), it is best to test it with barium chloride. When the salt is exposed to a strong heat, it blackens, and gives out inflammable gases with the odor of burnt sugar; the tartaric acid being destroyed, and a mixture of the carbonates of potassium and sodium left. It sometimes contains tartrate of calcium, which may be removed by solution and crystallization; but when the crystals are large and well defined, it may be assumed to be pure. It is incompatible with most acids, and with all acidulous salts except bitartrate of potassium. It is also decomposed by the acetate and subacetate of lead, by the soluble salts of calcium, and by those of barium, unless the solution of the tartrate be considerably diluted. The way in which acids act in decomposing it, is by combining with the sodium, and throwing down bitartrate of potassium as a crystalline precipitate. This double salt was discovered by Seignette, an apothecary of Rochelle, and hence is frequently called *Seignette's salt*, or *Rochelle salt*.

Composition, Tests, etc. Tartrate of potassium and sodium consists of the tartaric acid group $C_4H_4O_6$, which is dibasic, in combination with one atom of potassium and one of sodium $148 + 39 + 23 = 210$, together with 4 mols. of water $72 = 282$. "A dilute, aqueous solution should yield no precipitate with test-solution of oxalate of ammonium (abs. of calcium). On adding nitric acid to a dilute, aqueous solution of the salt, until the precipitate first formed is redissolved, the resulting solution should yield no precipitate with test-solution of chloride of barium (sulphate), and at most only a cloudiness with test-solution of nitrate of silver (limit of chloride). A portion heated with potassa should not give off vapor of ammonia. If 3·525 Gm. of Tartrate of Potassium and Sodium are ignited until gases cease to be evolved, the alkaline residue should require for complete neutralization not less than 25 C.c. of the volumetric solution of oxalic acid (corresponding to 100 per cent. of crystallized Tartrate of Potassium and Sodium)." *U. S.* "One hundred and forty-one grains of it, heated to redness till gases cease to be evolved, leave an alkaline residue which requires for neutralization 1000 grain-measures of the *volumetric solution of oxalic acid.*" *Br.*

Medical Properties and Uses. This salt is a mild, cooling purgative, well suited to delicate and irritable stomachs, being among the mildest and least unpalatable of the neutral salts. As it is not incompatible with tartar emetic, it may be associated with that salt in solution. It is an ingredient in the effervescing aperient called

Seidlitz powders. (See *Pulvis Effervescens Compositus.*) The dose as a purge is from half an ounce to an ounce (15·5–31·1 Gm.). Given in small and repeated doses it does not purge, but is absorbed and renders the urine alkaline. (Millon and Laveran, *Journ. de Pharm.*, 3e sér., vi. 222.)

Tartrate of potassium and magnesium, formed by saturating cream of tartar with carbonate of magnesium, has been proposed by M. Maillier as a safe and pleasant purgative. (*Journ. de Pharm.*, xiii. 252.)

Off. Prep. Pulvis Effervescens Compositus, *U. S.*

POTASSII FERROCYANIDUM. *U. S.* *Ferrocyanide of Potassium.*

(PỌ-TĂS′SỊ-Ī FĔR-RỌ-CȲ-ĂN′Ị-DŬM.)

$K_4 Fe(CN)_6 . 3H_2 O$; 421·9. $K_2 Fe (C_2 N)_3 . 3HO$; 210·95.

"Ferrocyanide of Potassium should be kept in well-closed vessels." *U. S.* "A salt obtained by fusing animal substances, such as the cuttings of horns, hoofs, and skins, with carbonate of potash in an iron pot, lixiviating the crude product with water, and purifying the salt by crystallization." *Br.*

Potassæ Prussias Flava, *Br.*, Yellow Prussiate of Potash; Kalium Ferrocyanatum, *P.G.;* Kalium Borussicum, Cyanuretum Ferroso-potassicum; Ferrocyanuret of Potassium, Ferroprussiate of Potassa, Prussiate of Potassa; Proto-cyanure jaune de Fer et de Potassium, Prussiate jaune de Potasse, Ferrocyanure de Potassium, *Fr.;* Cyaneisenkalium, Ferrocyankalium, Gelbes Blutlaugensalz, *G.*

It is the yellow double cyanide of potassium and iron, the salt from which cyanide of potassium is obtained by calcination at a low red heat.

Ferrocyanide of potassium is prepared on the large scale by heating animal matters, such as dried blood, hoofs, chips of horn, woollen rags, old leather, the refuse of tallow-chandlers called *greaves*, and other substances rich in nitrogen, with the pearlash of commerce and scrap iron, in an egg-shaped iron pot called a shell, ladling out the pasty mass called the *melt*, and, after it has cooled sufficiently, dissolving it in water, and evaporating the solution so that crystals may form. The melt, while still hot, contains cyanide of potassium only, the ferrocyanide being produced solely by the action of the water. The best temperature for making the solution is between 70° C. and 80° C. (158° F. and 176° F.); and the conversion of the cyanide into the ferrocyanide is facilitated by the presence of finely divided amorphous sulphide of iron, and of caustic potassa. (A. Reimann, *Chem. Gaz.*, Jan. 1, 1855.)

Some years ago this salt was manufactured by a process which dispensed with the use of animal matter; the necessary nitrogen being obtained by a current of atmospheric air. Fragments of charcoal, impregnated with 30 per cent. of carbonate of potassium, were heated to a white heat in a cylinder, through which a current of air was drawn by a suction-pump. This process is understood to have succeeded in a chemical sense, but failed on the score of economy, chiefly from the circumstance that the necessary fire-clay tubes could not be made to resist the combined action of the alkali and heat. The process of Richard Brunnquell consists in passing ammonia through tubes, filled with charcoal and heated to redness, so as to form cyanide of ammonium, and converting this into ferrocyanide of potassium by contact with solution of potash and suitable iron compounds. (*Chem. Gaz.*, Nov. 1, 1856.)

Properties. Ferrocyanide of potassium is in "large, coherent, lemon-yellow, translucent and rather soft, four-sided prisms or tablets, slightly efflorescent in dry air, odorless, having a sweetish and saline taste, and a neutral reaction. Soluble in 4 parts of water at 15° C. (59° F.), and in 2 parts of boiling water; insoluble in alcohol. When gently heated, the salt becomes white; and at 100° C. (212° F.), it becomes anhydrous, losing 12·8 per cent. of its weight. The aqueous solution yields a white, crystalline precipitate on the addition of a saturated solution of bitartrate of sodium, a dark blue precipitate with ferric salts, a bluish white precipitate, gradually turning darker, with ferrous salts, a red-brown precipitate with salts of copper, and a white one with acetate of lead. A concentrated aqueous solution of the salt should not effervesce on the addition of diluted sulphuric acid (abs. of carbonate), and, when diluted and acidulated with hydrochloric acid, should not yield more than a trifling precipitate or cloudiness with chloride of barium (limit of sulphate). If equal parts of the salt and of nitrate of potassium be cautiously deflagrated in a porcelain crucible, the residue extracted with water, and to the filtered solution, acidulated with nitric acid, test-solution of nitrate of silver be added, not more than a faint white opalescence should make its appearance (limit of chloride)." *U. S.* It acts but slightly, if at all, on turmeric paper. The alkaline reaction, when it exists, is probably owing to the presence of a little free potassa. When ignited, the insoluble residue amounts to 18·7 per cent. of sesquioxide of iron, resulting from the oxidation of the iron of the salt. It is characterized by striking a deep blue color with ferric salts,* a deep brown one with the salts of copper, and a white one with those of zinc, the several precipitates formed being ferrocyanides of the respective metals. Heated with eight or ten times its weight of concentrated sulphuric acid, it evolves carbonic oxide. Half an ounce of the salt yields about 250 cubic inches of the gas. (*C. Grimm and G. Ramdohr.*) When boiled with dilute sulphuric acid, it emits the smell of hydrocyanic acid. Ferrocyanide of potassium consists of six groups of the monad radical cyanogen (CN), saturated by four potassium atoms and one atom of the dyad iron. Thus, K_4,156 + Fe, 55·9 + $(CN)_6$, 156 = 367·9, together with $3H_2O$, 54 = 421·9 mol. wt. The potassium is more readily displaced than the iron, so that it is considered as the potassium salt of an acid called *ferrocyanic.* This acid in the free state would be $H_4Fe(CN)_6$. The salt is remarkably pure as it occurs in commerce.

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* *Ferri Ferrocyanidum*, U. S. 1870. *Ferri Ferrocyanuretum*, U. S. 1850. *Ferrocyanide of Iron. Ferrocyanuret of Iron. Pure Prussian Blue.* "Take of Ferrocyanide of Potassium *nine troyounces;* Solution of Tersulphate of Iron *a pint;* Water *three pints.* Dissolve the Ferrocyanide of Potassium in two pints of the Water, and add the solution gradually to the Solution of Tersulphate of Iron, previously diluted with the remainder of the Water, stirring the mixture during the addition. Then filter the liquid, and wash the precipitate on the filter with boiling water until the washings pass nearly tasteless. Lastly, dry it, and rub it into a powder." *U. S.* 1870.

In the above process the salt is decomposed by the gradual addition of the solution of ferrocyanide of potassium. Three mols. of ferrocyanide and two of ferric sulphate are mutually decomposed, with the result of forming one mol. of Prussian blue, or the 3–4 ferrocyanide of iron, which precipitates, and six mols. of sulphate of potassium, which remain in solution, the reaction being, $(FeK_4(CN)_6)_3 + 2Fe_2(SO_4)_3 = Fe_3Fe_4(CN)_{18} + 6K_2SO_4$.

Preparation for Use in the Arts. Prussian blue is manufactured on the large scale as follows. A mixture made of equal parts of carbonate of potassium (pearlash of commerce) and of animal matter, such as dried blood, hair, the shavings of horn, etc., is calcined at a red heat, in an iron vessel, until it becomes pasty. The mass, when cold, is thrown, by portions at a time, into twelve or fifteen times its weight of water, with which it is stirred for half an hour. The whole is then put upon a linen filter; and the clear solution obtained is precipitated by a mixed solution of two parts of alum and one of ferrous sulphate. An effervescence occurs, due principally to carbonic acid; and a very abundant precipitate is thrown down of a blackish brown color. This precipitate is washed, by decantation, by means of a large quantity of water, which is removed every twelve hours. By these washings, which last from twenty to twenty-five days, the precipitate becomes successively greenish brown, bluish, and finally deep blue. When of the latter color, it is collected and allowed to drain upon a cloth, after which it is divided into cubical masses and dried.

A preparation under the name of *Soluble Prussian Blue* has been introduced into use for injecting anatomical preparations by Schrœder van der Kolk, and is said to be much esteemed for this purpose. To obtain it there must be a great excess of the yellow prussiate of potassa in concentrated solution. The iron should be in the state of sesquichloride, in the proportion of not more than one-eighth or one-tenth of the prussiate employed. After their mixture, the precipitate is washed with water till it begins to become blue, when it is expressed and dried in the air. On the small scale it may be economically obtained in the following manner. Take solutions of the prussiate containing 217 grammes to the litre of water, and of the sesquichloride containing one part of the solid salt in 10 parts of water. Then, taking equal volumes of the two solutions, add to each one twice its volume of a cold concentrated solution of sulphate of sodium, and mix the solutions. Put on a filter, and treat as directed above. The product dried in the air is perfectly soluble, and admirably adapted for injection. (*Journ. de Pharm.*, 4e sér., iv. 238.) For other formula for Soluble Prussian Blue, see *Ibid.*, 4e sér., xix. 227.

Properties. Pure Prussian blue is a tasteless powder, insoluble in water and alcohol, and having a rich deep blue color. It is insoluble in dilute acids, decomposed by fuming nitric acid, and dissolved without decomposition by strong sulphuric acid, forming a white mass of the consistence of paste, from which the Prussian blue may be precipitated unchanged by water. Concentrated hydrochloric acid decomposes it, dissolving sesquioxide of iron, and liberating hydroferrocyanic acid (H_2Cfy). Boiled with red oxide of mercury, it generates mercuric cyanide. (See *Hydrargyri Cyanidum.*) By the contact of a red-hot body, it takes fire and burns slowly, leaving a residue of sesquioxide of iron. When it is heated in close vessels, water, hydrocyanic acid, and carbonate of ammonium are evolved, and carbide of iron is left. Its composition has been given above. The Prussian blue of commerce was discovered by accident, in 1710, by Diesbach, a preparer of colors at Berlin. It has the same general properties as the pure substance. It occurs in small rectangular masses, which are heavier than water, and have a fracture presenting a bronzed appearance. Besides the constituents of pure Prussian blue, it always contains uncombined sesquioxide of iron, and a portion of alumina, derived from the alum employed in its manufacture, which serves to give it body as a pigment. These substances may be detected by boiling the pigment with dilute hydrochloric acid, and precipitating the filtered solution with ammonia. Pure Prussian blue, treated in this manner, yields no precipitate.

Medical Properties. Prussian blue is deemed a tonic, febrifuge, and alterative, but is at present very rarely used. It is sometimes employed as an application to ill-conditioned ulcers, mixed with simple ointment in the proportion of a drachm to the ounce. The dose is from three to five grains (0·20 to 0·33 Gm.), repeated several times a day, and gradually increased until some effect is produced.

Medical Properties. Judging from the experiments of the German physicians, this salt possesses but little activity, and it is very rarely used in medicines. Callies, as quoted by Pereira, found the commercial salt slightly poisonous, but the pure salt unproductive of harm in the dose of several ounces. It should be borne in mind that it is the commercial salt which is used medicinally. Westrumb and Hering proved that it passed with rapidity into the blood and urine. The late Dr. Burleigh Smart, of Kennebec, Maine, found it to possess active medical properties. (*Am. Journ. of Med. Sci.*, xv. 362.) Its primary effect was that of a sedative, diminishing the fulness and frequency of the pulse, and allaying pain and irritation. It acted also, under favorable circumstances, as a diaphoretic and astringent, but, as a diaphoretic, only in cases attended with excessive vascular action and increased heat of skin. As an astringent, its power was most conspicuous in the colliquative sweats of chronic bronchitis and phthisis. The same power was evinced in several cases of leucorrhœa. It sometimes produced ptyalism, unattended, however, by swelling of the salivary glands or fetor of the breath. Its properties as an anodyne and sedative rendered it applicable to cases of neuralgic pains and hooping-cough, in which diseases, especially the latter, Dr. Smart found it useful. When given in an overdose, it occasioned vertigo, coldness, and numbness, with a sense of gastric sinking. The form of administration which Dr. Smart preferred was that of solution, in the proportion of two drachms to the fluidounce (7·8 Gm.–30 C.c.) of water. Of this the dose for an adult is from 30 to 45 drops (1·9–2·8 C.c.), equivalent to from 10 to 15 grains (0·65–1 Gm.) of the salt, repeated every four or six hours.

This salt is manufactured on a large scale, chiefly for the use of dyers and calico-printers. In pharmacy it is employed to prepare diluted hydrocyanic acid, Prussian blue, and the cyanides of potassium and silver.

Off. Prep. Acidum Hydrocyanicum Dilutum, *U. S.*

POTASSII HYPOPHOSPHIS. *U. S.* *Hypophosphite of Potassium.*

KH_2PO_2; 104. (PO̤-TĂS′SI̤-Ī HȲ-PO̤-PHŎS′PHĬS.) KO, 2HO, PO; 104.

Kali Hypophosphorosum, Hypophosphis Potassicus, s. Kalicus; Hypophosphite de Potasse, *Fr.;* Unterphosphorigsaures Kali, *G.*

This salt is prepared by mixing solutions of hypophosphite of calcium and granulated carbonate of potassium, in the proportion of six ounces of the former dissolved in four pints of water, to 5·75 ounces of the latter in half a pint. As a result of double decomposition between the two salts, carbonate of calcium and hypophosphite of potassium are formed; the former being precipitated, and the latter held in solution. The carbonate of calcium is removed by filtration, and the clear solution is evaporated till a pellicle forms, after which it is constantly stirred, with continuance of the heat, until the salt granulates. The heat employed in the evaporation should be kept considerably below 100° C. (212° F.), for fear of explosion. If the salt is required quite pure, it should be dissolved in the granulated state, in officinal alcohol, and the solution evaporated to a syrupy consistence, and then set aside to crystallize. The hypophosphite of calcium may be prepared by a formula given under the head of *hypophosphite of calcium.*

"Hypophosphite of Potassium should be kept in well-stopped bottles." *U. S.*

Properties. Hypophosphite of potassium, according to the Pharmacopœia, is in "white, opaque, confused-crystalline masses, or a white, granular powder, very deliquescent, odorless, having a sharp, saline, slightly bitter taste, and a neutral reaction. Soluble in 0·6 part of water and in 7·3 parts of alcohol at 15° C. (59° F.); in 0·3 part of boiling water and in 3·6 parts of boiling alcohol. When heated in a dry test-tube, the salt loses adhering moisture, then evolves a spontaneously inflammable gas (phosphoretted hydrogen), burning with a bright, yellow flame. On triturating or heating the salt with an oxidizing agent, the mixture will explode. The aqueous solution of the salt yields a white, crystalline precipitate on the addition of a saturated solution of bitartrate of sodium. With test-solution of nitrate of silver it yields a white precipitate which rapidly turns brown and black, separating metallic silver. Acidulated with hydrochloric acid and added to excess of test-solution of mercuric chloride, it first produces a white precipitate of calomel, and, on further addition, causes the separation of metallic mercury. The aqueous solution of the salt should not effervesce on the addition of an acid (abs. of carbonate), and should not be precipitated or rendered cloudy by test-solution of oxalate of ammonium (abs. of calcium). When acidulated with hydrochloric acid, it should not produce a white precipitate or cloudiness with test-solution of chloride of barium (sulphate). On mixing the aqueous solution with test-solution of magnesium, not more than a slight cloudiness should make its appearance (limit of phosphate)." *U. S.* Its composition is represented by the formula KH_2PO_2.*

Medical Properties and Uses. This salt was brought into notice a few years since, along with several other *hypophosphites*, as those of calcium, sodium, ammonium, etc., in consequence of their supposed efficiency in the introduction of phosphorus into the system, in cases in which this element might be thought to be deficient. Upon this principle they were recommended by Dr. Churchill, of Paris, in the treatment of phthisis, and came into extensive employment; but experience has hardly confirmed the first favorable impression of their usefulness in this complaint. There seem, however, to be good grounds for their application to diseases attended with deficiency of nerve-power from debility of the brain, and in certain scrofulous affections of children, especially those connected with a disordered condition of the bones. The dose of the hypophosphite of potassium is for adults from ten to thirty grains (0·65–1·95 Gm.) three times a day, and may be given dissolved in water, or in the form of syrup.

Off. Prep. Syrupus Hypophosphitum, *U. S.*

POTASSII IODIDUM. *U. S., Br.* *Iodide of Potassium.*

KI; 165·6. (PỌ-TĂS'SỊ-Ī Ī-ŎD'Ị-DŬM.) KI; 165·6.

"Iodide of Potassium should be kept in well-stopped bottles." *U. S.*

Kalium Iodatum, *P.G.;* Kali Hydriodicum, Ioduretum Potassicum, s. Kalicum; Iodure de Potassium, *Fr.;* Jodkalium, *G.*

No process is given in the present U. S. Pharmacopœia. That of U. S. 1870 did not differ essentially from the British.

"Take of Solution of Potash *one gallon* [Imperial measure]; Iodine *twenty-nine ounces* [avoirdupois], or *a sufficiency;* Wood Charcoal, in fine powder, *three ounces* [avoird.]. Put the Solution of Potash into a glass or porcelain vessel, and add the Iodine in small quantities at a time with constant agitation, until the solution acquires a permanent brown tint. Evaporate the whole to dryness in a porcelain dish, pulverize the residue, and mix this intimately with the Charcoal. Throw the mixture, in small quantities at a time, into a red-hot iron crucible, and, when the whole has been brought to a state of fusion, remove the crucible from the fire and pour out its contents. When the fused mass has cooled, dissolve it in two pints [Imp. Meas.] of boiling distilled water, filter through paper, wash the filter with a little boiling distilled water, unite the liquids, and evaporate the whole till a film forms on the surface. Set it aside to cool and crystallize. Drain the crystals, and dry them quickly with a gentle heat. More crystals may be obtained by evaporating the mother-liquor and cooling. The salt should be kept in a stoppered bottle." *Br.*

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* *Hypophosphorous Acid,* HPH_2O_2, 66,—50 per cent. solution,—may be made by dissolving 5⅓ ounces av. of hypophosphite of calcium, and 15⅓ ounces av. of acetate of lead, each, in a pint and a half of distilled water, and mixing the solutions. The precipitated hypophosphite of lead is washed with a small quantity of distilled water, then suspended in eight fluidounces of water, and sulphuretted hydrogen passed through until the precipitate is entirely decomposed. The liquid is then filtered, the precipitate washed with a small quantity of water, and the filtrate and washings evaporated at a low heat until all odor of sulphuretted hydrogen is dissipated. When cool, sufficient distilled water is added to make the whole weigh 8 ounces (av.).

An aqueous solution of potassa is treated with iodine in slight excess. The result of thus saturating potassa with iodine is the formation of two salts, iodide and iodate of potassium. Six atoms of iodine react with six mols. of potassa, and there are formed five mols. of iodide of potassium, and one of iodate of potassium, $6KOH + (I_2)_3 = 5KI + KIO_3 + 3H_2O$. By evaporating the solution to dryness the mixed salts are obtained; and, if the dry mass be exposed to a red heat, the iodate will be converted into iodide of potassium, thus removing this impurity from the iodide. In the formula the mixed salts, towards the close of their evaporation to dryness, are directed to be mixed with powdered charcoal, according to the plan of Mr. Scanlan, which facilitates the deoxidation of the iodate. This being accomplished by a dull red heat, the iodide of potassium is dissolved out of the mass, and the solution is set aside to crystallize.

In the old Ed. and Dubl. processes the first step was to form iodide of iron in solution, precisely as is done in the formula for that compound; and the second to decompose it by carbonate of potassium, which gave rise to iodide of potassium in solution, and a precipitate of ferrous carbonate. The solution of iodide of potassium was separated by filtration and washing from the precipitated carbonate, and evaporated to dryness. The dry salt was then freed from iron and other impurities by solution in boiling water or alcohol, filtration, and crystallization. Messrs. T. and H. Smith, of Edinburgh, instead of washing the precipitate, prefer the plan of pressing it strongly in a cloth, in order to extract the remains of the solution. The mass left is broken up in a portion of distilled water equal to about two-thirds of the weight of the iodine employed, and pressed a second time. Proceeding thus, less water is used, and less evaporation is necessary. The solution obtained by them is evaporated to dryness, and the dry salt is carefully fused in an iron pot, in order to free it from color. It is then dissolved, and the solution, by filtration, concentration, and cooling, furnishes a perfectly pure iodide nearly to the last.* According to E. Schering, the following three methods are now in actual use for the manufacture of potassium iodide on the large scale. 1. Decomposition of barium iodide (obtained from barium sulphide and iodine) with potassium sulphate. 2. Introduction of iodine into caustic potassa; evaporation to dryness, and fusion with carbon, in order to reduce iodate. 3. Decomposition of ferroso-ferric iodide with potassium carbonate. Satisfactory results can be obtained by any of these methods, and the choice must be determined by local considerations. (*N. R.*, July, 1879.)

Properties. Iodide of potassium, sometimes incorrectly called *hydriodate of potassa*, is in "colorless, translucent, cubical crystals, slightly deliquescent, having a peculiar, faint odor, a pungent, saline, afterward somewhat bitter taste, and a neutral reaction. Soluble in 0·8 part of water and in 18 parts of alcohol at 15° C. (59° F.); in 0·5 part of boiling water and in 6 parts of boiling alcohol. The commercial salt generally appears in white, opaque crystals, having a faintly alkaline reaction; but single crystals laid upon moistened red litmus paper should not at once produce a violet-blue stain (abs. of more than about 0·1 per cent. of alkali). At a dull red heat, the salt melts without losing weight. At a full red heat, it is slowly volatilized without decomposition. The aqueous solution of the salt yields a white, crystalline precipitate on the addition of a saturated solution of bitartrate of sodium. If disulphide of carbon be poured into a solution of the salt, then chlorine water added drop by drop, and the whole agitated, the disulphide of carbon will acquire a violet color." *U. S.* According to the Messrs. Smith, of Edinburgh, it is not at all deliquescent when perfectly pure. It generally crystallizes in cubes. If solution of iodide of potassium be mixed with solution of starch, and a minute solution of chlorine be added, a blue color will be produced; the chlorine combining with the potassium and thus liberating the iodine, which forms a blue compound with starch. Its solution is decomposed by the addition of a few drops of sulphuric acid, hydriodic acid being generated, which speedily undergoes decomposition, with evolution of iodine; and, if starch be added after the lapse of a few minutes, a blue color is produced. The starch test will not give the characteristic blue color immediately, if added simultaneously with the acid, unless the iodide of potassium contains iodate of potassium, which impurity causes an immediate liberation of iodine. The blue color being produced by the starch and acid, if simultaneously added, is, therefore, a sign of impurity. A very delicate test for iodide of potassium, and other soluble iodides, is that of M. Grange. It consists in pouring a little of the liquid to be examined into a test-tube, adding a few drops of solution of starch, and passing through the mixture a few bubbles of fuming nitrous acid. The liquid immediately assumes a pale rose color, inclining to violet, if containing 1-200,000th of its weight of the iodide, and a bright blue color, if 1-100,000th is present. (See page 806.) When tartaric acid is freely added to a strong solution of the iodide, it occasions a white crystalline precipitate; and the supernatant liquid, if mixed with starch, becomes first purple, and finally blue. Platinic chloride colors its solution reddish brown, without causing a precipitate; chloride of barium but slightly affects it; and sulphate of iron occasions no change. The non-action of the last test shows the absence of carbonate of potassium. The aqueous solution is capable of taking up a large quantity of iodine, forming a liquid of a deep brown color.

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* According to the method of E. Sonstadt, iodide of potassium is prepared directly from the mother-liquors of kelp by converting the alkaline iodides into iodates by means of chlorine or permanganate of potassium, precipitating the iodic acid by a soluble barium salt, heating the precipitate with solution of sulphate of potassium, drying up and melting the resulting iodate of potassium solution, and crystallizing its solution from the iodide of potassium thus obtained. (*Chem. News*, xxvi. 182.)

M. Payen has noticed a curious effect produced by iodide of potassium. In saturated solution, this salt causes in starch added to it an enlargement of its granules to twenty-five or thirty times their original volume, dissolving the interior substance of the granules, and enormously distending the exterior layer. The bromide of potassium produces the same effect; but the alkaline chlorides cause neither the enlargement referred to, nor a solution of the amylaceous substance; and if the saturated solution of the iodide be diluted with three and a half volumes of water or more, it is inert in reference to starch in the cold. (*Journ. de Pharm.*, 4e sér., ii. 373.) M. Ferières found that ether added to a solution of iodide of potassium decomposes it, but it has been shown by the researches of M. de Vrij and of M. Magnes-Lahens that this does not happen with pure ether, but is due to the acetic acid which is developed by sunlight in ether. (*Journ. de Pharm.*, 4e sér., xvi. 107, 468; xvii. 116.)

Tests. Exposed to a dull red heat, iodide of potassium fuses, and on cooling concretes into a crystalline pearly mass, without loss of weight; but at a full red heat it is slowly volatilized without decomposition. The most usual impurities contained in this salt are the chlorides of potassium and sodium, bromide of potassium, and carbonate and iodate of potassium. According to M. Payen, the iodide of potassium of commerce generally contains carbonate of potassium and iodine in excess. (*Journ. de Pharm.*, 4e sér., ii. 373.) He states, however, that it may be easily purified by saturating the potassa with hydriodic acid, and then eliminating the excess of iodine by sulphuretted hydrogen, boiling, rest, and filtration. (*Ibid.*, p. 368.) The presence of a chloride may be determined by nitrate of silver. This test will throw down nothing from the pure salt but iodide of silver, which is scarcely soluble in ammonia; while chloride of silver is readily soluble in it. If then a solution of the iodide be precipitated by an excess of nitrate of silver, and treated with ammonia, the latter will dissolve any chloride which may have been thrown down, and will yield it again as a white precipitate on being saturated with nitric acid. If, on the other hand, the iodide of potassium be pure, the ammonia will take up only a minute quantity of iodide of silver, and the addition of nitric acid will scarcely disturb the transparency of the solution. The iodide of silver precipitated from 10 grains of iodide of potassium weighs, when washed and dried, 14·1 grains. When acetate of lead is added to a solution of iodide of potassium, a yellow precipitate of iodide of lead is thrown down, soluble in boiling water. The officinal tests are as follows: "The aqueous solution of the salt, mixed with gelatinized starch and afterward with diluted sulphuric acid, should not at once acquire a blue color (abs. of iodate). If 1 Gm. of the salt be dissolved in 10 C.c. of water of ammonia, then shaken with a solution of 1·1 Gm. of nitrate of silver in 30 C.c. of water, and the filtrate be supersaturated with 7 C.c. of nitric acid, no cloudiness should make its appearance within ten minutes (abs. of more than about

0·5 per cent. of chloride or bromide). On adding to 1 Gm. of the salt, dissolved in 30 C.c. of water, 5 or 6 drops of test-solution of nitrate of barium, no immediate cloudiness or precipitate should make its appearance (limit of sulphate). 1 Gm. of the powdered and dried salt, when completely precipitated by nitrate of silver, yields, if perfectly pure, 1·415 Gm. of dry iodide of silver." *U. S.* The low price of bromide of potassium, compared with that of the iodide, has caused the former to be used to adulterate the latter. When bromide of potassium is sold for the iodide, the fraud may be detected by the fact that the addition of sulphuric acid produces copious reddish fumes, instead of the purple ones arising from the iodide. Mr. Edm. Van Melckebeke proposes taking advantage of the fact that a saturated solution of one salt will still dissolve another salt. He prepares a saturated solution of the bromide in boiling water, allows it to cool and crystallize, and then filters. To 10 cubic centimetres of this 10 drops of distilled water are added in a test-tube, and then one grain of the suspected iodide in coarse powder. If the iodide be pure, it dissolves almost instantly, but any bromide which may be present remains unaffected. (*A. J. P.*, xliv. 248.) Alfred E. Tanner affirms that he has found this test useless. (*P. J. Tr.*, June, 1873, p. 1033.) M. Lepage determines the amount of the bromide as follows. Dissolve one gramme of the corrosive sublimate in twenty cubic centimetres of water; also one gramme of the suspected iodide in thirty grammes of pure water. Add by means of a burette the former fluid to the latter until it just ceases to cause a turbidity. If the iodide is pure, at least 16 C.c. of the mercurial solution are required; if impure, the remaining solution will exceed the volume of 4 C.c. in proportion as the iodide has been replaced by bromide of potassium. For this test it is necessary that the iodide be free from chloride, carbonate, and iodate. (*A. J. P.*, xliv. 167.) In order to detect bromine, M. Personne first precipitates from an aqueous solution of the suspected iodide the whole of the iodine as cuprous iodide, by successively adding, in excess, a solution of sulphate of copper, and aqueous sulphurous acid, and then treats the filtered liquid with ether and chlorine water, the whole being shaken together and left at rest. If bromine be present, the ether which rises to the surface will be tinged of a reddish yellow color. Fresenius's test of chloride of gold is, according to Dr. J. H. Bill, of the U. S. Army, very delicate. The iodine having been separated by palladium, and the excess of palladium by sulphuretted hydrogen, the solution supposed to contain bromine, if treated first with a drop of hydrochloric acid, and then with a drop of solution of chloride of gold, will, if bromine be present, exhibit a decided yellowness, which will appear more obviously if the solution be compared with pure water or a weak solution of a chloride. (See *A. J. P.*, May, 1868, p. 272.) Carbonate of potassium may be discovered by lime-water, which causes a milkiness (carbonate of calcium), and by tincture of iodine, the color of which is destroyed. The Br. Pharmacopœia admits a slight degree of this impurity, directing that saccharated solution of lime should only faintly precipitate the solution. The iodate may be detected by adding a solution of tartaric acid to a solution of the suspected iodide. Bitartrate of potassium will be precipitated, and, if the iodide be pure, a yellow color is *soon* developed by the action of the air on the liberated hydriodic acid; but, if any iodate be present, the test will give rise to both iodic and hydriodic acids, which, by their mutual action, will *instantly* develop iodine.

Mr. William Copney has pointed out an excellent test for detecting carbonate and iodate of potassium, in the use of ferrous iodide, in the form of syrup of iodide of iron, recently prepared. (See *Syrupus Ferri Iodidi.*) A drop of the syrup is added to a solution of the suspected iodide of potassium. A bluish precipitate indicates the carbonate; a red one, the iodate; and a blue precipitate, followed by a red one, both impurities. Carbonate of potassium is generally present in the proportion of from 1 to 10 per cent. Dr. Christison has detected 74½ per cent., and Dr. Pereira as high as 77 per cent. An adulteration by the carbonate under 10 per cent. does not alter the crystalline appearance of the iodide, but gives it an increased tendency to deliquesce. When it is greater it renders the salt granular and highly deliquescent. As iodide of potassium is soluble in rectified spirit, anything left undissolved by that solvent is impurity. (*A. J. P.*, xxvi. 293.) A seemingly better method is that of M. Personne, founded upon the fact that when mercuric chloride is added to a solution of the iodide in just sufficient amount to form the iodo-hydrargyrate the solution remains clear; but on the further addition of the minutest quantity of the chloride a persistent reddish or rose-colored precipitate is formed. He prepares the titrating solution by dissolving 13·55 grammes of the mercuric chloride and 8 to 10 grammes of common salt in 200 to 250 grammes of distilled water, and then adding sufficient distilled water to make the whole measure one litre; 10 cubic centimetres of this equal 0·1355 of the chloride. Of the iodide to be tested 3·32 grammes are dissolved in sufficient water to make exactly 100 cubic centimetres. The titration is performed by putting 10 cubic centimetres of this in a beaker glass, and adding from a burette, drop by drop, the mercurial liquid, keeping the beaker in a constant agitation by means of the gyratory movement with the hand. When the red color appears the titration is complete. If the iodide be pure, 10 cubic centimetres of the mercurial solution will have been used; if only 8 C.c. have been used, it is known that the iodide only contains 80 per cent. of the pure salt; 9 C.c. indicate 90 per cent.; 7 C.c., 70 per cent., and so on. The presence of bromide, chloride, or carbonate of potassium is said not to interfere with this test. (*Journ. de Pharm.*, Janv. 1875, p. 5.) Iodide of potassium contains no water of crystallization.

According to M. Payen, a saturated solution of iodide of potassium, which will evince signs of decomposition by becoming orange-yellow, in the presence of atmospheric air, on the addition of small quantities of acetic, nitric, oxalic, and probably many other acids, remains unaffected by these additions if atmospheric air be excluded. The air oxidizes a portion of the potassium, which then unites with the acid, and the iodine liberated gives color to the solution. (*Journ. de Pharm.*, 4e sér., iii. 200.) As first pointed out by M. Loew (*A. J. P.*, xlii. 80), and confirmed by M. Vidau in an elaborate series of experiments, iodine is liberated from a solution of iodide of potassium by direct sunlight; the more concentrated the solution the more energetic is the action. (*Journ. de Pharm.*, 4e sér., xx. 351.)

Iodide of potassium is incompatible with calomel, the black and red oxides of mercury, turpeth mineral, white precipitate, blue mass, and metallic mercury. M. Melsens observes that iodide of potassium, given in connection with the insoluble preparations of mercury, renders them soluble and much more active. (See *A. J. P.*, xxvi. 222.) With nitrous ether iodide of potassium reacts, yielding, among other products, ethyl iodide and a little ordinary ether. (Juncadella, *Comptes-Rendus*, Fév. 1859, p. 345.) At ordinary temperatures iodide of potassium is slowly decomposed, with evolution of iodine, by nitrate of ammonium and boric acid; and at high temperatures, in a glass test-tube, with escape of violet vapors, not only by the two substances just named, but also by sulphate, oxalate, carbonate, and chloride of ammonium, sulphate, phosphate, nitrate, and borate of sodium, sulphates of potassium and magnesium, nitrate of calcium, chlorides of sodium, potassium, and calcium, and silicic acid. (Ubaldini, *Journ. de Pharm.*, Oct. 1859, p. 292.) M. Melsens has noticed another very important fact in relation to the operation of iodide of potassium. When this salt and chlorate of potassium are mixed in solution, no change takes place at ordinary temperatures; but if a certain amount of a mineral acid be added to the solution of the mixed salts, a reaction occurs, attended with the escape of iodine; and evidences are presented of the existence of iodic acid in the solution. Now, M. Melsens has ascertained by experiments on dogs that neither of these salts, if given separately and at different times, produces an evil effect; while if given together, so as to be in the system at the same time, they act as a poison, and may cause death in a few days. Seven grammes (108 grains) of a mixture of iodide of potassium and chlorate of potassium in equivalent proportions, given daily to a dog of medium size, uniformly proved fatal in less than a month, and often as early as the fifth day. M. Melsens ascribed the result to the production of iodate of potassium, which he has shown to be a poisonous salt. (*A. J. P.*, Nov. 1866, p. 521; from *Bullet. de la Soc. Chem. de Paris.*) With the alkaloids iodide of potassium is incompatible, and fatal results have been caused by the iodide of strychnine crystallizing out of a prescription, so that the whole of it was taken at a single dose.

Medical Properties. The general therapeutic properties of the preparations of iodine, of which iodide of potassium is the most important, have been given under the head of iodine. By most practitioners the preparation under notice is preferred for producing the constitutional effects of iodine. When it is administered in large repeated doses it produces evidences of systemic infection, known as *iodism.* The most usual indication of its constitutional action is a pain over the brow with coryza; in some cases a mild ptyalism with fetor of the breath and slight swelling of the gums is produced. In a number of cases it causes an eruption, sometimes simply of macula, but usually of acne. In unusual conditions of the system these skin affections may become very severe and ulcerations result. Thus, Dr. John O'Reilly, of New York, reports several cases, in which, after the use of this iodide, spots like purpura were produced, invading first the face, and then the trunk and extremities. These became bullæ, sometimes an inch in diameter, filled with a purple liquid, and finally sphacelated spots ending in ulcers. Great constitutional disturbance coexisted, with swollen tongue, fetor, and salivation. Drs. Bumstead (*Am. Jour. Med. Sci.*, lxii. 101) and H. C. Wood have seen similar cases. When it is given in a too concentrated form, its local irritant properties assert themselves, and severe gastro-intestinal irritation or inflammation may result. The amount of iodine which the individual will bear varies, but in those who have not been gradually accustomed to its use, the power of resisting very large doses is strong evidence of a syphilitic infection.

In periosteal nodes, specific rheumatism, diseases of the nervous system or large viscera, and in other forms of advanced secondary or tertiary syphilis, iodide of potassium acts as a specific, but must be given in very large doses and continuously for months or even years. It is when the symptoms are not very active, or when evidences of cachexia forbid mercurials, that it is especially indicated. In 1843, MM. Guillot and Melsens gave iodide of potassium with advantage, in doses of from a drachm to a drachm and a half daily, in mercurial tremors and lead poisoning. In a memoir published in 1849, M. Melsens gives a full account of his experiments with it as a remedy for the affections caused by mercury and lead. He effected a number of cures of mercurial tremors and lead palsy; and, during the progress of the cure, these metals were found in the urine. The manner in which the remedy acts, according to M. Melsens, is by rendering the poisonous metal, which has become fixed in the tissues, soluble, first converting it into an iodide, and then dissolving the iodide formed. This view is supported by the fact that all the compounds of mercury and lead are soluble in iodide of potassium.* The views and results of M. Melsens have been confirmed by therapeutic trials in lead poisoning by M. Malherbe, of Nantes, and by Drs. Parke and Sieveking, of London. An important fact observed by M. Melsens was that iodide of potassium, given at the same time with certain compounds of mercury, rendered them more active, and, when given after them, developed an activity not previously manifested, and sometimes to such an extent as to occasion serious accidents. This fact he explained by referring it to the power of the iodide to render the mercurial compounds soluble, in which state only are they capable of being eliminated with the urine. During the use of iodide of potassium, ptyalism sometimes occurs. This has been usually considered as a primary effect of the remedy; but the light shed on the subject by M. Melsens shows that it may in some cases be a secondary effect, resulting from the liberation from the tissues of mercury previously taken, which is thereby enabled, by becoming soluble, to produce its constitutional effects. Dr. Budd relates several cases, in which mercurial ptyalism came on, during the use of iodide of potassium, in persons who had not taken mercury for weeks or months before. It is probable that in these cases the mercury had been long lying fixed in the system, and was rendered soluble and active by the iodide. Every case in which prolonged mercurial treatment has been resorted to should subsequently be given a course with the iodide.

Dr. G. W. Balfour, of Edinburgh, published several cases of aneurism of the aorta, in which iodide of potassium was given in the dose of thirty grains twice or thrice daily, with apparently great advantage; the symptoms of the disease having not only been greatly relieved, but in some instances having entirely disappeared. (*Edin. Med. Journ.*, July, 1868, p. 33; also April, 1871, p. 935.) The results probably were due to the aneurisms being of syphilitic origin.

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* See the Memoir of M. Melsens, translated by Dr. Budd, of Bristol, England, in the *Brit. and For. Medico-Chir. Review,* Am. ed., for Jan. 1853, p. 157; also a paper by Dr. J. W. Corson, in the *N. Y. Journ. of Med.* for Sept. 1853.

Iodide of potassium has been used internally by Dr. A. Beaufort with much supposed advantage in reference to its local effects. Being largely secreted with the tears, and to a certain extent with the uterine fluids, he gives it with a view to its effects on the passages with which it thus comes in contact. In this way he explains the very good effects he has experienced from it in chronic inflammation of the lachrymal passages, and in chronic metritis with copious leucorrhœa. (*B. & F. Med.-Chir. Rev.*, Oct. 1868, p. 517; from *Bullet. Gén. de Thérap.*, Jan. 3, 1868.)

The dose of iodide of potassium is from two to ten grains or more (0·13–0·65 Gm.), three times a day, given in dilute solution. In syphilitic cases, two, four, and even six drachms (7·8–15·5–23·3 Gm.) may be given daily with excellent results. Dr. Buchanan, of Glasgow, assures us that he has given the pure salt in doses of half an ounce (15·5 Gm.). When it is given in large amounts, care should be exercised to secure free dilution. According to Dr. Gull, of London, the efficiency of the remedy is much increased by uniting it with carbonate of ammonium, in the proportion of two or three grains (0·13–0·20 Gm.) of the iodide to four or five (0·26–0·33 Gm.) of the carbonate.

Iodide of potassium passes quickly into the urine, in which it may be detected by first adding to the cold secretion a portion of starch, and then a few drops of nitric acid, when a blue color will be produced. It has been detected in six minutes after having been swallowed. According to Schottin, it passes slowly into the sweat. Taken in half-drachm doses daily, it did not appear in that secretion until five days had elapsed.

Iodide of potassium is employed as an external application in the form of ointment, either alone or mixed with iodine. (See *Unguentum Potassii Iodidi* and *Unguentum Iodi.*)

Off. Prep. Hydrargyri Iodidum Rubrum; Linimentum Iodi, *Br.;* Linimentum Potassii Iodidi cum Sapone, *Br.;* Liquor Iodi, *Br.;* Liquor Iodi Compositus, *U. S.;* Tinctura Iodi, *Br.;* Unguentum Iodi, *U. S.*, *Br.;* Unguent. Potassii Iodidi, *U. S.*

POTASSII NITRAS. *U.S.* *Nitrate of Potassium.*

KNO_3; 101. (PO̦-TĂS'SI̦-Ī NĪ'TRĂS.) KO, NO_5: 101.

"KO,NO_5. Nitrate of potash of commerce, purified, if necessary, by crystallization from solution in distilled water." *Br.*

Potassæ Nitras, *Br.;* Kali Nitricum, *P.G.;* Nitrum Depuratum, Sal Petræ, s. Nitri, Nitras Potassicus, s. Kalicus; Nitrate of Potash, Nitre, Saltpetre; Nitrate de Potasse, Azotate de Potasse, (Nitre prismatique), Salpêtre, *Fr.;* Salpetersaures Kali, Salpeter, Kalisalpeter, *G.*, *Dutch*, *Dan.*, *Sw.;* Nitro, *It.*, *Sp.*, *Port.*

Nitre, or saltpetre, is both a natural and an artificial product. It occurs in many countries, existing in the soil, on which it forms a saline efflorescence, in the fissures of calcareous rocks, and in caves. It has been found in different parts of Europe, in Egypt, and in Peru; but the country in which it is most abundantly produced is India, whence the principal part is furnished for the demands of commerce. In the United States it is found, for the most part, in caverns situated in limestone rock, called saltpetre caves, where it is associated with nitrate of calcium. The earths contained in them are lixiviated, and yield, according to their richness, from one to ten pounds of crude nitre to the bushel. These caves are particularly numerous in Kentucky, and furnished a large proportion of the nitre consumed in the United States during the last war with England. According to Mr. E. S. Wayne, of Cincinnati, nitre earth exists near Nashville, Tenn., which yields 15 per cent. of nitre, and is said to be sufficiently abundant to supply the demand of the United States. In Bradford County, Penn., a solid, uncrystalline deposit of very pure nitre exists in a sandstone rock. (*Prof. W. H. Ellet.*) "A mountain" of the salt is said to have been discovered by Dr. Harrison among the Rocky Mountains, "six miles N.E.

of Crystal Peak." (*A. J. P.*, 1866, p. 87.) Nitre exists also in the vegetable kingdom, having been found in tobacco, borage, bugloss, parietaria, hemlock, and the sunflower. The artificial sources of nitre are certain mixtures of animal and vegetable substances with wood-ashes and calcareous matter, called nitre-beds; and certain materials, impregnated with saltpetre, consisting principally of plaster rubbish, derived from the demolition of old buildings. The ashes of tobacco-stems, consisting almost exclusively of carbonate and chloride of potassium in nearly equal parts, have been proposed by M. Commaille as an artificial source of nitre, by adding them to the ordinary nitre-beds. (*Journ. de Pharm.*, Fév. 1856, p. 106.)

Preparation from its Natural Sources. In India the saline earth, which contains about seven parts of nitre in a thousand, is lixiviated in large mud filters, lined with stiff clay, and furnished with false bottoms of bamboo, covered with grass mats, on which wood-ashes are laid. The filters being then filled with the saline earth, water is added, and the solution filters through the wood-ashes, with the effect of converting the nitrate of calcium present, amounting to nearly 1 per cent., into nitrate of potassium. The solution obtained is evaporated in earthen pots, filtered, and set aside to crystallize. The impure nitre thus obtained contains from 45 to 70 per cent. of the pure salt. It is redissolved and crystallized, and thrown into commerce under the name of crude saltpetre. Besides the nitre obtained in India by the filtration of the soil deposited during the overflow of the Ganges, it appears, from the report of Dr. J. W. Palmer, that much of the crude salt is procured, in the northwestern provinces of Hindostan, from the saline incrustations formed in and around the mud walls surrounding the dwellings of the natives. The scrapings from these sources are lixiviated, and the impure solution allowed to evaporate in shallow pans exposed to the sun. The impure nitre extracted from the earthy matters crystallizes out; while from 1 to 9 per cent. of common salt remains in the mother-liquor, and is recovered by evaporation. (*A J. P.*, 1868, p. 436.)

Within recent years, nitre has been largely manufactured from the native potassium chloride of Stassfurt and the native sodium nitrate of Chili, two cheap and abundant crude materials, which by their reaction yield potassium nitrate. For this purpose equal molecular quantities of the two salts are dissolved in water until the specific gravity of the liquor reaches 1·5. Chloride of sodium is deposited, and the clear solution on cooling and on agitation deposits the saltpetre in the form of flour.

Artificial Preparation. The plan of forming saltpetre in artificial nitre-beds is principally practised in Germany; while the method of obtaining it from old plaster rubbish is followed in France. *Artificial nitre-beds* are formed of animal and vegetable remains, together with ashes and calcareous earth, which are mixed up with a portion of loose soil and placed under sheds, to shelter the mixture from the rain; while the sides are left open to admit the free access of air. The mixture is disposed in little ranges or heaps, which are frequently turned over with a spade, and sprinkled with urine, as a substance containing a large quantity of nitrogen. At the end of two or three years, the nitrogen is converted into nitric acid, and this, by uniting with the potassa existing in the vegetable remains, forms nitre. When the contents of the bed contain about four ounces of the salt for every cubic foot of the materials, they are deemed fit to be lixiviated. The lixiviation is performed with boiling water, which is repeatedly thrown upon fresh portions of the mass, until the solution obtained is sufficiently strong. The lixivium is of a brown color, and contains chiefly the nitrate of potassium, but at the same time more or less of the nitrates of calcium and magnesium, and of common salt. The earthy nitrates are then decomposed by a solution of wood-ashes, the potassa of which converts them into nitre, and precipitates the earths. The solution being further evaporated, the common salt rises to the surface as a scum, and is removed. The solution is then allowed to cool, and the nitrate crystallizes in dirty white crystals, called crude nitre. Nitrate of calcium may be converted into nitre by adding it to a solution of sulphate of potassium. Sulphate of calcium is precipitated, and nitrate of potassium remains in solution.

When obtained from old plaster rubbish, the material is reduced to powder and lixiviated, in order to exhaust it of everything soluble. The solution is found to contain the nitrates of potassium and calcium, and common salt, and is treated with wood-ashes, which convert the nitrate of calcium into nitrate of potassium, with precipitation of the earth as a carbonate. The liquor is separated from the precipitate and concentrated by heat; and the common salt, as it rises to the surface, is skimmed off. When the solution is so strong as to mark 45° of Baumé's areometer, it is allowed to cool and crystallize; and the crystals form the crude nitre of this process. The salt obtained in this way generally contains from 85 to 88 per cent. of pure nitre; the remainder being made up of chloride of sodium, and certain deliquescent salts. The details of this process, as formerly practised in Paris, are given by Thénard.

Theory of Nitrification. It is generally supposed that the continuous formation of nitre in nitre earths, and in artificial nitre-beds, depends upon the oxidation of the nitrogen of ammonia, thus generating nitric acid, the formation of which is facilitated by the presence of alkaline and earthy bases, with which the acid unites. The ammonia is derived, for the most part, from the organic remains in the nitre earths, and from the animal matter which is an essential ingredient in the artificial mixtures. According to Schoenbein, whose statement has been confirmed by Goppelsröder, the formation of the nitric acid is always preceded by that of nitrous acid. (*Journ. de Pharm.*, Avril, 1862, p. 334.)

Purification. Nitrate of potassium, as first obtained, either from natural or artificial sources, is called in commerce crude saltpetre, and requires to be purified before it can be used in medicine, or in most of the arts. The process, which is founded principally on the fact that nitre is more soluble than common salt in hot water, is conducted in the following manner in France. Thirty parts of saltpetre are boiled with six parts of water, and the portion which remains undissolved, or is deposited, consisting of common salt, is carefully removed. As the ebullition proceeds, a little water is added from time to time, to hold the nitre in solution. When common salt ceases to be separated, the solution is clarified with glue; and more water is added, at intervals, until the whole, including that previously added, amounts to ten parts. The clear solution is now transferred to large, shallow copper coolers, where it is agitated with wooden instruments to hasten the cooling, and to cause the nitre to crystallize in small grains. The purification is completed by washing the salt with water, or a saturated solution of nitre, in a kind of wooden hopper, with holes in the bottom stopped with pegs. The liquid employed is allowed to remain in contact with the nitre for several hours, after which it is permitted to drain off by taking out the pegs. The salt is now dried, and takes the name of purified nitre.

In Sweden, the process of purification is conducted in a different manner. The solution of the crude nitre is boiled until a saline crust (common salt) forms on its surface, and until it is so far concentrated that a small portion of it crystallizes upon cooling. The crust being removed, the solution is filtered, and diluted with 1-48th of water, with a view to retain in solution the common salt, which, being somewhat less soluble in cold than in boiling water, would otherwise be in part precipitated on refrigeration. This solution is now allowed to cool, and, at the moment crystals begin to form, is stirred constantly to cause the salt to crystallize in small grains. The granular salt is then washed after the French method, as above described, dried, and, being fused, is cast in sheet-iron moulds so as to form masses, each weighing from ten to twenty pounds. The preparation of nitre in this manner by fusion is, according to Berzelius, attended with several advantages; such as occupying less space, losing nothing by waste in transportation, and presenting, in this state, an obvious index of its quality. This index is the character of its fracture. When the salt is perfectly pure, the fracture is radiated, the radii being generally large. The presence of 1-80th of common salt renders the radii smaller; that of 1-40th, or a larger quantity, produces a zone in the substance of the mass devoid of the radiated structure, or causes this structure to disappear entirely. On the other hand, the melting of the salt has the disadvantage of converting it in part into nitrite if the heat be too high, and of rendering it difficult to pulverize.

Commercial History. Nitre is sometimes received in this country from Calcutta, packed in grass-cloth bags, containing from one hundred and fifty to one hundred and seventy-five pounds. Its quality varies considerably. That which comes in dirty yellow crystals is called *crude saltpetre;* while the finer lots, in small, comparatively clear crystals, approaching to white, are called *East India refined.* Very little crude saltpetre is at present obtained from native sources in the United States. The *refined saltpetre* is almost exclusively prepared by our own chemists.

As connected with the subject of saltpetre, it may be proper in this place to notice what is incorrectly called *South American saltpetre*, enormous quantities of which are exported from Peru and Chili. It is nitrate of sodium, and comes in bags containing about 270 pounds of the salt in the crude state. This nitrate is used by our manufacturing chemists, and is better suited than nitre for preparing nitric and sulphuric acids, on account of its greater proportional quantity of acid. It is, however, not applicable to the purpose of making gunpowder, from its tendency to absorb moisture. (See *Sodii Nitras.*)

Properties. Potassium nitrate occurs as "colorless, transparent, six-sided, rhombic prisms, or a crystalline powder, permanent in the air, odorless, having a cooling, saline and pungent taste, and a neutral reaction. Soluble in 4 parts of water at 15° C. (59° F.), and in 0·4 part of boiling water; almost insoluble in alcohol. When heated to about 340° C. (644° F.), the salt melts; at a higher temperature it is decomposed, giving off oxygen, and leaving a residue which emits nitrous vapors on the addition of sulphuric acid. Thrown upon red-hot coals, the salt deflagrates. The aqueous solution of the salt yields a white, crystalline precipitate on the addition of a saturated solution of bitartrate of sodium. The aqueous solution of the salt should remain unaffected by hydrosulphuric acid or sulphide of ammonium (abs. of metals), also by test-solution of carbonate of ammonium (alkaline earths). If previously acidulated with nitric acid, it should yield no precipitate or cloudiness with test-solution of nitrate of barium (sulphate), and, at most, only a faint opalescence with test-solution of nitrate of silver (limit of chloride). If 1 Gm. of the dried salt be moistened with 1 Gm. of concentrated sulphuric acid, and the mixture be kept at a red heat until it ceases to lose weight, the residue should weigh 0·86 Gm." *U. S.* It is devoid of water of crystallization, but is apt to contain a portion of liquid, mechanically lodged within the substance of the crystals. This is particularly the case with the *large* crystals, and, according to Berzelius, is a source of impurity; as the liquid in question is a portion of the mother-water in which they were formed. It is on this account that Berzelius recommends that the solution of the purified salt should be stirred during crystallization, so as to cause it to shoot into *small* crystals. The fused mass, when cast in moulds, or formed into little circular cakes, constitutes that form of nitre kept in the shops under the name of *crystal mineral* or *sal prunelle.** If the heat is increased, the salt is decomposed, evolves pure oxygen, and is reduced to the state of nitrite, which, in powder, emits orange-colored fumes of hyponitric acid, and nitrous oxide on the addition of sulphuric acid. Upon a further continuance of the heat, the nitrous acid itself is decomposed, and a large additional quantity of oxygen is evolved, contaminated, however, with more or less nitrogen. On account of the large proportion of oxygen which it contains, nitre increases the combustion of many substances in a remarkable degree. When thrown on burning coals, it deflagrates with bright scintillations. In the reaction of nitre with charcoal, carbonic acid is produced, and never carbonic oxide; and the nitric acid is variously decomposed into nitrous oxide, nitrogen dioxide, or nitrogen, according to the proportion of the charcoal and to the heat employed. (*A. Vogel, Jr.*) Nitre may be readily recognized by its effect in increasing the combustion of live coals, when thrown upon them; and by evolving white or reddish vapors on the addition of sulphuric acid. Its most usual impurity is common salt, which is seldom entirely absent, and which injures it for the manufacture of gunpowder. If the residue weighs less, part of it is probably sulphate of sodium, and the nitre tested may be assumed to have contained nitrate of sodium. The refined or purified saltpetre of commerce is sufficiently pure for medicinal use. Nitrate of potassium is composed of one atom of potassium in combination with one nitric acid group, which latter is monobasic. K, 39 + NO_3, 62 = 101.* M. Violette, on mixing a few grains, each, of nitrate of sodium and acetate of sodium, previously fused, noticed a few gaseous bubbles given off; and, at the same time, a violent explosion took place, which scattered the vial in fragments over his laboratory. On heating a mixture of a grain each of nitrate of potassium and acetate of sodium, the mixture remained fluid at 300° C. (572° F.) and perfectly quiet; but, when the temperature was increased to about 350° C. (662° F.), a slight ebullition was noticed, instantly followed by a loud explosion, with light and smoke like exploded gunpowder. (*A. J. P.*, 1873, p. 128; from *Journ. de Pharm. et de Chim.*, xvi. 333.)

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* *Sal prunelle,* as directed to be made in the French Codex of 1837, is a mixture of nitrate and sulphate of potassium. It is prepared by fusing nitre in a Hessian crucible, adding 1-128th part of sulphur, and pouring out the product on a smooth marble slab, where it is allowed to congeal. The sulphur immediately takes fire, and, by combining with oxygen from a part of the nitric acid of the nitre, becomes sulphuric acid, which then unites with a small portion of potassa, to form sulphate of potassium.

Medical Properties. Nitre is considered refrigerant, diuretic, and diaphoretic. It is known to be a powerful antiseptic. It generally promotes the secretion of urine and sweat, lessens the heat of the body and the frequency of the pulse, and has a tendency to keep the bowels in a soluble condition. When taken in health, in quantities increasing gradually from one to five drachms daily, for the space of from eight to twelve days, it was found by F. Löffler to produce general weakness, lowness of spirits, constant disposition to sleep, and slow and weak pulse. Towards the end of the experiment, the pulse several times fell to twenty beats in the minute. During the use of the medicine, the appetite and digestion continued good, and the bowels were regular; though, occasionally, some pain was experienced in the abdomen, followed by purging. The blood, drawn at the end of the period, resembled cherry-juice in color, exhibited paler blood-corpuscles than in health, coagulated very quickly, forming a clot of diminished firmness, was more watery than natural, and contained a smaller proportion of fat. (*Am. Journ. of Med. Sci.*, xviii. 204.)

Nitre is sometimes prescribed with tartar emetic and calomel, forming the so-called *nitrous powder*, which promotes most of the secretions, particularly those of the liver and skin, and is sometimes advantageous in lessening and modifying febrile excitement. The formula usually preferred is eight or ten grains (0·52–0·65 Gm.) of nitre, the eighth of a grain (0·008 Gm.) of tartar emetic, and from the fourth to the half of a grain (0·016–0·03 Gm.) of calomel, exhibited every two or three hours. Locally, nitre is an irritant or stimulant according to concentration, and is frequently given in active hemorrhages, particularly hæmoptysis, and is a useful ingredient of gargles in certain stages of inflammatory sore throat. In asthma, nitrous fumigation has been found useful, performed by inhaling the fumes from a piece of burning touch-paper about the size of a playing card, prepared by dipping blotting-paper in a saturated solution of nitre, and afterwards drying it. M. Vohl has examined the vapor resulting from the burning of paper thus impregnated, and found it to consist of carbonic acid and oxide, cyanogen, ammonia, nitrogen, aqueous vapor, and carbonate and nitrite of potassium; and he ascribes the beneficial results of its inhalation to the ammonia and nitrite of potassium. (*Journ. de Pharm. et de Chim.*, 4e sér., iii. 155, 1866.) If given too freely, or for too long a period, it is apt to excite pain in the stomach. In an overdose (half an ounce to an ounce or more), taken in concentrated solution, it causes heat and pain in the stomach, vomiting and purging of blood, great prostration, convulsions, and sometimes death. On dissection, the stomach and intestines are found inflamed. A fatal case of poisoning by nitre, in which, although three ounces and a half were taken at one dose, no painful symptoms were manifested, is related by Dr. John Snowden in the *New Jersey Med. Reporter* (viii. 117). The treatment consists in the speedy removal of the poison from the stomach, and in the administration of mucilaginous drinks, laudanum to allay pain and irritation, and cordials to sustain the system. No antidote is known.

Notwithstanding the toxical properties of nitre when taken largely in concentrated solution, it may be given, in divided doses, to the extent of one or two ounces (31·1–62·2 Gm.) in twenty-four hours, if copiously diluted with water. Administered in this way, the salt acts as a sedative on the circulation, decreasing the force and frequency of the pulse. In *acute* rheumatism these large doses have been much employed, but the practice has passed out of vogue. Large doses of this salt have also been employed with success in general dropsy following remittent fever. It is best given dissolved in sweetened barley-water, in the proportion of half an ounce to a pint and a half or two pints of the liquid.

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* For a method of estimating the nature and amount of the various impurities in commercial saltpetre, see M. Persoz, *A. J. P.*, 1861, p. 543.

In pharmacy nitre is employed to form crocus of antimony, to procure nitric acid, and sometimes in the preparation of sweet spirit of nitre. In the laboratory it is used to make black and white flux, as an oxidizing agent, and to yield oxygen at a red heat. It was formerly employed in the production of aqua fortis (common nitric acid), the manufacture of sulphuric acid, and is yet, in the fabrication of gunpowder. The Br. Pharmacopœia uses it in the purification of bismuth.

Off. Prep. Argenti Nitras Dilutus, *U. S.;* Charta Potassii Nitratis, *U. S.*

POTASSII PERMANGANAS. *U. S.* *Permanganate of Potassium.*

$K_2 Mn_2 O_8$; 314. (PỌ-TĂS′SỊ-Ī PĔR-MĂN′GẠ-NĂS.) $KO, Mn_2 O_7$; 157.

Potassæ Permanganas, *Br.;* Kali Hypermanganicum Crystallisatum, *P.G.;* Hypermanganas Potassicus, s. Kalicus; Permanganate of Potash; Permanganate de Potasse, *Fr.;* Uebermangansaures Kali, *G.*

"Permanganate of Potassium should be kept in well-stopped bottles, and should not be triturated nor combined in solution with organic or readily oxidizable substances." *U. S.*

"Take of Caustic Potash *five ounces* [avoirdupois]; Black Oxide of Manganese, in fine powder, *four ounces* [avoird.]; Chlorate of Potash *three ounces and a half* [avoird.]; Diluted Sulphuric Acid *a sufficiency;* Distilled Water *two pints and a half* [Imperial measure]. Reduce the Chlorate of Potash to fine powder, and mix it with the Oxide of Manganese; put the mixture into a porcelain basin, and add to it the Caustic Potash, previously dissolved in four [fluid]ounces of the Water. Evaporate to dryness on a sand-bath, stirring diligently to prevent spurting. Pulverize the mass, put it into a covered Hessian or Cornish crucible, and expose it to a dull red heat for an hour, or till it has assumed the condition of a semi-fused mass. Let it cool, pulverize it, and boil with a pint and a half [Imp. meas.] of the Water. Let the insoluble matter subside, decant the fluid, boil again with half a pint [Imp. meas.] of the Water, again decant, neutralize the united liquors accurately with the Diluted Sulphuric Acid, and evaporate till a pellicle forms. Set aside to cool and crystallize. Drain the crystalline mass, boil it in six [fluid]ounces of the Water and strain through a funnel, the throat of which is lightly obstructed by a little asbestos. Let the fluid cool and crystallize, drain the crystals, and dry them by placing them under a bell jar over a vessel containing sulphuric acid." *Br.*

By this process chlorate of potassium yields oxygen to binoxide of manganese, converting it into manganic acid, which unites with the potassa to form the manganate, chloride of potassium being formed at the same time; the reaction being $3MnO_2 + 6KOH + KClO_3 = 3K_2MnO_4 + KCl + 3H_2O$. When this solution is boiled, the potassium manganate reacts with the water and yields potassium permanganate, according to the reaction: $3K_2MnO_4 + 3H_2O = K_2Mn_2O_8 + H_2MnO_3 + 4KOH$, the hydrated peroxide separating out. Hence, when exhausted by water, the solution contains with the permanganate and chloride a portion of potassa, which requires to be neutralized by sulphuric acid. Unfortunately, it is extremely difficult to get rid of the sulphate and chloride of potassium, in the crystallization, which, therefore, are apt to contaminate the permanganate. At best, the product is small and uncertain in amounts. Other methods have been proposed in which chlorate of potassium is not used. (See U. S. D., 14th edition, pp. 742, 743.)

Properties. "Deep purple-violet, or nearly black, needle-shaped, rhombic prisms, of a metallic lustre, permanent in the air, odorless, having a sweet, afterward disagreeable, astringent taste, and a neutral reaction. Soluble, with the exception of a scanty, brown residue, in 20 parts of water at 15° C. (59° F.), and in 3 parts of boiling water. It is decomposed by alcohol. When heated to redness, the salt gives off oxygen and leaves a black residue of an alkaline reaction. A very dilute solution of the salt has a rose color without a tinge of green. This color is destroyed by the addition of oxalic acid, or of many other organic or readily oxidizable substances, with the formation of a brown precipitate, soluble in diluted sulphuric acid, forming a colorless liquid. If a solution of the salt be mixed with enough oxalic and diluted sulphuric acid to produce a clear, colorless liquid, and a portion of this be poured upon a cold solution of ferrous sulphate in sulphuric acid, no brown or blackish brown zone should make its appearance at the line of contact of the two liquids (abs. of nitrate). Another portion of the decolorized liquid should yield no permanent precipitate or cloudiness on the addition of a few drops of test-solution of nitrate of silver (chloride). On boiling an aqueous solution of the salt with an excess of ammonia, until all the manganese is precipitated as hydrated oxide, the colorless filtrate (acidulated with nitric acid) should yield no precipitate, or, at most, only a faint cloudiness, with test-solution of nitrate of barium (limit of sulphate). If 0·785 Gm. of the salt be dissolved in 50 C.c. of boiling distilled water and 5 C.c. of sulphuric acid be cautiously added, the solution so formed should require for complete decoloration not less than 24·7 C.c. of the volumetric solution of oxalic acid (corresponding to at least 98·8 per cent. of pure Permanganate of Potassium." *U. S.*

If the solution be evaporated to dryness, the salt has the form of an intensely black powder. If suddenly heated, the crystals detonate, evolving oxygen, and leaving a black residue, which yields potassa to water, recognized by its alkaline reaction, and by giving, when acidulated with hydrochloric acid, a yellow precipitate with platinic chloride. (*Br.*) Moderately heated, they are partially volatilized, giving out violet vapors of a disagreeable metallic odor. (*A. J. P.*, Sept. 1862, p. 409.) The salt, in consequence of the facility with which it parts with oxygen, is one of the most powerful oxidizing agents known. It causes the combustion of certain inflammable bodies, imparts oxygen to almost all organic substances, and in chemistry is employed to bring various compounds to a higher degree of oxidation. The readiness with which it yields oxygen in the nascent state is sufficient to account for its oxidizing power. It may be kept indefinitely if pure, and carefully secured from contact with organic substances, or other decomposing agents; but, in fact, in consequence of the almost universal presence of organic matter in the air, it is generally partially decomposed, and, when dissolved, leaves a slight residue of hydrated binoxide of manganese. In reference to the metals, mercury is quickly oxidized at the expense of the salt; a mixture of mercurous oxide and oxide of manganese being deposited as a brown powder, and caustic potassa remaining in solution. Zinc remains unchanged indefinitely in a solution of the permanganate, silver is little affected, and copper not at all even at 100° C. (212° F.). (Giles, *Journ. de Pharm. et de Chim.*, Mai, 1868, p. 397.)

The British Pharmacopœia requires that 5 grains, dissolved in water, should be completely decolorized by not less than 44 grains of granulated sulphate of iron, acidulated with two fluidrachms of officinal dilute sulphuric acid. Under the name of *Liquor Potassii Permanganatis*, a solution containing 64 grains of permanganate of potassium in a pint of distilled water was officinal in the U. S. P. 1870.

Medical Properties and Uses. Permanganate of potassium, first brought to the notice of the profession in 1857, by Mr. Condy, as a powerful disinfectant, has been proved to be very efficient not only in lessening fetid odors from organic sources, but in destroying the sources of the odor. It acts by oxidizing, but, as it can yield up only the oxygen within it, its powers are limited. Further, it is a comparatively expensive substance, so that it is very rarely employed when any considerable mass of material is to be affected. It also has the further disadvantage of staining the skin, clothes, etc. It is frequently used in the treatment of fetid and gangrenous ulcers, abscesses, carbuncles, and wounds of all kinds, of fetid discharges from the mucous membrane in ozæna, otorrhœa, gonorrhœa, and leucorrhœa, and of diphtheritic affections; and it has proved serviceable even in cancerous ulcers, as of the face, mouth, and uterus. In this country it has been employed extensively, and with extraordinary success, in hospital gangrene. As a local stimulant it has also been used in chronic and indolent ulcers. In all these cases it is applied to the diseased surface in solution of various strengths, according to the effect desired. In concentrated solution, it is capable of acting as a caustic, and therefore requires caution. With the view to its caustic action, it may be sprinkled on the diseased surface by means of a pepper-box, or applied in strong solution. As a disinfectant lotion it may be of various strengths, from one to ten grains to the fluidounce of water. M. Demarquay, who was among the first to employ it, uses for injection in cancer of the womb, and for application to gangrenous and fetid abscesses, a solution varying in strength from 5 to 20 parts of the salt to 100 of water, trying the weaker solution first. (*Ann. de Thérap.*, 1864, p. 251.) M. O. Reveil recommends as a standard solution 10 parts dissolved in 90 parts of water. This may be used of its full strength in dressing cancerous, phagædenic, and atonic ulcers, and diphtheritic patches at the beginning. For dressing simple wounds, or as an injection in ozæna, leucorrhœa, etc., half a fluidounce may be used to a pint of water; in gangrenous and diphtheritic wounds and scrofulous ulcers, and as a gargle in unhealthy ulcers of the mouth and fauces, a fluidounce to the pint; as a gargle in croup and diphtheritic angina with offensive breath, and as a wash for the hands after post-mortem examinations, two fluidounces to the pint. In preparing any solution of permanganate for use, it is of the utmost importance to avoid organic matters.

Internally, the medicine has been used in diphtheria, scarlatina, and various zymoses, and in dyscrasia. It has even been claimed that in doses of half a grain to a grain (0·03–0·065 Gm.) it has cured pyæmia. It is plain that any moderate amounts of the permanganate must be decomposed by the organic matters of the mouth, œsophagus, and stomach before absorption; and there is no reason for believing it of any value as an internal medicine.

Off. Prep. Liquor Potassæ Permanganatis, *Br.*

POTASSII SULPHAS. *U. S.* *Sulphate of Potassium.*

$K_2 SO_4$; 174. (PỌ-TĂS'SỊ-Ī SŬL'PHĂS.) KO, SO_3; 87.

Potassæ Sulphas, *Br.;* Sulphate of Potash; Vitriolated Tartar; Kali Sulfuricum, *P.G.;* Sulfas Potassicus, s. Kalicus, Tartarum Vitriolatum. Arcanum Duplicatum, Sal de Duobus; Sulfate de Potasse, Potasse vitriolée, *Fr.;* Schwefelsaures Kali, Vitriolisirtir Weinstein, *G.;* Solfato di Potassa, *It.*

Several chemical processes give rise to sulphate of potassium as a secondary product. Thus, it is produced in the distillation of nitric acid from a mixture of nitre and sulphuric acid; in the decomposition of sulphate of magnesium by carbonate of potassium, in one of the processes for preparing carbonate of magnesium; in the manufacture of sulphuric acid; in the manufacture of bichromate of potash; and in the decomposition of tartrate of potassium by sulphate of calcium. When nitric acid is obtained by calcining a mixture of nitre and sulphate of iron, the residue consists of sesquioxide of iron and sulphate of potassium, the latter of which, being alone soluble, is separated by means of water, and crystallized from its solution. The impure sulphate of potassium with sulphur, forming the residue of the combustion of sulphur and nitre in making sulphuric acid, is employed in the manufacture of alum. The *kainite* of the Stassfurt salt-beds is a native double sulphate of potassium and magnesium, combined with magnesium chloride. To obtain potassium sulphate, the mineral is exposed to the air; it deliquesces, and as soon as the soluble magnesium chloride has been run off, the remaining salt is partially decomposed by boiling water, so that on cooling the difficultly soluble sulphate separates out.

According to the directions of the British Pharmacopœia, the acid sulphate which remains after the distillation of nitric acid is brought to the neutral state by saturation, in boiling solution, with slaked lime. The solution is then filtered to separate the sulphate of calcium, and carbonate of potassium is added at the boiling temperature to remove lime and sulphate of calcium. It is again filtered, then either neutralized or rendered slightly acid with diluted sulphuric acid, and finally, having been evaporated to a pellicle, is set aside for twenty-four hours to crystallize.

The manufacturer of tartaric acid who avails himself of sulphate of calcium to decompose tartrate of potassium, forms sulphate of potassium as a collateral product. For the manner in which the latter salt may be economically crystallized for use in the arts, see *A. J. P.* (xxiii. 343).

Properties. "Colorless, hard, six-sided, rhombic prisms, permanent in the air, odorless, having a sharp, saline, slightly bitter taste, and a neutral reaction. Soluble in 9 parts of water at 15° C. (59° F.), and in 4 parts of boiling water; insoluble in alcohol. When heated, the crystals decrepitate, and at a white heat they fuse, solidifying on cooling to a crystalline mass of an alkaline reaction. The aqueous solution yields a white, crystalline precipitate on the addition of a saturated solution of bitartrate of sodium. With test-solution of chloride of barium it yields a white precipitate, insoluble in nitric acid." *U. S.* Its solution is precipitated yellow by platinic chloride. Added to a solution of sulphate of aluminium, it generates alum, recognized by the octahedral shape of its crystals. It is decomposed by tartaric acid, which forms bitartrate of potassium, and by the soluble salts of baryta, strontia, lime, silver, and lead, forming insoluble or sparingly soluble sulphates. This salt is not liable to adulteration. "The aqueous solution of the salt should not be precipitated, nor be rendered cloudy, by test-solution of carbonate of ammonium, nor by test-solution of phosphate of sodium with addition of ammonia (abs. of alkaline earths). It should remain unaffected by hydrosulphuric acid or sulphide of ammonium (abs. of metals), and should not be precipitated or rendered cloudy by test-solution of nitrate of silver (abs. of chloride). 1 Gm. of Sulphate of Potassium, when completely precipitated by chloride of barium, yields 1·338 Gm. of dry sulphate of barium." *U. S.* It consists of two atoms of potassium combined with the dyad group, SO_4, characteristic of sulphuric acid, $78 + 96 = 174$.

The *plate-sulphate of potassa*, so well described by Prof. Penny, of Glasgow, is, when pure, the double sulphate of potassium and sodium, having the formula $3K_2SO_4 + Na_2SO_4$. It is so called from the circumstance of being crystallized in hard thick cakes, or slabs, consisting of successive crops of crystals. It is a technical product from kelp, and may be formed by allowing successive quantities of concentrated kelp-ley to run into coolers, there to crystallize in successive layers; the mother-liquor being drawn off by a siphon, after the deposit of each layer. (*Philos. Mag.*, Dec. 1855.)*

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* *Potassæ Sulphas cum Sulphure,* Edinburgh Pharmacopœia. *Sulphate of Potassa with Sulphur. Sal Polychrestus Glaseri. Sal Polychrest.* This old preparation is still used, and it merits some notice, although no longer officinal.

It was prepared by mixing thoroughly equal parts of nitrate of potassium and sulphur, then throwing the mixture in small successive portions into a red-hot crucible; and, when the deflagration had ceased, and the salt had cooled, reducing it to powder, and keeping it in well-closed bottles.

When the mixture, indicated in this formula, is thrown into a red-hot crucible, each successive portion melts, and the sulphur floats on the surface of the nitre with the appearance of a brown oil, burns vividly, and gives rise to a copious evolution of sulphurous acid gas. The product of the deflagration is a grayish white friable mass, intermixed apparently with unconsumed sulphur.

The nature of this preparation has not been well determined. On the supposition that it is the sulphate of potassium, mixed with a portion of sulphur, as the Edinburgh name implies, its formation may be thus explained. By the combined influence of the sulphur and of the heat employed, the nitric acid of the nitre is totally decomposed, and is thus enabled to furnish sufficient oxygen to convert a portion of the sulphur into sulphuric acid, which, as soon as formed, combines with the base of the nitre, to form the sulphate of potassium. This is left mixed with a portion of sulphur which has escaped combustion; but the greater part of the latter undergoes ordinary combustion, and is dissipated as sulphurous acid fumes. Supposing the saline matter to be a sulphate containing a little free sulphur, this combustible is evidently used in great excess; but whether this excess is necessary to obtain the exact preparation desired by the Edinburgh College, it is not easy to determine. The late Dr. Duncan ascertained that the product amounted only to four-tenths of the materials employed. It is, therefore, smaller than it ought to be, even supposing that the residue consisted of nothing but sulphate of potassium.

Dr. Duncan was of opinion that the preparation under consideration cannot be viewed as a sulphuretted sulphate, and for the following satisfactory reasons. In the first place, it is more soluble in water than sulphate of potassium, and forms a yellowish solution, the water leaving undissolved only a small residue of a black color, which is not sulphur. In the second place, it exhales during solution a sulphurous smell, and its taste is sulphurous. These facts seem to show that a small portion of sulphite of potassium is present in the preparation, or at least some sulphurous acid in a state of loose combination. It does not yield sulphuretted hydrogen on the addition of an acid, and is not precipitated by the salts of lead. These characters are inconsistent with the opinion of Mr. John Mackay, of Edinburgh, who believes that this preparation contains sulphide of potassium. (See his remarks on it, in the *P. J. Tr.* for Jan. 1842.)

Medical Properties and Uses. Sulphate of potassium is a mild purgative, operating usually without heat, pain, or other symptom of irritation. In small doses of from a scruple to half a drachm (1·3–1·95 Gm.) it operates as an aperient; in larger doses, of four or five drachms (15·5–19·4 Gm.), it acts slowly as a purge. Combined with rhubarb, in the proportion of about a drachm of the salt (3·9 Gm.) to ten grains (0·65 Gm.) of the root, Dr. Fordyce recommended it as an excellent alterative cathartic in the visceral obstructions of children characterized by a tumid abdomen and defective digestion and nutrition; and we can bear testimony to its efficacy in such cases. On the continent of Europe it is frequently given as an aperient after delivery, and for the purpose of drying up the milk. Sulphate of potash is undoubtedly a powerful irritant, and capable of producing a fatal result; an ounce and a half (46·6 Gm.) of it are said to have caused death. It is, like the nitrate and the chlorate, more dangerous when not given in sufficiently dilute solution. (See *Am. Jour. of the Med. Sci.*, N.S., vii. 88.)

Off. Prep. Pilula Colocynthidis Composita, *Br.*

POTASSII SULPHIS. *U. S.* *Sulphite of Potassium.*

$K_2SO_3.2H_2O$; 194. (PỌ-TĂS'SỊ-Ī SŬL'PHĬS.) $KO, SO_2.2HO$; 97.

"Sulphite of Potassium should be kept in well-stopped bottles." *U. S.*

Kali Sulfurosum, Sulfis Potassicus, s. Kalicus; Sulfite de Potasse, *Fr.;* Schwefligsaures Kali, *G.*

Sulphite of potassium is prepared by causing sulphurous acid to pass through a strong solution of carbonate of potassium until decidedly acid; an equal weight of carbonate of potassium is now added. The sulphite crystallizes out upon standing.

Properties. "White, opaque, obliquely-rhombic, octahedral crystals, or a crystalline powder, somewhat deliquescent, odorless, having a bitter, saline, and sulphurous taste, and a neutral or feebly alkaline reaction. Soluble in 4 parts of water at 15° C. (59° F.) and in 5 parts of boiling water; only sparingly soluble in alcohol. When gently heated, the salt loses its water of crystallization (18·5 per cent.); at a red heat it is decomposed and leaves a residue of an alkaline reaction. The aqueous solution of the salt yields a white, crystalline precipitate on the addition of a saturated solution of bitartrate of sodium. Addition of diluted hydrochloric acid to the aqueous solution gives rise to the odor of burning sulphur, and the solution does not become cloudy (difference from hyposulphite)." *U. S.* It decrepitates when heated. In the air it effloresces, absorbing oxygen, and being partially converted into the sulphate. The occurrence of a yellow precipitate, when it is added to a solution of chloride of platinum, shows that it is a salt of potassa. "A one per cent. aqueous solution of the salt, strongly acidulated with hydrochloric acid, should produce no precipitate, or, at most, only a white cloudiness, on the addition of a few drops of test-solution of chloride of barium (limit of sulphate). If 0·485 Gm. of the salt be dissolved in 25 C.c. of water, and a little gelatinized starch added, at least 45 C.c. of the volumetric solution of iodine should be required, until a permanent blue tint appears after stirring (corresponding to at least 90 per cent. of pure Sulphite of Potassium)." *U. S.*

Medical Properties and Uses. The effect on the system and uses in medicine are essentially the same as those of the other sulphites. It produces little impression on the system, and has never been shown to have poisonous effects in whatever dose administered. From four to six drachms (15·5–23·3 Gm.) in 24 hours have been given without unpleasant results. The sulphite of potassium, after administra-

Properties, etc. This salt has an acid and sulphurous taste, and an acid reaction with test-paper. When pulverized, it yields a pale yellowish white powder. It is soluble in eight times its weight of cold water. It is, however, not a uniform preparation; different specimens, apparently prepared with equal care, exhibiting some points of difference in properties. It was called by the earlier chemists *sal Polychrestus Glaseri*, or *sal Polychrest.* Its other properties coincide generally with those of sulphate of potassium, which may be considered as its basis.

Medical Properties and Uses. The medical effects of this preparation differ but little, if at all, from those of sulphate of potassium. Its action on the system is stated by Dr. Duncan to resemble that of the sulphurous mineral waters which contain a portion of neutral salt. The dose is from half a drachm to a drachm (1·9 to 3·75 Gm.).

tion, is absorbed into the circulation, from which it escapes with the urine, and may be found for some hours unchanged in the state of the sulphite; at the end of 24 hours, the sulphate of potassium is found in the urine instead of the sulphite; proving that the salt undergoes in the body the same change as when exposed to the atmosphere out of it; that is, the sulphurous acid absorbs oxygen and is converted into the sulphuric, and the salt consequently into the sulphate. According to Dr. Polli, the sulphite given to dogs, if these are afterwards killed, is found in all the fluids and solids of the body. The most decided effects on the system appear to be a slight laxative operation, and an increased secretion of urine. The chief remedial power of this salt is based on its hostility, through its acid constituent, to the lower forms of organic life, especially the microscopic animalcula and fungi. Among its first applications was to the cure of the sarcina ventriculi; but, though the sarcina was destroyed, the disease of the stomach was little improved, showing that the fungus was not the cause of the gastric affection, but simply grew in the stomach because the conditions favored it. It has since been applied to the treatment of diseases believed to be dependent upon the presence of low organisms in the blood, where they produce fermentative processes supposed to constitute the essence of the disease. Intermittent and remittent fevers, typhoid fever, puerperal fever, malignant erysipelas, hospital gangrene, and all affections connected with putrefactive inflammation, in fact, all the diseases classed together as zymotic, have been repeatedly treated with medicines of the class; but the trials have been by no means so successful as to unite medical opinion in their favor, and this use of the sulphites must be considered as among the eccentricities of medicine; nevertheless, with all the unfavorable reports, so many statements have been in their favor as to justify the use of these remedies by those disposed to try them. The sulphite of potassium may be given in the dose of from fifteen grains to a drachm (1–3·9 Gm.), and repeated so as to amount to from a fourth of an ounce to an ounce in 24 hours.

The local effects of the salt are probably less doubtful than the constitutional. In all cases of cutaneous disease originating in or maintained by microscopic parasites, it may be applied in solution with hope of good effect. A solution containing one part of the salt in five or ten parts of water may be applied by compresses to the part affected. For this purpose, however, the sulphite of sodium is preferred by some, on account of its more ready solubility.

POTASSII TARTRAS. *U.S.* *Tartrate of Potassium.*

$(K_2C_4H_4O_6)_2 . H_2O$; 470. (PO̤-TĂS'SI̤-Ī TÄR'TRĂS.) $2KO, C_8H_4O_{10} . HO$; 235.

"Tartrate of Potassium should be kept in well-stopped bottles." *U. S.*

Potassæ Tartras, *Br.*, Tartrate of Potash; Soluble Tartar; Kali Tartaricum, *P.G.;* Tartras-potassicus, s. Kalicus; Tartarus Tartarisatus, Tartarus Solubilis; Tartrate de Potasse, Tartre soluble, Sel végétal, *Fr.;* Neutrales Weinsaures Kali, *G.*

"Take of Acid Tartrate of Potash *twenty ounces* [avoirdupois], or *a sufficiency;* Carbonate of Potash *nine ounces* [avoird.], or *a sufficiency;* Boiling Distilled Water *two pints and a half* [Imperial measure]. Dissolve the Carbonate of Potash in the Water; add by degrees the Acid Tartrate of Potash, and if, after a few minutes' boiling, the liquid is not neutral to test-paper, make it so by the careful addition of more of the Carbonate or of the Acid Tartrate. Then filter, concentrate till a pellicle forms on the surface, and set it aside to cool and crystallize. More crystals may be obtained by evaporating and cooling the mother-liquor. Drain the crystals, dry them by exposure to the air in a warm place, and preserve them in a stoppered bottle." *Br.*

In the process U. S. 1870,* the excess of acid in the bitartrate is saturated by the potassa of the carbonate, the carbonic acid is liberated with effervescence, and the neutral tartrate of potassium is formed. On account of the greater solubility of the carbonate than of the bitartrate, the former is first dissolved, and the latter added to the solution to full saturation. As the bitartrate is gradually added, the mutual action of the salts should be promoted by constant stirring, and the addition continued so long as effervescence takes place, which is a better mode of proceeding than to add any specified quantity of the acid tartrate; since, from its variable quality, it is impossible to adjust precisely the proportions applicable to all cases. It is necessary that the solution should be exactly neutral, or a little alkaline; and hence, if inadvertently too much bitartrate has been used, the proper state may be restored by adding a little of the alkaline carbonate. When the saturation has been completed, the solution is filtered in order to separate tartrate of calcium, which appears in white flocks, and which is always present in cream of tartar as an impurity. The evaporated liquor should then be placed in *warm* earthen-ware vessels, to insure a slow refrigeration; and, after remaining at rest for several days, the crystals begin to form. In order that the crystallization should proceed favorably, it is necessary, according to Baumé, that the solution should be somewhat alkaline. Iron vessels should not be used in the process, as this metal is apt to discolor the salt.

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* "Take of Carbonate of Potassium *sixteen troyounces;* Bitartrate of Potassium [cream of tartar], in fine powder, *thirty-six troyounces,* or *a sufficient quantity;* Boiling Water *eight pints.* Dissolve the Carbonate of Potassium in the Water; then gradually add Bitartrate of Potassium to the solution until it is completely saturated, and boil. Filter the liquid, evaporate it until a pellicle forms, and set it aside to crystallize. Lastly, pour off the mother-water, and, having dried the crystals on bibulous paper, keep them in a well-stopped bottle." *U. S.* 1870.

Tartrate of potassium is sometimes made in the process for preparing tartaric acid. When thus obtained, the excess of acid of the bitartrate is neutralized by means of carbonate of calcium. This generates an insoluble tartrate of calcium, and leaves the neutral tartrate in solution, from which it may be obtained by evaporation and crystallization. (See *Acidum Tartaricum.*)

Properties. "Small, transparent or white, monoclinic crystals, or a white powder, somewhat deliquescent, odorless, having a saline, slightly bitter taste, and a neutral reaction. Soluble in 0·7 part of water at 15° C. (59° F.), and in 0·5 part of boiling water; almost insoluble in alcohol. When heated, the salt melts, then chars, and evolves inflammable vapors having the odor of burnt sugar. On moderate ignition, it leaves a blackened residue of an alkaline reaction, strongly effervescing with acids. A concentrated, aqueous solution of the salt yields a white, crystalline precipitate on the addition of acetic acid. With test-solution of nitrate of silver it yields a white precipitate which becomes black on boiling." *U. S.* For medical use it should be crystallized; but, as it ordinarily occurs in the shops, it is a white granular powder, obtained by evaporating the solution to dryness, while it is constantly stirred. In this state it is said to require four times its weight of water for solution. It is not known to be purposely adulterated; but, if obtained by evaporation to dryness, it is liable to contain an excess of carbonate or bitartrate of potassium, when it will have either an alkaline or an acid reaction. It is decomposed by all the strong acids, and by many acidulous salts, which cause the precipitation of minute crystals of bitartrate of potassium, by abstracting one atom of alkali from the salt. Chloride of barium or acetate of lead occasions a white precipitate of tartrate of barium or lead, distinguishable from the sulphate of those bases by being wholly soluble in dilute nitric acid. "A 10 per cent. aqueous solution should yield no precipitate with test-solution of oxalate of ammonium (abs. of calcium). On adding nitric acid to a one per cent. solution of the salt, until the precipitate first formed is redissolved, the resulting solution should yield no precipitate with test-solution of chloride of barium (sulphate), and, at most, only a cloudiness with test-solution of nitrate of silver (limit of chloride). If 2·938 Gm. of Tartrate of Potassium are ignited till gases cease to be evolved, the alkaline residue should require, for complete neutralization, not less than 25 C.c. of the volumetric solution of oxalic acid (corresponding to 100 per cent. of pure Tartrate of Potassium)." *U. S.* Tartrate of potassium is composed of two atoms of potassium 78 combined with the dyad group $C_4H_4O_6$ characteristic of tartaric acid $148 = 226$. Two molecules of this salt $= 452$ are crystallized with one mol. of water $18 = 470$. It is a neutral salt. According to Berzelius, the crystals contain no water of crystallization. "One hundred and thirteen grains, heated to redness till gases cease to be evolved, leave an alkaline residue, which requires for exact neutralization 1000 grain-measures of the *volumetric solution of oxalic acid.*" *Br.*

Medical Properties. Tartrate of potassium is a mild cooling purgative, operating, like most of the neutral salts, without much pain, and producing watery stools. It is applicable to febrile diseases, and is occasionally combined with senna, the griping effects of which it has a tendency to obviate. The dose is from a drachm to an ounce (3·9–31·1 Gm.), according to the degree of effect desired.

PRINOS. *U. S.* *Prinos.* [*Black Alder.*]

(PRĪ′NOS.)

"The bark of Prinos verticillatus, Linné, Ilex verticillata, Gray. (*Nat. Ord.* Aquifoliaceæ.)" *U. S.*

Gen. Ch. Calyx small, six-cleft. *Corolla* monopetalous, subrotate, six-parted. *Berry* six-seeded; seeds nuciform. *Nuttall.*

Prinos verticillatus. Willd. *Sp. Plant.* ii. 225; Bigelow, *Am. Med. Bot.* iii. 141; Barton, *Med. Bot.* i. 203. A shrub, with a stem six or eight feet high, furnished with alternate, spreading branches, and covered with a bluish gray bark. The leaves, which stand alternately or irregularly on short petioles, are oval, pointed, tapering at the base, acutely serrate, of a dark green color, smooth above, but downy on the veins beneath. The flowers are small, white, nearly sessile, and grow three or four together at the axils of the leaves. They are often diœcious. The calyx is persistent; the segments of the corolla obtuse; the stamens usually six, and furnished with oblong anthers; the germ large, green, and roundish, with a short style, terminating in an obtuse stigma. The fruit when ripe consists of glossy, scarlet, roundish berries, about the size of a pea, containing six cells and six seeds. Several of these berries are clustered, so as to form little bunches at irregular intervals on the stem. In the latter part of autumn, after the leaves have fallen, they still remain attached to the stem, and render the shrub a striking object in the midst of the general nakedness of vegetation. Hence the plant is often called *winterberry.*

It grows in all parts of the United States, from Canada to Florida, frequenting low wet places, such as swamps, and the borders of ponds, ditches, and streams. Its flowers appear in June. The berries, which have a bitter, sweetish, somewhat acrid taste, are sometimes used medicinally for the same purposes with the bark.

Properties The dried bark is in slender pieces, more or less rolled, brittle, greenish white internally, and covered with a smooth epidermis, easily separable, and of a whitish ash color, alternating or mingled with brown. It is officinally described as in "thin, slender fragments, about one twenty-fifth of an inch (1 mm.) thick, fragile, outer surface brownish ash-colored, with whitish patches and blackish dots and lines, the corky layer easily separating from the green tissue; inner surface pale greenish or yellowish; fracture short, tangentially striate; nearly inodorous, bitter, slightly astringent." *U. S.* It has no smell, but a bitter and slightly astringent taste. Boiling water extracts its virtues. Led by a suggestion of Prof. Maisch, Mr. Thos. J. Lerch endeavored to find berberine in it, but failed to do so in a series of experiments. (*A. J. P.*, 1873, p. 251.)

Medical Properties and Uses. Black alder is usually considered tonic and astringent, and is among the remedies proposed as substitutes for Peruvian bark, with which, however, it has very little analogy. It has been recommended in intermittent fever, diarrhœa, and other diseases connected with debility, especially gangrene and mortification. It is a popular remedy in gangrene or flabby and ill-conditioned ulcers, and in chronic cutaneous eruptions, in which it is given internally, and applied locally in the form of a wash or poultice. It may be used in substance or decoction. The dose of the powder is from thirty grains to a drachm (1·95 to 3·9 Gm.), to be repeated several times a day. The decoction, which is usually preferred both for internal and external use, may be prepared by boiling two ounces of the bark with three pints of water to a quart, and given in the dose of two or three fluidounces (60 or 90 C.c.). A saturated tincture, as well of the berries as of the bark, is sometimes employed.

PRUNUM. *U. S., Br.* *Prune.*

(PRŪ′NŬM.)

"The fruit of Prunus domestica. Linné. (*Nat. Ord.* Rosaceæ, Amygdaleæ.)" *U. S.* "The dried drupe of the Plum, Prunus domestica. Linn. From Southern Europe." *Br.*

Prunes; Pruneaux, *Fr.;* Pflaumen, Zwetschen, *G.;* Pruni, *It.;* Ciruelas secas, *Sp.*

Gen. Ch. Calyx inferior, bell-shaped, deciduous, with five obtuse, concave segments. *Petals* five, roundish, concave, spreading, larger than the segments of the calyx, into the rim of which they are inserted. *Filaments* awl-shaped, nearly as long as the corolla, from the rim of the calyx within the petals. *Anthers* short, of two round lobes. *Ovary* superior, roundish. *Style* of the length of the stamens. *Stigma* orbicular, peltate. *Drupe* roundish or elliptical. *Nut* hard, somewhat compressed, of one cell, and two more or less distinct sutures with an intermediate furrow. *Leaves* rolled up when young. *Lindley.*

Prunus domestica. Willd. *Sp. Plant.* ii. 995; Woodv. *Med. Bot.* p. 520, t. 187. The cultivated prune or plum tree is so well known as to render a minute description unnecessary. We merely give the specific character. "*Peduncles* subsolitary; *leaves* lanceolate-ovate, convolute; *branches* not spiny." The varieties of the tree produced by cultivation are very numerous. Nearly one hundred are to be found in the British gardens. Though at present growing wild in various parts of Europe, it is thought to have been brought originally from Asia Minor and Syria. It is the dried fruit only that is officinal. They are officinally described as "oblong or subglobular, shrivelled, blackish blue, glaucous; the sarcocarp brownish yellow, sweet and acidulous; putamen hard, smooth, or irregularly ridged; the seed almond-like in shape, but smaller, and of a bitter taste."

The prunes brought to our market come chiefly from the south of France, the best from Bordeaux. They are derived from the variety of the tree named *Juliana* by Linnæus. The fresh fruit, called *Prune de Saint Julien* by the French, is of an oval shape, nearly an inch in length, and of a deep violet color. It is prepared by drying in the sun, after having been exposed to the heat of an oven. The finest prunes, used on the tables in France, are prepared from the larger kinds of plums, such as the *Saint Catharine*, and *Reine-Claude* or *green-gage*. An inferior sort is brought from Germany.

Prunes have a feeble odor, and a sweet mucilaginous taste, which is generally also somewhat acid. They contain uncrystallizable sugar, malic acid, and mucilaginous matter. The following is given as the average of nine analyses of dried prunes. Water 29·30 per cent., nitrogenous material 2·35 per cent., fat 0·53 per cent., free acid 2·72 per cent., sugar 44·35 per cent., other nitrogen-free material 17·89 per cent., woody fibre (not including the stone) 1·48 per cent., ash 1·38 per cent. (*König Nahrungsmittel*, ii. 397, 1880.) In Germany a kind of brandy (*zwetschenbranntwein*) is obtained from them, which in some districts is largely consumed. Bonneberg, a German chemist, has extracted from prunes crystallizable sugar equal to that of the cane.

Medical Properties and Uses. Prunes are laxative and nutritious, and, stewed with water, form an excellent diet in costiveness, especially during convalescence from febrile and inflammatory diseases. Imparting their laxative property to boiling water, they serve as a pleasant and useful addition to purgative decoctions. Their pulp is used in the preparation of laxative confections. Too largely taken, in a debilitated state of the digestive organs, they are apt to occasion flatulence, and griping pain in the stomach and bowels.

Off. Prep. Confectio Sennæ.

PRUNUS VIRGINIANA. *U. S.* *Wild-cherry.*

(PRŪ′NŬS VĬR-ĢĬN-Ị-Ā′NẠ.)

"The bark of Prunus serotina, Ehrhart (Cerasus Serotina, Loiseleur. *Nat. Ord.* Rosaceæ, Amygdalæ), collected in autumn." *U. S.*

Écorce de Cerisier de Virginie, *Fr.;* Wildkirschenrinde, *G.*

CERASUS. See *Lauro-Cerasus.*

The genus Prunus of Linnæus has been variously subdivided, and De Candolle included the officinal wild-cherry in a section, which he gave the name of Cerasus. At present the best authorities consider the sections of Prunus as entitled only to the rank of subgenera, and the plant under consideration is placed in the subgenus *Padus*, Mill, which is distinguished from the true cherries (Cerasus) in having the flowers in racemes which terminate the branches and appear after the leaves.

Cerasus (not *Prunus*) *serotina.* De Candolle, *Prodrom.* ii. 540.—*Prunus serotina.* Ehrhart; Watson's *Bibliographical Index.*—*Cerasus Virginiana.* Michaux, *N. Am. Sylv.* ii. 205; *B. & T.* 97.

Prunus Virginiana, transverse section.

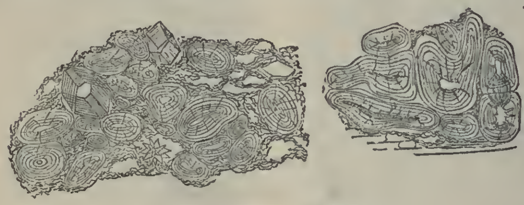
Prunus Virginiana, longitudinal section.

The name *Prunus Virginiana*, which has been wrongly applied to this species, was given by Linnæus to the *choke-cherry*, a small tree or shrub, growing in the Northern States, and bearing a dark red, globular, astringent fruit, about as large as that of the *wild-cherry.* The officinal species, or wild-cherry tree, is, according to Michaux, one of the largest productions of the American forest. Individuals were seen by that botanist on the banks of the Ohio, from eighty to one hundred feet high, with trunks from twelve to fifteen feet in circumference, and undivided to the height of twenty-five or thirty feet. But, as usually met with in the Atlantic States, the tree is much smaller. In the open fields it is less elevated than in forests, but sends out more numerous branches, which expand into an elegant oval summit. The trunk is regularly shaped, and covered with a rough blackish bark, which detaches itself semicircularly in thick narrow plates. The leaves are oval-oblong, or lanceolate-oblong, acuminate, unequally serrate, smooth on both sides, of a beautiful brilliant green, and supported alternately upon petioles, which are furnished with from two to four reddish glands. The flowers are small, white, and collected in long erect or spreading racemes. They appear in May, and are followed by globular drupes, about the size of a pea, and when ripe of a shining blackish purple color.

This tree grows throughout the Union, flourishing most in those parts where the soil is fertile and the climate temperate, and abounding in the Middle Atlantic States, and in those which border on the Ohio. In the neighborhood of Philadelphia it affects open situations, growing solitarily in the fields and along fences, and seldom aggregated in woods or groves. It is highly valued by the cabinet-makers for its wood, which is compact, fine-grained, susceptible of polish, and of a light red tint which deepens with age. The leaves have been found by Prof. Procter to yield volatile oil and hydrocyanic acid on distillation, and in such proportion that a water distilled from them might with propriety be substituted for the cherry-laurel water. (*Proc. A. P. A.*, 1858, p. 325.) The fruit has a sweetish, astringent, bitter taste, and is much used in some parts of the country to impart flavor to spirituous liquors.

The bark is obtained indiscriminately from all parts of the tree, though that of the roots is thought to be most active. Mr. J. S. Perot has ascertained that it is stronger when collected in autumn than in the spring. Thus, from a portion gathered in April he obtained 0·0478 per cent. of hydrocyanic acid, and from another in October 0·1436 per cent., or about three times as much. The parcels tried were taken from the same tree, and from the same part of the tree. (*A. J. P.*, xxiv. 111.) The bark should be preferred recently dried, as it deteriorates by keeping.

Properties. Wild-cherry bark is officinally described as follows. "In curved pieces or irregular fragments, one-twelfth of an inch (2 mm.) or more thick, outer surface greenish-brown, or yellowish-brown, smooth and somewhat glossy, marked with transverse scars; if collected from old wood and deprived of the corky layer, the outer surface is nut-brown and uneven; inner surface somewhat striate or fissured. Upon maceration in water it develops a distinct bitter-almond odor; its taste is astringent, aromatic and bitter. The bark of the small branches is to be rejected." *U. S.* It is brittle and pulverizable, presenting a reddish gray fracture, and affording a fawn-colored powder. In the fresh state, or when treated with water, it emits an odor resembling that of peach leaves. Its taste is agreeably bitter and aromatic, with the peculiar flavor of the bitter almond. It imparts its sensible properties to water, either cold or hot, producing a clear reddish infusion closely resembling Madeira wine in appearance. Its peculiar flavor as well as medical virtues are injured by boiling, in consequence partly of the volatilization of the principles upon which they depend, partly upon a chemical change effected by the heat. On microscopical examination it is seen to be chiefly composed of brown parenchymatous tissue, enclosing numerous groups of very thick-walled bast-cells of irregular outline, and loaded with numerous raphides, in tufts or single large crystals (see cut). The medullary rays are usually distinct. From an analysis by Dr. Stephen Procter, it appears to contain starch, resin, tannin, gallic acid, fatty matter, lignin, red coloring matter, salts of lime and potassa, and iron. He obtained also a volatile oil, associated with hydrocyanic acid, by distilling the same portion of water successively from several different portions of the bark. This oil was of a light straw color, and very analogous in its properties to the volatile oil of bitter almonds. In the quantity of two drops it proved fatal to a cat in less than five minutes. (*Journ. of the Phila. Coll. of Pharm.*, vi. 8.) Prof. William Procter proved that, as in the case of bitter almonds, the volatile oil and hydrocyanic acid do not exist ready formed in the bark, but are the result of the reaction of water with amygdalin, which he ascertained to be one of its constituents. In order, however, that this change may take place, the agency of another principle, probably analogous to if not identical with *emulsin* or the *synaptase* of Robiquet, is also essential; and, as this principle becomes inoperative at the boiling temperature, we can understand how decoction may interfere with the virtues of the bark. (*A. J. P.*, x. 197.) The conjecture was advanced, in former editions of this work, that wild-cherry bark might contain also *phlorizin*, a glucoside proved to exist in the bark of the apple, pear, cherry, and plum trees; but Mr. Perot sought for this principle, without success, in specimens of the bark of different ages, and taken from different parts of the tree; so that the tonic property, which is undoubtedly possessed by the bark, must reside either in the portion of amygdalin which may remain undecomposed, in the pure volatile oil resulting from its reaction with water, or in some yet undiscovered principle. (*Ibid.*, xxiv. 111.) That the last of these inferences is the correct one, would seem to be proved by an experiment by Professor Procter, who found the bitterness of an extract of the bark to remain after it had been wholly deprived of amygdalin. The sedative properties of the bark depend upon the hydrocyanic acid which it yields. The beautiful wine-color of the infusion varies in different



Prunus Virginiana, showing raphides.

specimens of the bark, the shade being much lighter in some than in others. Mr. Jos. L. Lemberger prepared infusions from the bark collected every month of the year, and, on comparing them, found that they varied with the season in which they were gathered; the darkest infusions proceeding from the bark gathered in April, October, and November, the lightest from those of January and August, and the intermediate from the other months, September yielding the deeper of these. He also seems to have determined that the color is due to tannic acid. (*A. J. P.*, July, 1872, p. 303.)

Medical Properties and Uses. Uniting with a tonic power the property of calming irritation and diminishing nervous excitability, this bark is theoretically adapted to the treatment of diseases in which debility of the stomach or of the system is united with general or local irritation; and when very largely taken it diminishes the action of the heart. Thus, Dr. Eberle found copious draughts of the cold infusion, taken several times a day, and continued for nearly two weeks, to reduce his pulse from seventy-five to fifty strokes in the minute. But in the doses usually prescribed, the remedy is too feeble to exert much influence. Nevertheless, it has been much employed in this country, in the hectic fever of scrofula and consumption.

It may be used in the form of powder, infusion, fluid extract, or syrup. The dose of the powder is from thirty grains to a drachm (1·95–3·9 Gm.); of the infusion, which is properly directed in the Pharmacopœia to be prepared with cold water, two or three fluidounces (60 or 90 C.c.); of the fluid extract, a fluidrachm (3·75 C.c.); and of the syrup, half a fluidounce (15 C.c.).

Off. Prep. Extractum Pruni Virginianæ Fluidum, *U. S.;* Infusum Pruni Virginianæ, *U. S.;* Syrupus Pruni Virginianæ, *U. S.*

PULSATILLA. *U. S.* *Pulsatilla.*

(PŬL-SA̤-TĬL′LA̤.)

Herba Pulsatillæ, *P.G.;* Pulsatille, Coquelourde, *Fr.;* Küchenschelle, *G.*

"The herb of Anemone Pulsatilla and Anemone pratensis, Linné, and of Anemone patens, Linné, *var.* Nuttalliana, Gray (*Nat. Ord.* Ranunculaceæ), collected soon after flowering. It should be carefully preserved and not be kept longer than one year." *U. S.*

Gen. Ch. Sepals 5 to 15, petal-like. *Petals* none, or like abortive gland stamens. *Achenia* short-beaked or blunt, or with long feathery tails. *Seed* suspended. Perennial herbs with radical leaves; those of the stem two or three together, opposite or whorled, and forming an involucre remote from the flower.

This is a large genus of small herbal plants, growing in almost all of the temperate countries of the world, and probably possessed very generally of the acrid rubefacient properties of the Ranunculaceæ. The *A. Ludoviciana*, an American species, growing in Minnesota and other parts beyond the Mississippi, has been employed with supposed advantage by Dr. W. H. Miller, of St. Paul, in chronic diseases of the eyes, in cutaneous eruptions, and in syphilitic affections. Mr. A. W. Miller, having submitted the plant to chemical examination, succeeded in obtaining anemonin from it. (*A. J. P.*, 1862, p. 300.) Mr. F. E. Miller has found the principle in abundance, and that it has an acid reaction. (*A. J. P.*, xlv. 299.) *A. nemorosa*, which is common in Europe and the United States, is said to act as a poison to cattle, producing bloody urine and convulsions. It is stated also to have proved, when applied to the head, a speedy cure for tinea capitis.

A. Pulsatilla. Linnæus. *Pulsatilla vulgaris.* Mill. This plant has its flower-stalk from five to eight inches high, with large solitary flowers, having six dull violet-purple sepals, which are very downy on the exterior, and an involucre which is at first near the flower and afterwards becomes more remote. The radical leaves are on long stalks, and two or three times divided into long linear segments. It is a very common plant in England and Northern Europe.

A. pratensis, which affects Southern Europe, is especially distinguished by its having the involucre so close to the flower as to assume the appearance of a calyx.

A. patens, Linné, *var.* Nuttalliana, Gray. Dr. Gray affirms that this plant is more like *A. pulsatilla* than *A. patens*, and that it is a distinct species, to which the name of *A. Nuttalliana*, Gray, should be given. It grows a span high, with an erect flower having five to seven purplish spreading sepals.

Properties. The characters of the herb are sufficiently given in the description of the plant. It contains a peculiar crystallizable principle, named *anemonin*, convertible into *anemonic acid* by the action of alkalies. (*Ann. der Pharm.*, xxxii. 276.) Anemonin is deposited by water distilled from the fresh herb upon standing, and resembles camphor. According to J. Müller, it is formed by a metamorphosis of the acrid matters which are distilled with the water. (*Pharm. Centralb.*, Sept. 11, 1850, p. 618.) M. Dobraschinky obtains it by a method founded on its solubility in chloroform. The distilled water of *Anemone pratensis* is agitated with one-tenth of this liquid, with which it is continued in contact for some hours; the liquid on standing separates into two layers, the heavier of which, containing the chloroformic solution, is distilled. The chloroform passes, and the residue, constituting one-eighth of the solution, is treated with strong alcohol, heated, and set aside to crystallize. Anemonin separates in handsome crystals. (*Journ. de Pharm.*, 4e sér., i. 319.) Its formula is $C_{15}H_{12}O_6$. It is only slightly soluble in cold alcohol, but readily soluble in hot alcohol, very slightly soluble in boiling ether or water. It is decomposed at temperatures above 150° C. (302° F.), and dissolves in alkalies with yellow color, changing at the same time into *anemonic acid*, $C_{15}H_{14}O_7$.

Medical Properties and Uses. We have no exact knowledge as to the action of this new officinal. It has been employed in Germany and other parts of Europe, especially by homœopathic practitioners, by whom the drug is much used for the relief of amenorrhœa and dysmenorrhœa, and for other purposes. Given in infinitesimal amounts, with due ceremony as to dilution, tumblers, and spoons, to credulous, hysterical women, it may be sometimes of service; but whether it has any other application is very doubtful. In one or two trials very carefully made in nervous dysmenorrhœa, it has failed in our hands absolutely. Baron Störck thought that he found *A. pratensis* useful in amaurosis and other complaints of the eye, in secondary syphilis, and in cutaneous diseases. *A. pulsatilla* is supposed also to possess emmenagogue properties, and to exert an alterative influence over the mucous membranes, rendering it useful in ophthalmia, in catarrhal inflammation of the nostrils, throat, and respiratory passages, and in similar conditions of the alimentary canal and urinary organs. Dr. Peters, of New York (*Boston Med. and Surg. Journ.*, vol. 77, p. 77), states that in large doses pulsatilla causes profuse perspiration, which may be followed by an eruption of small vesicles or even pustules on the skin, and believes that therapeutically it is very nearly equivalent to senega.

The preparation employed by Störck was an extract of the herbaceous part of the plant, which was given in the dose of one or two grains daily, gradually increased to twenty grains or more. The dried herb, and a tincture and distilled water of the plant, were used; the dose of the powder being two or three grains (0·13 or 0·20 Gm.), of the tincture half a fluidrachm (1·9 C.c.), and of the water two or three drachms (7·5 or 11·25 C.c.). In large doses it was found frequently to produce nausea and vomiting.

PULVERES. *Powders.*

(PŬL′VẸ-RĒŞ.)

Poudres, *Fr.;* Pulver, *G.*

The form of powder is convenient for the exhibition of substances which are not given in very large doses, are not very disagreeable to the taste, have no corrosive property, and do not deliquesce rapidly on exposure. As the effect of pulverization is to expose a more extended surface to the action of the air, care should be taken to keep substances which are liable to be injured by such exposure in closely-stopped bottles. In many instances it is also important to exclude the light, which exercises a deleterious influence over numerous medicines when minutely divided. This may be done by coating the bottles with black varnish. In relation to substances most liable to injury from these causes, the best plan is to powder them in small quantities as wanted for use.*

Powders may be divided into the *simple*, consisting of a single substance, and the *compound*, of two or more mixed together. The latter only are embraced under the present head. In the preparation of the compound powders, the ingredients, if of different degrees of cohesion or solidity, should be pulverized separately and then mixed. Deliquescent substances, and those containing fixed oil in large proportion, should not enter into the composition of powders intended to be kept; the former because they render the preparation damp and liable to spoil; the latter because they are apt to become rancid and impart an unpleasant odor and taste. When deliquescent substances are extemporaneously prescribed, the apothecary should enclose them before delivery in waxed paper or other impervious covering; and the same remark is applicable to volatile powders, as carbonate of ammonium and camphor.

The lighter powders may in general be administered in water or other thin liquid; the heavier, such as those of metallic substances, require a more consistent vehicle, as syrup, molasses, honey, or one of the confections. Resinous powders, if given in water, require the intervention of mucilage or sugar. For many powders the *cachet de pain* affords the best method of administration.†

In the act of powdering, the whole substance in the mortar should not be beaten till completely pulverized; as the portion already powdered interferes with the action of the pestle upon the remainder, while the finer matter is apt to be dissipated; so that there is a loss both of time and material. The proper plan is to sift off the fine powder after a short continuance of the process, then to return the coarser parts to the mortar, and to repeat several times this alternate pulverization and sifting, until the process is completed. Care should be taken to mix thoroughly the several portions of fine powder thus obtained.

The preparations of this class which have been dismissed at the recent revision of the U. S. Pharmacopœia are the *Effervescing* or *Soda Powders* and *Powder of Aloes and Canella.*

PULVIS AMYGDALÆ COMPOSITUS. *Br.* *Compound Powder of Almonds.*

(PŬL′VỊS Ạ-MY̆G′DẠ-LÆ CỌM-PŎṢ′Ị-TŬS.)

Confectio Amygdalæ, *Lond.;* Conserva Amygdalarum, *Ed.;* Confection of Almond; Conserve d'Amandes, *Fr.;* Mandelconserve, *G.*

"Take of Sweet Almonds *eight ounces;* Refined Sugar, in powder, *four ounces;* Gum Arabic, in powder, *one ounce.* Steep the Almonds in warm water until their skins can be easily removed; and, when blanched, dry them thoroughly with a soft cloth, and rub them lightly in a mortar to a smooth consistence. Mix the Gum and the Sugar; and, adding them to the pulp gradually, rub the whole to a coarse powder. Keep it in a lightly covered jar." *Br.*

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* In contradiction to what has been stated in the text in relation to keeping powders in well-stopped bottles, it is asserted by M. Hérouard, a French pharmaceutist, that this plan, instead of preserving powders, tends to their more speedy and certain change. Whatever pains may be taken in drying medicines previously to powdering them, most of them during the process attract moisture, so as to put themselves in this respect in equilibrium with the surrounding air; and, if enclosed in this state in air-tight vessels, they are exposed to injurious influence from their own absorbed water, which, vaporized in hot weather, is in the colder seasons condensed on the inner surface of the vessel, and determines a movement of fermentation: and even cryptogamic growths appear. The best method of preservation, the author thinks, is to enclose the powders in strong paper bags of a blue or gray color, so as to exclude the light, while the air has exit or entrance through the porous walls. Whatever may be our theoretical opinions on the point, M. Hérouard asserts the fact, as the result of observation, that powders keep best in this way. They may be more likely to cake or harden into aggregate masses; but this disadvantage is easily counteracted by a new pulverization when required. (*Journ. de Pharm.*, Août, 1862, p. 98.) There is probably some truth in these statements; and the inference may be drawn that, where powders are kept in air-tight bottles, they should be thoroughly dried, after pulverization, before being enclosed.

† *Cachet de Pain.* These very useful articles are wafers made of unleavened bread in such a manner that they offer a concavity, so that when two are placed face to face there is a space in which a powder may be contained. They are of different sizes and capacities, the largest readily holding as much as ten grains of quinine. In filling them one wafer is placed upon a board, the requisite amount of the medicine put in it: then a second wafer, whose interior margin has been wetted, is laid upon the first and pressed down upon it. When taken they should be dipped in water, placed immediately upon the back of the tongue, and swallowed with a gulp of fluid. For most powders of disagreeable taste, the cachet de pain affords the best method of administration.

This is nothing more than the old *Almond Confection* under a new name. It is intended to afford a speedy method of preparing the almond mixture, which, when made immediately from the almonds, requires much time, and which cannot be kept ready made in the shops. But, from its liability to be injured by keeping, it was omitted from the U. S. Pharmacopœia, which directs the almond mixture to be made immediately from the ingredients.

Off. Prep. Mistura Amygdalæ, *Br.*

PULVIS ANTIMONIALIS. *U. S., Br.* *Antimonial Powder.* [*James' Powder.*]

(PŬL′VIS ĂN-TI-MŌ-NI-Ā′LIS.)

Pulvis Antimonii Compositus, Pulvis Jacobi; Poudre antimoniale de James, *Fr.;* James's Antimonpulver, *G.*

"Oxide of Antimony, *thirty-three parts* [or one ounce av.]; Precipitated Phosphate of Calcium, *sixty-seven parts* [or two ounces av.], To make *one hundred parts* [or three ounces av.]. Mix them intimately." *U. S.*

"Take of Oxide of Antimony *one ounce;* Phosphate of Lime *two ounces.* Mix them thoroughly." *Br.*

This preparation has been introduced into the U. S. Pharmacopœia as a substitute for the different forms of antimonial powder formerly officinal with the British Colleges, and because of its revived employment at the present time. The officinal preparations are identical. In order that the subject may be properly understood, it will be necessary to introduce a notice of the powder as formerly directed to be prepared by the London and Dublin Colleges; the process of the Edinburgh College having been so similar to the London that it does not require special consideration.

Antimonial Powder of the London College. The following was the London process. "Take of Tersulphate of Antimony, powdered, *a pound;* Horn shavings *two pounds.* Mix, and throw them into a red-hot crucible, and stir constantly until vapor ceases to arise. Rub the residue to powder, and put it into a crucible. Then apply heat, and raise it gradually to redness, and keep it so for two hours. Rub the remaining powder until it is as fine as possible." *Lond.*

This preparation consists mainly of bone-phosphate of calcium, or calcined bone, mixed with antimonous acid, and is intended to furnish a substitute for the celebrated nostrum of Dr. James, an English physician who died in 1776, and after whom the original preparation was called *James's powder.* Dr. Pearson, of London, found the genuine powder, on analysis, to consist of phosphate of calcium and oxidized antimony, and, guided by his results, devised the formula adopted by the London College. By burning the materials directed by the College, the sulphur is expelled in the form of sulphurous acid, and the antimony oxidized; while the horn, which is of the nature of bone, has its animal matter converted into charcoal. By the subsequent calcination the charcoal is dissipated, leaving only the phosphate of calcium of the horn mixed with the oxidized antimony.

The antimonial powder made by this formula is a tasteless, inodorous, gritty powder, of a dull white color. As often prepared, it is insoluble in water; but usually a small portion, consisting of antimonite and acid phosphate of calcium, dissolves in boiling distilled water. Its composition varies exceedingly, a circumstance which forms a strong objection to it as a medicine. When entirely insoluble in boiling water, it probably contains nothing but antimonous acid and phosphate of calcium; for, when its soluble constituents are absent, the teroxide is absent also.

The only essential difference between the officinal and the Dublin powder is that its ingredients are taken already prepared and mixed in fixed proportion, while those of the latter result simultaneously from one operation. It is of course much more easily prepared, and less liable to uncertainty from any error in the process.*

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* Mr. Michael Donovan believes that none of the officinal formulas fairly represent James's powder, and gives an elaborate history of this celebrated proprietary medicine, and a method of its preparation, in *P. J. Tr.,* 1869.

Medical Properties and Uses. This preparation is stated to be alterative, diaphoretic, purgative, or emetic, according to the dose in which it is given. Until within a few years it was often prescribed in febrile diseases, with a view to its diaphoretic effect. According to Dr. A. T. Thomson, it is advantageously given in acute rheumatism, conjoined with camphor, calomel, and opium, and with calomel and guaiac in several cutaneous affections. The estimation in which this preparation is held is very various; but it is generally admitted that, as formerly prepared, it is very uncertain in the percentage of teroxide of antimony, and consequently in its activity; indeed, it was this uncertainty of its action that led to its omission from the U. S. Pharmacopœia, upon the revision of 1830.

The antimonial powder at present officinal is exempt from the objection of irregularity of composition. Nevertheless, as it depends for its greater or less energy on the presence or absence in the alimentary canal of an acid which may form a salt with the antimonial oxide, it cannot always be relied on for a definite effect, being sometimes mild, and sometimes more active than might be desirable. The dose, as a diaphoretic, is from three to eight grains (0·20–0·52 Gm.) every third or fourth hour, given in the form of pill. In larger doses it is purgative and emetic. Dr. Jonathan Osborne has found the teroxide, given separately in three-grain (0·20 Gm.) doses, evening and night, to cause in some cases nausea and vomiting, in others mild purgation. (*P. J. Tr.*, 1855, p. 331.)

PULVIS AROMATICUS. *U. S.* *Aromatic Powder.*

(PŬL′VIS ĂR-O-MĂT′I-CŬS.)

Pulvis Cinnamomi Compositus, *Br.;* Compound Powder of Cinnamon; Poudre aromatique, *Fr.;* Aromatisches Pulver, *G.*

"Cinnamon, in No. 60 powder, *thirty-five parts* [or seven ounces av.]; Ginger, in No. 60 powder, *thirty-five parts* [or seven ounces av.]; Cardamom, deprived of the capsules and crushed, *fifteen parts* [or three ounces av.]; Nutmeg, in No. 20 powder, *fifteen parts* [or three ounces av.], To make *one hundred parts* [or twenty ounces av.]. Rub the Cardamom and Nutmeg with a portion of the Cinnamon, until reduced to a fine powder; then add the remainder of the Cinnamon and the Ginger, and rub them together until they are thoroughly mixed." *U. S.*

"Take of Cinnamon Bark, in powder, Cardamom Seeds, in powder, Ginger, in powder, of each, *one ounce.* Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle." *Br.*

The Aromatic Powder of the present Pharmacopœia differs but little from that formerly officinal. The proportions of the cinnamon and ginger have been very slightly increased.

These powders now closely resemble each other; the only material difference being that, instead of the cardamom and nutmeg of the U.S. Pharmacopœia, together equal in quantity to each of the other ingredients, the British takes only the cardamom in double the proportion, or equal to each of the others. The present British formula differs from that of 1864, in the substitution of ginger for nutmeg, cloves, and saffron, and especially in the absence of sugar, which in the latter constituted two-thirds of the whole, having probably been added in order that, by the addition of a little water to the powder, an aromatic confection might be readily prepared, without the necessity of keeping it. It is obvious that this end may be as effectually attained by the addition of a little syrup to the present powder.

The cardamom seeds should always be separated from their capsules before being weighed; and the powder, when prepared, should be kept in well-stopped bottles. The aromatic powder is stimulant and carminative, and the U. S. preparation may be given in the dose of from ten to thirty grains (0·65–1·95 Gm.), in cases of enfeebled digestion with flatulence; but it is chiefly used as a corrigent and adjuvant of other medicines. A mixture of aromatic powders in the form of a cataplasm is much used as a mild rubefacient, especially in nausea and vomiting, being applied over the epigastrium. Such mixtures are commonly called *spiced plasters.* The following is a good formula. Take of ginger, cloves, cinnamon, and black pepper, each, in powder, an ounce; tincture of ginger half a fluidounce; honey a sufficient quantity.

Mix the powders, and then add the tincture and honey, so as to form a stiff cataplasm;* or the mixed powder may be distributed in a thin flannel bag, quilted in position, and the whole wet with bathing whisky when applied and covered with oiled silk. A still preferable method in some cases is to put the above mixture, without the honey, in a quart of alcohol and apply the tincture thus formed upon flannel.

Off. Prep. Extractum Aromaticum Fluidum, *U. S.;* Pilula Aloes et Ferri, *Br.;* Pilula Aloes et Myrrhæ, *U. S.;* Pilula Cambogiæ Composita, *Br.*

PULVIS CATECHU COMPOSITUS. *Br.* *Compound Powder of Catechu.*

(PŬL'VỊS CĂT'Ẹ-ÇHŪ CỌM-PŎŞ'Ị-TŬS.)

"Take of Pale Catechu, in powder, *four ounces;* Kino, in powder, Rhatany Root, in powder, of each, *two ounces;* Cinnamon Bark, in powder, Nutmeg, in powder, of each, *one ounce.* Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle." *Br.*

This is an agreeable form for the administration of kino or catechu; but we do not see the propriety of mixing two substances so similar in their properties, at least in relation to taste and medicinal effect, that they may be considered identical. The dose is from fifteen to thirty grains (1–1·95 Gm.).

PULVIS CRETÆ AROMATICUS. *Br.* *Aromatic Powder of Chalk.*

(PŬL'VỊS CRĒ'TÆ ĂR-Ọ-MĂT'Ị-CŬS.)

"Take of Cinnamon Bark, in powder, *four ounces;* Nutmeg, in powder, Saffron, in powder, of each, *three ounces;* Cloves, in powder, *one ounce and a half;* Cardamom Seeds, in powder, *one ounce;* Refined Sugar, in powder, *twenty-five ounces;* Prepared Chalk *eleven ounces.* Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle." *Br.*

This is the former "Aromatic Powder" of the Br. Pharmacopœia, with the addition of chalk, and differs from the former "Aromatic Powder of Chalk" only in having the ingredients severally directed instead of being mixed in the form of the "Aromatic Powder." The color of the genuine powder, according to Mr. Archibald Paterson, varies from a bright yellow ochre to a dark brown, almost resembling that of Dover's powder. (*P. J. Tr.*, June, 1873, p. 992.) It is a warm stimulant and astringent, as well as antacid, and is well calculated for diarrhœa connected with acidity and without inflammation. In such a combination, however, the due proportion, and even the choice of the ingredients, vary so much with the symptoms that they might with propriety be left to extemporaneous prescription. The dose is from thirty to sixty grains (1·95–3·9 Gm.), given in mucilage or sweetened water, and frequently repeated.

Off. Prep. Pulvis Cretæ Aromaticus cum Opio, *Br.*

PULVIS CRETÆ AROMATICUS CUM OPIO. *Br.* *Aromatic Powder of Chalk and Opium.*

(PŬL'VỊS CRĒ'TÆ ĂR-Ọ-MĂT'Ị-CŬS CŬM Ō'PỊ-Ō.)

"Take of Aromatic Powder of Chalk *nine ounces and three-quarters;* Opium, in powder, *a quarter of an ounce.* Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle." *Br.*

The addition of the opium greatly increases the efficacy of the compound powder of chalk in diarrhœa; and its equal diffusion through the powder presents this advantage, that it may be conveniently given in minute doses applicable to infantile cases. Two scruples of the powder contain a grain of opium. In the diarrhœa of adults from ten to twenty grains (0·65–1·3 Gm.) may be given for a dose, and repeated several times a day, or after each evacuation.

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* *Aromatic Sugar.* Mr. Wm. L. Turner proposes an ingenious mode of obtaining the effects of the aromatic powder, in certain cases where the use of the powder itself would be inconvenient. He prepares an aromatic sugar by submitting eight ounces of the freshly prepared powder to percolation with stronger alcohol to exhaustion, pouring the percolate over eight ounces of sugar, and evaporating at a low heat. The sugar thus prepared may be added to mixtures, solutions, etc., requiring aromatic addition. (*A. J. P.*, March, 1869, p. 118.)

PULVIS CRETÆ COMPOSITUS. *U. S.* *Compound Chalk Powder.*

(PŬL'VỊS CRĒ'TÆ CỌM-PŎŞ'Ị-TŬS.)

"Prepared Chalk, *thirty parts* [or one and a half ounces av.]; Acacia, in fine powder, *twenty parts* [or one ounce av.]; Sugar, in fine powder, *fifty parts* [or two and a half ounces av.], To make *one hundred parts* [or five ounces av.]. Mix them intimately." *U. S.*

This is a new officinal powder. It has been introduced for the purpose of having on hand, in a convenient form, the dry powders necessary to make chalk mixture. (See *Mistura Cretæ.*) This powder will be found, however, a very convenient basis for administering chalk in powder; and it will be easy to direct the addition of morphine, kino, pepsin, subnitrate of bismuth, or any other suitable agent.

Off. Prep. Mistura Cretæ, *U. S.*

PULVIS EFFERVESCENS COMPOSITUS. *U. S.* *Compound Effervescing Powder.* [*Seidlitz Powder.*]

(PŬL'VỊS ĔF-FẸR-VĔS'CẸNŞ CỌM-PŎŞ'Ị-TŬS.)

Pulveres Effervescentes Aperientes, *U. S.* 1870; Seidlitz Powders; Pulvis Aërophorus Laxans, s. P. Aërophorus Seidlitzensis, *P.G.;* Poudre gazifère purgative, Poudre de Sedlitz, *Fr.;* Abführendes Brausepulver, Seidlitzpulver, *G.*

"Bicarbonate of Sodium, in fine powder, *four hundred and eighty grains* (31 Gm.); Tartrate of Potassium and Sodium, in fine powder, *fourteen hundred and forty grains* (93 Gm.); Tartaric Acid, in fine powder, *four hundred and twenty grains* (27 Gm.). Mix the Bicarbonate of Sodium intimately with the Tartrate of Potassium and Sodium, divide the mixture into *twelve equal parts*, and wrap each part in a separate paper of some pronounced color, as blue. Then divide the Tartaric Acid into the *same number* (12) *of equal parts*, and wrap each part in a separate paper of a color distinctly different from that used for wrapping the mixture, as white. Keep the powders in well-closed vessels." *U. S.**

It will be observed that the title of this preparation has been changed at the last revision to Pulvis Effervescens Compositus. There seemed to be no good reason for this change, but it can do no special harm, because the Latin title is very rarely used. Though named from the saline springs of Seidlitz, in Bohemia, Seidlitz Powders do not correspond in composition with those famous waters. Of each pair of powders, one, much the smaller of the two, contains thirty-five grains (2·3 Gm.) of tartaric acid, the other forty grains (2·6 Gm.) of bicarbonate of sodium mixed with two drachms (7·8 Gm.) of Rochelle salt. The acid powder is usually put into a white, the alkaline into a blue paper, which latter should not be colored by aniline; a number of them are enclosed in a paper or tin box. They should not be kept in a damp place, as the tartaric acid is liable to be dissolved by the moisture and absorbed into the substance of the paper, thus altering the due proportion of the ingredients. We have known the whole of the contents of the white paper thus to disappear in the course of two or three years. The Rochelle salt is the ingredient upon which the aperient property mainly depends. In their administration, each powder is dissolved separately, the smaller in a fluidounce or more of water, the larger in twice or three times the quantity; and the two solutions are mixed gradually. A reaction takes place between the tartaric acid and the bicarbonate of sodium, by which tartrate of sodium is produced, adding somewhat to the laxative property of the draught, and carbonic acid escapes, causing a brisk effervescence. The acid is in slight excess, and thus causes an agreeable acidity in the solution. These powders are refrigerant and aperient, and generally very acceptable to the stomach in consequence of the carbonic acid eliminated. They are especially adapted to febrile cases with a somewhat irritable stomach. One pair of them will generally operate slightly; but, if required, two may be given at once; or the dose may be repeated every three or four hours till the desired effect is produced. The flavor may sometimes be advantageously improved by adding syrup of ginger, orange peel, or lemon to one of the solutions before admixture.

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* *Pulveres Effervescentes,* U. S. 1870. *Effervescing Powders. Soda Powders. Pulvis Aërophorus Anglicus,* P.G.: *Poudre gazeuse, P. aërophore, P. de Seltz,* Fr.; *Brausepulver,* G. "Take of Bicarbonate of Sodium, in fine powder, *three hundred and sixty grains;* Tartaric Acid, in fine powder, *three hundred grains.* Divide each of the powders into twelve equal parts, and keep the parts, severally, of the Bicarbonate and of the Acid in separate papers of different colors." *U. S.* 1870. This is a formula dismissed at the last revision of our national Pharmacopœia. It is a preparation which has been long in use under the name of *soda powders.* The powders consist, severally, of twenty-five grains (1·565 Gm.) of the acid in one paper, and thirty (1·95 Gm.) of the bicarbonate in the other. They are administered in solution. An acid and an alkaline powder may be dissolved in separate portions of water and then mixed; or they may be thrown together, or successively, into the same portion of water. The whole draught should be half a pint or somewhat less. It may be rendered more agreeable by adding two or three fluidrachms (7·5–11·25 C.c.) of syrup of ginger or orange peel to the water, before dissolving the powders. The rationale is simple. The tartaric acid seizes the alkali of the bicarbonate, forming a tartrate of sodium, while the carbonic acid escapes with effervescence. The effervescing powders are refrigerant and slightly laxative, and afford an agreeable and refreshing drink, suitable to febrile complaints, and generally very acceptable to the stomach.

PULVIS GLYCYRRHIZÆ COMPOSITUS. *U. S., Br.* *Compound Powder of Glycyrrhiza.*

(PŬL′VỊS GLȲÇ-ỴR-RHĪ′ZÆ CỌM-PŎŞ′Ị-TŬS.)

Pulvis Liquiritiæ (Glycyrrhizæ) Compositus, s. P. Pectoralis Kurellæ, *P.G.;* Poudre de Réglisse composée, *Fr.;* Brustpulver, *G.*

"Senna, in No. 60 powder, *eighteen parts* [or eighty-six grains]; Glycyrrhiza, in No. 60 powder, *sixteen parts* [or seventy-six grains]; Fennel, in No. 60 powder, *eight parts* [or thirty-eight grains]; Washed Sulphur, *eight parts* [or thirty-eight grains]; Sugar, in fine powder, *fifty parts* [or two hundred and forty grains], To make *one hundred parts* [or four hundred and eighty grains]. Rub them together until they are thoroughly mixed." *U. S.*

"Take of Senna, in fine powder, Liquorice Root, in fine powder, of each, *two ounces;* Refined Sugar, in powder, *six ounces.* Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar." *Br.*

This officinal preparation, which has just been introduced into the U. S. P. 1880, is identical with that of the German Pharmacopœia; but, as will be seen, it is quite different from the British preparation. The object of the fennel is patent, but the advantage that is to be gained by the use of washed sulphur in the proportion of only 8 per cent. must be purely imaginary. It is used as an agreeable laxative in the dose of from thirty to sixty grains (1·95 to 3·9 Gm.).

PULVIS IPECACUANHÆ ET OPII. *U. S.* *Powder of Ipecac and Opium.* [*Dover's Powder.*]

(PŬL′VỊS ĬP-Ẹ-CĂC-Ů-ĂN′HÆ ĔT Ō′PỊ-Ī—ĭp-ẹ-kăk-ů-ăn′ē).

Pulvis Ipecacuanhæ Compositus, *U. S.* 1870; Pulvis Ipecacuanhæ Opiatus, s. Pulvis Doweri, *P.G.;* Poudre de Dower, *Fr.;* Dower'sches Pulver, *G.*

"Ipecac, in No. 60 powder, *ten parts* [or sixty grains]; Powdered Opium, *ten parts* [or sixty grains]; Sugar of Milk, in No. 30 powder, *eighty parts* [or four hundred and eighty grains], To make *one hundred parts* [or six hundred grains]. Rub them together into a very fine powder." *U. S.*

"Take of Ipecacuanha, in powder, *half an ounce* [av.]; Opium, in powder, *half an ounce* [av.]; Sulphate of Potash, in powder, *four ounces* [av.]. Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle." *Br.*

In the desire for change, this old and well-known preparation has not been spared in the last revision. The title which in 1870 was at last brought into conformity with that of the British Pharmacopœia has been changed back to the old 1850 name. The altering of well-established officinal titles of such important preparations as this is a practice which should be earnestly opposed. In the present instance there was no necessity for it, whilst the substitution of sugar of milk for the sulphate of potassium formerly used will have a still further unsettling tendency;

the only reason that can be put forward for this latter change is that sugar of milk is more agreeable to the taste than sulphate of potassium, but it yet remains to be determined whether the effects of the two preparations are identical.

The sulphate of potassium and the sugar of milk serve, by the hardness of their particles, to promote that minute division and consequent thorough intermixture of the opium and ipecacuanha upon which the peculiar virtues of the compound depend. They also serve to dilute the active ingredients, and thus allow of their division into minute doses adapted to the complaints of children. This composition, though called Dover's powder, does not precisely correspond with that originally recommended by Dr. Dover, which was prepared as follows. Four ounces of nitrate of potassium and the same quantity of sulphate of potassium were mixed in a red-hot crucible, and afterwards very finely powdered; one ounce of opium, sliced, was then added, and ground to powder with the saline mixture; lastly, an ounce of ipecacuanha and an ounce of liquorice root, in powder, were mixed with the other ingredients. This process was adopted in a former French Codex, and has been retained with little change in the present.

This powder is an admirable anodyne diaphoretic, applicable to all cases, not attended with much fever, cerebral disease, or sick stomach, in which there is an indication for diaphoresis, especially in painful affections, or in those connected with unhealthy discharges. It is admirably adapted to the phlegmasiæ, particularly rheumatism and pneumonia, when complicated with a typhoid tendency, or after sufficient depletion. Under similar circumstances, it is useful in dysentery, diarrhœa, and the various hemorrhages, especially hemorrhage from the uterus. In bowel affections, and whenever the hepatic secretion is deranged, it is frequently combined with small doses of calomel. Ten grains of the powder contain one grain of opium. The dose is from five to fifteen grains (0·33–1 Gm.), given diffused in water, or mixed with syrup, or in the form of bolus, and repeated at intervals of four, six, or eight hours, when it is desirable to maintain a continued diaphoresis. Its action may be promoted by warm drinks, such as lemonade or balm tea.

PULVIS JALAPÆ COMPOSITUS. *U. S., Br.* *Compound Powder of Jalap.*

(PŬL'VIS JA-LĀ'PÆ COM-PŎS'I-TŬS.)

"Jalap, in No. 60 powder, *thirty-five parts* [or one hundred and sixty-eight grains]; Bitartrate of Potassium, in fine powder, *sixty-five parts* [or three hundred and twelve grains], To make *one hundred parts* [or four hundred and eighty grains]. Rub them together until they are thoroughly mixed." *U. S.*

"Take of Jalap, in powder, *five ounces;* Acid Tartrate of Potash *nine ounces;* Ginger, in powder, *one ounce.* Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar." *Br.*

The bitartrate, by being rubbed with the jalap, is thought to favor its more minute division, while it increases its hydragogue effect. A combination of these two ingredients, though with a larger proportion of cream of tartar (see *Jalapa*), forms a good cathartic in dropsy, and in scrofulous diseases of the joints and glands. The dose of the powder is from thirty grains to a drachm (1·95–3·9 Gm.).

PULVIS KINO COMPOSITUS. *Br., Lond.* *Compound Powder of Kino.*

(PŬL'VIS KĪ'NŌ COM-PŎS'I-TŬS.)

Pulvis Kino cum Opio, *Br.* 1864; Powder of Kino and Opium.

"Take of Kino, in powder, *three ounces and three-quarters;* Opium, in powder, *a quarter of an ounce;* Cinnamon Bark, in powder, *one ounce.* Mix them thoroughly, pass the Powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle." *Br.*

This is an anodyne astringent powder, useful in some forms of diarrhœa, but of which the composition would be better left to extemporaneous prescription, as the proportion of the ingredients should vary with the circumstances. Twenty grains contain one grain of opium. The dose is from five grains to a scruple (0·33–1·3 Gm.).

PULVIS MORPHINÆ COMPOSITUS. *U.S.* *Compound Powder of Morphine.* [*Tully's Powder.*]

(PŬL′VỊS MŎR-PHĪ′NÆ CỌM-PŎṢ′Ị-TŬS.)

"Sulphate of Morphine, *one part* [or eight grains]; Camphor, *twenty parts* [or one hundred and sixty grains]; Glycyrrhiza, in No. 60 powder, *twenty parts* [or one hundred and sixty grains]; Precipitated Carbonate of Calcium, *twenty parts* [or one hundred and sixty grains]; Alcohol, *a sufficient quantity*. Rub the Camphor with a little Alcohol, and afterward with the Glycyrrhiza and Precipitated Carbonate of Calcium, until a uniform powder is produced. Then rub the Sulphate of Morphine with this powder, gradually added, until the whole is thoroughly mixed." *U. S.*

This is a new officinal compound powder: it originated with Dr. Wm. Tully, of New Haven, Conn., who devised it as a substitute for Dover's Powder. It is very necessary to comply strictly with the directions of Dr. Tully in its preparation, *i.e.*, to mix the ingredients thoroughly and then sift the powder, and it is to be regretted that this last direction was not included in the officinal formula. The diaphoretic action depends largely upon the intimate admixture of the ingredients. There is the one-sixtieth of a grain of sulphate of morphine in one grain of the powder. The dose is ten grains (0·65 Gm.), containing one-sixth of a grain (0·01 Gm.) of sulphate of morphine.

PULVIS OPII COMPOSITUS. *Br.* *Compound Powder of Opium.*

(PŬL′VỊS Ō′PỊ-Ī CỌM-PŎṢ′Ị-TŬS.)

"Take of Opium, in powder, *one ounce and a half;* Black Pepper, in powder, *two ounces;* Ginger, in powder, *five ounces;* Caraway Fruit, in powder, *six ounces;* Tragacanth, in powder, *half an ounce.* Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle." *Br.*

This seems to have been introduced in order to have at hand all the dry ingredients of the Confection of Opium. (See *Confectio Opii*, page 481.)

Ten grains (0·65 Gm.) of the powder contain one grain (0·065 Gm.) of opium.

Off. Prep. Confectio Opii, *Br.*

PULVIS RHEI COMPOSITUS. *U.S., Br.* *Compound Powder of Rhubarb.*

(PŬL′VỊS RHĒ′Ī CỌM-PŎṢ′Ị-TŬS.)

Pulvis Magnesiæ cum Rheo, s. P. Infantum, s. P. Antacidus, *P.G.;* Poudre de Rhubarbe composée, *Fr.;* Kinderpulver, *G.*

"Rhubarb, in No. 60 powder, *twenty-five parts* [or one hundred and twenty grains]; Magnesia, *sixty-five parts* [or three hundred and twelve grains]; Ginger, in No. 60 powder, *ten parts* [or forty-eight grains], To make *one hundred parts* [or four hundred and eighty grains]. Rub them together until they are thoroughly mixed." *U. S.*

"Take of Rhubarb Root, in powder, *two ounces;* Light Magnesia, *six ounces;* Ginger, in powder, *one ounce.* Mix them thoroughly, and pass the powder through a fine sieve." *Br.*

This is a good laxative antacid, well adapted to bowel complaints, especially in children. The dose for an adult is from half a drachm to a drachm (1·95–3·9 Gm.); for a child two or three years old, from five to ten grains (0·33–0·65 Gm.).

PULVIS SCAMMONII COMPOSITUS. *Br.* *Compound Powder of Scammony.*

(PŬL′VỊS SCẠM-MŌ′NỊ-Ī CỌM-PŎṢ′Ị-TŬS.)

"Take of Scammony, in powder, *four ounces;* Jalap, in powder, *three ounces;*

Ginger, in powder, *one ounce*. Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar." *Br.*

This does not appear to us a very eligible preparation. Though the ginger may tend to correct the griping property of the purgative ingredients, the jalap too closely resembles the scammony in its operation to exert any important modifying influence upon it. The dose is from ten to twenty grains (0·65–1·3 Gm.).

PULVIS TRAGACANTHÆ COMPOSITUS. *Br.* *Compound Powder of Tragacanth.*

(PŬL'VI̥S TRĂG-Ḁ-CĂN'THÆ CO̥M-PŎS̥'I̥-TŬS.)

"Take of Tragacanth, in powder, Gum Acacia, in powder, Starch, of each, *one ounce;* Refined Sugar, in powder, *three ounces.* Rub them well together." *Br.*

This is applicable to the general purposes of the demulcents, but is chiefly employed in Great Britain as a vehicle for heavy insoluble powders. The dose is from thirty grains to a drachm (1·95–3·9 Gm.).

PYRETHRUM. *U. S.* *Pyrethrum.* [*Pellitory.*]

(PȲ-RĒ'THRŬM.)

"The root of Anacyclus Pyrethrum. De Candolle. (*Nat. Ord.* Compositæ.)" *U. S.* "The root of Anacyclus Pyrethrum. De Cand. Imported from the Levant." *Br.*

Pyrethri Radix, *Br.;* Radix Pyrethri Romani; Pellitory of Spain; Pyrèthre (salivaire), *Fr.;* Bertramwurzel, Römische Bertramwurzel, *G.;* Pietro, *It.;* Pelitre, *Sp.*

ANACYCLUS. Differing from Anthemis by its winged and obcordate *achenia*. *Lindley.* See *Anthemis.*

Anacyclus Pyrethrum. De Cand. *Prodrom.* vi. 15.—*Anthemis Pyrethrum.* Willd. *Sp. Plant.* iii. 2184; *B. & T.* 151. The root of this plant is perennial, and sends up numerous stems, usually trailing at the base, erect in their upper portion, eight or ten inches high, and terminated by one large flower. The leaves are doubly pinnate, with narrow nearly linear segments of a pale green color. The florets of the disk are yellow; the rays white on their upper surface, and reddish or purple beneath and at their edges.

The plant is a native of the Levant, Barbary, and the Mediterranean coast of Europe. The root is the part used under the name of pellitory, or *pellitory of Spain.* According to Hayne, the pellitory of the shops is derived from the *Anacyclus officinarum,* a plant cultivated in Thuringia for medical purposes. This remark, however, can apply only to Germany.

Properties. The dried root of *A. Pyrethrum* is about the size of the little finger, cylindrical, straight or but slightly curved, wrinkled longitudinally, of an ash-brown color externally, whitish within, hard and brittle, and sometimes furnished with a few radicles. It is destitute of odor, though, when fresh, of a disagreeable smell. Its taste is peculiar, slight at first, but afterwards acidulous, saline, and acrid, attended with a burning and tingling sensation over the whole mouth and throat, which continues for some time, and excites a copious flow of saliva. It is officinally described as "from two to four inches (5 to 10 cm.) long, somewhat fusiform, nearly simple, about half an inch (12 mm.) thick, annulate above, wrinkled below, externally dark grayish brown; internally brownish white, fracture short; the bark is rather thick, contains two circles of resin-cells, and surrounds the slender wood-bundles and medullary rays, the latter having about four circles of shining resin-cells; it is inodorous, pungent, and very acrid." *U. S.* Its analysis by Koene gives, in 100 parts, 0·59 of a brown, very acrid substance, of a resinous appearance, and insoluble in caustic potassa; 1·06 of a dark brown, very acrid, fixed oil, soluble in potassa; 0·35 of a yellow acrid oil, also soluble in potassa; traces of tannin; 9·40 parts of gum; inulin; 7·60 parts of sulphate and carbonate of potassium, chloride of potassium, phosphate and carbonate of calcium, alumina, silica, etc., and 19·80 of lignin, besides loss. (See *A. J. P.*, viii. 175.)

Medical Properties and Uses. Pellitory is a powerful irritant, used almost exclusively as a sialagogue in certain forms of headache, rheumatic and neuralgic affections of the face, toothache, etc., or as a local stimulant, in palsy of the tongue or throat, and in relaxation of the uvula. For these purposes it may be chewed, or employed as a gargle in decoction or vinous tincture. The dose as a masticatory is from thirty grains to a drachm (1·95–3·9 Gm.). Its action upon the general system has not been studied to any extent, but 50 minims of a tincture of it very nearly killed a child three and a half years old. The symptoms were those of gastro-enteritis, followed by convulsions. (*London Practitioner*, Aug. 1876.) An alcoholic extract is sometimes employed by dentists as a local application to carious teeth, with a view to a benumbing effect before plugging.

Off. Prep. Tinctura Pyrethri, *Br.*

PYROXYLINUM. *U. S., Br.* *Pyroxylin.* [*Soluble Gun Cotton.*]

(PỴ-RŎX-Ỵ-LĪ′NŬM.)

Pyroxylon, *U. S.* 1870; Gun Cotton; Fulmicoton soluble, *Fr.;* Collodiumwolle, *G.*

"Cotton, *one part* [or half an ounce av.]; Nitric Acid, *ten parts* [or five ounces av.]; Sulphuric Acid, *twelve parts* [or six ounces av.]; Alcohol, Stronger Ether, Water, each, *a sufficient quantity.* Mix the Acids gradually in a glass or porcelain vessel, and, when the temperature of the mixture has fallen to 32° C. (90° F.), add the Cotton. By means of a glass rod imbue it thoroughly with the Acids and allow it to macerate for ten hours, or, until a small sample of the Cotton, taken out, thoroughly washed with a large quantity of Water and subsequently with Alcohol and pressed, is found to be soluble, when shaken in a test-tube with a mixture of *one volume* [or one fluidrachm] of Alcohol and *three volumes* [or three fluidrachms] of Stronger Ether. Then remove the Cotton from the Acids, transfer it to a larger vessel and wash it, first with cold Water until the washings cease to have an acid taste, and afterward with boiling Water. Finally drain the Pyroxylin on filtering paper and dry it, in small, detached pellets, by means of a water-bath. Pyroxylin should be kept loosely packed, in well-closed vessels, containing not more than about 31 grammes (or about 480 grains), in a cool and dry place, remote from lights or fire." *U. S.*

"Take of Cotton *one ounce* [avoirdupois]; Sulphuric Acid, Nitric Acid, of each, *five fluidounces* [Imperial measure]. Mix the acids in a porcelain mortar, immerse the Cotton in the mixture, and stir it for three minutes with a glass rod, until it is thoroughly wetted by the Acids. Transfer the Cotton to a vessel containing water, stir it well with a glass rod, decant the liquid, pour more water upon the mass, agitate again, and repeat the affusion, agitation, and decantation, until the washings cease to give a precipitate with chloride of barium. Drain the product on filtering-paper, and dry in a water-bath." *Br.*

Gun cotton, discovered by Schönbein, of Basel, in Switzerland, is a name applied to several closely related yet distinct products. Thus, when nitric acid of moderate strength is taken alone and made to act in the cold on cotton, *mono-nitro-cellulose*, $C_6H_9(NO_2)O_5$, is the chief product; if, however, a mixture of equal volumes of nitric acid (1·42 sp. gr.) and sulphuric acid (1·85 sp. gr.) is taken, the cotton is converted into *dinitro-cellulose*, $C_6H_8(NO_2)_2O_5$; and if cellulose is acted on in the cold by a mixture of the strongest nitric acid (1·52 sp. gr.) and two or three times its bulk of concentrated sulphuric acid, *trinitro-cellulose*, $C_6H_7(NO_2)_3O_5$, is obtained.

The second of these compounds, dinitro-cellulose, is the *pyroxylin* of the Pharmacopœia. It differs from the other two compounds by being soluble in a mixture of three parts of ether and one part of rectified spirit, forming when dissolved what is known as *collodion.* The third compound, when very thoroughly washed free from acid, is insoluble in water, alcohol, ether, and all mixtures of alcohol with ether. It constitutes the true explosive gun cotton, which, when compressed in cakes and fired by a fulminate, explodes with great violence. Other compounds intermediate between some of these have been described by different chemists, but Abel, the chemist of the Woolwich Arsenal in England, has shown that they were imperfectly purified preparations.

Properties. Gun cotton has the appearance of ordinary cotton, but is harsh to the touch. When intended for solution it is best made by the joint action of sulphuric and nitric acid, or, as originally proposed by Dr. Ellet, of South Carolina College, of nitre and sulphuric acid. Experience is said to have shown that the use of the acids as practised in the present officinal formula gives better results than the employment of nitre and sulphuric acid, which was directed in the U. S. Pharmacopœia of 1860. Care should be exercised not to let the mixture attain a temperature much above 32° C. (90° F.). It is perfectly insoluble in water, and nearly so in strong alcohol, but dissolves in large quantity in acetic ether. M. Guichard proposes the use of chemically pure filtering-paper as yielding a superior product to cotton. He takes 1400 parts of sulphuric acid, sp. gr. 1·82 ; 700 parts of nitric acid, sp. gr. 1·37 ; 70 parts of the paper ; puts the mixed acid in a vessel surrounded by cold water to keep down the temperature, drops the paper in leaf by leaf, allows to stand three hours, and then washes freely with water. (*Journ. de Pharm.*, 4e sér., xii. 290.) According to Dr. J. H. Gladstone, of England, gun cotton is subject to spontaneous decomposition if kept for some time. The same fact was observed by Mr. James Beatson, of New York, and Prof. Procter, of Philadelphia. The specimen observed by Prof. Procter to undergo decomposition had not been well washed. The change is shown by the bottle, in which the gun cotton is kept, becoming full of nitrous acid vapor ; and the substance is so far altered that it is no longer explosive or soluble in ether. M. Bouet states that the decomposition from exposure to light takes place sooner in gun cotton which has been prepared with nitre and sulphuric acid, than where the mixed acids have been used. He says that, with both, the sides and bottom of the bottle are nearly covered with crystals of oxalic acid. (See *A. J. P.*, March, 1862, p. 187.) According to M. Béchamp, of Strasburg, the product is soluble in ether, if the cotton be immersed in a mixture of nitric and sulphuric acid, while still hot from their reaction ; but not soluble, if the cotton be added to the mixture when cold. By treating gun cotton with ferrous chloride, M. Béchamp caused the disengagement of nitrous oxide gas, and gave the filaments a coating of oxide of iron, which was readily dissolved by hydrochloric acid. After this treatment the gun cotton was restored to its original state of cotton. (*Chem. Gaz.*, Jan. 1, 1854, p. 11.) When kindled, gun cotton flashes off like gunpowder, burning without residue. Yet, according to M. Bleekrode, when wet with ether, or similar fluid, and touched with a light, the liquid will burn out of it without firing it. (*Journ. de Pharm.*, 4e sér., xviii.) Its inflaming point is at 187·7° C. (370° F.). Dr. Marx makes it lower. It has been tried as a substitute for gunpowder in fire-arms, etc.; but it has not been found useful except for some special purposes.

Off. Prep. Collodium ; Collodium cum Cantharide, *U. S.;* Collodium flexile, *U. S.*, *Br.;* Collodium Stypticum, *U. S.*

QUASSIA. *U. S.* *Quassia.*

(QUAS'SI-A—kwŏsh-e-a.)

"The wood of Picræna excelsa, Lindley, Quassia excelsa, Swartz. (*Nat. Ord.* Simarubaceæ.)" *U. S.* "The wood of Picræna excelsa. Lindley. From Jamaica."

Quassiæ Lignum, *Br.;* Quassia Wood ; Bitter Wood ; Bitter Ash ; Quassie, Bois amer, Bois de Quassie, *Fr.;* Quassienholz, *G.;* Legno della Quassia, *It.:* Leno de Quassia, *Sp.*

Genus Quassia. *Calyx* five-leaved. *Petals* five. *Nectary* five-leaved. *Drupes* five, distant, bivalve, one-seeded, inserted into a fleshy receptacle. *Willd.*

Of the species included by Linnæus in this genus, some, as *Quassia amara*, are hermaphrodite; others, as *Q. excelsa* and *Q. Simaruba*, are monœcious or polygamous. The latter have been associated by De Candolle in a distinct genus, named *Simaruba*, which has been again divided by Lindley into *Simaruba* with monœcious, and *Picræna* with polygamous flowers. To the last-mentioned genus belongs the proper Quassia plant, the *Q. excelsa* of Linnæus.

The medicine was formerly obtained from *Quassia amara;* but more than twenty years since, Lamarck stated that, in consequence of the scarcity of this tree, *Quassia excelsa* had been resorted to as a substitute, and the Pharmacopœias now acknowledge only the latter plant. The genuine quassia plant, however, of Surinam is the *Q. amara;* and we shall, therefore, give a brief description of both species.

Picræna excelsa. Lindley, *Flor. Med.* 208; *B. & T.* 57.—*Quassia excelsa.* Willd. *Sp. Plant.* ii. 569. *Simaruba excelsa.* De Cand. *Prodrom.* i. 733; Hayne, *Darstel. und Beschreib.* etc. ix. 16. As its name imports, this is a lofty tree, sometimes attaining not less than one hundred feet in height, with a straight, smooth, tapering trunk, which is often three feet in diameter near its base, and covered with a smooth, gray bark. The leaves are pinnate, with a naked petiole, and oblong pointed leaflets standing upon short footstalks, in opposite pairs, with a single leaflet at the end. The flowers are small, of a yellowish green color, and disposed in panicles. They are polygamous and pentandrous. The fruit is a small black drupe. This species inhabits Jamaica and the Caribbean islands, where it is called *bitter ash.*

Quassia amara. Willd. *Sp. Plant.* ii. 567; Woodv. *Med. Bot.* p. 574, t. 204. The bitter quassia is a small branching tree or shrub, with alternate leaves, consisting of two pairs of opposite pinnæ, with an odd one at the end. The leaflets are elliptical, pointed, sessile, smooth, of a deep green color on their upper surface, and paler on the under. The common footstalk is articulated, and edged on each side with a leafy membrane. The flowers, which are hermaphrodite and decandrous, are bright red, and terminate the branches in long racemes. The fruit is a two-celled capsule containing globular seeds. *Quassia amara* is a native of Surinam, and is said also to grow in some of the West India islands. Its root, bark, and wood were formerly officinal. They are excessively bitter, as in fact are all parts of the plant. It is uncertain whether any of the produce of this tree now reaches our markets.

Quassia comes in cylindrical billets of various sizes, from an inch to near a foot in diameter, and several feet in length. These are frequently invested with a light-colored smoothish bark, brittle, and but slightly adherent, and possessing in at least an equal degree the virtues of the wood. Their shape and structure clearly evince that they are derived from the branches or trunk and not from the root of the tree. In the shops they are usually in splinters, chips, or raspings. The wood is "dense, tough, of medium hardness, porous, with a minute pith and narrow, medullary rays," *U. S.*, and intensely bitter.

Properties. The wood is at first whitish, but becomes yellow by exposure, and sometimes has blackish spots or markings, due to the presence of the mycelium of a fungus. It is inodorous, and has a purely bitter taste, surpassed by that of few other substances in intensity and permanence. It imparts its active properties, with its bitterness and yellow color, to water and alcohol. Its virtues depend upon a peculiar bitter crystallizable principle, denominated *quassin*, which was first discovered by Winckler, who assigned it the formula $C_{10}H_{12}O_3$. This formula is, however, considered as doubtful at present. *Quassin* is white, opaque, unalterable in the air, inodorous, and of an intense bitterness, which in the solutions of this principle is almost insupportable. The bitterness is pure, and resembles that of the wood. When heated, quassin melts like a resin. It is but slightly soluble in water, 100 parts of which at 54° dissolve only 0·45, and that slowly. By the addition of salts, especially of those with which it is associated in quassia, its solubility is strikingly increased. It is also but slightly soluble in ether, but is very soluble in alcohol, more so in that liquid hot than cold, and the more so the purer it is. Quassin is perfectly neutral, though both alkalies and acids increase its solubility in water. It is precipitated by tannic acid from its aqueous solution, which is not disturbed by iodine, chlorine, corrosive sublimate, the salts of iron, sugar of lead, or even subacetate of lead. Goldschmidt and Weidel (*Jahresber.*, 1877, p. 931) could not get Wiggers's quassin, but obtained a resin which when fused with caustic potash yielded acetic and protocatechuic acids. Among the salts contained in quassia, Mr. George Whipple has detected a considerable proportion of sulphate of sodium. (*P. J. Tr.*, xiii. 643.)

Medical Properties and Uses. Quassia has in the highest degree all the properties of the simple bitters. It is purely tonic, invigorating the digestive organs, with little excitement of the circulation or increase of animal heat. It has not been very long known as a medicine. About the middle of the last century, a negro of Surinam, named Quassi, acquired considerable reputation in the treatment of the malignant fevers of that country, by a secret remedy, which he was induced to disclose to Mr. Rolander, a Swede, for a valuable consideration. Specimens were taken to Stockholm by this gentleman in the year 1756; and the medicine soon became popular in Europe. The name of the negro has been perpetuated in the generic title of the plant. But the quassia of Surinam is not now in use, having been superseded by the product of *Quassia excelsa*, from the West Indies. This medicine is useful whenever a simple tonic impression is desirable. It is particularly adapted to dyspepsia, and to that debilitated state of the digestive organs which sometimes succeeds acute disease. It may also be given with advantage in the remission of certain fevers in which tonics are demanded. No one at present would expect from it any peculiar controlling influence over malignant fevers. It is said to be largely employed in England by the brewers, to impart bitterness to their liquors.

It is administered in infusion, tincture, or extract, in doses respectively of half to one fluidounce (15 to 30 C.c.), half to one fluidrachm (1·9 to 3·75 C.c.), and half to one grain (0·03 to 0·065 Gm.). Some dyspeptic patients, who have become habituated to its bitterness, chew the wood occasionally with benefit.

Off. Prep. Extractum Quassiæ; Extractum Quassiæ Fluidum, *U. S.;* Tinctura Quassiæ, *U. S.*

QUERCUS ALBA. *U. S.* *White Oak.*

(QUĔR'CU̧S ĂL'BA̧.)

"The bark of Quercus alba. Linné. (*Nat. Ord.* Cupuliferæ.)" *U. S.*

QUERCUS CORTEX. *Oak Bark.*

(QUĔR'CU̧S CŎR'TĔX.)

"The dried bark of the small branches and young stems of Quercus pedunculata (Willd.); collected in spring, from trees growing in Britain." *Br.*

Écorce de Chêne, *Fr.;* Eichenrinde, *G.;* Corteccia della Quercia, *It.;* Corteza de Roble, *Sp.*

Gen. Ch. MALE. *Calyx* commonly five-cleft. *Corolla* none. *Stamens* five to ten. FEMALE. *Calyx* one-leafed, entire, rough. *Corolla* none. *Styles* two to five. *Nut* coriaceous, surrounded at the base by the persistent calyx. *Willd.*

This genus comprises not less than eighty species, of which between thirty and forty are within the limits of the United States. Many of these are applied to important practical purposes. In the Northern hemisphere, the oak is the most valuable, as it is the most widely diffused, of all forest trees. Notwithstanding the great number of species, few, comparatively, have found a place in the officinal catalogues. *Q. robur*, or common European oak, was formerly recognized by the British Colleges; but at present only *Q. pedunculata*, or European white oak, is admitted in the Br. Pharmacopœia. As these do not grow in the United States, and their products are not imported, it is unnecessary to treat of them particularly in this work. According to Michaux, they grow in the same countries, frequently together, constituting the greater part of the forests of Europe, and spreading over almost the whole northern section of Asia, and the northern coast of Africa. *Q. pedunculata* is the common British oak, celebrated as well for its majestic growth, and the venerable age which it attains, as for the strength and durability of its timber. Our own Pharmacopœia recognizes only *Q. alba*, or white oak. *Q. tinctoria*, or *black oak*, which was formerly officinal, and various other species, afford actively astringent barks. Such are *Q. falcata*, or *Spanish oak*, *Q. prinus*, or *white chestnut oak*, and *Q. montana*, or *rock chestnut oak*. The following remarks in relation to white-oak bark will apply also to that of the three last-mentioned species. The bark of *Q. tinctoria* is somewhat peculiar.

1. *Quercus alba*. Willd. *Sp. Plant.* iv. 448; Michaux, *N. Am. Sylv.* i. 17; *B. & T.* 250. Of all the American species, the *white oak* approaches nearest, in the character of its foliage, and the properties of its wood and bark, to *Q. pedunculata* of Great Britain. When allowed to expand freely in the open field, it divides at a short distance from the ground into numerous widely spreading branches, and attains under favorable circumstances a magnificent size. Its trunk and large branches are

covered with a whitish bark, which serves to distinguish it from most of the other species. The leaves are regularly and obliquely divided into oblong, obtuse, entire lobes, which are often narrowed at their base. When full grown, they are smooth and light green on their upper surface, and glaucous beneath. Some of the dried leaves remain on the tree during the whole winter. The acorns are large, ovate, contained in rough, shallow, grayish cups, and supported singly or in pairs upon peduncles nearly an inch in length.

The white oak abounds in the Middle States, and extends also through the whole Union, though comparatively rare in the northern, southern, and western sections. It is the most highly valued for its timber of all the American oaks, except the *live oak* (*Q. virens*), which is preferred in ship-building. The bark is sometimes used for tanning, but that of the *red* and *Spanish oaks* is preferred. All parts of the tree, with the exception of the epidermis, are more or less astringent, but this property predominates in the fruit and bark.

White-oak bark, deprived of its epidermis, is of a light brown color, of a coarse, fibrous texture, and not easily pulverized. It is officinally described as "in nearly flat pieces, deprived of the corky layer, about a quarter of an inch (6 mm.) thick, pale brown; inner surface with short, sharp, longitudinal ridges; tough; of a coarse, fibrous fracture, a faint, tan-like odor, and a strongly astringent taste. As met with in the shops it is usually in an irregularly coarse, fibrous powder, which does not tinge the saliva yellow." *U. S.* Water and alcohol extract its active properties. The chief soluble ingredients are tannin, gallic acid, and extractive matter. It is upon the tannin that its medical virtues, as well as its use in the preparation of leather, chiefly depend. The proportion of this ingredient varies with the size and age of the tree, the part from which the bark is derived, and even the season when it is gathered. It is most abundant in the young bark; and the English oak is said to yield four times as much in spring as in winter. Sir H. Davy found the inner bark most abundant in tannin, the middle portion or cellular integument much less so, and the epidermis almost wholly destitute as well of this principle as of extractive.

Gerber discovered, in European oak bark, a peculiar bitter principle upon which he conferred the name of *quercin*. It is obtained by boiling the bark with water acidulated with one hundredth of sulphuric acid, adding first milk of lime until the sulphuric acid is removed, and then a solution of carbonate of potassium so long as a white precipitate is produced, filtering the liquor, evaporating to the consistence of a thin extract, adding alcohol, and finally evaporating the spirituous solution down to a small volume, and allowing it to rest for some days. Yellow crystals form, which may be obtained colorless by repeated crystallizations. Quercin is a neutral principle, in small, white crystals, inodorous, very bitter, readily soluble in water, less so in alcohol containing water, and insoluble in absolute alcohol, ether, and oil of turpentine. (*Arch. der Pharm.*, xxxiv. 167.)

2. *Quercus tinctoria*, or *black oak*, is one of our largest trees, frequently attaining the height of eighty or ninety feet. Its trunk is covered with a deeply furrowed bark, of a black or dark brown color. The leaves are ovate-oblong, pubescent, slightly sinuated with oblong, obtuse, mucronate lobes. The fructification is biennial. The acorn is globose, flattened at top, and placed in a saucer-shaped cup.

Black-oak bark has a more bitter taste than that of the other species, and may be distinguished also by staining the saliva yellow when it is chewed. Its cellular integument contains a coloring principle, capable of being extracted by boiling water, to which it imparts a brownish yellow color, which is deepened by alkalies and rendered brighter by acids. Under the name of *quercitron*, large quantities of this bark, deprived of its epidermis and reduced to coarse powder, are sent from the United States to Europe, where it is used for dyeing wool and silk of a yellow color. The coloring principle is called *quercitrin*, and the formula $C_{33}H_{30}O_{17}$ is given to it. It was discovered by M. Chevreul; and its properties have been investigated by MM. Bolley and Rigaud. These chemists obtained it by forming a tincture of the bark with alcohol of the sp. gr. 0·849, freeing this from tannin and a brown substance by gelatin, distilling off the alcohol, and replacing it as it was evaporated by water. The quercitrin was deposited, and afterwards purified by repeated solution in alcohol, and separation by water as before. Thus procured, it is yellow, slightly bitter, inodorous, in microscopic crystals of the right-rhombic system, soluble in 425 parts of boiling water (Rigaud), almost insoluble in cold water, sparingly soluble in ether, and freely soluble in alcohol and alkaline solutions.* According to Rigaud, quercitrin is a glucoside, being resolvable into isodulcite, $C_6H_{14}O_6$, and a neutral substance which he calls *quercetin*, $C_{27}H_{18}O_{12}$. (*Journ. de Pharm.*, Janv. 1860, p. 76.) Besides this principle, the bark contains much tannin of a special variety called *quercitannic acid*, $C_{17}H_{16}O_9$. This, when treated with dilute acids, yields glucose and a red coloring matter, $C_{28}H_{24}O_{12}$; but it is less used in tanning than the other barks, in consequence of the color which it imparts to the leather, and it was very properly dropped from the U. S. P. on account of its decoction staining so decidedly when used.

Medical Properties and Uses. Oak bark is astringent and somewhat tonic; but it is not employed as an internal remedy. On account of its cheapness it is much used externally. The decoction may be advantageously used as a bath, particularly for children, when a combined tonic and astringent effect is desirable, and the stomach is not disposed to receive medicines kindly. It has been employed in this way in marasmus, scrofula, intermittent fevers, chronic diarrhœa, and cholera infantum. As an injection in leucorrhœa, a wash in prolapsus ani and hemorrhoidal affections, and as a gargle in slight inflammation of the fauces, attended with prolapsed uvula, the decoction is often useful. It has also been recommended as an injection into dropsical cysts. Reduced to powder and made into a poultice, the bark was recommended by the late Prof. Barton as an excellent application in external gangrene and mortification; and the infusion obtained from tanners' vats has been used beneficially as a wash for flabby, ill-conditioned ulcers.

Off. Prep. Decoctum Quercûs, *Br.*

QUILLAIA. *U.S.* *Quillaia.* [*Soap Bark.*]

(QUĬL-LĀ'IẠ—kwĭl-lā'yạ.)

"The bark of Quillaia Saponaria. Molina. (*Nat. Ord.* Rosaceæ, Roseæ.)" *U. S.*

Écorce de Quillaya, *Fr.;* Seifenrinde, *G.;* Quillay, *Chilian.*

Gen. Ch: Calyx lobes valvate, abracteolate. *Disk* thick, five-lobed, the lobes adnate with the apex of the staminiferous calyx lobes. *Follicles* patent, many-seeded. *Leaves* entire. *Bentham & Hooker.*

The name of this genus is said to be derived from the popular name of the tree *Quillay*, which in turn comes from the Chilian word *quillean*, to wash.

Quillaya Saponaria, Molina. This is a tree of moderate size, with alternate oval or oblong leaves, with entire or slightly denticulate margins. Male and female flowers grow on the same branch, are axillary, pedunculate, and without corolla. The calyx of the female flower persists in fruit, and has its limb deeply divided into five oval, acute segments. The bark is thick, the wood very hard.†

Properties. Soap bark is officinally described as in "flat, large pieces, about one-fifth of an inch (5 mm.) thick; outer surface brownish white, often with small patches of brown cork attached, otherwise smooth; inner surface whitish, smooth; fracture splintery, checkered with pale brownish bast-fibres imbedded in white tissue; inodorous, very acrid and sternutatory." *U. S.* When bruised and macerated in water, it imparts to that liquid the property of frothing like soap, when agitated. This has been found by MM. Fleury, Jr., and Boutron Chalard to be owing to the existence of *saponin* in the bark, the same principle as that which gives a similar property to *Saponaria officinalis.* (See Part II.) The bark contains neither tannic acid nor any bitter principle.

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* Quercitrin has been found also in various other plants; as in the leaves of *Ruta graveolens*, and the flower-buds of *Capparis spinosa*, *Sophora Japonica*, and *Æsculus Hippocastanum*, or horse-chestnut. (*Chem. Gaz.*, May 2, 1859, p. 161.) As this principle is capable of assuming various colors under various chemical influences, the idea has been advanced that it might be the coloring principle of flowers. (*A. J. P.*, 1860, 222.)

Acorns, besides the bitter and astringent principles of the bark, contain a peculiar saccharine matter (*quercite*), which is insusceptible of the vinous fermentation. (*Journ. de Pharm.*, 3e sér., xx. 335.) They are sometimes used as a tonic or astringent; and a decoction made from roasted acorns has been long employed in Germany as a remedy in scrofula. Before roasting they should be deprived of their shells; and the cotyledons, according to Dausse, should lose, during the process, 140 parts of their weight out of 500. (*Pharm. Centralb.*, Oct. 9, 1850, p. 687.) From half an ounce to an ounce may be prepared and taken like coffee at breakfast. (*Richter.*)

† This tree was first described by the famous Abbé Giovanni Ignazio Molina in the *Saggio sulla Storia naturale dell' Chili*, published at Bologna, in 1782; second edition, 1810. (Translated into German, I. D. Brandis, Leipsic, 1786; into French, M. Gruvel, Paris, 1789; into English, London, 1809; also, Middletown, Conn., 1880.) It is first noticed by systematic writers in the second (Gmelin's) edition of the *System. Nat*, tome ii. p. 767.

Medical Properties. Saponin, the active principle of soap bark, is a powerful poison, but the bark has no application in practical medicine. Its infusion is much used in the arts as a detergent for washing silks, cloths, etc., but we know of no sufficient reason for its introduction into the Pharmacopœia. Its powder, snuffed into the nostrils, provokes free secretion and sneezing, and might be used as a sternutatory.

QUINIDINÆ SULPHAS. *U. S. Sulphate of Quinidine.*

(QUĬN-Ị-DĪ′NÆ SŬL′PHĂS.)

$(C_{20}H_{24}N_2O_2)_2H_2SO_4.2H_2O$; 782. $(C_{20}H_{12}NO_2)_2$, HO SO_3. 2HO; 391.

"The neutral sulphate of an alkaloid prepared from different species of Cinchona, chiefly Cinchona pitayensis. Weddell. (*Nat. Ord.* Rubiaceæ, Cinchoneæ.)" *U. S.*

This is a new officinal salt. The alkaloid which forms the base is quinidine, which is isomeric with quinine, having the composition $C_{20}H_{24}N_2O_2$. Quinidine was discovered in 1833 by MM. O. Henry and Delondre, but they afterwards concluded that it was the hydrate of quinine, as it had the same composition as quinine. Winckler, in 1844, announced anew the existence of the same alkaloid, which he considered distinct, and named it "*chinidine;*" this substance was not pure, and Pasteur, in 1853, proved that it really consisted of two alkaloids, one of which he called *cinchonidine*, and the other *quinidine.* This view is now generally accepted, although Hesse insists on calling quinidine "*conchinine;*" but the latter name is only used to a limited extent in Germany, and scarcely at all elsewhere.

Quinidine crystallizes in rhombic prisms, which contain two molecules of water. It effloresces on exposure to the air. It is sublimable by heat without change, and is condensed in a crystalline form. It resembles quinine not only in composition, but also in its chemical relations with chlorine and ammonia, being rendered green by the successive action of those agents. According to Dr. Herapath, it resembles it also in causing a fluorescent appearance when dissolved in water, which is not the case with either cinchonine or cinchonidine, or is so, at least, in a much less degree. It differs, however, in its greater facility of crystallization, in its much less solubility in ether, and in its influence on polarized light, quinidine producing deviation to the right, and quinine to the left. De Vrij, of Rotterdam, states, as the result of his observation, that quinidine forms a salt of very difficult solubility with hydriodic acid, and that, consequently, when a solution of iodide of potassium is added to a solution of sulphate of quinidine a white precipitate takes place. By this test quinidine may be distinguished from the other cinchona alkaloids, and detected when mixed with them in solution; no other yielding a precipitate with iodide of potassium. (See *A. J. P.*, xxix. 233.) Dr. Herapath proposes another test to distinguish this alkaloid from quinine. If to a solution of sulphate of quinine in acetic acid tincture of iodine be added, and the mixture heated and then allowed to cool, a beautiful emerald-green compound is formed; while sulphate of quinidine treated in the same way yields a brown precipitate. When the mixture of this alkaloid with cinchonidine is exposed to hot air, the crystals of quinidine effloresce, and may be distinguished from the others by their opaque whiteness.

Commercial quinidine, consisting generally of quinidine with a much larger proportion of cinchonidine, and sometimes, there is reason to believe, exclusively, or nearly so, of the latter alkaloid, was carefully examined by H. G. Leers. It readily crystallizes from its alcoholic solution, by spontaneous evaporation in hard, shining, colorless crystals, which are easily pulverized, and yield a snow-white powder. They melt without decomposition or loss of water at 175° C. (347° F.), and on cooling concrete into a grayish white crystalline mass. At a higher heat they take fire, and burn with an odor resembling that of volatile oil of bitter almond. Their taste is bitter, but less intensely so than that of quinine. Quinidine is soluble, according to Leers, in 2580 parts of water at 16·6° C. (62° F.), and in 1858 parts at 100° C. (212° F.), in 143 (169, *Winckler*) of ether and 12 of alcohol of 0·835, both at 16·6° C. (62° F.); but the solubilities of commercial quinidine vary more or less according to the relative quantities of quinidine proper and cinchonidine contained in it. With the acids it forms salts, most of which are beautifully crystallizable, and much more soluble than those of quinine. There are, as of quinine and cinchonine, two sets of the salts of quinidine, which may be considered either as neutral and acid, or as basic and neutral. It differs from quinine by its much slighter solubility in ether. From the aqueous solution of its salts, the alkalies, their carbonates, and bicarbonates throw down pulverulent precipitates not soluble in an excess of the precipitant. With phosphate of sodium, nitrate of silver, and mercuric chloride it forms white, with terchloride of gold light yellow, and with platinic chloride orange yellow precipitates. It may be obtained by first precipitating it from the solution of one of its salts by an alkali, and then repeatedly dissolving in alcohol and crystallizing, until it is entirely freed from a greenish yellow resinous substance which is apt to attend it. From quinine it may be separated by repeated washing with ether, until the ethereal solution no longer affords evidence of the presence of quinine by the test of chlorine water and ammonia.

Properties. Sulphate of quinidine is, according to one view, neutral, consisting of one mol. each of quinidine, sulphuric acid, and water; according to another, basic, containing two mols. of base, one of acid, and one of water, and therefore a disulphate. It is obtained from the quinidine barks by the same process as that by which sulphate of quinine is procured from the quinine-yielding barks. When the two alkaloids are contained in the same bark, the sulphate of quinidine (commercial) remains in the mother-waters in consequence of its greater solubility. By the addition to its solution of a quantity of sulphuric acid equal to that which it contains, it is converted into the bisulphate (sulphate on the basic view) crystallizable in fine acicular crystals like asbestos. It is officinally described as in "white, silky needles, permanent in the air, odorless, having a very bitter taste, and a neutral or faintly alkaline reaction. Soluble in 100 parts of water, and in 8 parts of alcohol at 15° C. (59° F.); in 7 parts of boiling water, and very soluble in boiling alcohol; also in acidulated water, and in 20 parts of chloroform, but almost insoluble in ether. It parts with its water of crystallization (4·3 per cent. of its weight) at 120° C. (248° F.). On ignition, the salt burns slowly without leaving a residue. The aqueous solution, when acidulated with sulphuric acid, has a decided, blue fluorescence. When treated, first, with fresh chlorine water, and then with a slight excess of water of ammonia, the salt produces an emerald-green color. If a little water of ammonia be added to a solution of the salt, a white precipitate (Quinidine) is produced, which requires a considerable excess of water of ammonia, or about 30 times its weight of ether to dissolve it. Test-solution of chloride of barium added to an aqueous solution of the salt, throws down a white precipitate insoluble in hydrochloric acid. The salt should not be colored or not more than very slightly colored by undiluted sulphuric acid (abs. of foreign organic matters), nor be reddened by nitric acid (difference from morphine). If 0·5 Gm., each, of Sulphate of Quinidine and of iodide of potassium (not alkaline to test-paper), be agitated with 10 C.c. of water at about 60° C. (140° F.), the mixture then macerated at 15° C. (59° F.) for half an hour, with frequent stirring, and filtered,—the addition, to the filtrate, of a drop or two of water of ammonia should not cause more than a slight turbidity (abs. of more than small proportions of cinchonine, cinchonidine or quinine)." *U. S.*

Medical Properties. The action of the sulphate of quinidine upon the system appears to be identical with that of quinine, except in being less powerful. It has been asserted to produce less cerebral and stomachic disturbance, but this statement is probably incorrect for equivalent doses. The exact relation of it in strength to quinine is not thoroughly determined, but the proportion seems to be very nearly that of 2 to 3. In malarial diseases from twenty to sixty grains (1·3 to 3·9 Gm.) may be given in divided doses during the intermission.

QUININA. *U.S.* *Quinine.*

(QUỊ-NĪ′NẠ.)

$C_{20}H_{24}N_2O_2.3H_2O$ (crystallized); 378. $C_{20}H_{12}NO_2.3HO$; 189.

"An alkaloid prepared from different species of Cinchona." *U. S.*

This alkaloid is prepared by adding to the solution of the sulphate a quantity of water of ammonia or solution of soda just sufficient to precipitate the alkaloid.

Properties. Quinine is whitish, rather flocculent, and not crystalline; but it may with care be crystallized from its alcoholic solution in silky needles; and Liebig obtained it from a somewhat ammoniacal watery solution in the same form. It is inodorous and very bitter. The crystals obtained from alcoholic solution have the composition $C_{20}H_{24}N_2O_2 + 3H_2O$, and fuse at 57° C. (134·6° F.). They may be deprived of water by warming or exposure over oil of vitriol, and they then fuse at 177° C. (350·6° F.). By carefully regulated heat, it may be sublimed unchanged, assuming a crystalline form. (Waddington, *P. J. Tr.*, March, 1868, p. 413.) According to Hesse, anhydrous crystalline quinine is soluble in 1960 parts of water at 15° C. (59° F.), and the trihydrate in 1670 parts. It is soluble in about 900 parts of boiling water, in about 6 parts of cold, and 2 parts of boiling alcohol, very soluble in ether, chloroform, benzol, benzin, bisulphide of carbon, fixed and volatile oils, and in about 200 parts of glycerin. The alcoholic solution is intensely bitter. Quinine is unalterable in the air. It forms salts with the acids which readily crystallize. The tannate, tartrate, and oxalate are said to be insoluble or nearly so, but are dissolved by an excess of acid. The acetate, according to Prof. J. M. Maisch, is so slightly soluble that it is precipitated from a solution of the sulphate by the acetates of magnesium and the alkalies. (*A. J. P.*, xxx. 386.) When recently precipitated quinine, diffused in water, is exposed to the action of a stream of carbonic acid gas, the quinine is dissolved; and, if the solution be exposed, acicular crystals of carbonate of quinine are deposited, which effloresce in the air, are soluble in alcohol, but insoluble in ether, have an alkaline reaction, and effervesce with acids. After the deposition of the crystals has ceased, the solution yields quinine on evaporation. (Langlois, *Comptes-Rendus*, Nov. 7, 1853, p. 727.) Freshly precipitated quinine is scarcely soluble to an appreciable extent in an excess of potassa, but is more readily dissolved by ammonia. (Wadgymar, *A. J. P.*, Sept. 1866, p. 451.) Prof. Flückiger (1878) noticed that solutions of quinine exposed to sunlight rapidly turned brownish yellow, and subsequently deposited a flocculent precipitate, which he proved to be neither quinine nor quinicine, but an entirely different substance. It lost the alkaloidal character, yet possessed the same chemical composition as quinine. He named it *Quiniretin*. (*P. J. Tr.*, May, 1878.)

Quinine and its salts may be distinguished from all other alkaloids and their salts, excepting only quinidine and quinicine, by the beautiful emerald-green color (*thalleioquin*) which results, when their solution is treated first with solution of chlorine and then with ammonia, and which changes to a white or violet upon saturation with a dilute acid. The statement which has been frequently made that the chlorine water must be fresh, was disproved by C. F. Zeller. (See *A. J. P.*, 1880, p. 385.) The least quantity of quinine may be detected by powdering the substance supposed to contain it, then shaking it with ether, and adding successively the tests just mentioned. Its salts are precipitated by mercuric and platinic chlorides, and of a buff color by auric chloride.

Quinine in solution turns the plane of polarization to the left, to varying degrees, however, according to the concentration, the solvent used, etc. Acids increase the amount of deviation.

In relation to the property, possessed by quinine, of imparting fluorescence to its watery solution, which is possessed also, though in less degree, by other cinchona alkaloids, and other properties common to both quinine and its sulphate, there will be occasion to speak under sulphate of quinine; a singular discovery was made by Dr. Bence Jones, of London, of a substance normally present in the animal system having analogous properties, and named by him "*animal quinoidine.*"

Quinine is officinally described as "a white, flaky, amorphous or minutely crystalline powder, permanent in the air, odorless, having a very bitter taste, and an alkaline reaction. Soluble in about 1600 parts of water, and in 6 parts of alcohol at 15° C. (59° F.); in 700 parts of boiling water, in 2 parts of boiling alcohol, in about 25 parts of ether, in about 5 parts of chloroform, in about 200 parts of glycerin, and also soluble in benzin, benzol, water of ammonia, or in diluted acids, which latter it neutralizes. When heated to 57° C. (135° F.), it melts, and, at the temperature of the water-bath, loses about 9 per cent. (about 2 molecules) of its water of crystallization, the remainder being expelled at 125° C. (257° F.). On ignition, the alkaloid burns slowly without leaving a residue. The solution of Quinine in diluted sulphuric acid has a vivid, blue fluorescence. Treated, first, with fresh chlorine water, and then with a slight excess of water of ammonia, Quinine produces an emerald-green color. Quinine should afford no color, or none darker than a pale yellow, with undiluted sulphuric acid (abs. of foreign organic matters), nor should it be reddened by nitric acid (difference from morphine). If 1 Gm. of Quinine be mixed, in a mortar, with 0·5 Gm. of sulphate of ammonium and 5 C.c. of distilled water, the mixture thoroughly dried on the water-bath, the residue (which should be neutral to test-paper) agitated with 10 C.c. of distilled water, this mixture macerated at 15° C. (59° F.) for half an hour, then filtered through a small filter, 5 C.c. of the filtrate taken in a test-tube, and 7 C.c. of water of ammonia (sp. gr. 0·960) then added,—on closing the test-tube with the finger and gently turning it until the ammonia is fully intermixed, a clear liquid should be obtained. If the temperature of maceration has been 16° C. (60·8° F.), 7·5 C.c. of the water of ammonia may be added; if 17° C. (62·6° F.), 8 C.c. may be added. In each instance a clear liquid indicates the absence of more than about 1 per cent. of cinchonidine and quinidine, and of more than traces of cinchonine." *U. S.*

Quinicine (quinicia). When quinine and cinchonine, or quinidine and cinchonidine, or their salts, are exposed to heat, they are changed into other but isomeric alkaloids; quinine and quinidine into quinicine, isomeric with themselves; and cinchonine and cinchonidine into *cinchonicine*, isomeric with its own antecedents. These new alkaloids are, therefore, products rather than educts, and generally result, in greater or less proportion, from the processes employed in extracting the other alkaloids from bark; though it is not impossible that they may pre-exist in bark to a certain extent, being formed by a natural process, from the same original alkaloids, either in the living tree, or in the barks while drying, after separation from the tree.

Quinicine is almost insoluble in water, but very soluble in alcohol, and differs from quinine in causing deviation of the plane of polarization to the right instead of to the left (*Regnault*), and in being apparently uncrystallizable.

Cinchonicine is also insoluble in water and soluble in alcohol. It agrees with cinchonine, from which it is derived, in producing deviation of the plane of polarization to the right; but differs from cinchonidine in this respect, and differs from both of these alkaloids in being amorphous or uncrystallizable.

The most important artificial salt of quinine is the *sulphate*, the process for procuring which, as well as its properties, will be hereafter described. The *bisulphate*, *hydrobromate*, *hydrochlorate*, and *valerianate* have been introduced into the U. S. Pharmacopœia, and the *citrate of iron and quinine* both into this and the British, which give processes for its preparation. The *phosphate*, *acetate*, *citrate*, *lactate*, *camphorate*, *ferrocyanate*, *tannate*, *arsenite*, *antimoniate*, *urate*, *hypophosphite*, and *chlorate*, *hydrochlorate with urea*, *citro-thymate*, *sulphovinate*, *salicylate*, *sulphosalicylate*, and *meconate*, have also been employed or recommended; but none of them has yet gained admittance into the Pharmacopœias, and none probably is superior to the officinal sulphate. The first four may be prepared by saturating a solution of the acids respectively with quinine, and evaporating the solutions. The *camphorate* is recommended as a substitute for the valerianate. (*A. J. P.*, July, 1865, p. 254.) The *ferrocyanate* is directed to be made by boiling together four parts of sulphate of quinine and one of ferrocyanide of potassium, both in concentrated solutions, pouring off the liquor from a greenish yellow substance of an oily consistence which is precipitated, washing the latter with distilled water, then dissolving it in strong alcohol at 37·7° C. (100° F.), filtering immediately, and afterwards evaporating the solution. M. Pelouze believes this preparation to be pure quinine, mixed with a little Prussian blue. (*Archives Gén.*, 3e sér., xv. 236.) The *tannate* may be prepared by precipitating one part of sulphate of quinine, dissolved in 30 parts of water acidulated with a few drops of sulphuric acid, with a solution of three parts of tannic acid dissolved in 30 parts of cold water, and then washing and drying the precipitate. It has the advantage of possessing little taste, but doubts have been repeatedly expressed about its efficiency. At best it is a feeble preparation, not containing more than 32 per cent. of quinine. Either of these salts may be given in the same dose as the sulphate. *Arsenite of quinine* has been recommended by Dr. Ringdon, especially in chronic cutaneous affections. Adler prepares it by dissolving arsenious acid in water, with enough alkali to make the solution neutral, adding about five times its weight of nitrate of silver, washing the precipitated arsenite of silver, drying, and mixing with three times its weight of hydrochlorate of quinine, digesting the mixture for a day with 70 per cent. alcohol, filtering, and allowing the filtrate to evaporate spontaneously. The salt is crystalline, soluble in alcohol, chloroform, and ether, but sparingly so in water. The dose is one-third of a grain (0·02 Gm.), given at first twice a day, and afterwards three or four times a day. *Antimoniate of quinine* has been recommended by Dr. La Camera, of Naples, as a febrifuge, being especially applicable to cases of doubtful periodicity. It unites, he thinks, the evacuant properties of the antimonials with the antiperiodic property of quinine. The dose is two or three grains (0·13 to 0·20 Gm.), four times a day. (*Journ. de Pharm.*, 3e sér., xxv. 471.) The *urate of quinine* is thought by Dr. Pérayre, of Bordeaux, to be peculiarly efficacious in obstinate intermittents. It is prepared by boiling 10 parts of crude quinine in water, adding gradually 20 parts of crystallized uric acid, and, after sufficient ebullition, filtering and evaporating. A yellow salt is obtained, sometimes amorphous, more frequently crystalline, soluble in hot and less so in cold water, and, according to the author, capable of curing intermittent fever in smaller doses than the sulphate, with less cerebral disturbance, less bitterness, and easier tolerance by the stomach. (*Journ. de Pharm.*, 3e sér., xxxvii. 139.) The *hypophosphite of quinine* may be prepared by dissolving 3 parts of hypophosphite of calcium in 60 parts of distilled water, and adding the filtered solution to a solution of 13 parts of sulphate of quinine in 200 parts of alcohol, allowing the mixture to stand two hours, and filtering, distilling off the alcohol and evaporating the solution and setting aside to crystallize. The salt is soluble in 25 parts of cold, 1·5 parts of boiling water, and in 10 parts of alcohol.

The *hydrochlorate of quinine and urea*, "*chininum bimuriaticum carbamidatum*," discovered by Kutais (1878), is best prepared by Rice's process. 79 parts of hydrochlorate of quinine are dissolved in 70 parts of hydrochloric acid (sp. gr. 1·050), the solution filtered, 12 parts of urea added, and the whole warmed until the liquid is clear. It is then set aside that crystals may form. These are soluble in an equal weight of water, and also in strong alcohol. This salt has been recommended especially for hypodermic uses.

The *citrothymate of quinine* is prepared by Pavesi by heating in a flask on a water-bath 4 parts of quinine and 6 parts of oil of thyme, with enough alcohol to dissolve both. After standing 12 hours, 2 parts of powdered citric acid are added, the whole heated, filtered, evaporated to a syrup, and allowed to crystallize.*

* *Extemporaneous Preparation of Various Quinine Salts. Carbolate of Quinine.* Quinine, pure, 10 parts; carbolic acid, 5 parts.

Citrate of Quinine. Quinine, pure, 15 parts; citric acid, 8 parts. The product corresponds to 20 parts of true citrate of quinine.

Hydrobromate of Quinine. Sulphate of quinine, 100 parts; bromide of potassium, 28 parts. The product corresponds to 100 parts of hydrobromate of quinine.

Hydriodate of Quinine. Sulphate of quinine, 95 parts; iodide of potassium, 40 parts. The product corresponds to 100 parts of hydriodate of quinine.

Iodized Hydriodate of Quinine. Hydrochlorate of quinine, 70 parts; iodide of potassium, 50 parts; iodine, 20 parts. To be triturated together with a little alcohol. Corresponds to 100 parts of the above quinine salt.

Off. Prep. Ferri et Quininæ Citras; Liquor Ferri et Quininæ Citratis; Syrupus Ferri, Quininæ et Strychninæ Phosphatum.

QUININÆ BISULPHAS. *U. S.* *Bisulphate of Quinine.*

(QUI-NĪ'NÆ BĪ-SŬL'PHĂS.)

$C_{20}H_{24}N_2O, H_2SO_4 . 7H_2O$; 548. $C_{20}H_{12}NO_2,HO, SO_3 . 7HO$; 274.

"Bisulphate of Quinine should be kept in well-stopped bottles." *U. S.*

This is a new officinal salt. It is made by suspending sulphate of quinine in water, and adding a molecule of sulphuric acid, filtering and crystallizing. It has been introduced because of the great advantages in solubility that it possesses over the ordinary sulphate. It requires but 10 parts of water to dissolve it, whilst the sulphate requires 740. For use in the form of pills it is greatly superior on this account, whilst it may be administered in solution without the excess of acid which must be used when the ordinary sulphate is prescribed in order to dissolve it. Its use is rapidly extending, and when these very important practical points of superiority are fully appreciated by the profession, it will be used exclusively. It is officinally described as in "colorless, clear, orthorhombic crystals, or small needles, efflorescing and becoming opaque on exposure to air, odorless, having a very bitter taste, and a strongly acid reaction. Soluble in about 10 parts of water (with vivid blue fluorescence), and in 32 parts of alcohol at 15° C. (59° F.); very soluble in boiling water and in boiling alcohol. At 100° C. (212° F.) it loses all its water of crystallization, and at 135° C. (275° F.) it is converted into bisulphate of quinicine. On ignition, the salt burns slowly without leaving a residue. Treated, first, with fresh chlorine water, and then with a slight excess of water of ammonia, it produces an emerald-green color. Its aqueous solution yields, with water of ammonia, a precipitate readily soluble in an excess of water of ammonia, or in ether. With test-solution of chloride of barium it produces a white precipitate insoluble in hydrochloric acid. The salt should not be colored, or not more than very slightly colored, by undiluted sulphuric acid (abs. of foreign organic matters), nor be reddened by nitric acid (difference from morphine). If 1 Gm. of Bisulphate of Quinine be dried, on a water-bath, to constant weight, the residue should weigh not less than 0·77 Gm.

Hypophosphite of Quinine. Hydrochlorate of quinine, 100 parts; hypophosphite of calcium, 24 parts. Corresponds to 100 parts of the above quinine salt.

Lactate of Quinine. Quinine, pure, 70 parts; lactic acid, 35 parts. To be triturated together, if necessary, with a few drops of alcohol. Corresponds to 100 parts of the above quinine salt.

Phosphate of Quinine. Sulphate of quinine, 94 parts; phosphate of sodium, 80 parts. Corresponds to 100 parts of the above quinine salt. (*Journ. de Ph. et Chem.*, May, 1879; *N. R.*, Nov. 1879.)

Sulphovinate of quinine, according to Carles, is prepared by dissolving 16·9 parts of sulphovinate of sodium in 200 parts of hot alcohol: and 42·8 parts of sulphate of quinine in 600 parts of hot alcohol. The hot solutions are mixed, cooled, and the precipitated sulphate of sodium filtered out. The filtrate is distilled, and the residue evaporated and dried at a low temperature. It is soluble in 3 parts of water.

Salicylate of quinine may be prepared by Jobst's process, by double decomposition between solutions of hydrochlorate of quinine and salicylate of ammonium, or by saturating an alcoholic solution of quinine with an alcoholic solution of salicylic acid. The crystals are soluble in 225 parts of water and in 20 parts of alcohol.

Phenate, or *carbolate of quinine*, is obtained by Jobst, having the composition $C_{20}H_{24}N_2O_2,C_6H_6O$. It is soluble in 400 parts of water, 80 parts of alcohol. (*P. J. Tr.*, June 12, 1875.) *Sulphosalicylate of quinine*, on account of its slow solubility in water, will probably not be very useful medically. (See *N. R.*, 1878, p. 103.) *Meconate of quinine* is prepared by mixing alcoholic solution of meconic acid and quinine.

The *chlorate of quinine* is best prepared, according to Mr. C. R. C. Tichborne, from chlorate of barium. He mixes in a porcelain dish 310 grains of chlorate of barium dissolved in a little boiling water with 2 ounces avoird. of sulphate of quinine, and 12 ounces of hot water, at 90° C. (194° F.); a slight excess of the sulphate being used to insure the precipitation of all the barium. Owing to this excess, a slight pellicle of sulphate of quinine floats on the surface. Apply heat, and gradually add a very little precipitated carbonate of barium till the coating of sulphate is replaced by a slightly oily pellicle of alkaloid. The chlorate of quinine is now obtained by evaporation and crystallization. For a mode of preparing the chlorate of barium, see *A. J. P.*, 1868, p. 101.

The chlorate crystallizes from its solution in fungoid tufts, consisting of filiform, snow-white crystals, radiating from a centre. It melts with heat, and in the air at length takes fire, burning vividly, and if dry sometimes with explosion, leaving a carbonaceous residue. It is very soluble in boiling water, but sparingly in cold, and is deposited from its hot solution on cooling. Gently warmed with hydrochloric acid, it emits chlorine copiously; and ammonia now added in excess occasions an emerald-green color; thus showing that it is a compound of chloric acid and quinine. (*P. J. Tr.*, 2d ser., viii. 135.)

(abs. of free water). If 1 Gm. of the salt, previously dried at 100° C. (212° F.), be agitated with 8 C.c. of distilled water, the mixture made exactly neutral to test-paper by the cautious addition of water of ammonia, then increased by the addition of distilled water to 10 C.c., and macerated at 15° C. (59° F.) for half an hour, upon proceeding further as directed for the corresponding test under Quinine (see *Quinina*), the results there given should be obtained." *U. S.*

This salt contains 13 per cent. less of the alkaloid than does the sulphate. The difference is to some extent compensated for by the greater solubility, and the dose given is usually that of the sulphate. Nevertheless, strict therapeusis would demand an increase of about 13 per cent. in the dose.

QUININÆ HYDROBROMAS. *U. S.* *Hydrobromate of Quinine.*

(QUỊ-NĪ′NÆ HȲ-DRỌ-BRŌ′MĂS.)

$C_{20}H_{24}N_2O_2HBr.2H_2O$; 440·8. $(C_{20}H_{12}NO_2)_2$, HBr. 4HO; 440·8.

"Hydrobromate of Quinine should be kept in well-stopped bottles." *U. S.*

This is a new officinal salt. It may be made by suspending 10 parts of sulphate of quinine in 80 parts of water, boiling, and adding 3·4 parts of bromide of barium dissolved in 20 parts of water, filtering, evaporating, and crystallizing. It may also be made by Leger's process, as follows. Sulphate of quinine, commercial, crystallized, 40 parts; bromide of potassium, dried and powdered, 11 parts; alcohol (80 per cent.), 400 parts; distilled water, 400 parts. Dissolve the sulphate in two hundred parts of alcohol by the aid of heat, add the bromide of potassium, dissolved in thirty parts of distilled water, continue the heat five or six minutes in order to allow the sulphate of potassium, which is formed, to acquire greater compactness, so that it will more readily settle. Filter off from the precipitate, and wash four times with fifty parts of boiling alcohol. Let the alcoholic solution cool, when a further small quantity of sulphate of potassium will be deposited. The solution is then again filtered through white filtering paper, and evaporated on a water-bath to one hundred parts. Next, four hundred parts of distilled water are poured on, and heat is applied until the bromhydrate is completely dissolved. After allowing the solution to stand in the cold, for about twenty-four hours, the capsule will be found filled with a compact crystalline mass. The crystals are transferred to a filter, allowed to drain, and dried by exposure to air. Heating would cause them to fuse. The product thus obtained amounts to about thirty parts of perfectly white hydrobromate of quinine. By evaporating the mother-water to one-third of its volume, about six parts more may be obtained. It is absolutely necessary, as has been already pointed out by Boille, to redissolve the hydrobromate in water as above stated, if the salt is to be obtained in white and bulky crystals. The above quantity of four hundred parts should not be diminished, for, if this were done, the salt (which fuses at 90° F.) would separate at first in the form of an oily liquid, and afterwards would form a crystalline crust. (*Répert. de Pharm.*, 1880, p. 390; *N. R.*, Jan. 1881.)

Properties. It is in "colorless, lustrous needles, permanent in ordinary air, but readily efflorescing at a gentle heat, odorless, having a very bitter taste, and a neutral or slightly alkaline reaction. Soluble in about 16 parts of water and in 3 parts of alcohol at 15° C. (59° F.); in 1 part of boiling water, and in less than 1 part of boiling alcohol, in 6 parts of ether, in 12 parts of chloroform, and moderately soluble in glycerin. On ignition, the salt burns slowly without leaving a residue. The aqueous solution, when acidulated with sulphuric acid, has a blue fluorescence, and, when treated, first, with fresh chlorine water, and then with a slight excess of water of ammonia, it produces an emerald-green color. Water of ammonia added to the aqueous solution throws down a white precipitate readily soluble in an excess of water of ammonia, or in ether. Test-solution of nitrate of silver produces a white precipitate, which is insoluble in diluted nitric acid, and, when filtered off and washed, insoluble in solution of carbonate of ammonium. The salt should not be colored, or not more than very slightly colored, by undiluted sulphuric acid (abs. of foreign organic matters), nor be reddened by nitric acid (difference from morphine). If a small portion of the salt be dried on the water-bath until it ceases to lose weight, and the residue cooled in a desiccator, the loss of weight should not exceed 8·2 per cent. The aqueous solution should not be rendered turbid by diluted sulphuric acid (abs. of barium), and not more than slightly turbid by test-solution of chloride of barium (limit of sulphate). If 1·5 Gm. of the salt be dissolved in 15 C.c. of hot distilled water, the solution stirred with 0·6 Gm. of crystallized sulphate of sodium in powder, the mixture maintained at 15° C. (59° F.) for half an hour and then drained through a filter only large enough to contain it, until 5 C.c. of filtrate are obtained—upon treating this liquid as directed for the corresponding test under Quinine (see *Quinina*), the results there given should be obtained." *U. S.*

Medical Properties. This salt is well fitted for hypodermic injection on account of its ready solubility, but is not superior, if equal, to the bisulphate. The plan which has been advocated of injecting a hot saturated solution is to be deprecated, as tending to cause precipitation in the cellular tissue. It is very capable of causing cinchonism, but the amount of hydrobromic acid is too small to affect the system sensibly. The dose is that of the other salts of the alkaloid.

QUININÆ HYDROCHLORAS. *U. S.* *Hydrochlorate of Quinine.*

(QUI̩-NĪ′NÆ HȲ-DRO̩-CHLŌ′RĂS.)

$C_{20}H_{24}N_2O_2HCl.2H_2O$; 396·4. $(C_{20}H_{12}NO_2)_2$, HCl. 4HO ; 396·4.

"Hydrochlorate of Quinine should be kept in well-stopped bottles." *U. S.*

This is another new officinal quinine salt, for the introduction of which there seems to be no good reason, as its medical properties and uses are precisely those of the sulphate. It may be readily prepared by treating the alkaloid with diluted hydrochloric acid, or by double decomposition between chloride of barium and sulphate of quinine. The hydrochlorate of quinine is in "white, lustrous needles, forming tufts, permanent in ordinary air, but readily efflorescing at a gentle heat, odorless, having a very bitter taste, and a neutral or faintly alkaline reaction. Soluble in 34 parts of water, and in 3 parts of alcohol at 15° C. (59° F.); in 1 part of boiling water and very soluble in boiling alcohol; when rendered anhydrous, it is soluble in 1 part of chloroform. On ignition, the salt burns slowly without leaving a residue. The saturated, aqueous solution does not show any blue fluorescence, which, however, appears, in some degree, in more dilute solutions, if not acidulated. When treated, first, with fresh chlorine water, and then with a slight excess of water of ammonia, it produces an emerald-green color. Water of ammonia added to the aqueous solution throws down a white precipitate readily soluble in an excess of water of ammonia, or in ether. Test-solution of nitrate of silver produces a white precipitate insoluble in nitric acid, but soluble in ammonia. The salt should not be colored, or only very slightly colored, by undiluted sulphuric acid (abs. of foreign organic matters), nor be reddened by nitric acid (difference from morphine). The aqueous solution of the salt should not be rendered turbid by diluted sulphuric acid (abs. of barium), nor more than slightly turbid by test-solution of chloride of barium (limit of sulphate). If a small portion of the salt be dried on a water-bath until it ceases to lose weight, and the residue cooled in a desiccator, the loss of weight should not exceed 9 per cent. If 1·5 Gm. be dissolved in 15 C.c. of hot distilled water, the solution stirred with 0·75 Gm. of crystallized sulphate of sodium in powder, the mixture maintained at 15° C. (59° F.) for half an hour, and then drained through a filter only large enough to contain it, until 5 C.c. of filtrate are obtained—upon treating this liquid as directed for the corresponding test under Quinine (see *Quinina*), the results there given should be obtained." *U. S.*

QUININÆ SULPHAS. *U. S.* *Sulphate of Quinine.*

(QUI̩-NĪ′NÆ SŬL′PHĂS.)

$(C_{20}H_{24}N_2O_2)_2H_2SO_4.7H_2O$; 872. $(C_{20}H_{12}NO_2)_2$. HO SO$_3$. 7HO ; 436.

"Sulphate of Quinine should be kept in well-stopped bottles." *U. S.*

Quiniæ Sulphas, *Br.*, also *U. S.* 1870; **Chininum Sulfuricum**, *P.G.;* **Sulfas Quinicus; Disulphate or Basic Sulphate of Quinia; Sulfate de Quinine**, *Fr.;* **Schwefelsaures Chinin**, *G.*

No process is given in the U. S. Pharmacopœia for preparing sulphate of quinine; that of U. S. P. 1870 is appended.*

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* "Take of Yellow Cinchona, in coarse powder, *forty-eight troyounces;* Muriatic Acid *three troyounces and a half;* Lime, in fine powder, *five troyounces;* Animal Charcoal, in fine powder, Sulphuric Acid, Alcohol, Water, Distilled Water, each, *a sufficient quantity.* Boil the Cinchona in thirteen pints of water mixed with one-third of the Muriatic Acid, and strain through muslin. Boil the residue twice successively with the same quantity of Water and Acid as before, and strain. Mix the decoctions, and, while the liquid is hot, gradually add the Lime, previously mixed with two pints of Water, stirring constantly, until the quinia is completely precipitated. Wash the precipitate with Distilled Water, and, having pressed, dried, and powdered it, digest it in boiling Alcohol. Pour off the liquid, and repeat the digestion several times, until the Alcohol is no longer rendered bitter. Mix the liquids, and distil off the Alcohol until a brown viscid mass remains. Upon this, transferred to a suitable vessel, pour four pints of Distilled Water, and, having heated the mixture to the boiling point, add as much Sulphuric Acid as may be necessary to dissolve the quinia. Then add a troyounce and a half of Animal Charcoal, boil the liquid for two minutes, filter while hot, and set it aside to crystallize. Should the liquid, before filtration, be entirely neutral, acidulate it very slightly with Sulphuric Acid; should it, on the contrary, change the color of litmus paper to a bright red, add more Animal Charcoal. Separate the crystals from the liquid, dissolve them in boiling Distilled Water slightly acidulated with Sulphuric Acid, add a little Animal Charcoal, filter the solution, and set it aside to crystallize. Lastly, dry the crystals on bibulous paper with a gentle heat, and keep them in a well-stopped bottle. The mother-water may be made to yield an additional quantity of Sulphate of Quinia by precipitating the quinia with Water of Ammonia, and treating the precipitated alkaloid with Distilled Water, Sulphuric Acid, and Animal Charcoal, as before." *U. S.* 1870.

Both this and the French Codex process, which it closely resembles, are modifications of the plan originally proposed by M. Henry, Jr., of Paris, which has been almost universally employed where alcohol is not too expensive. Henry's process, with all its details, may be found in former editions of this work. An explanation of the several directions given in the U. S. P. 1870 will be useful to the student, by enabling him to comprehend each step of the process.

Cinchona barks are always selected by previous assay by the manufacturer, but Calisaya bark was selected here because its alkaloids are most free from cinchonine. The alkaloid exists in the bark combined with kinic acid, and probably also with one or more of the coloring principles, as suggested by M. Henry. As in this latter state it is difficult of solubility, if it be not insoluble in water, the whole of the quinine cannot be extracted from the bark by means of that liquid alone. Berzelius, however, attributes the difficulty of exhausting the bark to the circumstance that water converts the native neutral kinates into soluble superkinates which are dissolved, and insoluble subkinates which remain. By adding hydrochloric or sulphuric acid to the water in such quantities as to be in excess in relation to the quinine, the whole of the alkaloid combines with the acid to form a very soluble hydrochlorate or sulphate, in which state it exists, together with various impurities, in the decoctions procured by the first steps of the process. By the addition of lime to the filtered and mixed decoctions, the salt of quinine is decomposed, giving up its acid to the lime, while the quinine is liberated, and, being insoluble in water, is precipitated; the water retaining most of the impurities. If sulphuric acid was employed in the commencement of the process, sulphate of calcium is deposited along with the quinine; but if hydrochloric acid was employed, the resulting chloride of calcium is retained in solution; and a reason is thus afforded for the preference of the latter acid. But, in either case, the excess of lime, and a compound formed of the lime and coloring matter, which is insoluble both in water and alcohol, are thrown down with the alkaloid. The precipitate, having been washed in order to remove from it everything soluble in water, is then pressed, dried and powdered; the next step is to separate the quinine from the insoluble impurities. This is accomplished by the repeated action of alcohol, which dissolves the former, and leaves most of the latter behind. The whole of the alkaloid having been abstracted, the alcoholic solution of quinine is then concentrated so as to afford a brown viscid mass, which is impure quinine. Portions of this may be reserved, if thought advisable, for the preparation of other salts of quinine. The mass is treated with boiling distilled water acidulated with sulphuric acid, which forms the officinal sulphate (disulphate of many chemists) with the quinine, and, being somewhat in excess, enables the salt to be readily dissolved. The animal charcoal now added should be the *unpurified* bone-black, the carbonate of calcium contained in which neutralizes a portion of the sulphuric acid, and thus facilitates the crystallization of the sulphate of quinine when the solution cools. Should the quantity of the bone-black added be sufficient to render the solution quite neutral, so as in no degree to affect litmus paper, as much sulphuric acid should be added as will give the paper a slightly vinous tint; for otherwise the crystallization may commence before the liquor is completely filtered. If, on the contrary, the bone-black has been deficient, and the solution colors litmus paper cherry-red, more of that substance is to be added. This, however, is merely an incidental advantage of the animal charcoal; its chief use being to decolorize the liquid. The second crystallization is necessary to obtain the salt of quinine free from color; and sometimes it cannot be rendered perfectly white without a third. It is essential that the heat employed in drying the crystals should be gentle, in order to prevent their efflorescence. The small quantity of cinchonine contained in Calisaya bark is extracted along with the quinine; but, as the sulphate of the former is more soluble than that of the latter, it remains in the mother-liquors.

According to M. Calvert, the proportion of sulphate of quinine obtained from bark is never certain when hydrochloric acid is employed as the solvent, and lime as the precipitant; for quinine is dissolved by a solution of chloride of calcium, and by lime-water; and a portion, therefore, remains in the liquid unprecipitated, which is greater when the lime employed is in excess. Having ascertained by trial that quinine is not dissolved by a solution of soda, and in scarcely appreciable proportion by chloride of sodium, he proposes to substitute this alkali for lime; first neutralizing the excess of acid by the carbonate, and then precipitating the quinine by caustic soda. (*Journ. de Pharm.*, 3e sér., ii. 388.)

"Take of Yellow Cinchona Bark, in coarse powder, *one pound* [avoirdupois]; Hydrochloric Acid *three fluidounces* [Imperial measure]; Distilled Water *a sufficiency;* Solution of Soda *four pints* [Imp. meas.]; Diluted Sulphuric Acid *a sufficiency.* Dilute the Hydrochloric Acid with ten pints [Imp. meas.] of the Water. Place the Cinchona Bark in a porcelain basin, and add to it as much of the Diluted Hydrochloric Acid as will render it thoroughly moist. After maceration, with occasional stirring for twenty-four hours, place the bark in a displacement apparatus, and percolate with the Diluted Hydrochloric Acid, until the solution which drops through is nearly destitute of bitter taste. Into this liquid pour the Solution of Soda, agitate well, let the precipitate completely subside, decant the supernatant fluid, collect the precipitate on a filter, and wash it with cold Distilled Water, until the washings cease to have color. Transfer the precipitate to a porcelain dish containing a pint [Imp. meas.] of Distilled Water, and, applying to this the heat of a water-bath, gradually add Diluted Sulphuric Acid until very nearly the whole of the precipitate has been dissolved, and a neutral liquid has been obtained. Filter the solution while hot through paper, wash the filter with boiling Distilled Water, concentrate till a film forms on the surface of the solution, and set aside to crystallize. The crystals should be dried on filtering paper without the application of heat." *Br.*

The British process seems to be based on that of M. Rabourdin, of Orleans, published in the *Journal de Pharmacie* (Juin, 1861, p. 408), for which the advantages are claimed, that it does not require the use of alcohol, escapes the loss incurred in the ordinary process by the solvent property of lime, and is enabled, by the use of soda as the precipitant, to dispense with animal charcoal, and thereby avoid the waste incurred through its absorbent properties. The soda in this process is employed not only as a precipitant, for which purpose a much smaller quantity would suffice, but in order to hold in solution the tannin, cinchonic red, and coloring and resinous matters, which it does without in the least dissolving the quinine. The precipitated quinine is thus obtained so far exempt from foreign matters that it may be immediately converted into the sulphate without the necessity of using animal charcoal. From the precipitate by soda, M. Rabourdin obtains the quinine white and pure by treating it with a quantity of dilute hydrochloric acid insufficient to dissolve the whole of the alkaloid, whereby impurities are left behind, then filtering, and precipitating by ammonia. The same end is accomplished in the Br. process by the use of sulphuric acid. The residue of the precipitate may be reserved.

Pelletier proposed to substitute oil of turpentine for alcohol in the ordinary process for procuring sulphate of quinine. The impure quinine, precipitated by lime from the acidulous decoctions, after being washed, pressed, and dried, is digested with the oil, which dissolves the quinine. The solution thus obtained is agitated with water acidulated with sulphuric acid, by which the sulphate of quinine is formed. The oil, separating, rises to the top, and is removed for future use; and the watery solution of the salt is evaporated, and treated as in the original process. A disadvantage of this method is said to be, that the oil does not completely exhaust the precipitate.

A similar process has been employed here and in England, *fusel oil* or *benzol* being substituted for oil of turpentine. In this instance, however, the solvent is added to the impure quinine, without separation from the acidulated decoction from which it was precipitated by lime. The mixture being well agitated, the fusel oil or benzol dissolves the alkaloids, and, rising to the surface of the liquid, is drawn off by a siphon. The solution thus drawn off is treated as above with water acidulated with sulphuric acid, and the process is completed in the same manner. (See *P. J. Tr.*, xiv. 29, 92, and 139.)*

* Mr. Clark proposes to prepare quinine by means of the fatty acids as follows. Having exhausted the bark as usual by acidulated water, he treats the solution with an alkaline carbonate so long as a precipitate is produced, then adds a little stearic acid, and boils the whole. The fatty acid melts, floats on the surface, and there attracts the quinine and cinchonine, forming a kind of insoluble soap, while the precipitate and liquid become black. On cooling, the fatty matter coagulates, and, on being withdrawn and boiled in water so long as this remains limpid, and then treated with boiling acidulated water, yields the quinine and cinchonine to the acid. The hot solution, being neutralized by an alkali, deposits a brown matter, which is to be separated by filtration, and on cooling yields the

According to the French Codex, 1000 parts of yellow bark ought to yield from 29 to 30 parts of sulphate of quinine, when treated by the process first described. Messrs. Powers & Weightman, who are among the largest manufacturers of sulphate of quinine in the world, inform us that they have usually obtained from 2·5 to 3 per cent. as an average product. The production of sulphate of quinine of the world is estimated at from 230,000 to 260,000 lbs. per year, as follows: Germany, 56,250 lbs.; Italy, 45,000 lbs.; France, 40,000 lbs.; England, 27,000 lbs.; America, 63,000 lbs.; India, 12,250 lbs. The two Italian factories produce 45,000 lbs. of the sulphate of quinine. (*N. R.*, May, 1881.)

It was announced in the *Comptes-Rendus* of April 3, 1882, that E. J. Maumené had discovered a successful method of making quinine synthetically. Up to this time (December, 1882) the details have not been made public.

When barks containing the alkaloids *cinchonidine* and *quinidine* are used, as their sulphates are much more soluble than that of quinine, it follows that, in the mother-waters left after the crystallization of sulphate of quinine, there will be found a portion of sulphate of cinchonidine or quinidine, or of both. In fact, there is generally, under these circumstances, more or less of the sulphates of the four alkaloids, quinine, cinchonine, quinidine, and cinchonidine, all of which are contained in many barks; and, besides these, a portion of amorphous alkaloid, incapable of crystallization, probably resulting, in part at least, from the heat employed in the process. These may in a great degree be separated through their different solubilities in water. Sulphate of quinine being least soluble will first crystallize, afterwards the salt of cinchonidine or quinidine, and finally that of cinchonine, which is the most soluble of the four; while the uncrystallizable salt will remain in solution, and may be obtained in the amorphous state by evaporation to dryness.

Properties. "Snow-white, loose, filiform crystals, fragile and somewhat flexible, making a very light and easily compressible mass, lustreless from superficial efflorescence after standing in the air, odorless, having a persistent, very bitter taste, and a neutral reaction. Soluble in 740 parts of water, and in 65 parts of alcohol at 15° C. (59° F.); in about 30 parts of boiling water, in about 3 parts of boiling alcohol, in small proportions of acidulated water, in 40 parts of glycerin, in 1000 parts of chloroform, and very slightly soluble in ether. When long exposed to the air, or when kept at 50° to 60° C. (122° to 140° F.) for some hours, it loses most of its water of crystallization (all except 4·6 per cent., or 2 to 3 molecules of water), the last portion being slowly expelled at 100° to 115° C. (212° to 239° F.). On ignition, the salt burns slowly without leaving a residue. The aqueous solution of the salt, especially when acidulated with sulphuric acid, has a vivid, blue fluorescence. When treated, first, with fresh chlorine water, and then with a slight excess of water of ammonia, the salt produces an emerald-green color. Water of ammonia added to the aqueous solution of the salt, throws down a white precipitate readily soluble in an excess of water of ammonia, and soluble in about 20 times its weight of ether (the other cinchona alkaloids requiring larger proportions of ether or of water of ammonia for solution). Dissolved in water, it yields, with test-solution of chloride of barium, a white precipitate insoluble in hydrochloric acid." *U. S.* Its cold solution is opalescent. The acid salts of quinine possess fluorescent properties, but, according to Prof. Henry Morton, the chloride is an exception, and hydrochloric acid will destroy the fluorescence of a solution of the sulphate. The diluted acids, and tartaric and oxalic acids in excess, dissolve the sulphate easily. With an additional equivalent of sulphuric acid it forms another sulphate, which is more soluble in water than the officinal salt, and crystallizes from its solution with much greater difficulty. This is now considered by many as strictly neutral, and therefore entitled to the name

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sulphate of the two alkaloids in a crystalline state. The quinine and cinchonine can then be separated in the ordinary mode. (See *Journ. de Pharm.*, Dec. 1861, p. 463.)

We have been told that considerable quantities of a preparation have been imported from South America, consisting of a mixture of the alkaloids of bark in an impure state, obtained by forming acidulated decoctions of bark, precipitating with lime, treating the precipitate with alcohol, and evaporating the alcoholic solution. From this material the sulphates of quinine and cinchonine have been prepared on a large scale. It has sometimes yielded 25 per cent. of quinine converted into sulphate, and more than an equal quantity of cinchonine.

of sulphate of quinine; while the officinal salt is thought to contain two equivalents of base to one of acid, and is therefore a *subsulphate of quinine.* The latter name was adopted by the London College, and has been much used by chemical writers. In the U. S., Dublin, and Edinburgh Pharmacopœias, as well as in the French Codex, the name of sulphate of quinine, originally given to the officinal salt, under the impression that it was neutral, was retained; and it has been assumed in the new British Pharmacopœia. Hence has arisen a confusion of nomenclature, which must be embarrassing to the student. The following statement may serve to clear up this confusion. There are at least three sulphates of quinine that have been obtained, of which two are now officinal. The first of these, $(C_{20}H_{24}N_2O_2)_2H_2SO_4 + 7H_2O$, is a "diquinic sulphate," but is the officinal salt known as quinine sulphate, or *Quininæ Sulphas, U. S.;* the second, formed by dissolving this first in dilute sulphuric acid, has the formula $C_{20}H_{24}N_2O_2,H_2SO_4 + 7H_2O$, and is the officinal bisulphate of quinine, or *Quininæ Bisulphas, U. S.;* while the third, a still more acid sulphate, $C_{20}H_{24}N_2O_2,2H_2SO_4 + 7H_2O$, may be obtained from a solution of quinine in excess of dilute sulphuric acid. This last salt is not officinal.*

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* *Iodo-Sulphate of Quinine, etc.* This remarkable compound of officinal sulphate of quinine was discovered by Dr. Wm. Bird Herapath, of Bristol, England, who also investigated its singular optical properties. If to a solution of sulphate of quinine in a mixture of acetic acid and diluted alcohol, tincture of iodine be added by drops, and the mixture kept at 54·4° C. (130° F.) until perfect solution takes place, upon the cooling of the liquid, crystals will gradually form, which Dr. Herapath has found to consist of iodine, quinine, and sulphuric acid, probably combined in the state of *sulphate of iodo-quinine*, or, as it is more generally called now, *iodo-sulphate of quinine*, and possessing the formula $4C_{20}H_{24}N_2O_2,3H_2SO_4.2HI,I_4 + 3Aq$. To obtain fine crystals various precautions are necessary, for which the reader is referred to the paper of Dr. Herapath. The crystals are of a brilliant emerald-green when viewed by reflected light, but almost colorless by transmitted light, and present a curious play of colors under varying circumstances of position. Their shape is very diversified, but traceable to the rhombic prism. They are dissolved by heated acetic acid and heated alcohol, and deposited on cooling. Their most remarkable property is that of polarizing light, in which they are equal if not superior to the tourmaline, for which they may be substituted with advantage in experiments in this branch of optics. (*P. J. Tr.*, xi. 448 and 449, and xiii. 378. See also *A. J. P.*, xxvi. 18.) From subsequent experiments of Dr. Herapath, it appears that the other cinchona alkaloids form similar salts with iodine; so that crystals may be obtained of the *sulphates of iodo-quinidine, iodo-cinchonine*, and *iodo-cinchonidine*, as well as of iodo-quinine. But the reader will note that the nomenclature of the alkaloids adopted by Dr. Herapath differs from that now in use (Pasteur's). The quinine and cinchonine are the same with both, but the quinidine of to-day is the cinchonidine of Herapath, and vice versa. Of these different compounds, there is a close analogy in crystalline forms between the iodo-quinine and iodo-cinchonidine salts on the one hand, and the iodo-cinchonine and iodo-quinidine salts on the other, while between the two twin sets there is a decided difference; so that there is no difficulty in deciding whether a quinine salt contains quinidine or cinchonine, or a cinchonine salt cinchonidine or quinine, yet it may not be so easy to discriminate between the salts of analogous forms. Nevertheless there are sufficient points of dissimilarity to enable a correct diagnosis to be made. It is not by their chemical characters that these iodo-salts can be discriminated; though the cinchonine and quinidine salts dissolve with greater difficulty than the others in consequence of their greater thickness and less extent of surface. The crystals of the *quinidine* salt, like those of the sulphate of iodo-quinine, are derived from the rhombic prism, but differ in certain points which we have not space to detail, and in reference to which we must be content to refer to Dr. Herapath's paper. They are distinguishable to the practised eye by their different tint with reflected and transmitted light. But these salts differ greatly from the *iodo-cinchonine* and *iodo-cinchonidine sulphates.* The crystals of the latter of these salts are long quadrilateral acicular prisms, of a deep ruby or garnet-red color, with bluish violet or light purplish reflection tints, or they have the form of thin plates, or long, flat, acicular prisms, which, when thin, transmit a pure yellow, but if thicker, a reddish color tinged with brown. The analogous *iodo-cinchonine sulphate* is in long, acicular, quadrilateral prisms, of a deep purplish black color; and in relation to transmitted light also closely resembles the preceding. All these iodo-salts have double refractive properties. When the acid sulphates of the mixed alkaloids, quinine, quinidine, cinchonine, and cinchonidine, are dissolved in dilute alcohol, and the solution heated to from 80° to 120° F., tincture of iodine readily separates the quinine salt; further treatment in the same manner separates the *quinidine* salt, more or less mixed with the preceding; still further treatment, the *cinchonidine* salt with its well-marked characters; and the cinchonine salt, being by far the most soluble, is the last to appear, but if in large proportion will be mixed with the cinchonidine salt. Quinidine may thus be readily detected in cinchonine, which might otherwise be considered pure. In like manner a mixture of cinchonidine with quinine is easily made evident.

The rotating powers of the cinchonine salts in reference to polarized light also afford means of distinguishing them, to those who may possess the requisite apparatus. Allusion has been made to these properties under the several alkaloids. It may be proper to say here that quinine and cinchonidine are strongly lævogyrate, while cinchonine and quinidine are strongly dextrogyrate, and quinicine and cinchonicine slightly dextrogyrate.

We may here, moreover, refer to another test, requiring instrumental aid, offered by Mr. W.

Incompatibles and Tests. "The salt should not be colored, or not more than very slightly colored, by undiluted sulphuric acid (abs. of foreign organic matters), nor be reddened by nitric acid (difference from morphine). 20 C.c. of absolute alcohol should dissolve 0·2 Gm. of the salt, forming a clear liquid. If a portion of the salt be boiled with milk of lime, no ammoniacal vapor should be given off. If 1 Gm. of the salt be placed in a porcelain capsule, and dried at a temperature of 100° C. (212° F.) for three hours, or until a constant weight is attained, the remainder, cooled in a desiccator, should weigh not less than 0·838 Gm. (abs. of more than 8 molecules, or 16·18 per cent. of water). If the residue thus dried at 100° C. (212° F.), be agitated with 10 C.c. of distilled water, the mixture macerated at 15° C. (59° F.) for half an hour, then filtered through a small filter, 5 C.c. of the filtrate taken in a test-tube, and 7 C.c. of water of ammonia (sp. gr. 0·960) then added,—on closing the test-tube with the finger and gently turning it until the ammonia is fully intermixed, a clear liquid should be obtained. If the temperature of maceration has been 16° C. (60·8° F.), 7·5 C.c. of the water of ammonia may be added; if 17° C. (62·6° F.), 8 C.c. may be added. In each instance, a clear liquid indicates the absence of more than about 1 per cent. of cinchonidine or quinidine, and of more than traces of cinchonine." *U. S.* The officinal test is probably the most reliable of all, to prove the presence of small quantities of other cinchona alkaloids. It is a modification of Kerner's, and admits the presence of about 1 per cent. of the other alkaloids. This certainly is as pure as the sulphate of quinine need be. To separate the remaining one per cent. of alkaloids entirely would more than double the cost of the salt.

Sulphate of quinine is decomposed by the alkalies, their carbonates, and the alkaline earths. In solution, it affords white precipitates with potassa, soda, and ammonia, which are partly soluble in an excess of alkali. It is also precipitated by astringent infusions, the tannic acid of which forms a white insoluble compound with quinine. The soluble salts of lead and of baryta occasion precipitates; and that produced by the salts of baryta is insoluble in the acids. The soluble salts of oxalic, tartaric, and gallic acids occasion more or less precipitation with solution of sulphate of quinine without excess of acid; and Prof. Maisch has ascertained the same to be true of the acetates. (*A. J. P.*, xxvii. 97.) A freshly prepared solution of chlorine, added to a solution of sulphate of quinine and followed by the addition of water of ammonia, occasions an emerald-green color, and, in certain proportions, the deposition of a green precipitate. The green compound has received the name of *thalleioquin.* The drop of ammonia should be put in without agitation. According to Flückiger, $\frac{1}{5000}$ part of quinine can thus be found. With bromine, instead of chlorine, the test is more delicate. Flückiger states that $\frac{1}{20000}$ part of the alkaloid can be detected. (See a paper by C. F. Zeller, *A. J P.*, 1880, p. 385; *P. J. Tr.*, 1872, p. 901.) If, previously to the use of ammonia in the chlorine test, a concentrated solution of ferrocyanide of potassium be added, a dark red color is produced, which persists for several hours, but ultimately passes into green. This does not take place with cinchonine; and, though sulphate of quinidine gives the same red color, this does not disappear as with the salt of quinine, but is persistent. (Schwartzer, *Journ. de Pharm.*, 4e sér., iii. 475.) Sulphate of quinine gives a reddish brown precipitate with iodine dissolved in a solution of iodide of potassium. It is possible that under some circumstances the galvanic current may

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Walter Stoddart. If a drop of a solution of sulphocyanate of potassium be added to a saturated and neutral solution of a suspected specimen of sulphate of quinine upon a glass slide, and the mixture be observed by the microscope, if cinchonine or quinidine or cinchonidine be present, characteristic crystals of sulphocyanate of these alkaloids will be noticed; sulphocyanate of quinine is in the form of oily drops. (*P. J. Tr.*, Oct. 1864, p. 155, and *A. J. P.*, Jan. 1865, p. 41.) Our experience with this test is such that we would not recommend it for practical use.

A mode of distinguishing between quinine and cinchonine, suggested by M. Palm, is based on the influence of polysulphide of potassium on those alkaloids. If a solution of this reagent be added to a boiling solution of a salt of quinine, this, however small may be its proportion, will be thrown down as a red, viscid mass, which hardens upon cooling, and assumes a resinous appearance; whereas cinchonine is separated as a white powder containing sulphur. The polysulphide is prepared by boiling a solution of potassa with an excess of sulphur. (*Journ. de Pharm.*, Mai, 1864, p. 459.)

be of service in detecting the alkaloid; a paper on the electrolysis of the salt may be found in the *Journ. de Pharm.*, 4e sér., xi. 16.*

Adulterations. Sulphate of quinine has often been adulterated. The effects of adulteration may be produced by the variable quantity of water which sulphate of quinine may contain, without any observable alteration in its sensible properties. MM. Millon and Commaille, having exposed sulphate of quinine to a very moist atmosphere, at the temperature of about 16·6° C. (62° F.), found it always to increase in weight; so that a specimen of the salt, previously deprived of all its water capable of being separated by heat, had in five days absorbed 28·77 per cent. of water, and another specimen dried after its precipitation simply by draining, and supposed to contain 18 per cent. of water, had in ten days absorbed 14 per cent. more, making its whole percentage of water 32, or about one-third of its weight. (*Journ. de Pharm.*, Nov. 1862, p. 379.) This is an important fact, and will explain, to some extent, the frequent variable effects from apparently the same quantity of the salt. It is easy to detect and to obviate this natural sophistication by exposing a suspected specimen to a heat of 100° C. (212° F.). The loss of weight will indicate the quantity of water not essential to the salt. Sulphate of calcium, and other alkaline or earthy salts, gum, sugar, mannit, starch, stearin, caffeine, salicin, phlorizin, and the sulphates of cinchonine and other cinchona alkaloids, are among the substances which are said to have been fraudulently added. By attending to the degree of solubility of the sulphate in different menstrua, and to its chemical relations with other substances already described, there can be little difficulty in detecting these adulterations. The presence of any mineral substance, not readily volatilizable, may be at once ascertained by exposing the salt to a red heat, which will completely dissipate the sulphate of quinine, leaving the mineral behind. A volatile ammoniacal salt may be detected by the smell of ammonia emitted upon the addition of potassa. The absence of organic substances may be inferred, if pure cold concentrated sulphuric acid forms a colorless solution. Gum and starch are left behind by alcohol, and fatty matters by water acidulated with sulphuric acid. Sugar and mannit cause a solution of the salt in acidulated water to have a sweet taste, after the precipitation of the quinine by an alkaline carbonate. Salicin imparts the property of becoming red upon the contact of sulphuric acid; but, according to Pelletier, this change of color does not take place unless the proportion of salicin exceeds one-tenth. If only in this proportion, the salicin must be isolated. To 1 part of the suspected salt, 6 parts of concentrated sulphuric acid may be added, and to the brown liquid which results, 125 parts of water. The salicin is thus separated, and may be obtained by filtration, in the form of a bitter, white powder, becoming bright red with sulphuric acid. (See *A. J. P.*, xvii. 156.) Caffeine alters the solubility of the medicine in different menstrua. According to M. Calvert, a saturated solution of sulphate of quinine in cold water gives, with a solution of chlorinated lime, a precipitate soluble in an excess of the latter; while a solution of sulphate of cinchonine of the same strength, treated in the same manner, gives a precipitate which is insoluble in a great excess of the reagent. The same effect is produced with lime-water, and solution of ammonia; and solution of chloride of calcium, while it furnishes a precipitate with a solution of sulphate of cinchonine, yields none with a solution of sulphate of quinine. (*Journ. de Pharm.*, 3e sér., ii. 394.)† Though sulphate of quinine, as prepared for use, frequently contains a portion of one or more of the cinchona alkaloids, the salt is probably not less efficacious on that account; as these alkaloids have been shown to possess identical therapeutical properties with those of quinine, and to be little inferior in strength, if at all, in relation to most of them.

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* Morphine has been mixed with quinine with fatal results. If there be more morphine than will form $\frac{1}{1000}$ part of the solution, the thalleioquin test fails to develop the green color. The morphine in these cases is to be recognized by adding nitric acid or chloride of iron to the suspected powder, or, better still, iodic acid, which is decomposed by the alkaloid and forms a beautiful violet solution with chloroform. This test is said to succeed with solutions containing less than $\frac{1}{10000}$ of morphine. (*P. J. Tr.*, May, 1872, p. 901.)

† *Liebig's test* of the presence of cinchonine is one of the simplest. Rub together fifteen grains of the suspected salt and two ounces of solution of ammonia, put the mixture into a flask, add two ounces of ether, and shake frequently. The quinine liberated by the ammonia is dissolved by the ether, while any cinchonine that may be present remains undissolved, floating between the ethereal solution above and the ammoniacal beneath. But M. O. Henry has shown that cinchonine is slightly soluble in ammonia, so that a small portion might escape detection. It has, therefore, been proposed to modify the test by heating the mixture of the suspected salt and ammonia, so as almost entirely to drive off the excess of this alkali, and then to add the ether. If the liquid

Medical Properties and Uses. The first symptoms of cinchonism, as produced by small therapeutic doses of quinine (ten grains) in man, are usually ringing in the ears, slight fulness in the head, and perhaps some deafness. With the use of larger doses these symptoms are intensified; the deafness is very marked, disturbed vision may exist, and the flushed face, with the sense of distention in the head, may point towards a cerebral congestion, which is in some cases relieved by spontaneous epistaxis. In decided cinchonism, giddiness and staggering in walking are very common. After toxic doses, severe headache, delirium, stupor, complete deafness and blindness, dilated pupils, embarrassment of respiration, great weakness, convulsions, paralysis, and finally collapse, may result, either comatose or delirious. The deafness produced by large doses of quinine usually passes off rapidly; very rarely is there a permanent impairment of hearing. Amaurosis, with a peculiar ischæmia of the retinal vessels, has in a small number of cases been produced by very large therapeutic doses of the alkaloid. Besides its effects on the brain, sulphate of quinine sometimes occasions great gastric and intestinal irritation, marked by oppression of stomach, nausea, abdominal pains, vomiting, and purging. In general these effects of excessive doses gradually pass off, although partial deafness often continues for several days, and sometimes much longer, and permanent deafness has resulted. It is capable of taking life, although enormous amounts of it are requisite for this. Several cases are recorded in which an ounce has been taken by the stomach and recovered from, probably because only a portion of the drug was absorbed. Five ounces taken in ten days has caused death.

Although it is not possible at present to point out the connection between the known physiological action of quinine and its clinical use, yet it seems proper to speak here briefly of our knowledge of its influence upon the healthy organism, referring the reader for details to H. C. Wood's Treatise on Therapeutics. The action of the drug upon the cerebrum is somewhat uncertain. It is probable that moderate doses stimulate the brain to some extent, especially the basal ganglia connected with the special senses, and it is very certain that toxic doses overwhelm and paralyze the gray matter of the brain. Upon the spinal cord of man therapeutic doses produce no marked effect. Two facts, first pointed out by Dr. T. A. Chaperon (*Pflüger's Archiv*, 1869, p. 295), have been so abundantly substantiated that we must accept them as established. They are—quinine in *small* doses causes in the frog a lessening of the reflex activity, which is removed by section of the medulla: quinine in *large* doses produces a permanent palsy of reflex activity. The first of these actions is considered to show that the alkaloid stimulates Setschenow's

now remain quite transparent, without any turbid layer between the upper and lower stratum, it may be inferred that no cinchonine is present. For papers on this subject see *Journ. de Pharm.* (3e sér., xiii. 102, xvi. 327, and xxi. 284), and *A. J. P.* (xx. 231, and xxiv. 166).

The precise quantities originally proposed in Liebig's test were one gramme of sulphate of quinine, ten grammes of ether, and two grammes of caustic ammonia. But M. Roger has proved that, with these proportions, in order that the test may succeed, it is necessary to use ether containing alcohol, which is the case with commercial ether. Of pure ether 25 grammes would be requisite for the perfect solution of the quinine from a gramme of the sulphate, while 10 grammes of ether containing but two per cent. of alcohol will produce the same effect. In these proportions the presence of quinidine as well as cinchonine would be detected. (Roger, *Journ. de Pharm.*, Mars, 1862, p. 204.)

Kerner's test. Dr. G. Kerner proposed (*Zeitschrift für Analytische Chemie*, 1862) a test by which the alkaloids may be distinguished; their solubilities, namely, in water of ammonia of given strength, which, according to Dr. Kerner, are more fixed and reliable than their solubilities respectively in water, or other ordinary solvent. The mode of application is by taking a certain quantity of the sulphate of the alkaloid dissolved in a certain quantity of water, and then adding the water of ammonia gradually until the precipitated alkaloid is redissolved; and the quantity of the ammoniacal liquid necessary to produce this effect indicates inversely the solubility of the alkaloid. Quinidine requires from 10 to 11 times more of the ammoniacal liquid than quinine, cinchonidine from 12 to 13 times more; while cinchonine is not dissolved by a much larger proportion than is required by either of the others, and though when mixed in very small proportion with quinine it is dissolved at first, yet it afterwards separates on standing. This test of Kerner's is now officinal (1882), and as modified is regarded as the best test for quinine sulphate.

centre in the base of the brain, the second is probably due to a paralysis of the spinal cord. It has been proved by Prof. Binz and subsequent observers that when the alkaloid is added to blood outside of the body in a proportion of not less than one part to four thousand, it immediately checks, and finally arrests, the amœboid movements of the white blood-corpuscles. How far this occurs when the medicine has been taken into the living organism has not been exactly determined, but we certainly are not able to appreciate any such effect in health or disease by therapeutic doses. The ozonizing power of the red corpuscles in drawn blood is lowered by the addition of quinine. Ordinary therapeutic doses exert, however, no perceptible influence. How far the marked antipyretic influence exerted by large doses of quinine is dependent upon its action upon the blood is at present purely a matter of conjecture. In 1765, Dr. Pringle called attention to the power of cinchona bark over putrefaction, and it has recently been experimentally proved by Binz, Hallier, Pavesi, and others, that one part of the alkaloid in three hundred parts of milk, albuminous solutions, meat, honey, syrup, etc., will keep in check for a long time putrefaction and other fermentations. Prof. Binz has shown that this is due to a poisonous influence upon the low forms of life which accompany or produce these changes. Introduced into the jugular vein or coronary artery, or in any way brought in direct contact with the heart, it lessens the force and frequency of the pulsations, and finally produces diastolic arrest. In man, very large doses of quinine (thirty to sixty grains) lower the force and frequency of the pulse; a pulse-rate of forty has been noted, and in reported cases of quinine-poisoning the pulse has been imperceptible at the wrist. Under the latter circumstances the pulse-rate may be increased, but the cardiac force is reduced to a minimum. The evidence is conclusive that both in man and in the lower animals quinine in sufficient amount is a powerful depressant to the heart-muscle or ganglia. An enormous amount has been written during the last ten years concerning the action of quinine upon the uterus. The result of it all seems to indicate very positively that the alkaloid has no power to originate uterine contractions in the pregnant female, but that when once parturition has commenced the flagging pains are greatly stimulated and increased by a dose of ten grains of the drug. When abortion is threatened through malarial influence, no hesitation need be felt in using the drug to avert the impending catastrophe. Any salt of quinine which escapes absorption in the stomach must be precipitated by the alkaline juices of the bowels, and be absorbed very slowly or not at all. What seems *a priori* almost inevitable has been shown to be the case by the researches of Kerner, who found the alkaloid in the fæces. The importance of giving the salt in some easily soluble form, if it is intended for all of it to be absorbed, is plain. When taken into the system, it seems to find its way into all the secretions,—it having been found in the tears, sweat, milk, urine, and saliva. Some of it is eliminated unchanged, but, according to the researches of Dr. G. Kerner, a portion of it escapes in an amorphous uncrystallizable form and a second portion as a substance free from bitter taste, though crystallizable and having the fluorescence of quinine; for this substance he has proposed the name of *dihydroxyl-quinine.* Upon the elimination both of uric acid and urea the salts of quinine appear to have a decided influence, decreasing it very decidedly.

Sulphate of quinine may be given in pill or solution, or suspended in water by the intervention of syrup and mucilage. The form of pill is usually preferred. The solution may be readily effected by the addition of a little acid of almost any kind to the water. Eight grains (0·52 Gm.) of the sulphate will dissolve in a fluidounce (30 C.c.) of water acidulated with about twelve minims (0·72 C.c.) of the diluted sulphuric acid or aromatic sulphuric acid of the Pharmacopœias; one of the best ways of exhibiting it to children is to mix the dose quickly with half a teaspoonful of aromatic elixir of liquorice (see page 538), and administer it before it can dissolve. A few drops of laudanum may be added if nausea or disturbance of the bowels is apprehended. Mr. J. S. Blockley ascertained that glycerin will, if gently heated, dissolve eight grains of the sulphate in each fluidrachm, and may therefore be conveniently used as a vehicle. (*Lond. Chemist*, Sept. 1857.) Dr. R. H. Thomas, of Baltimore, found that one part of tannic acid will deprive five parts of sulphate of quinine of bitterness, without impairing its medicinal efficacy. (*Am. Journ. of Med. Sci.*, N. S., xix. 541.) It is obvious that tannate of quinine is thus formed; and as this, though insoluble in water, is readily dissolved in dilute acids, and consequently in the gastric liquor when acid, there can be no doubt that it will generally prove efficacious. It may, however, happen that the stomach may be quite free from acid, and that the operation of this salt may prove less certain than that of the sulphate; and such is asserted to have been the case in some instances; but a little lemonade taken after the medicine would probably obviate the difficulty.

Quinine is used in practical medicine as a tonic, antiperiodic, antipyretic, and a uterine stimulant. It is certainly the most efficient remedy known in malarial diseases. It should be administered in such a way that the last dose shall be ingested about 2 hours before the expected return of the paroxysm, and the first dose 4 or 5 hours previous to the last. When there is sufficient time, its influence is almost always very sensibly aided by the exhibition, 12 or more hours before, of a mercurial or other purge. Quinine exerts in febrile disease a decided antipyretic action, which is especially manifested during those stages of disease in which the natural tendency is towards a lowering of temperature. In typhus and typhoid fever, scarlatina, severe erysipelas, rheumatic hyperexia, etc., after the use of the cold bath, twenty grains of the alkaloid are often very efficacious in preventing a rapid return of the excessive fever. As an antipyretic the drug should be used whenever there is serious elevation of temperature, except it be in cases of simple inflammation of the brain or its membranes.

Twelve grains of sulphate of quinine are equivalent to about an ounce of good bark. The dose varies exceedingly, according to the circumstances of the patient and the object to be accomplished. As a tonic simply, a grain (0·065 Gm.) may be given three or four times a day, or more frequently in acute cases. In intermittents, from twelve to twenty-four grains (0·80–1·5 Gm.) should be given between the paroxysms, divided into smaller or larger doses according to the condition of the stomach or the length of the intermission. From one to four grains (0·065–0·26 Gm.) may be given at once, and some even advise the whole amount. In malignant intermittents and remittents, the quantity may be increased to thirty grains (1·95 Gm.) or even a drachm (3·9 Gm.) between the paroxysms. M. Maillot gave one hundred and twenty-eight grains, in the course of a few hours, in a case of malignant fever occurring in Northern Africa, with the happiest results. The caution, however, is necessary, not to employ this heroic practice against easily conquerable diseases. When the stomach will not retain the medicine, it may be administered with nearly as much efficacy by enema; from six to twelve grains (0·4–0·8 Gm.) with two fluidounces (60 C.c.) of acidulated starch water, and from twenty to forty drops (0·6–1·12 C.c.) of laudanum, being injected into the rectum, in ordinary cases, every six hours. Should circumstances render this mode of application impracticable, the hypodermic syringe should be resorted to. If the ordinary sulphate be used, the solution for hypodermic use should be made with tartaric acid, grain for grain, and should always be carefully filtered. The sulphovinate has been especially recommended, but is of doubtful advantage. (*P. J. Tr.*, May, 1875, p. 909.) The officinal hydrobromate and bisulphate are to be preferred. Administered in this way, quinine acts with great promptness; but no precaution will always prevent the production of severe local abscesses and ulcerations by the hypodermic use of quinine, and even fatal tetanus has been induced, so that the method should be employed only in emergencies.

Locally applied to the mucous membranes quinine is stimulant or irritant, according to its concentration. In gastritis or enteritis its evil effects are often very pronounced. In various subacute mucous inflammations it is a good local remedy. In hooping-cough the use of quinine by atomization has been warmly recommended. In hay-fever a warm solution, as nearly neutral as possible, and of the strength of two grains to the fluidounce (0·13 Gm. to 30 C.c.), may be used with the Thudichum douche. Solutions of sulphate of quinine have been advantageously employed as local applications to indolent ulcers and chronic mucous inflammations. (Wedderburn and Fearn, *New Orleans Med. and Surg. Journ.*, iii. 161 and 341.)

Off. Prep. Ferri et Quiniæ Citras; Pilula Quiniæ, *Br.;* Quiniæ Valerianas, *U. S.;* Tinctura Quiniæ, *Br.;* Vinum Quiniæ, *Br.*

QUININÆ VALERIANAS. *U. S.* *Valerianate of Quinine.*

(QUỊ-NĪ′NÆ VẠ-LĒ-RỊ-Ā′NĂS.)

$\mathbf{C_{20}H_{24}N_2O_2C_5H_{10}O_2.H_2O}$; **444.** $(C_{20}H_{12}NO_2)_2, C_{10}H_{10}O_4.2HO$; 444.

"Valerianate of Quinine should be kept in well-stopped bottles." *U. S.*

No process is given for this salt; that of U. S. P. 1870 will be found below.*

Quiniæ Valerianas, *U. S.* 1870; Chininum Valerianicum, *P.G.;* Valérianate de Quinine, *Fr.;* Baldriansaures Chinin, *G.*

In the process of U. S. P. 1870 quinine is first obtained by decomposing sulphate of quinine, by means of ammonia, and then combined directly with valerianic acid, to form valerianate of quinine, which crystallizes from the solution when it cools, because much less soluble in cold than in hot water. By the late Dublin formula, which, with the salt itself, has been omitted in the British Pharmacopœia, the valerianate was obtained by double decomposition between hydrochlorate of quinine and valerianate of sodium, resulting in the production of chloride of sodium, which remained in solution, and valerianate of quinine, which crystallized.

Valerianate of quinine is in "white, or nearly white, pearly, lustrous, triclinic crystals, permanent in the air, having a slight odor of valerianic acid, a bitter taste, and a neutral reaction. Soluble in about 100 parts of water and in 5 parts of alcohol at 15° C. (59° F.); in 40 parts of boiling water, in 1 part of boiling alcohol, and slightly soluble in ether. When heated to about 90° C. (194° F.), the salt melts, forming a colorless liquid. On ignition, it burns slowly without leaving a residue. The aqueous solution, when acidulated with sulphuric acid, has a blue fluorescence, and emits the odor of valerianic acid. When treated, first, with fresh chlorine water, and then, with a slight excess of water of ammonia, it produces an emerald-green color. Water of ammonia added to the aqueous solution, throws down a white precipitate readily soluble in an excess of water of ammonia, or in ether." The salt should not be colored, or not more than slightly colored by undiluted sulphuric acid (abs. of foreign organic matters), nor be reddened by nitric acid (difference from morphine). The addition of test-solution of chloride of barium to the aqueous solution of the salt should not cause more than a slight precipitate (limit of sulphate)." *U. S.*

It may be given in the dose of a grain or two (0·065–0·13 Gm.), repeated several times a day, in cases of debility attended with nervous disorder. A combination of Peruvian bark and valerian has long been known as peculiarly efficacious in hemicrania. Perhaps the valerianate of quinine may be used advantageously in the same affection. (*Journ. de Pharm.*, 4e sér., i. 269.)

RESINÆ. *Resins.*

(RẸ-ṢĪ′NÆ.)

The *Resinæ* or *Resins* of the U. S. Pharmacopœia constitute a peculiar class of preparations, made by exhausting the substances from which they are obtained by alcohol, and then precipitating the resinous matter from the tincture, by the addition of water, which abstracts the alcohol by its stronger affinity. It is obvious that the resins thus prepared are different substances from the alcoholic extracts, which contain all the ingredients of the medicine which alcohol is able to take from it. This set of substances has been much employed by the practitioners styling themselves "eclectics;" but with great want of discrimination. They have applied names to these resinous precipitates, which, in their proper scientific use, are employed to designate neutral proximate principles of plants, generally representing more or less completely the effects of the plants respectively on the system; as we say *columbin*, *quassin*, *santonin*, etc., themselves proper proximate principles, and representing the virtues, in part at least, of colombo, quassia, santonica, etc., from which they are obtained, and from which they derive their names. By applying similar names to their precipitated resins, such as podophyllin, iridin, cimicifugin, etc., *i.e.*, to the impure resins obtained by precipitating the tinctures of podophyllum, iris versicolor, cimicifuga, etc., they justify the suspicion either that they ignorantly believe them to be in fact the active principles of these medicines respectively, or that, knowing better themselves, they seek to impose such a conviction upon the ignorant. The fact is that the substances thus obtained, and thus named, are impure resins, which may possibly contain more or less of the active principles mixed with them, but are not entitled to names which imply that they are distinct proximate principles themselves. Another member of this class was introduced at the last revision—*Resina Copaibæ*.

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* "Take of Valerianic Acid *half a troyounce;* Sulphate of Quinia *two troyounces;* Diluted Sulphuric Acid, Water of Ammonia, Water, each, *a sufficient quantity.* Dissolve the Sulphate of Quinia in a pint of Water, with the aid of Diluted Sulphuric Acid; then add Water of Ammonia in slight excess, and wash the precipitated quinia with water until freed from sulphate of ammonium. Dissolve the Valerianic Acid in five pints of Water, heated to 180° F., add the quinia to the solution, and, when it is dissolved, set the whole aside for several days to crystallize. Decant the mother-water from the crystals, dry them on bibulous paper, and keep them in a well-stopped bottle. By evaporating the mother-water at a temperature not exceeding 120° F., more crystals may be obtained." *U. S.* 1870.

RESINA. *U.S., Br.* *Resin.* [*Colophony.*]

(RE-ȘĪ'NA.)

"The residue left after distilling off the volatile oil from Turpentine." *U.S.* "The residue of the distillation of the turpentines from various species of Pinus (Linn.) and Abies (Lam.)." *Br.*

Colophonium, *P.G.;* Rosin, Colophony; Colophane, Résine blanche, Résine jaune, *Fr.;* Kolophonium, Geigenharz, Fichtenharz, *G.;* Ragea di Pino, *It.;* Resina de Pino, *Sp.*

After the distillation of the volatile oil from the turpentines (see *Terebinthina*), a resinous matter remains, which on the continent of Europe is called *colophony*, but with us is commonly known by the name of *rosin.* It is the RESINA of the U. S. and Br. Pharmacopœias. It is sometimes called *resina flava*, or *yellow resin.* When this, in a state of fusion, is strongly agitated with water, it acquires a distinct appearance, and is denominated *resina alba*, or *white resin.* Before describing this officinal, we give the characteristic properties of the proximate principles denominated resins.

Resins are solid, brittle, of a smooth and shining fracture, and generally of a yellowish color and semi-transparent. When perfectly pure, they are probably inodorous and often insipid; but, as usually found, they have a slight odor, and a somewhat acrid or bitterish taste. Their sp. gr. varies from 0·92 to 1·2. They are fusible by a moderate heat, decomposed at a higher temperature, and in the open air take fire, burning with a yellow flame and much smoke. Insoluble in water, they are dissolved by ether and the volatile oils, and generally by alcohol; and their alcoholic and ethereal solutions afford precipitates upon the addition of water. With pure potassa and soda they unite to form soaps, which are soluble in water; and the same result takes place when they are heated with solutions of the alkaline carbonates. Concentrated sulphuric acid dissolves them with mutual decomposition; and nitric acid converts them into artificial tannin. They readily unite by fusion with wax and the fixed oils.*

Common, or *yellow resin*, in its purest state, is beautifully clear and pellucid, but much less so as usually found in the shops. Its color is yellowish brown with a tinge of olive, and more or less dark according to its purity, and the degree of heat to which it has been exposed in its preparation. Sometimes it is almost black. It is rather heavier than water. It is completely liquid at 152·5° C. (306° F.), begins to emit bubbles of gas at 157·5° C. (316° F.), and is decomposed at a red heat. "A transparent, amber-colored substance, hard, brittle, with a glossy and shallow conchoidal fracture, and having a faintly terebinthinate odor and taste. Sp. gr. 1·070 to 1·080. It melts at about 135° C. (275° F.), and is soluble in alcohol, ether, and fixed or volatile oils." *U. S.* The composition of colophony is expressed by the formula $C_{44}H_{62}O_4$. By shaking coarsely powdered colophony with dilute alcohol and warming, it is converted into *abietic acid*, $C_{44}H_{64}O_5$, obviously a hydrate of the first. Colophony may be considered, therefore, as the anhydride of the abietic acid, and yields from 80 to 90 per cent. of it under this treatment. Colophony, when boiled with alkaline solutions, forms greasy salts of abietic acid, the so-called resin soaps which are used in admixture with other soaps. Colophony, distilled by itself, yields the so-called "rosin oil," of which two fractions are taken separately; the first that distilling under 360° C. (674° F.), and the second that over 360° C. (674° F.), and some 31 per cent. of fixed gases. When distilled with superheated steam, colophony yields benzol and toluol. *Silvic acid*, formerly considered to be a constituent of colophony, is now regarded as a decomposition product of abietic acid. Similarly *pinic* and *pimaric acids*, announced as found in colophony, are impure products, although the latter acid, or one of the same name, is found in Galipot resin.

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* M. Losch recommends the following process for rendering the resins as white as possible. Boil together 5 parts of the resin, 1 of carbonate of potassium or of sodium, and 20 of water, until a perfectly homogeneous mass is obtained; allow this to cool, and pass into it sulphurous acid, which saturates the alkali, and precipitates the resin in white flakes. Finally, wash the precipitate well with water, and dry it. (*Journ. de Pharm.*, Juin, 1856, p. 465.)

White resin differs from the preceding only in being opaque and of a whitish color. These properties it owes to the water with which it is incorporated, and which gradually escapes upon exposure, leaving it more or less transparent.

Medical Uses. Resin is important as an ingredient of ointments and plasters, but is never used internally. According to Professor Olmsted, it has the property of preventing the oxidation of fatty substances, and thus contributes to the preservation of ointments. (*A. J. P.*, xxii. 325.)

Off. Prep. Ceratum Cantharidis, *U. S.;* Ceratum Extracti Cantharidis, *U. S.;* Ceratum Resinæ, *U. S.;* Charta Epispastica, *Br.;* Emplastrum Calefaciens, *Br.;* Emplastrum Cantharidis, *Br.;* Emplastrum Hydrargyri, *U. S.;* Emplastrum Picis, *Br.;* Emplastrum Resinæ; Emplastrum Saponis, *Br.;* Unguentum Resinæ, *Br.;* Unguentum Terebinthinæ, *Br.*

RESINA COPAIBÆ. *U. S.* *Resin of Copaiba.*

(RȨ-ŞĪ'NA̧ CO̧-PĀ'I̧-BÆ.)

"The residue left after distilling off the volatile oil from Copaiba." *U. S.*

This is a new officinal preparation. Schweitzer first obtained from copaiba resin *copaivic acid*, which, analyzed by H. Rose, was found to have the formula $C_{20}H_{32}O_2$. When crystallized from alcohol the acid fuses at 116°–117° C. (240·8°–242·6° F.). Another acid, *oxycopaivic*, was obtained by Von Fehling, and still a third, *metacopaivic acid*, by Strauss. The first of these has the formula $C_{20}H_{28}O_3$, and the second $C_{22}H_{34}O_4$. The properties of copaivic acid have been fully treated of under *Copaiba*, page 491, and *Massa Copaiba*, page 926, which see. It is officinally described as "a yellowish or brownish yellow, brittle resin, of a weak odor and taste of copaiba, and an acid reaction. Soluble in alcohol, benzol, or amylic alcohol." *U. S.*

Medical Properties. Bernatzik exhibited nearly four drachms of this resin in five hours, causing violent gastro-intestinal irritation, with vomiting and purging, besides renal disturbance. The resin is eliminated by the urine, and exerts some influence upon the genito-urinary mucous membrane. It is, however, inferior either to the volatile oil or the balsam. The dose is from ten to twenty grains (0·65 to 1·3 Gm.).

RESINA JALAPÆ. *U. S., Br.* *Resin of Jalap.*

(RȨ-ŞĪ'NA̧ JA̧-LĀ'PÆ.)

Jalapæ Resina, *Br.;* Résine de Jalap, *Fr.;* Jalapenharz, *G.*

"Jalap, in No. 60 powder, *one hundred parts* [or sixteen ounces av.]; Alcohol, Water, each, *a sufficient quantity.* Moisten the powder with *twenty-five parts* [or three and three-quarter fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until *two hundred* *parts* [or two pints] of tincture are obtained, or until the tincture ceases to produce more than a slight turbidity when dropped into water. Distil off the Alcohol, by means of a water-bath, until the tincture is reduced to *forty parts* [or six and a half fluidounces], and add the latter, with constant stirring, to *nine hundred parts* [or eight pints] of Water. When the precipitate has subsided, decant the supernatant liquid, and wash the precipitate twice, by decantation, with fresh portions of Water. Place it upon a strainer, and, having pressed out the liquid, dry the Resin with a gentle heat." *U. S.*

"Take of Jalap, in coarse powder, *eight ounces* [avoirdupois]; Rectified Spirit, Distilled Water, each, *a sufficiency*. Digest the Jalap with sixteen fluidounces of the Spirit in a covered vessel, at a gentle heat, for twenty-four hours; then transfer to a percolator, and, when the tincture ceases to pass, continue the percolation with successive portions of Spirit until it ceases to dissolve anything more. Add to the tincture four fluidounces of the Water, and distil off the Spirit by a water-bath. Remove the residue while hot to an open dish, and allow it to become cold. Pour off the supernatant fluid from the resin, wash this two or three times with hot water, and dry it on a porcelain plate by the heat of a stove or water-bath." *Br.*

The two processes probably do not differ very materially in the result; though, if jalap yielded anything to alcohol that is insoluble in water besides resin, it will be necessarily found in the British preparation, while that of the U. S. Pharmacopœia consists of resin almost exclusively. The difference arises from the circumstance that, in the Br. process, probably to enable the whole of the alcohol to be saved by distillation, the water for precipitation is added before the spirit is distilled off, while, in the U. S. process, it is not added until so much of the alcohol has been distilled as to leave only enough to hold the extracted matters in solution. It is obvious, therefore, that the resin of the former contains everything insoluble in water that the alcohol had extracted; while that of the latter contains nothing which water was unable to precipitate from the strong tincture left in the still. "Resin of Jalap is partly soluble in ether, and the residue, when dissolved in solution of potassa, is not precipitated by the addition of diluted hydrochloric acid in excess. It is insoluble in disulphide of carbon. One part of the Resin is soluble in 50 parts of warm water of ammonia. On cooling, the solution does not gelatinize, and remains clear after being supersaturated with acids. If the ammoniacal solution is quickly evaporated, the residue is soluble in water." *U. S.*

The U. S. resin, although pure enough for practical purposes, is still colored. To obtain it colorless, the powdered jalap should be mixed, before percolation, with an equal quantity of finely powdered animal charcoal, and, previously to the introduction of this mixture into the percolator, half the quantity of animal charcoal, similarly powdered, should be packed in the bottom of the instrument.. The coloring matter is thus left behind; and the resulting tincture, treated as directed in the process, yields the resin as white as starch.

Resin of jalap consists of two portions, one of which is hard and insoluble in ether, the other is soft and soluble in that menstruum; the former constituting about 70 per cent. It is insoluble in oil of turpentine. (*Squire.*) For its chemical properties, see *Jalapa.* It was at one time supposed that the purgative properties resided chiefly if not exclusively in the hard resin; but experiments by Mr. John C. Long appear to prove that the soft is equally energetic. (*A. J. P.*, 1861, p. 489.)

Guaiac, rosin, and other resinous substances are said to be sometimes fraudulently added to the resin of jalap. Guaiac may be detected by the green color it produces, when a few drops of solution of chloride of sodium or of calcium are added to an alcoholic solution of the suspected resin. (*Journ. de Pharm.*, 3e sér., x. 357.) M. Blacher triturates 50 centigrammes of the pulverized suspected resin, 20 centigrammes of the black oxide of copper, and 20 drops of alcohol, and then with 5 drops of liquor ammonia; if guaiac be present in sufficient proportion, in less than a minute a beautiful apple-green color is developed. (*Journ. de Pharm.*, Juillet, 1870.) Aloes, suspected by the bitterness of the resin, was detected in a specimen by M. Daenen, of Brussels, who obtained picric acid from it by acting on it with nitric acid. (*A. J. P.*, 1866, p. 375.) According to G. A. Kaiser, jalap resin may be distinguished from all other resins by being gradually dissolved by concentrated sulphuric acid, and depositing, after some hours, a brown soft viscid matter. (*Chem. Gaz.*, Jan. 1845; from *Liebig's Annalen.*) A better test is probably that proposed by A. Buchner. When pure jalap resin is dissolved in an alkaline solution, it is not precipitated by the addition of sulphuric or hydrochloric acid, having been converted, through the agency of the alkali, into an acid soluble in water. All the adulterating resins yield precipitates under the same circumstances. The resins of scammony and of fusiform jalap act in this respect like the true jalap resin, but are distinguishable by being wholly soluble in ether, while jalap resin is not. (*Neues Repert. für Pharm.*, No. 1, 1854.)

It is now generally believed that the resin of jalap is its sole purgative principle, the gummy extractive being either simply diuretic or wholly inert. To obviate the occasional harshness of the resin, it has been advised to triturate it with milk-sugar, sulphate of potassium, almond emulsion, or other substance calculated to separate its particles. (See *Abstractum Jalapæ.*) It may be conveniently made into pill with mucilage or alcohol. (Hasselby, *P. J. Tr.*, 2d ser., vii. 231.) The dose is from two to five grains (0·13–0·33 Gm.).

RESINA PODOPHYLLI. *U. S.* *Resin of Podophyllum.*

(RẸ-ŞĪ'NẠ PŎD-Ọ-PHȲL'LĪ.)

Podophylli Resina, *Br.:* Resin of May-Apple; Résine de Podophylle, *Fr.:* Podophyllumharz, *G.*

"Podophyllum, in No. 60 powder, *one hundred parts* [or sixteen ounces av.]; Hydrochloric Acid, *one part* [or one fluidrachm]; Alcohol, Water, each, a *sufficient quantity.* Moisten the powder with *forty parts* [or seven fluidounces] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until *one hundred and fifty parts* [or one and a half pints] of tincture are obtained, or until the tincture ceases to produce more than a slight turbidity when dropped into water. Distil off the Alcohol, by means of a water-bath, until the tincture is reduced to the consistence of honey, and pour it slowly, with constant stirring, into *one hundred parts* [or one pint] of Water, previously cooled to a temperature below 10° C. (50° F.), and mixed with the Hydrochloric Acid. When the precipitate has subsided, decant the supernatant liquid, and wash the precipitate twice, by decantation, with fresh portions of cold Water. Spread it, in a thin layer, upon a strainer, and dry the Resin by exposure to the air, in a cool place." *U. S.*

"Take of Podophyllum Root, in coarse powder, *one pound* [avoirdupois]; Rectified Spirit, *three pints*, or *a sufficiency;* Distilled Water, Hydrochloric Acid, each, *a sufficiency.* Exhaust the Podophyllum with the Spirit by percolation; place the tincture in a still, and draw off the greater part of the spirit. Acidulate the Water with one twenty-fourth of its bulk of Hydrochloric Acid, and slowly pour the liquid which remains after the distillation of the tincture into three times its volume of the acidulated water, constantly stirring. Allow the mixture to stand for twenty-four hours to deposit the resin. Wash the resin on a filter with Distilled Water, and dry it in a stove." *Br.*

Resin of podophyllum has a light brown color, an acrid bitter taste, and a slight odor of the root. It consists of two resins, one soluble both in ether and alcohol, the other in alcohol only. The resin extracted by ether constitutes, according to Mr. John W. Cadbury, 75 per cent. of the whole (*A. J. P.*, July, 1858, p. 301), according to Mr. Harvey Allen, 80 per cent. (*Ibid.*, May, 1859, p 206.) "Resin of Podophyllum is partly soluble in ether, and the residue, when dissolved in solution of potassa, is precipitated by the addition of diluted hydrochloric acid in excess." *U. S.* The officinal resin is soluble in alkaline solutions, from which it is precipitated by acids, in this respect differing strikingly from the resins of jalap and scammony. It is insoluble in oil of turpentine. The name of *podophyllin*, given to it by the practitioners calling themselves eclectics, who have long been in the habit of using this resin, is inappropriate, and should be abandoned.

Resin of podophyllum is a powerful cathartic, occasionally producing some griping and nausea, but capable of being favorably modified by combination, and of being very usefully employed in connection with other cathartics, to give them increased energy. It is supposed to be especially cholagogue, and this belief has been confirmed by the experiments of Rutherford. There has been much difference of opinion as to the relative activity of the two resins composing it, some maintaining that both are active, others that the activity resides mainly, if not exclusively, in the resin soluble in ether. It is difficult to resist the evidence of the experiments of Mr. Cadbury, who states in the paper above referred to that, while half a grain of the ethereal resin acted energetically, and a cathartic effect was produced by even one-fourth of a grain, the portion insoluble in that menstruum was given in the dose of one grain without any effect whatever. Moreover, this evidence was subsequently confirmed by the experiments of Prof. F. B. Power. (*A. J. P.*, xlvi. 227.) It is asserted by Prof. Power, and confirmed by Prof. Maisch (*Ibid.*, 226), that the purgative principle of podophyllum is soluble in hot water. The researches of Power (*A. J. P.*, 50, p. 369), Maisch, (*P. J. Tr.*, 1880, p. 621), Quereschi (*Ber. Chem. Ges.*, 12, p. 683), and Podwissotsky have established the fact that podophyllum does not contain berberine or any alkaloid, and that its activity is due to principles present in the resins. (See *Podophyllum.*) Resin of podophyllum is a mixture of the active and inert principles of the root. The dose of the officinal resin is from one-eighth of a grain to half a grain (0·008–0·03 Gm.). A small proportion of extract of belladonna or hyoscyamus mitigates its irritant action. Care must be used in handling it in quantity, as it is a powerful irritant, frequently producing conjunctivitis.

RESINA SCAMMONII. *U.S.* *Resin of Scammony.*

(RẸ-ṢĪ′NẠ SCẠM-MŌ′NỊ-Ī.)

Scammoniæ Resina, *Br.;* Resina Scammoniæ, *P.G.;* Résine de Scammonée, *Fr.;* Scammoniaharz, *G.*

"Scammony, in No. 60 powder, *one hundred parts* [or sixteen ounces av.]; Alcohol, Water, each, *a sufficient quantity.* Digest the Scammony with successive portions of boiling Alcohol until exhausted. Mix the tinctures, and reduce the mixture to a syrupy consistence by distilling off the Alcohol. Then add the residue to *two hundred and fifty parts* [or two and a half pints] of Water, separate the precipitate formed, wash it thoroughly with Water, and dry it with a gentle heat." *U. S.*

"Take of Scammony Root, in coarse powder, *eight ounces* [avoirdupois]; Rectified Spirit, Distilled Water, each, *a sufficiency.* Digest the Scammony Root with sixteen fluidounces of the Spirit in a covered vessel, at a gentle heat, for twenty-four hours; then transfer to a percolator, and, when the tincture ceases to pass, add more Spirit and let it percolate slowly until the root is exhausted. Add to the tincture four fluidounces of the Water, and distil off the Spirit by a water-bath. Remove the residue while hot to an open dish, and allow it to become cold. Pour off the supernatant fluid from the resin, wash this several times with hot water, and dry it on a porcelain plate with the heat of a stove or water-bath. It may also be prepared in a similar way from Scammony." *Br.*

The U. S. and British resins, though procured, the former from the gum-resin, the latter from the root of the plant, are nearly identical in their effects. Indeed, the elaborate researches of Professor H. Spirgatis (*A. J. P.*, xlvi. 421) appear to have established the identity of the two products. Mr. A. Hess, however (*Ibid.*, 1875, p. 210), states that the resin obtained from the root contains tannic acid. The advantage of the preparation is that the resin is obtained free from the inert matters with which it is often associated in the scammony of commerce. When pure virgin scammony can be procured, any preparation is unnecessary. Obtained according to the U. S. process, the resin is of a dirty greenish brown color, with a feeble odor and taste of scammony, and is very soluble in ether, alcohol, and boiling proof spirit. When purified with animal charcoal it has a pale brownish yellow color, and is without odor or taste, but retains its purgative property. "Resin of Scammony is wholly soluble in ether. It dissolves in [officinal] solution of potassa, and the heated solution is not precipitated by the addition of hydrochloric acid in excess." *U. S.* The Br. resin is in brownish translucent pieces, with a resinous fracture, and of a sweetish, fragrant odor derived from the root, and wholly different from that of scammony.

The resin of scammony is liable to adulteration. Jalap resin may be detected by its partial insolubility in rectified ether, which dissolves that of scammony in all proportions. Sulphuric acid is the best test of common rosin or colophony, producing instantaneously with this substance an intense red color; while in the resin of scammony it causes no immediate change. For the tests of guaiac, the reader is referred to that article on page 728. (See also *A. J. P.*, xxiv. 158.) In regard to this sophistication, the Br. Pharmacopœia directs that the tincture shall not render the fresh-cut surface of a potato blue. The presence of other resins may be known by yielding precipitates when sulphuric acid is added to their alkaline solution; the resin of scammony agreeing with that of jalap in not affording a precipitate under such circumstances. Mr. Chas. Bullock has found this resin, as well as that of jalap and of podophyllum, to be insoluble in benzol, thus enabling any resin soluble in this liquid, which may be employed in their sophistication, to be readily detected. (*A. J. P.*, 1862, p. 114.) When rubbed with unskimmed milk, the resin of scammony forms a uniform emulsion, undistinguishable from rich milk itself. This is an excellent mode of administration. The resin should always be given either rubbed up with some mild powder, or in emulsion. The dose is from four to eight grains (0·26–0·52 Gm.).

Off. Prep. Extractum Colocynthidis Compositum, *U. S.;* Mistura Scammonii, *Br.*

RHAMNI SUCCUS. *Br.* *Buckthorn Juice.*

(RHĂM'NĪ SŬC'CUS.)

"The recently expressed juice of the ripe berries of common Buckthorn, Rhamnus catharticus. Linn." *Br.*

Suc de Nerprun, *Fr.:* Kreuzdornbeerensaft, *G.*

R. catharticus. Willd. *Sp. Plant.* i. 1092; *B. & T.* 64. For generic and specific characters, see *Frangula*, p. 697.

This shrub flowers in May and June, and ripens its fruit in the latter part of September. The berries and their juice are used. When ripe they are of the size of a pea, round, somewhat flattened at top, black, smooth, shining, with four seeds in a green, juicy parenchyma. Their odor is unpleasant, their taste bitterish, acrid, and nauseous. The expressed juice has the color, odor, and taste of the parenchyma. It is reddened by the acids, and from deep green is rendered light green by the alkalies. Upon standing it soon begins to ferment, and becomes red in consequence of the formation of acetic acid. Evaporated to dryness, with the addition of lime or an alkali, it forms the color called by painters *sap-green.* The dried fruit of another species, *R. infectorius*, yields a rich yellow color, and is employed in the arts under the name of *French berries.*

M. Fleury obtained a peculiar crystallizable principle, which is contained both in the expressed juice and in the residue remaining after expression, and for which he proposed the name of *rhamnin;* but he did not ascertain whether it possessed cathartic properties. (See *Journ. de Pharm.*, xxvii. 666.) Winckler obtained from the ripe fruit a principle which he called *cathartin*, and believes that the rhamnin of Fleury, which was obtained from the unripe berries, is converted into that principle and grape sugar as the fruit matures. (*Chem. Gaz.*, viii. 232.) Lefort (*Journ. de Pharm.*, 1866, p. 420) studied Fleury's rhamnin, and describes it as forming pale yellow, translucent tables. It is scarcely soluble in cold water, soluble in hot alcohol, insoluble in ether or bisulphide of carbon. It is very soluble in caustic alkalies, from which it is precipitated by mineral acids. He gives it the formula $C_{12}H_{12}O_5 + 2H_2O$. Lefort also found a principle, *rhamnegin*, soluble in cold water, but otherwise agreeing in properties with rhamnin. Schützenberger (1868) decomposed rhamnegin, proving it to be a glucoside, having the formula $C_{24}H_{32}O_{14}$, and yielding *rhamnetin*, $C_{12}H_{10}O_5$, and a sugar isomeric with mannit. Schützenberger also finds a body isomeric with rhamnegin, and distinguishes the two as *α rhamnegin* and *β rhamnegin*, which, with Lefort's rhamnin, are present in buckthorn juice.

Liebermann and Hörmann (*Ber. Chem. Ges.*, xi. (1878), pp. 952, 1618) confirm Schützenberger's results, and give the name of *xanthorhamnin* to his *α* rhamnegin. They find his formula $C_{12}H_{10}O_5$ for rhamnetin to be correct, but get results that give for xanthorhamnin rather the formula $C_{48}H_{66}O_{29}$.

Medical Properties and Uses. Both the berries and the expressed juice are actively purgative; but, as they are apt to occasion nausea and severe griping, with much thirst and dryness of the mouth and throat, they are now little employed. They formerly enjoyed considerable reputation as a hydragogue cathartic in dropsy, and were given also in rheumatism and gout. The only shape in which they are now used is that of syrup, which is sometimes added to hydragogue or diuretic mixtures. The dose of the recent berries is about a scruple (1·3 Gm.), of the dried a drachm (3·9 Gm.), of the expressed juice a fluidounce (30 C.c.).

Off. Prep. Syrupus Rhamni, *Br.*

RHEUM. *U.S.* *Rhubarb.*

(RHĒ'ŬM.)

"The root of Rheum officinale, Baillon, and of other undetermined species of Rheum. (*Nat. Ord.* Polygonaceæ.)" *U. S.* "The dried root, deprived of the bark, from one or more undetermined species of Rheum (Linn.), from China, Chinese Tartary, and Thibet. Imported from Shanghai and Canton, and brought overland by way of Moscow." *Br.*

Rhei Radix, *Br.*, Rhubarb Root; Rhabarbarum; Rhubarbe, *Fr.;* Rhabarber, *G.;* Rabarbaro, *It.;* Ruibarbo, *Sp.;* Hainoung, *Chin.;* Schara-modo, *Thibet.*

Gen. Ch. Calyx petaloid, six-parted, withering. *Stamens* about nine, inserted into the base of the calyx. *Styles* three, reflexed. *Stigmas* peltate, entire. *Achenium* three-cornered, winged, with the withered calyx at the base. *Embryo* in the centre of the albumen. *Lindley.*

Notwithstanding the length of time that rhubarb has been in use, it has not yet been determined from what precise plant the Asiatic drug is derived; the remoteness of the region where it is collected, and the jealous care with which the monopoly of the trade is guarded, having prevented accurate information.

The terms *rha* and *rheon*, from the former of which were derived the names *rhabarbarum* and *rhubarb*, and from the latter the botanical title *Rheum*, were applied by the ancients to a root which came from beyond the Bosphorus, and which is supposed, though upon somewhat uncertain grounds, to have been the product of the *Rheum Rhaponticum*, growing on the banks of the Caspian Sea and the Volga. This species was also at one time believed to be the source of the medicine now in use; but the true rhubarb has long been known to be wholly distinct from the Rhapontic, and derived from a different source. It was not till the year 1732 that any probable information was obtained as to its real origin. At that time plants were received from Russia by Jussieu in France, and Rand in England, which were said to be of the species affording the genuine rhubarb, and were named by Linnæus, under this impression, *Rheum Rhabarbarum*, a title which has since given way to *Rheum undulatum.* Subsequently, Kauw Boerhaave obtained from a merchant, who dealt in the rhubarb of Tartary, some seeds which he said were those of the plant producing the root sold by him. These, having been planted, yielded two species of Rheum, *R. undulatum*, and another which Linnæus named *R. palmatum.* Seeds transmitted by Dr. Mounsey from St. Petersburg to Dr. Hope, and planted in the botanic garden at Edinburgh, produced the latter species; and the same was also raised at Upsal from a root received by Linnæus from De Gorter, and was described in 1767 by the younger Linnæus, two years after the appearance of Dr. Hope's paper in the Philosophical Transactions. Thus far the evidence appears equally in favor of *R. palmatum* and *R. undulatum.* Colonel Przewalski has recently reasserted from personal observation that *R. palmatum* produces rhubarb; but the specimens of the root which he brought to St. Petersburg are stated by Prof. Dragendorff to be essentially different from true rhubarb. Claims have also been made from time to time for various other species of Rheum as sources of the drug. Pallas, upon exhibiting the leaves of *R. palmatum* to some Bucharian merchants, was told that the leaves of the rhubarb plant were entirely different in shape; and the description he received of them corresponded more closely with those of *R. compactum*, than of any other known species. Seeds of this plant were, moreover, sent to Miller from St. Petersburg, as those of the true Tartarian rhubarb. Dr. Wallich, superintendent of the botanical garden at Calcutta, received seeds that were said to be those of the plant which yielded the Chinese rhubarb, growing on the Himalaya Mountains and the highlands of Tartary. These produced a species not previously described, which Dr. Wallich named *R. Emodi*, from the native title of the plant. It is the *R. australe* of Mr. Don and of Colebrooke, and has been ascertained to afford a root which, though purgative, is very unlike the officinal rhubarb. In 1867, French missionaries in Southeastern Thibet forwarded to Dr. Soubeiran, of Paris, live specimens of a plant which they assert yields the true rhubarb; and Baillon subsequently described the flowering plant under the name of *R. officinale.* Its root resembles the true rhubarb, but the most careful cultivation has failed to obtain an identical product,[*] and it cannot yet be considered as settled how far the commercial drug is obtained from it.

All the plants of this genus are perennial and herbaceous, with large branching roots, which send forth vigorous stems from four to eight feet or more in height, surrounded at their base with numerous very large petiolate leaves, and terminating in lengthened branching panicles, composed of small and very numerous flowers, resembling those of the Rumex or dock. There is some difficulty in arranging the species, in consequence of the tendency of the cultivated plants to form hybrids; and it is frequently impossible to ascertain to which of the wild types the several garden varieties are to be referred. Lindley states that *R. Rhaponticum*, *R. hybridum*, and *R. compactum*, and their hybrids, are the common garden rhubarbs.[†]

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[*] Senier found that, as raised in England, the root of *R. officinale* yielded less than half the percentage of extract obtained from the East Indian drug. In ten-grain doses the extract was decidedly cathartic.

[†] The following descriptions are from the *Flora Medica* of Dr. Lindley.

Rheum palmatum. Willd. *Sp. Plant.* ii. 489; Lindley, *Flor. Med.* p. 358; Carson, *Illust. of Med. Bot.* ii. 22, pl. 69; *B. & T.* 214. "Leaves roundish-cordate, half palmate; the lobes pinnatifid, acuminate, deep dull green, not wavy, but uneven and very much wrinkled on the upper side, hardly scabrous at the edge, minutely downy on the under side; sinus completely closed; the lobes of the leaf standing forwards beyond it. Petiole pale green, marked with short purple lines, terete, obscurely channelled quite at the upper end. Flowering stems taller than those of any other species."

R. undulatum. Willd. *Sp. Plant.* ii. 489; Lindley, *Flor. Med.* p. 357; Woodv. *Med. Bot.*, 3d ed., v. 81. "Leaves oval, obtuse, extremely wavy, deep green, with veins purple at the base, often shorter than the petiole, distinctly and copiously downy on each side, looking as if frosted when young, scabrous at the edge; sinus open, wedge-shape, with the lower lobes of the leaves turned upwards. Petiole downy, blood-red, semi-cylindrical, with elevated edges to the upper side, which is narrower at the upper than the lower end." This is a native of Siberia, and probably Tartary and China. It was cultivated by the Russian government as the true rhubarb plant; but the culture has been abandoned. It contributes to the rhubarb produced in France.

R. compactum. Willd. *Sp. Plant.* ii. 489; Lindley, *Flor. Med.* p. 358; Carson, *Illust. of Med. Bot.* ii. 24, pl. 71. "Leaves heart-shaped, obtuse, very wavy, deep green, of a thick texture, scabrous at the margin, quite smooth on both sides, glossy and even on the upper side; sinus nearly closed by the parenchyma. Petiole green, hardly tinged with red except at the base, semi-cylindrical, a little compressed at the sides, with the upper side broad, flat, bordered by elevated edges, and of equal breadth at each end." This plant is said to be a native of Tartary and China. It is one of the garden rhubarbs, and has been cultivated in France for its root.

R. australe. Don, *Prod. Flor. Nepal.* p. 75.—*R. Emodi.* Wallich; Lindley, *Flor. Med.* p. 354; Carson, *Illust. of Med. Bot.* ii. 24, pl. 70. "Leaves cordate, acute, dull green, but little wavy, flattish, very much wrinkled, distinctly rough, with coarse short hairs on each side; sinus of the base distinctly open, not wedge-shaped but diverging at an obtuse angle, with the lobes nearly turned upwards. Petioles very rough, rounded-angular, furrowed; with the upper side depressed, bordered by an elevated edge, and very much narrower at the upper than the lower end." The root of this species was at one time conjectured to be the source of officinal Asiatic rhubarb, but has been found to have scarcely any resemblance to it. The plant has been cultivated both in Europe and this country, and its petioles answer well for tarts, etc.

R. Rhaponticum. Willd. *Sp. Plant.* ii. 488; Lindley, *Flor. Med.* p. 357; London's *Encyc. of Plants*, p. 335. "Leaves roundish-ovate, cordate, obtuse, pale green, but little wavy, very concave, even, very slightly downy on the under side, especially near the edge, and on the edge itself; sca-

R. officinale. Baillon—*B. & T.* 213—is described in the *Pharmacographia* "as a perennial, noble plant, resembling the common garden rhubarb, but of larger size. It differs from the latter in several particulars: the leaves spring from a distinct crown rising some inches above the surface of the ground; they have a subcylindrical petiole, which, as well as the veins of the under side of the lamina, is covered with a pubescence of short erect hairs. The lamina, the outline of which is orbicular, cordate at base, is shortly 5- to 7-lobed, with the lobes coarsely and irregularly dentate; it attains 4 to 4½ feet in length, and rather more in breadth. The first leaves in spring display before expanding the peculiar metallic red hue of copper."

Besides the species already mentioned, *R. leucorrhizum*, growing in the Kirghese desert in Tartary, *R. Capsicum* from the Altai Mountains, *R. Webbianum*, *R. speciforme*, and *R. Moorcraftianum*, natives of the Himalaya Mountains, and *R. crassinervium* and *R. hybridum*, cultivated in Europe, but of unknown origin, yield roots which have either been employed as purgatives, or possess properties more or less analogous to those of officinal rhubarb, though they have not entered into general commerce. In Java, the root of an indigenous species is used as a purgative. According to the analysis of J. H. Schmidt, it contains more chrysophan and emodin, and less chrysophanic and rheotannic acids, than does the officinal drug.

Rhubarb is produced abundantly in the elevated lands of Tartary, about the lake Koko Nor, and is said to be cultivated in the neighboring Chinese province of Shen-see, and in that of Setchuen. From these sources it is generally supposed that our supplies of Russian and Chinese rhubarb are exclusively derived; but the root is also collected in Boutan and Thibet, on the north of the Himalaya Mountains; and it is probable that the plant pervades the whole of Chinese Tartary. It flourishes best in a light sandy soil. It is stated by Mr. Bell, who, on a journey from St. Petersburg to Pekin, had an opportunity of observing it in a growing state, that it is not cultivated by the Tartars, but springs up spontaneously, in tufts, wherever the seeds have fallen upon the heaps of loose earth thrown up by the marmots. In other places the thickness of the grass prevents their access to the soil. The root is not considered sufficiently mature for collection till it has attained the age of six years. It is dug up twice a year in Tartary, in the spring and autumn; in China not till the winter. After removal from the ground, it is cleaned, deprived of its cortical portion and the smaller branches, and then divided into pieces of a convenient size. These are bored with holes, and strung upon cords to dry; according to Mr. Bell, about the tents and on the horns of sheep; according to Sievers, under sheds, by which the rays of the sun are excluded, while the air has free access. The Chinese are said first to place the pieces on a stone slab heated by fire beneath, and afterwards to complete the drying process by exposing them to the sun and air. In Boutan the roots are hung up in a kind of drying-room, in which a moderate and regular heat is maintained. Much time and attention are devoted to the preparation of the root; and Sievers states that a year sometimes elapses from the period of its collection, before it is ready for exportation. A large proportion of its weight is lost in drying, according to some accounts four-fifths, to others not less than seven-eighths. It is probably in order to favor the drying that the bark is removed. The trade in rhubarb is said to have formerly centred in the Chinese town of Si-nin, where a Bucharian company or family was established, which possessed a monopoly of this trade, in consideration of a certain tribute paid to the government. At present rhubarb is chiefly purchased for the European trade at the town of Hankow, on the upper Yangtse, the yearly export reaching, it is said, over 5000 peculs (pecul = 133·33 lbs.). There were formerly two varieties of Asiatic rhubarb, the Russian and Chinese, but at present little or no rhubarb finds its way overland to Europe. As long back as 1687, the Russian government subjected the export of

brous at the margin; sinus quite open, large, and cuneate. Petiole depressed, channelled on the upper side, with the edges regularly rounded off, pale green, striated, scarcely scabrous. Panicles very compact and short, always rounded at the ends, and never lax as in the other garden species. Flowering stem about three feet high." The Rhapontic rhubarb grows upon the banks of the Caspian Sea, in the deserts between the Volga and the Oural, and in Siberia. It is said also to grow upon the borders of the Euxine. It is cultivated as a garden plant in Europe and this country; and the root is produced for sale both in France and in England.

rhubarb from China into Russia to official surveillance, and finally monopolized the trade entirely. At Kiachta a very rigorous inspection of the drug was enforced; the selected pieces being finally sewed into linen sacks pitched and coated with hide. All the pieces which did not pass examination were committed to the flames; and the remainder was sent to St. Petersburg. This variety was sometimes called *Turkey Rhubarb*, from the circumstance that it was formerly derived from the Turkish ports, whither it is said to have been brought from Tartary by caravans through Persia and Natolia. The circumstance of the identity of the Russian and Turkey rhubarb, and its decided difference from the Chinese, would appear to indicate a distinct origin for the two varieties. Inferior parcels of the root, which could not pass the inspection of the Russian authorities, were said to enter Russia by Taschkend, and to be known to the druggists of that country by the name of *Taschkend rhubarb*. As Russian rhubarb no longer occurs in commerce, the description of it is given in a foot-note.*

CHINESE RHUBARB (*India Rhubarb*, *Rheum Sinense* vel *Indicum*) is in cylindrical or roundish pieces, sometimes flattened on one or both sides, of a dirty brownish yellow color externally, appearing as if the cortical portion of the root had been removed by scraping, and the surface rendered smooth and somewhat powdery by attrition. The best pieces have a rather close and compact texture, and, when broken, present a ragged uneven surface, variegated with intermingled shades of dull red, yellowish, and white, which are sometimes diversified or interrupted by darker colors, and especially marked with dark lines so arranged as to form an internal ring of star-like spots. The pieces are generally perforated with small holes, intended for convenience of suspension during the drying process; and portions of the suspending cord are not unfrequently found remaining in the holes. Chinese rhubarb has a peculiar somewhat aromatic smell, and a bitter astringent taste, is gritty when chewed, imparts a yellow color to the saliva, and affords a yellowish powder with a reddish brown tinge. With the pieces of good quality others often come mingled, defective from decay or improper preparation. These are usually lighter, and of a dark or russet color. Like all the other varieties of rhubarb, this is liable to be attacked by worms; and in almost every large parcel pieces may be found which have suffered from this cause.†

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* The pieces of Russian rhubarb are irregular and somewhat angular, appearing as if the bark had been shaved off longitudinally by successive strokes of a knife, and a portion of the interior substance removed with each shaving. They have a cleaner and fresher appearance than the Chinese, and their color both internally and externally, though of the same general character, is somewhat more lively. They are less compact and heavy; and are cut with less facility, owing to their giving way before the knife. Another distinction is the character of the perforations, which in the Russian rhubarb are large, frequently reaching only to the centre, and evidently made for the purpose of inspection; while in the Chinese they are small, penetrate completely through the pieces, and were intended for the passago of a suspending cord. The taste and smell of the former closely resemble those of the latter, except that the Russian is rather more aromatic. There is the same crackling under the teeth, and the same yellow stain imparted to the saliva; but the color of the powder in this variety is a bright yellow, without the brownish tinge exhibited by the Chinese. When thin slices, previously boiled in water, are examined by the microscope, they exhibit numerous clusters of minute crystals of oxalate of calcium. Mr. Quekett found between 35 and 40 grains of them in 100 grains of the root. They are observed both in Russian and Chinese rhubarb. For further information as to the varieties of Russian rhubarb, see *A. J. P.*, 1867, p. 212, or abstract in 14th edition U. S. D.

† In former editions of this work a variety of rhubarb imported from Canton has been noticed, which was evidently prepared, before leaving China, so as to resemble the Russian, having an angular surface as if pared with a knife. The pieces were obviously selected with great care, as they were remarkably free from defects. But in most of those which came under our notice, the small penetrating hole was observable, which characterizes the Chinese rhubarb, though it had in some instances been filled with the powdered root, so as in some measure to conceal it. Besides, the colors were not quite so bright as those of Russian rhubarb. This is undoubtedly the variety described by Pereira, under a distinct head, as the *Dutch-trimmed* or *Batavian rhubarb*, and considered by him as probably Bucharian or Russian rhubarb of inferior quality, sent by the way of Canton. A sufficient proof, we think, that this is not the case, is the presence in most pieces of the small penetrating hole, occasionally filled with the remains of the cord, and in some pieces almost shaved away in the paring process. We have never seen such a hole in any piece of true Russian rhubarb, which does not appear to be strung up like the Chinese when dried.

Under the title of *Canton stick rhubarb*, Pereira describes a variety of which small quantities have been imported from Canton into London. It closely resembles the English stick rhubarb, and is supposed to be derived from the branches of the root of the plant which yields the true Chinese rhubarb.

European Rhubarb. In various parts of Europe, particularly in England, France, Belgium, and Germany, the rhubarb plants have been cultivated for many years; and considerable quantities of the root were at one time brought into the market. At present it appears not to be imported.

English Rhubarb. This formerly came in two forms. In one the root was cut and perforated in imitation of the Russian. The pieces were of various shape and size, sometimes cylindrical, but more commonly flat, or somewhat lenticular, and of considerable dimensions. In the other, the so-called *stick rhubarb*, the pieces were somewhat cylindrical, five or six inches long by an inch or less in thickness, and more or less irregular upon the surface, as if they had shrunk unequally in drying. English rhubarb is lighter than the Asiatic, more spongy, and often somewhat pasty under the pestle. It is redder, and when broken exhibits a more compact and regular marbling; the pinkish lines being arranged like rays from the centre towards the circumference. The "star-like spots" are either wanting or very few and scattered. The powder also has a deeper reddish tint. The odor is feeble and less aromatic than that of the Asiatic varieties; the taste is astringent and mucilaginous with little bitterness; and the root, when chewed, scarcely feels gritty between the teeth, and but slightly colors the saliva. Few crystals of oxalate of calcium are discoverable by means of the microscope. Considerable quantities of rhubarb are yearly produced by Mr. Rufus Usher, near Banbury, but even in London it can scarcely be bought. It is probable that the powder is used to adulterate that of true rhubarb.

French Rhubarb. Rhapontic Rhubarb. Crimea Rhubarb. The rhubarb produced in France is, according to Guibourt, chiefly from *R. Rhaponticum*, *R. undulatum*, and *R. compactum;* that of *R. palmatum*, which most closely resembles the Asiatic, having been found to degenerate so much as not to be a profitable object of culture. Most of the French rhubarb is produced in the neighborhood of L'Orient, in the department of Morbihan; and the spot where it grows has, from this circumstance, received the name of *Rheumpole.* Two kinds were described by Guibourt, both under the name of *Rhapontic root*,*—one proceeding from the *R. Rhaponticum*, growing in the gardens in the environs of Paris; the other, from this and the two other species above mentioned, cultivated at Rheumpole; but, according to the authors of the *Pharmacographia*, the cultivation in France has been almost entirely abandoned.†

Choice of Rhubarb. In selecting good rhubarb, without reference to the commercial variety, those pieces should be preferred which are moderately heavy and compact, of a lively color, brittle, presenting when broken a fresh appearance, with reddish and yellowish veins intermingled with white, of an odor decidedly aromatic, of a bitter and astringent not mucilaginous taste, feeling gritty and staining the saliva yellow when chewed, and affording a powder either bright yellow, or yellow with but a slight reddish brown tinge. When very light, rhubarb is usually rotten or worm-

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* M. E. Billot gives the following method of detecting the rhapontic root, when used in powder to adulterate Russian or Chinese rhubarb. On a little of the suspected powder, upon a plate, let fall two or three drops of oil of anise, oil of fennel, or other essential oil; then add magnesia, and rub the mixture well for three or four minutes. If the powder be pure, it will remain yellow; but if it contain the smallest quantity of the French rhapontic root, it will assume a reddish tint, varying from a salmon to a bright rose color, according to the quantity of the impurity present. (See *A. J. P.*, May, 1860, p. 224.)

† Besides the varieties of rhubarb above described, others are noticed by writers. Pallas speaks of a *white rhubarb*, brought to Kiachta by the Bucharian merchants, who conveyed to that place the drug for Russian commerce. It was white as milk, of a sweet taste, and equal to the best rhubarb in quality. It was supposed to be the product of *R. leucorrhizum.* At present, however, it is unknown in St. Petersburg. The *Himalaya rhubarb* is produced by *R. australe*, and other species mentioned in the text as growing in the Himalaya Mountains. According to Dr. Royle, it makes its way to the lower countries in Hindostan, where it sells for one-tenth of the price of the best rhubarb. Mr. Twining tried it in the Hospital at Calcutta, and found it superior as a tonic and astringent to Russian rhubarb, and nearly equal to it in purgative power. A variety known in Russia as *Bucharian rhubarb*, differing from the variety which we call Russian, and which is known in Russia as Chinese rhubarb, is imported into that country from Tartary, and reaches St. Petersburg by Nishni Novgorod. Parcels of it are said also to reach Vienna, by the way of Brody in Gallicia. Still another variety is that called *Siberian rhubarb*, which is known in Russia by the name *Siberian Rhapontic root.* As these are inferior kinds, and probably never reach our markets, we have not thought it necessary to discuss them in detail. For further information, see *A. J. P.* (xviii. 63 and 123).

eaten; when very heavy and compact, it is of inferior species, culture, or preparation. Rotten, worm-eaten, or otherwise inferior rhubarb is often powdered, and colored yellow with turmeric; and the shavings left when Chinese rhubarb is trimmed for powdering, or to imitate the Russian, are applied to the same purpose. Rhubarb is officinally described as "in cylindrical, conical, or flattish segments, deprived of the dark brown, corky layer, smoothish or somewhat wrinkled, externally bright yellowish brown, marked with white, elongated meshes, containing a white, rather spongy tissue, and a number of short, reddish brown or brownish yellow striæ; compact, hard; fracture uneven; internally white, with numerous, red, irregularly curved and interrupted medullary rays, which are radially parallel only near the cambium line; of a peculiar aromatic odor, gritty between the teeth, and of a bitter, somewhat astringent taste." *U. S.*

Chemical Properties. Rhubarb yields all its activity to water and alcohol. The infusion is of a dark reddish yellow color, with the taste and odor of rhubarb; and the residue, after sufficient maceration, is whitish, inodorous, and insipid. By long boiling, the virtues of the medicine are impaired. The first examination of rhubarb yielding results of value was that of Schlossberger and Döpping. Besides extractive, tannic and gallic acids, sugar, starch, pectin, lignin, oxalate of calcium, and various inorganic salts, they discovered three coloring principles, holding an intermediate place between resin and extractive matter, being freely soluble in alcohol, and slightly so in water. Two of these were uncrystallizable, and denominated *brown resin* and *red resin*, or *phæoretin* and *erythroretin;* the other, crystallizable in granular crystals, and identical with *chrysophanic acid*, previously discovered by Rochleder and Heldt in the yellow lichen, or *Parmelia parietina* of Sprengel. Another resinous substance was also obtained, which was named *aporetin;* but, as it was insoluble in the alcohol from which it had been precipitated by ether, and was isomeric with phæoretin, there is reason to think that it was a product of the operation. Chrysophanic acid crystallizes in golden yellow needles or plates, and is soluble in ether, alcohol, or benzol. Alkalies also dissolve it, forming fine dark red solutions. Its formula is $C_{15}H_{10}O_4$, and it is now recognized as a derivation of anthracene, $C_{14}H_{10}$, and as closely related to alizarine, $C_{14}H_8O_4$. (See *Chrysarobinum.*)

De La Rue and Müller (*Jour. Chem. Soc.*, x., p. 298) extracted from rhubarb an allied substance, *emodin*, which crystallizes in orange-colored prisms. Its formula is $C_{15}H_{10}O_5$. The relations of both this compound and chrysophanic acid to alizarine and anthracene will be better shown by writing their molecular formulas, as follows:

$C_{14}H_{10}$.	$C_{14}H_6(OH)_2O_2$.	$C_{14}H_5(CH_3)(OH)_2O_2$.	$C_{14}H_4(CH_3)(OH)_3O_2$.
Anthracene.	Alizarine.	Chrysophanic acid.	Emodin.

Kubly (*Zeitschrift Pharm. Russland*, 6, p. 603) has obtained results both confirmatory and explanatory of those already given. He finds a glucoside, *chrysophan*, which, under the influence of dilute acids or ferments, splits up into chrysophanic acid and sugar: also a characteristic tannic acid, *rheo-tannic acid*, $C_{26}H_{26}O_{14}$, which is decomposed by dilute acids into *rheumic acid*, $C_{20}H_{16}O_9$, and sugar. Chrysophan is a yellowish powder, abundantly present in rhubarb, soluble in water or alcohol, not in ether; rheo-tannic acid is a reddish brown powder, sparingly soluble in cold water. Kubly finds further a colorless neutral compound, sparingly soluble in hot water, of the formula $C_{10}H_{12}O_4$, which he does not name. Dragendorff states that from 11 to 17 per cent. of arabic acid and pectose are present.

There are other interesting principles in rhubarb. Some have been disposed to ascribe its odor to a volatile oil; but this has not been isolated. The oxalate of calcium is interesting from its quantity, and from the circumstance that, existing in distinct crystals, it occasions the grittiness of the rhubarb between the teeth. The proportion seems to vary exceedingly in different specimens. According to Scheele and Henry, it constitutes nearly one-third, and Quekett found between 35 and 40 per cent.; while Brandes obtained only 11, Schrader only 4·5 parts in the hundred, and Dragendorff, in five samples analyzed, from 1·2 to 5·6 per cent. Little or no difference of composition has been found between the Russian and Chinese rhubarb. The European contains but a small proportion of oxalate of calcium, and is therefore less gritty when chewed. It has, however, more tannin and starch than the Asiatic.

When powdered rhubarb is heated, odorous yellow fumes rise, which are probably in part the vapor of chrysophanic acid. Its infusion is reddened by the alkalies, in consequence of their union with this acid, and their reaction on the other coloring principles. It yields precipitates with gelatin, most of the acids, ferric salts, acetate of lead, mercurous nitrate, nitrate of silver, stannous chloride, lime-water, and solutions of quinine. Nitric acid occasions at first a turbidness, and afterwards the deposition of a yellow precipitate. The substances producing precipitates may be considered as incompatible with the infusion.*

Medical Properties and Uses. The medical properties of rhubarb are peculiar and valuable. Its most remarkable singularity is the union of a cathartic with an astringent power; the latter of which, however, does not interfere with the former, as the purgative effect precedes the astringent. It is also tonic and stomachic; invigorating, in small doses, the process of digestion. It is not probable that these properties reside in a single proximate principle; and, as rhubarb owes its chief value to their combination, it is not to be expected that chemical analysis will be productive of the same practical advantages in this, as in some other medicines, the virtues of which are concentrated in one ingredient. In its purgative operation, rhubarb is moderate, producing fæcal rather than watery discharges, and appearing to affect the muscular fibre more than the secretory function. It sometimes occasions griping. Its coloring principle is absorbed, and may be detected in the urine. By its long-continued use, the perspiration, especially that of the axilla, is said to become yellow, and the milk of nurses cathartic. It gives a yellow color to the alvine discharges.

The conditions of disease to which it is applicable may be inferred from its peculiar properties. When the stomach is enfeebled, or the bowels relaxed, at the same time that a gentle cathartic is required, rhubarb, as a general rule, is preferable to all others. Hence its use in dyspepsia attended with constipation, in diarrhœa when purging is indicated, in the secondary stages of cholera infantum, in chronic dysentery, and in almost all typhous diseases when fæcal matter has accumulated in the intestines, or the use of cathartic medicine is necessary to prevent such accumulation. When employed in cases of habitual constipation, its astringent tendency should be counteracted by combining it with soap. Magnesia is also an excellent associate in disorders of the stomach and bowels. By combination with other cathartics, rhubarb frequently acquires additional activity, while it gives increased efficiency to the associated substance. A mixture of calomel and rhubarb is a brisk and powerful cathartic, often used at the commencement of bilious fevers. As a general rule, rhubarb is not applicable to cases attended with much inflammatory action. Its griping effect may be counteracted by combining it with aromatics.

The dose of rhubarb as a purgative is from twenty to thirty grains (1·3–1·95 Gm.), as a laxative and stomachic from five to ten grains (0·33–0·65 Gm.). European rhubarb must be given in double or treble the dose to produce an equal effect. Few medicines are used in a greater variety of forms. It is most effectual in substance. It is frequently given in the shape of pill, combined with an equal proportion of soap, when its laxative effect is desired. The infusion is much used in cases of delicate stomach, and is peculiarly adapted to children. The syrup, tincture, and fluid extract are also useful preparations. They are all officinal.

By the roasting of rhubarb its cathartic property is diminished, probably by the volatilization of the purgative principle, while its astringency remains unaffected. This mode of treatment has, therefore, been sometimes resorted to in cases of diarrhœa. By long boiling the same effect is said to be produced.

Powdered rhubarb has been usefully applied to indolent and sloughing ulcers. It is said to have proved purgative when sprinkled over a large ulcerated surface; and the same effect is asserted to have been produced by rubbing it, mingled with saliva, over the abdomen.

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* For a method of detecting the presence of turmeric in powdered rhubarb by the influence of chloroform on the coloring principles of each of these substances, and of distinguishing through the same agency between the true Chinese rhubarb and that of European origin, the reader is referred to a paper, by Mr. W. L. Howie, contained in *A. J. P.* (Jan. 1874, p. 16); from *P. J. Tr.* (Nov. 15, 1873).

Off. Prep. Extractum Rhei; Extractum Rhei Fluidum, *U. S.;* Infusum Rhei, *Br.;* Pilulæ Rhei, *U. S.;* Pilulæ Rhei Comp.; Pulvis Rhei Comp.; Syrupus Rhei, *Br.;* Syrupus Rhei Aromaticus, *U. S.;* Tinctura Rhei; Tinctura Rhei Aromatica, *U. S.;* Tinctura Rhei Dulcis, *U. S.;* Vinum Rhei.

RHŒADOS PETALA. *Br.* *Red-Poppy Petals.*

(RHŒ'Ạ-DŎS PĔT'Ạ-LẠ—rē'ạ-dŏs.)

"The fresh petals of Papaver Rhœas. Linn. From indigenous plants." *Br.*

Flores Rhœados, *P.G.;* Corn Poppy, Corn Rose; Pavot rouge, Coquelicot, *Fr.;* Wilder Mohn, Klapperrose, Klatschrosen, *G.;* Rosoluccio, *It.;* Amapola, *Sp.*

Papaver Rhœas. Willd. *Sp. Plant.* ii. 1146; *B. & T.* 19. The *red* or *corn poppy* is distinguished by its hairy stem, which is branched, and rises about a foot in height, by its incised pinnatifid leaves, by its urn-shaped capsule, and by the full, bright, scarlet color of its petals. It is a native of Europe, where it grows wild in great abundance, adorning especially the fields of grain with its brilliant flower. It has been naturalized in this country.

Its capsules contain the same kind of milky juice as that found in *P. somniferum*, and an extract has been prepared from them having the properties of opium; but the quantity is too small to repay the trouble of its preparation. M. Filhol has shown that the extract contains morphine, but in a proportion exceedingly minute compared with that in which it exists in opium. (*Journ. de Pharm.*, ii. 513.) The petals are the officinal portion. They have a narcotic smell, and a mucilaginous, slightly bitter taste. By drying, they lose their odor, and assume a violet-red color. Chevallier believed that he had detected a very minute proportion of morphine in an extract obtained from them; but Prof. Attfield seems to have determined satisfactorily the non-existence of morphine in the petals, having sought this alkaloid by three different processes, using a pound of the petals in each experiment, and failed to detect the least evidence of its presence. (*P. J. Tr.*, Oct. 1873, p. 291.) Their operation on the system is exceedingly feeble, and they are valued more for their beautiful scarlet color, which they communicate to water, than for their medical virtues. According to Leo Meier, the coloring principles of the flowers are two acids, which he denominates *rhœadic* and *papaveric acids.* (See *A. J. P.*, xviii. 211.) A syrup is prepared from them, which was formerly prescribed as an anodyne in catarrhal affections, but is now little esteemed except for its color.

An alkaloid has been discovered in this species of poppy by O. Hesse, who proposes to name it *rhœadine.* It seems to pervade all parts of the plant, from which, as the first step in its preparation, a watery extract is prepared. This is treated with carbonate of sodium, and repeatedly agitated with ether; the ethereal liquid is shaken with a solution of bitartrate of sodium; and the mixture is precipitated by ammonia. The precipitate is washed with cold water, dried, and boiled with alcohol, by which coloring matter and another alkaloid in small quantity, probably thebaine, are removed. The residue, consisting mainly of rhœadine, is purified by combining it with acetic acid, treating with animal charcoal, and precipitating with ammonia. The alkaloid is in small white prismatic crystals, tasteless, fusible at 232·2° C. (450° F.), becoming brown at the same temperature and partially subliming. It is almost insoluble in water, alcohol, ether, chloroform, benzol, ammonia, solution of carbonate of sodium, and lime-water, but is dissolved by dilute acids, which produce colorless solutions. Its composition is represented by the formula $C_{21}H_{21}NO_6$. It does not appear to be poisonous. Hydrochloric and sulphuric acids, moderately concentrated, decompose and dissolve it, with the production of a purple color, which disappears under the action of the alkalies, but is restored by acids. One part of the alkaloid produces a purple color with 10,000 parts of water, an intense rose color with 20,000 parts, and a perceptible redness with 800,000 parts. This is a very delicate test, by means of which the alkaloid may be detected in all parts of *Papaver Rhœas*, in the ripe capsules of the opium poppy, and in opium itself. It is said also to exist in Merck's porphyroxine. (*A. J. P.*, 1867, p. 122.) According to Hesse, the milky juice also contains *meconic acid.*

Off. Prep. Syrupus Rhœados, *Br.*

RHUS GLABRA. *U. S.* *Rhus Glabra.*

(RHŬS GLĀ'BRẠ.)

"The fruit of Rhus glabra. Linné. (*Nat. Ord.* Terebinthaceæ, Anacardieæ.)" *U. S.*
Rhus Glabrum, *U. S.* 1870; Sumach; Sumac, *Fr.;* Sumach, *G.*

Gen. Ch. Calyx five-parted. *Petals* five. *Berry* small, with one nuciform seed. *Nuttall.*

Rhus glabrum. Willd. *Sp. Plant.* i. 1478. This species of Rhus, called variously *smooth sumach, Pennsylvania sumach,* and *upland sumach,* is an indigenous shrub from four to twelve feet or more in height, with a stem usually more or less bent, and divided into straggling branches, covered with a smooth, light gray, or somewhat reddish bark. The leaves are upon smooth petioles, and consist of many pairs of opposite leaflets, with an odd one at the extremity, all of which are lanceolate, acuminate, acutely serrate, glabrous, green on their upper surface, and whitish beneath. In the autumn their color changes to a beautiful red. The flowers are greenish red, and disposed in large, erect, terminal compound thyrses. The fruit is in clusters of small crimson berries, which are officinally described as "sub-globular, about one-eighth of an inch (3 mm.) in diameter, drupaceous, crimson, densely hairy, containing a roundish-oblong, smooth putamen." *U. S.*

The shrub is found in almost all parts of the United States, growing in old neglected fields, along fences, and on the borders of woods. The flowers appear in July, and the fruit ripens in the early part of autumn. The bark and leaves are astringent, and are largely used, especially the leaves, in tanning leather and in dyeing. Mr. W. J. Watson found, in the bark of the root, albumen, gum, starch, tannic and gallic acids, caoutchouc, resin, coloring matter, and evidences of volatile oil. (*A. J. P.*, xxv. 194.) Excrescences are produced under the leaves resembling galls in character, and containing large quantities of tannic and gallic acids. These have been used as a substitute for the imported galls by Dr. Walters, of New York, who thought them in every respect preferable. They may be collected at little expense; as they are produced very abundantly, especially in the Western States. From the experiments of Dr. Stenhouse, it appears that the tannic acid of sumach is identical with that of galls, being, like it, resolved, under the influence of sulphuric acid, into glucose and gallic acid; and this change is supposed to take place spontaneously in sumach when long kept. (*Ibid.*, xxxiv. 252.)

The berries have a sour, astringent, not unpleasant taste, and are often eaten by the country-people with impunity. According to Mr. Cozzens, of New York, the malic acid is contained in the pubescence which covers their surface; as, when it is washed away by warm water, the berries are wholly free from acidity. Professor W. B. Rogers found the acid to be combined with lime,* as acid malate. Mr. W. J. Watson ascertained that free malic acid and acid malate of calcium coexist in the berries, which contain also, upon the same authority, tannic and gallic acids, fixed oil, extractive, red coloring matter, and a little volatile oil. A wine has been prepared from the fruit by adding sugar to an infusion and fermenting, which is spoken of by Dr. John H. Griscom, of New York, as a valuable remedy. (*Med. and Surg. Reporter*, Feb. 9, 1867, p. 118.)

Medical Properties and Uses. Sumach berries are astringent and refrigerant. A strong decoction, or the fluid extract diluted, affords a very effective and pleasant gargle in inflammation and ulceration of the throat, especially in combination with the chlorate of potassium.

Off. Prep. Extractum Rhois Glabræ Fluidum, *U. S.*

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* Prof. Procter obtained from the berries malic acid by the following process. Pour boiling water on the ripe berries; macerate for twelve hours; strain, evaporate to one-fourth, and again strain; resume the evaporation and continue it till the liquid assumes the consistence of thin syrup; then set it aside to crystallize. Wash the crystals of acid malate of calcium with a little water, and recrystallize from a boiling solution. Dissolve the salt in hot water, and decompose it with a solution of acetate of lead. Wash the precipitated malate of lead, suspend it in water, and pass sulphuretted hydrogen through the liquid until the whole of the lead is separated. Lastly, filter, and evaporate to dryness in a porcelain vessel.

RHUS TOXICODENDRON. *U. S.* *Rhus Toxicodendron.*

(RHŬS TŎX-Ị-CỌ-DĔN′DRỌN.)

"The fresh leaves of Rhus Toxicodendron,* Michaux, Rhus Toxicodendron and Rhus radicans, Linné. (*Nat. Ord.* Terebinthaceæ, Anacardicæ.)" *U. S.*

Toxicodendron, *U. S.* 1870; **Sumach vénéneux,** *Fr.;* **Gift-Sumach,** *G.;* **Albero del Veleno,** *It.*

R. Toxicodendron, Linn., or poison-oak, has the form of a shrub from one to three feet high, with leaflets angularly indented, and pubescent beneath. But this character of the foliage is probably not constant; and the stunted growth may be owing to peculiarities of situation. Dr. Bigelow states that the young plants of *R. radicans* do not put forth rooting fibres until several years old, and are influenced in this respect by the contiguity of supporting objects.†

The leaves are officinally described as "long, petiolate, trifoliate; the lateral leaflets sessile, about four inches (10 cm.) long, obliquely ovate, pointed; the terminal leaflets stalked, ovate or oval, pointed, with a wedge-shaped base; the leaflets entire and glabrous (in *Rhus radicans*, L.), or variously notched, coarsely toothed or lobed, downy beneath (in *Rhus Toxicodendron*, L.); when dry, papery and brittle; inodorous, somewhat astringent and acrid. Rhus Toxicodendron should not be confounded with the leaves of *Ptelea trifoliata*, Linné, which are similar in appearance, but have all the leaflets sessile." *U. S.*

This species of Rhus grows in woods, fields, and along fences from Canada to Georgia. It flowers in June and July. When wounded it emits a milky juice, which becomes black on exposure to the air, and leaves upon linen or other cloth a stain, which cannot afterwards be removed by washing with soap and water, or by alcohol either hot or cold, but deepens by age. It has been proposed as an indelible ink. Ether dissolves it.

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* There are four indigenous species of Rhus, which are poisonous,—*R. toxicodendron*, *R. venenata*, *R. pumila*, and *R. diversiloba*.

R. venenata, D. C. (syn. *R. vernix*, L.) *Swamp sumach* is a beautiful shrub or small tree, usually ten or fifteen feet high, but sometimes thirty feet. The bark of the trunk is dark gray, of the branches lighter, of the extreme twigs and petioles beautifully red. The leaves are pinnate, with four or five pairs of opposite leaflets, and an odd terminal one. These are oblong or oval, entire or slightly sinuated, acuminate, smooth, and, except the one at the end, nearly sessile. The flowers are diœcious. They are very small, greenish, and in loose axillary panicles. The berries are small, roundish, and greenish white. The tree grows in swamps and low grounds, from Canada to Carolina, and flowers in June and July. It is thought to be identical with a species of Rhus which grows in Japan and furnishes a fine black varnish much used in that country. Dr. Bigelow found that the opaque whitish juice which exudes from our native plant when wounded, and which becomes permanently black on exposure, may be made to afford a brilliant, glossy, durable varnish, by boiling it sufficiently before applying it.

R. venenata is more poisonous than *R. toxicodendron*. Persons coming within its influence are more apt to be affected with the poison, and generally suffer more severely. The whole body is sometimes enormously swollen, and the patient for many days scarcely able to move; but the complaint almost always spontaneously subsides without destroying life. The susceptibility to the influence of the poison is exceedingly various, and some persons handle the plant with impunity.

Rhus pumila, Michaux, is a southern species, growing in upper Carolina, and not more than a foot in height. It is characterized by its pubescent branches and petioles; its pinnate leaves, with many pairs of oval, nearly acuminate, incised-dentate leaflets, downy beneath; and by its silky fruit. According to Pursh, it is the most poisonous of the genus.

Rhus diversiloba, Torrey & Gray (syn. *R. lobata*. Hooker, *Flor. Bor. Am.* i. 127, t. 46), has a somewhat climbing stem, with short, leafy branches. The leaves have three or rarely five leaflets, which are very obtuse, in the female plant slightly, in the male rather deeply pinnately lobed, the lobes being very obtuse, and the incisions acute. The flowers are in axillary, racemose panicles often shorter than the petioles, and the fruit white, somewhat pubescent, and subglobose. The leaves in the male and female plant are so different that they might readily be mistaken for different species. (*Torrey & Gray.*) Though generally a shrub, the plant sometimes climbs over large trees and has a stem six inches in diameter. The poisonous effects of this plant are described by Dr. C. A. Canfield (*A. J. P.*, 1860, p. 412), who found an invariable antidote to its effects in another California plant, *Grindelia hirsutula*, applied to the part either simply bruised or in the form of strong decoction.

† *R. radicans*, L., is a variety of this plant, and not a distinct species. The difference, however, in their appearance is sufficient to have led to the adoption of different common names; R. radicans being called *poison vine* or *poison ivy*, and R. Toxicodendron *poison-oak*. The former has a climbing stem, rising to a great height upon trees, rocks, and other objects, to which it adheres by strong rooting fibres, which it throws out from its sides. The leaves, which stand upon long footstalks, are ternate, with broad-ovate or rhomboidal, acute leaflets, smooth and shining on both sides, sometimes slightly hairy on the veins beneath, entire, or irregularly lobed and toothed. The flowers are small, greenish white, diœcious, and grow in lateral, usually axillary panicles, or compound racemes. The male flowers have five stamens, and the rudiments of a style; the female, which are of only half the size, have abortive stamens, and a short erect style, standing on a roundish germ, and terminating in three stigmas. The berries are roundish, pale green, or whitish.

The juice is at first milky, but darkens on exposure; applied to the skin it frequently causes inflammation and vesication; and even its emanations produce in certain persons, when they come into the vicinity of the plant, an exceedingly troublesome erysipelatoid affection, particularly of the face. Itching, redness, a sense of burning, tumefaction, vesication, and ultimate desquamation, are some of the attendants of this poisonous action. The swelling of the face is sometimes so great as almost entirely to obliterate the features. The effects are experienced soon after exposure, and usually begin to decline within a week. A light, cooling regimen, with saline purgatives, and the local use of cold lead-water, are the best remedies. Alkaline applications would seem to be indicated by the discovery of toxicodendric acid as a constituent of the plant, and the probable cause of the eruption. Dr. A. Livezey, of Lumberville, Penna., strongly recommends a saturated tincture of lobelia as a local application in this affection. He applies it by means of linen or muslin cloths, and believes that it arrests the inflammation. (*Boston Med. and Surg. Journ.*, lv. 262.) According to the late Prof. Procter, who was himself very susceptible to this poison, a weak alkaline solution, applied immediately after exposure, seldom fails to prevent the effects; and after the vesicles are formed, he has found that Monsel's solution (*Liq. Ferri Subsulphatis*, U. S.), introduced by a pointed instrument into the vesicle, renders it abortive. (*A. J. P.*, Nov. 1863, p. 506.) Analyzed by Dr. Joseph Khittel, the leaves yielded tannic acid of the variety which gives greenish precipitates with salts of iron, chlorophyll, wax, fixed oil, resin, sugar, albumen, gum, pectin, starch, oxalic acid, a peculiar neutral substance, and a *volatile alkaloid*, on which the poisonous properties of the plant were supposed to depend. (*A. J. P.*, 1858, p. 544.) This supposed alkaloid probably does not exist. Prof. Maisch has shown that the activity of the plant depends upon an acid (*toxicodendric acid*). To obtain this acid, the leaves were bruised with six per cent. of slaked lime, and after maceration with water were expressed. The expressed liquid, having been mixed with an excess of sulphuric acid, was distilled, and the vapors were condensed, partly by themselves, so as to obtain the pure acid, and partly in water containing carbonate of barium in suspension, so as to get the toxicodendrate of barium. The acid solution thus obtained is colorless, strongly reddens litmus paper, and neutralizes bases. For further particulars, see *A. J. P.*, Jan. 1866, p. 4.

Medical Properties and Uses. The leaves of *Rhus Toxicodendron* appear to be stimulant and narcotic, producing when swallowed irritation of the stomach and bowels. They have been used in palsy, nocturnal incontinence, and cutaneous diseases with asserted success, but the practice has found no recent imitators, and the remedy is a dangerous and probably useless one. A teacupful of a strong infusion has been administered without evil results by Dr. Horsfield. An extract has been given in enormous doses in France; its inertness probably being the result of the dissipation of the volatile principle during its preparation.

Two instances of poisoning by the internal use of the plant have been recorded; one by the fruit (*Am. Journ. Med. Sci.*, April, 1866); one by the root (*Med. and Surg. Rep.*, Nov. 1867). In the first instance, in which nearly a pint of the fruit had been eaten by two children, one six and the other eight years old, after a few hours from the swallowing of the poison, drowsiness and stupor came on, soon followed by vomiting, first of the partially digested fruit, and afterwards of a thick viscid fluid of a wine color. This was succeeded by convulsive movements of different parts of the body, with slight delirium. The pupils were dilated. The respiration was hurried, the pulse at first full and strong, but afterwards slow, small, frequent, and feeble. The vomiting was promoted by the use of warm water; and carbonate of sodium was then given freely in solution as an antidote. Both children recovered. In the cases in which an infusion of the root was taken, one, a boy of twelve years, was covered with an eruption over the body, which was especially vesicular in the face, with a dry, hoarse cough, soreness of throat, burning sensations extending to the stomach, high fever, a coated tongue, scanty, high-colored, and irritating urine, nervous twitchings, and occasional wandering. The diagnosis, somewhat difficult at first, became easy on the occurrence of two other cases, girls respectively of fifteen and seventeen, who with their brother, the boy just mentioned, had been drinking of the infusion referred to. They were treated by saline cathartics in small doses, the local use of lead-water, and an improved diet, and all recovered, with general desquamation.

ROSÆ CANINÆ FRUCTUS. *Br.* *Fruit of the Dog Rose.* *Hips.*

(RŌ′ṢÆ CẠ-NĪ′NÆ FRŬC′TŬS.)

"The ripe fruit of the Dog Rose, Rosa canina (Linn.), and other indigenous allied species." *Br.*

Cynosbata, Fructus Cynosbati; Gratte-cul, Cynorrhodon, Rose sauvage, *Fr.;* Hagebutten, Hainbutten, Hundsrose, *G.*

Rosa. See *Rosa centifolia.*

Rosa canina. Willd. *Sp. Plant.* ii. 1077; *B. & T.* 103. The *dog rose, wild brier*, or *hep-tree*, is a native of Europe, and distinguished as a species by its glabrous ovate ovaries, smooth peduncles, prickly stem and petioles, and ovate, smooth, rigid leaves. It is eight or ten feet high, and bears white or pale red flowers, having usually five obcordate fragrant petals. The plant has been introduced into this country, but is not much cultivated. The fruit is fleshy, smooth, oval, red, and of a pleasant, sweet, acidulous taste. It contains 30 per cent. of sugar, uncombined citric and malic acids, and salts of these acids. The pulp, separated from the seeds and the silky bristles in which they are embedded, is employed in Europe for the preparation of a confection used chiefly as an agreeable vehicle.

Off. Prep. Confectio Rosæ Caninæ, *Br.*

ROSA CENTIFOLIA. *U.S.* *Pale Rose.*

(RŌ′ṢẠ CĔN-TỊ-FŌ′LỊ-Ạ.)

"The petals of Rosa centifolia. Linné. (*Nat. Ord.* Rosaceæ, Roseæ.) When it is desired to keep fresh Pale Rose for some time, it may be preserved by mixing it well with half its weight of chloride of sodium, pressing the mixture in a suitable jar and keeping it, well closed, in a cool place." *U. S.* "The fresh petals, fully expanded, of Rosa centifolia. Linn. From plants cultivated in Britain." *Br.*

Rosæ Centifoliæ Petala, *Br.;* Cabbage-rose Petals; Flores Rosæ, *P.G.;* Flores Rosarum Incarnatarum; Rose pâle, Roses à cent feuilles, *Fr.;* Hundertblätterige Rose, Rosenblätter, *G.;* Rosa pallida, *It.;* Rosa de Alexandria, *Sp.*

Gen. Ch. Petals five. *Calyx* urceolate, five-cleft, fleshy, contracted at the neck. *Seeds* numerous, hispid, attached to the inner side of the calyx. *Willd.*

Rosa centifolia. Willd. *Sp. Plant.* ii. 1071; *B. & T.* 105. This species of rose has prickly stems, usually from three to six feet high. The leaves consist of two or three pairs of leaflets, with an odd one at the end, closely attached to the common footstalk, which is rough, but without spines. The leaflets are ovate, broad, serrate, pointed, and hairy on the under surface. The flowers are large, with many petals, generally of a pale red color, and supported upon peduncles beset with short bristly hairs. The germ is ovate, and the segments of the calyx semi-pinnate. The varieties of *R. centifolia* are very numerous, but may be indiscriminately employed. The plant is now cultivated in gardens all over the world; but its original country is not certainly known. It has sometimes been mistaken for the damask rose, which is a distinct species.

The petals are officinally described as "roundish-obovate and retuse, or obcordate, pink, fragrant, sweetish, slightly bitter and faintly astringent." *U. S.* They are extremely fragrant, and have a sweetish, slightly acidulous, somewhat bitterish taste. They contain, according to Enz, malic and tartaric acids, tannin, fat, resin, sugar, and a coloring matter which seems to be identical with that of the red rose. Their odor is said to be increased by iodine. It depends on a volatile oil, which may be separated by distillation with water. (See *Oleum Rosæ.*) They should be collected when the flower is fully expanded but has not begun to fall. Their fragrance is impaired but not lost by drying. They may be preserved fresh, for a considerable time, by compressing them with alternate layers of common salt in a well-closed vessel, or beating them with twice their weight of that substance. They are slightly laxative, and are sometimes administered in syrup combined with cathartic medicines; but their chief use is in the preparation of rose-water. (See *Aqua Rosæ.*)

Off. Prep. Aqua Rosæ; Syrupus Sarsaparillæ Compositus, *U. S.*

ROSA GALLICA. *U.S.* *Red Rose.*

(RŌ′ṢẠ GĂL′LỊ-CẠ.)

"The petals of Rosa Gallica, Linné (*Nat. Ord.* Rosaceæ, Roseæ), collected before expanding." *U. S.* "The fresh and dried unexpanded petals of Rosa Gallica. From plants cultivated in Britain." *Br.*

Rosæ Gallicæ Petala, *Br.;* Red-rose Petals; Flores Rosarum Rubrarum; Rose de Provins, Roses rouges, *Fr.;* Französische Rose, Essigrosen, Essigrosenblätter, *G.;* Rosa domestica, *It.;* Rosa rubra 6 Castillara, *Sp.*

Rosa Gallica. Willd. *Sp Plant.* ii. 1071; *B. & T.* 104. This species is smaller than *R. centifolia*, but resembles it in the character of its foliage. The stem is beset with short bristly prickles. The flowers are very large, with obcordate widely-spreading petals, which are of a rich crimson color, and less numerous than in the preceding species. In the centre is a crowd of yellow anthers on thread-like filaments, and as many villose styles bearing papillary stigmas. The fruit is oval, shining, and of a firm consistence. The red rose is a native of the south of Europe, and is cultivated in gardens throughout the United States.

The drug is officinally described as "in small cones, consisting of numerous imbricated, roundish, retuse, deep purple-colored, yellow-clawed petals, having a roseate odor and a bitterish, slightly acidulous, and distinctly astringent taste." *U. S.*

The petals, which are the part employed, should be gathered before the flower has blown, separated from their claws, dried in a warm sun or by the fire, and kept in a dry place. Their odor, which is less fragrant than that of *R. centifolia*, is improved by drying. They have a velvety appearance, a purplish red color, and a pleasantly astringent and bitterish taste. Their constituents, according to M. Cartier, are tannin, gallic acid, coloring matter, a volatile oil, a fixed oil, albumen, soluble salts of potassa, insoluble salts of lime, silica, and oxide of iron. (*Journ. de Pharm.*, vii. 531.) According to M. Filhol, the astringency of red roses is ascribable less to tannic acid, of which they contain but a trace, than to *quercitrin*, which he obtained in notable proportion, and with which their color is probably connected. Rochleder found that in red roses the gallic acid is accompanied by quercitannic acid. They also contain much uncrystallizable sugar. (*Repert. de Pharm.*, Mai, 1863.) The sensible properties and medical virtues of the flowers are extracted by boiling water. Their coloring matter, according to Senier (*Year-Book of Pharm.*, 1877, p. 63), is an acid, which appears to form crystallizable salts with potassium and sodium, and amorphous ones with the heavy metals. Senier gives as the formula of the insoluble lead compound $Pb_2C_{21}H_{29}O_{30}$. Their infusion is of a pale reddish color, which becomes bright red on the addition of sulphuric acid. As their color is impaired by exposure to light and air, they should be kept in opaque well-closed bottles or canisters.

Medical Properties and Uses. Red roses are slightly astringent and tonic, and were formerly thought to possess peculiar virtues. They are at present chiefly employed as affording an elegant vehicle for tonic and astringent medicines.

Off. Prep. Confectio Rosæ, *U. S.;* Confectio Rosæ Gallicæ, *Br.;* Extractum Rosæ Fluidum, *U. S.;* Infusum Rosæ Acidum, *Br.;* Mel Rosæ, *U. S.;* Pilulæ Aloes et Mastiches, *U. S.;* Syrupus Rosæ, *U. S.;* Syrupus Rosæ Gallicæ, *Br.*

ROSMARINUS. *U.S.* *Rosemary.*

(RŎṢ-MẠ-RĪ′NŬS.)

"The leaves of Rosmarinus officinalis. Linné. (*Nat. Ord.* Labiatæ.)" *U. S.*

Folia Rosmarini, s. Roris Marinis, *P.G.;* Folia Anthos; Feuilles de Romarin, Romarin, *Fr.;* Rosmarin, Rosmarinblätter, *G.;* Rosmarino, *It.;* Romero, *Sp.*

Gen. Ch. *Corolla* unequal, with the upper lip two-parted. *Filaments* long, curved, simple, with a tooth. *Willd.*

Rosmarinus officinalis. Willd. *Sp. Plant.* i. 126; *B. & T.* 207. Rosemary is an evergreen shrub, three or four feet high, with an erect stem, divided into many long, slender, ash-colored branches. The leaves are numerous, sessile, opposite, more than an inch long, about one-sixth of an inch broad, rigid, linear, entire, obtuse at the summit, folded backward at the edges, of a firm consistence, smooth and green on the upper surface, whitish, woolly, and glandular beneath. The flowers are pale blue or white, and disposed in opposite groups at the axils of the leaves, towards the ends of the branches. The naked seeds are four in number, oblong.

The plant grows spontaneously in the countries which border on the Mediterranean, and is cultivated in the gardens of Europe and this country. The leaves, which have already been described, have a strong balsamic odor, which is possessed, but in a less degree, by all parts of the plant. Their taste is bitter and camphorous. These properties are imparted partially to water, completely to alcohol, and depend on a volatile oil. (See *Oleum Rosmarini.*) The tops lose a portion of their sensible properties by drying, and become inodorous by age.

Medical Properties and Uses. Rosemary is gently stimulant, and has been considered emmenagogue. In the practice of this country it is scarcely used; but in Europe, especially on the continent, it enters into the composition of several syrups, tinctures, etc., to which it imparts its agreeable odor and excitant property. It is sometimes added to sternutatory powders, and is used externally in connection with other aromatics in the form of fomentation. In some countries it is employed as a condiment; and its flowers, which are much sought after by the bees, impart their peculiar flavor to the honey of the districts in which the plant abounds.

Off. Prep. Vinum Aromaticum, *U. S.*

RUBUS. *U. S.* *Blackberry.*

(RŪ'BŬS.)

"The bark of the root of Rubus villosus, Aiton, Rubus Canadensis, Linné, and Rubus trivialis, Michaux. (*Nat. Ord.* Rosaceæ, Dryadeæ.)" *U. S.*

Ecorce de Ronce noir, *Fr.;* Brombeerrinde, *G.*

Gen. Ch. *Calyx* five-cleft. *Petals* five. *Berry* compound, with one-seeded acini. *Willd.*

Of this extensive genus not less than twenty species are indigenous in the United States, where they are called by the various names of *raspberry*, *blackberry*, *dewberry*, *cloudberry*, etc. Most of them are shrubby or suffruticose briers, with astringent roots and edible berries; some have annual stems without prickles. They are naturally divided into the *raspberries*, in which the edible fruit is composed of pulpy, one-seeded, coherent little drupes, separate from the dry receptacle, and the *blackberries*, in which the receptacle is juicy, and coheres with the drupes to form the fruit.

1. *Rubus Canadensis.* Willd. *Sp. Plant.* ii. 105; Gray, *Manual of Bot.*, etc., p. 121.—*R. trivialis.* Pursh, *Flor. Am. Sept.* p. 347. The *dewberry*, sometimes also called *low blackberry*, or *creeping blackberry*, has a slender, somewhat prickly stem, which runs along the ground, and occasionally puts forth roots. The leaves are composed of three or five leaflets, which are ovate or ovate-lanceolate, generally pointed, sharply serrate, thin, and nearly smooth. The flowers are large, white, and arranged in racemes, with leaf-like bracts. The plant grows abundantly in old fields and neglected grounds in the Northern and Middle States. Its fruit is large, black, and of a very pleasant flavor, and ripens somewhat earlier than that of *R. villosus.*

2. *R. villosus.* Ait. Willd. *Sp. Plant.* ii. 1085; Bigelow, *Am. Med. Bot.* i. 160; Barton, *Med. Bot.* ii. 151; *B. & T.* 100. The stem of the *blackberry* is somewhat shrubby, from three to seven feet high, branching, more or less furrowed and angular, and armed with strong prickles. The smaller branches and young shoots are herbaceous. The leaves are ternate or quinate; the leaflets ovate, acuminate, unequally and sharply serrate, and pubescent on both sides; the footstalk and midrib usually armed with short recurved prickles. The flowers are large, white, and in erect racemes, with a hairy, prickly stalk. The calyx is short, with acuminate segments. This plant is very common in thickets, half-cultivated fields, etc., fruiting in August and September. It is the original of the cultivated blackberry.

R. trivialis, Michaux, is distinguished by its shrubby, procumbent, bristly habit, and its leathery, nearly smooth, evergreen leaves. The flowers are large and borne on one- to three-flowered peduncles. The plant grows in the Southern United States, affecting especially sandy soils.

The blackberry root is branching, cylindrical, of various dimensions, from nearly an inch in thickness down to the size of a straw, ligneous, and covered with a thin bark, which is externally of a light brownish or reddish brown color, and in the dried root is wrinkled longitudinally. The dewberry root is usually smaller, without the longitudinal wrinkles, but with transverse fissures through the epidermis, and of a dark ash color, without any reddish tinge. Both are inodorous. The bark is "in tough, flexible bands, outer surface blackish or blackish gray, inner surface pale brownish, sometimes with strips of whitish, tasteless wood adhering; inodorous; strongly astringent, somewhat bitter." *U. S.* Its virtues are extracted by boiling water, and by diluted alcohol, and depend chiefly upon tannin, which is an abundant constituent.* The woody part of the roots is inert.

Medical Properties and Uses. Dewberry and blackberry roots are tonic and strongly astringent. They have long been a favorite domestic remedy in bowel affections, and from popular favor have passed into regular medical use. Given in decoction, they are usually acceptable to the stomach, without being offensive to the taste, and may be employed with great advantage in cases of diarrhœa from relaxation of the bowels, whether in children or adults. We can add our own decided testimony to that of others who have spoken favorably of their use in this complaint; and there is no doubt that they are applicable to all other cases in which the vegetable astringents are found serviceable. The decoction may be prepared by boiling an ounce of the smaller roots, or of the bark of the larger, in a pint and a half of water down to a pint; of which from one to two fluidounces (30–60 C.c.) may be given to an adult three or four times, or more frequently, during the twenty-four hours. The dose of the powdered root is 20 or 30 grains (1·3–1·95 Gm.). The fluid extract is an excellent preparation: the dose is 30 minims (1·9 C.c.).

Off. Prep. Extractum Rubi Fluidum, *U. S.*

RUBUS IDÆUS. *U. S.* *Raspberry.*

(RŪ′BŬS I-DÆ′ŬS—ī-dē′ŭs.)

"The fruit of *Rubus idæus*, Linné. (*Nat. Ord.* Rosaceæ, Dryadeæ.)" *U. S.*

Both the plant and the fruit of the ordinary cultivated raspberry are too well known to need description. For the cultivated fruit that of the ordinary *wild red raspberry*, of the extreme Northern United States, *R. Strigosus* (Michaux), may very well be substituted, as in flavor it is at least equal to the cultivated berry. The specific distinctness of the two plants is questionable. The U. S. P. also allows the substitution of the fruit of *R. occidentalis*, Linné, or the *wild black raspberry*, of the Middle United States; but this is greatly inferior.

Off. Prep. Syrupus Rubi Idæi, *U. S.*

RUMEX. *U. S.* *Yellow Dock.*

(RŪ′MĔX.)

"The root of Rumex crispus and other species of Rumex. (*Nat. Ord.* Polygonaceæ.)" *U. S.*

Radix Rumicis, s. Lapathi; Racine de Patience frisée, *Fr.;* Grindwurzel, *G.*

Gen. Ch. Calyx three-leaved. *Petals* three, converging. *Seed* one, three-sided. *Willd. Calyx* six-parted, persistent, the three interior divisions petaloid, connivent. *Seed* one, three-sided, superior, naked. *Stigmata* multifid. *Nuttall.*

Several species of Rumex have sour leaves, and are distinguished by the common name of *sorrel* from the others, which are called *dock.* Of the former, *Rumex*

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* *Aromatic Syrup of Blackberry.* Take of Blackberry Root ℥ij; Cinnamon, Cloves, each, ʒiss; Mace ʒi; Sugar ℥xxx. Reduce the root and spices to a powder which will pass through a sieve of 50 meshes to the square inch, moisten this with two fluidounces of alcohol, put into a percolator, and displace with water till 17 fluidounces have passed, and dissolve the sugar in the filtrate. A fluidounce is equivalent to 30 grains of the root. (*A. J. P.*, Nov. 1859, p. 552.)

acetosa, or *common English sorrel*, formerly held a place in the London and Dublin Pharmacopœias. *R. acetosella* is the common sorrel of our fields, though supposed to have been originally introduced from Europe. The leaves of both these plants are agreeably sour to the taste, and owe their acidity to acid oxalate of potassium with a little tartaric acid. They quite lose this taste in drying. They are refrigerant and diuretic, and may be used advantageously as an article of diet in scurvy. For this purpose they are prepared in the form of salad. The juice of the leaves forms with water an agreeable acidulous drink, sometimes used in fevers. Taken very largely, the leaves are said to have produced poisonous effects. (See *Wood's Quarterly Retrospect*, i. 109.) *R. scutatus* also ranks among the sorrels.

Of the proper docks, the roots of *R. Patientia* and *R. Alpinus*, European plants, and of *R. aquaticus*, *R. acutus*, and *R. sanguineus*, belonging both to Europe and the United States, may be employed indiscriminately with those of the officinal species. *R. Britannica* and *R. obtusifolius* were formerly officinal. *R. Hydrolapathum* (Hudson), which is the *R. aquaticus* of the old Dublin Pharmacopœia, is thought to be the *Herba Britannica* of the ancients, celebrated for the cure of scurvy and diseases of the skin. The docks are herbaceous plants with perennial roots. The flowers are in terminal or axillary panicles. Some of the species are diœcious; but the one here described has perfect flowers.

Rumex crispus. L. Willd. *Sp. Plant.* ii. 251; Gray, *Manual of Botany, etc.*, p. 377. From a perennial, spindle-shaped, yellow root, which penetrates deeply into the ground, a stem rises annually, three or four feet high, furnished with smooth, lanceolate leaves, strongly waved at their margins, and terminating in panicled racemes of small, inconspicuous, greenish flowers. The lower leaves are truncate or cordate at the base, and those which spring from the root have long footstalks. The flowers are in crowded whorls, upon long wand-like racemes, which are leafless above. The valves or inner sepals of the calyx are roundish cordate, entire or slightly denticulate, and one or all grain-bearing. A native of Europe, but naturalized in this country, and now a common weed, growing in roads and fields.

Dock root, from whatever species derived, has an astringent, bitter taste, with little or no smell. It readily yields its virtues to water by decoction. It is officinally described as "from eight to twelve inches (20 to 30 cm.) long, about half an inch (12 mm.) thick, somewhat fusiform, fleshy, nearly simple, annulate above, deeply wrinkled below; externally rusty brown, internally whitish, with fine, straight, interrupted, reddish, medullary rays, and a rather thick bark." *U. S.* According to Riegel, the root of *R. obtusifolius* contains resin, extractive matter resembling tannin, starch, mucilage, albumen, lignin, sulphur, and various salts, among which are phosphate of calcium, and different acetates and malates. (*Journ. de Pharm.*, 3e sér., i. 410.) *Rumicin*, a supposed peculiar principle, also obtained by Riegel, has since been ascertained, by Karl von Thaun, to be identical with chrysophanic acid. (See *Rheum.*) (*Chem. Centralbl.*, Nov. 10, 1858, p. 795.) The leaves of most of the species are edible when young, and are occasionally used as spinage. They are somewhat laxative, and form an excellent diet in scorbutic cases. The roots are used to dye a yellow color. According to Dr. J. H. Salisbury (*N. Y. Journ. Med.*, March, 1855), the petioles of the leaves contain nearly one per cent. of oxalic acid; the cortical part of the root, which is the most active, yielded, on analysis, starch, a little sugar, albuminous matter, gummy matter, bitter extractive, tannic acid of the kind which gives green precipitates with the salts of iron, lignin, and various salts. The root yields its virtues to water and alcohol, but is injured by long boiling.

Medical Properties and Uses. Dock root is astringent, and gently tonic, and is also supposed to possess an alterative property, which renders it useful in scorbutic disorders, and cutaneous eruptions, particularly the itch, in the cure of which it enjoyed at one time considerable reputation. It is said to have proved useful in scrofula and syphilis. Dr. Thomson found a decoction of the root of *R. Patientia* very efficacious in obstinate ichthyosis. *R. aquaticus* and *R. Britannica* are the most astringent. The roots of some species unite a laxative with the tonic and astringent property, resembling rhubarb somewhat in their operation. Such are those of *R. crispus* and *R. obtusifolius;* and *R Alpinus* has in some parts of

Europe the name of *mountain rhubarb*. This resemblance is not singular, as the two genera belong to the same natural family. Dock root is given in powder or decoction. Two ounces (62·2 Gm.) of the fresh root bruised, or one ounce (31·1 Gm.) of the dried, may be boiled in a pint (472 C.c.) of water, of which two fluidounces (60 C.c.) may be given at a dose, and repeated as the stomach will bear it. The root has often been applied externally, in the shape of ointment, cataplasm, and decoction, to the cutaneous eruptions and ulcerations for which it has been used internally. The powdered root is recommended as a dentifrice, especially when the gums are spongy.

Off. Prep. Extractum Rumicis Fluidum.

SABADILLA. *Br.* *Cevadilla.*

(SĂB-Ạ-DĬL′LẠ.)

"The dried Fruit of Asagræa officinalis. Lind. Imported from Mexico." *Br.*

Fructus (Semen) Sabadillæ, *P.G.;* Cévadille, *Fr.;* Sabadillsame, Säusekörner, *G.;* Cebadilla, *Sp.*

At one time cevadilla was generally believed to be derived from *Veratrum Sabadilla*. Schiede, during his travels in Mexico, ascertained that it was, in part at least, collected from a different plant, of the same natural order of Melanthaceæ, growing upon the eastern declivity of the Mexican Andes. This was considered by Schlechtendahl as another species of Veratrum, by Don as an Helonias, and by Lindley as belonging to a new genus which he named Asagræa. Hence it has been variously denominated *Veratrum officinale*, *Helonias officinalis*, *Asagræa officinalis*, and *Schœnocaulon officinale*. It is not probable that *Veratrum Sabadilla* yields much, if any, of the seed of commerce; but it would seem that very much of the drug is the product of a plant so different from *Asagræa officinalis* that Ernst, of Caraccas, believes it to be a new species. It differs chiefly in having its leaves broader and more carinate. More exact information, however, is wanted before we can determine the precise origin of the drug. It is brought from Vera Cruz.*

Cevadilla seeds usually occur in commerce mixed with the fruit. This consists of three coalescing capsules or follicles, which open above, and appear like a single capsule with three cells. It is three or four lines long and a line and a half in thickness, obtuse at the base, light brown or yellowish, smooth, and in each capsule contains one or two seeds. A resemblance, existing or supposed, between this fruit and that of barley is said to have given rise to the Spanish name cevadilla, which is a diminutive of barley. The seeds are elongated, pointed at each end, flat on one side and convex on the other, somewhat curved, two or three lines long, wrinkled, slightly winged, black or dark brown on the outside, whitish within, hard, inodorous, and of an exceedingly acrid, burning, and durable taste.

Pelletier and Caventou first noted the presence of an alkaloid in cevadilla, which base they called *veratrine;* Meissner in the same year announced the presence of an alkaloid, *sabadilline*, and Couërbe, Merck, and Weigelin all described what they considered as distinct bases, but its exact composition remained unsettled until the investigation of Wright and Luff. (*Journ. Chem. Soc.*, 33, p. 338.)

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* We give in a note a brief description of the two plants above referred to.

Veratrum Sabadilla. Retzius, *Obs.* i. 31; Carson, *Illust. of Med. Bot.* ii. 50, pl. 94. See *Veratrum album.* The leaves of this plant are numerous, ovate-oblong, obtuse, with from eight to fourteen ribs, glaucous beneath, and all radical. The flower-stem is erect, simple, and round, rises three or four feet in height, and bears a spreading, simple, or but slightly branched panicle of somewhat nodding flowers, supported upon very short pedicels. The flowers, which are of a blackish purple color, approximate in twos and threes, the fertile turning at length to one side, and the sterile falling off. The segments of the corolla are ovate-lanceolate, and without veins. The capsules occupy only one side of the stem. This plant grows in Mexico and the West Indies, and was cultivated by Descourlitz at San Domingo, from seeds obtained in Mexico.

Asagræa officinalis. Lindley, *Botan. Reg.*, June, 1839.—*Veratrum officinale.* Schlechtendahl, *Linnæa*, vi. 45.—*Helonias officinalis.* Don, *Ed. New Philos. Journ.*, October, 1832, p. 234. The following is the generic character given by Lindley. "*Flowers* polygamous, racemose, naked. *Perianth* six-partite, segments linear, veinless, almost equal, with a nectariferous excavation at the base, equal to the stamens. *Stamens* alternately shorter; anthers cordate as if unilocular, after dehiscence shield-shaped. *Ovaries* three, quite simple, attenuated into an obscure stigma. *Follicles* three, acuminate, papery; seeds scimitar-shaped, corrugated, winged. Bulbous herbs, with grass-like leaves, and small, pale, and densely racemed flowers. *A. officinalis*, which is the only known species, has linear, acuminate, subcarinate leaves, roughish at the margin, and four feet in length by three lines in breadth, and a round flower-stem, about six feet high, terminating in a very dense, straight, spike-like raceme, eighteen inches long, of white flowers with yellow anthers.

They find three bases: 1, *cevadine*, $C_{32}H_{49}NO_9$ (agreeing with the base described by Merck as veratrine), crystallizing in needles or compact crystals, fusing at 205° C. (401° F.), insoluble in water, easily soluble in alcohol and ether, and decomposed by hot alcoholic potash into *cevine*, $C_{27}H_{43}NO_8$, and methyl-crotonic acid (cevadic acid of Pelletier and Caventou). $C_5H_8O_2$; 2, *veratrine*, $C_{37}H_{53}NO_{11}$, obtained from the syrupy mother-liquor from which the cevadine has crystallized; it is uncrystallizable, soluble in ether, and decomposed by alcoholic soda into *verine*, $C_{28}H_{45}NO_8$, and dimethyl-protocatechuic acid (veratric acid of Merck), $C_7H_4(CH_3)_2O_4$; 3, *cevadilline*, $C_{34}H_{53}NO_8$, obtained after the extraction of the veratrine with ether; it is insoluble in ether, slightly soluble in boiling benzol, and readily soluble in fusel oil, uncrystallizable, and appears to yield methyl-crotonic acid on treatment with alcoholic soda.*

Cevadilla yields about 0·3 per cent. of veratrine. See *Veratrina.*

Medical Properties and Uses. Cevadilla is an acrid, drastic emeto-cathartic, operating occasionally with great violence, and in overdoses capable of producing fatal effects. Known in Europe as early as 1752, and formerly used to some extent as a tæniacide, in doses of five to twenty grains (0·33–1·3 Gm.), it is now officinal solely as the source of veratrine. It is the principal ingredient of the *pulvis Capucinorum,* sometimes used in Europe for the destruction of vermin in the hair.

SABINA. *U.S.* *Savine.*

(SA-BĪ'NA.)

"The tops of Juniperus Sabina. Linné. (*Nat. Ord.* Coniferæ.)" *U. S.* "The fresh and dried tops of Juniperus Sabina. Linn. Collected in spring, from plants cultivated in Britain." *Br.*

Sabinæ Cacumina, *Br.;* **Savine Tops; Summitates (Herba) Sabinæ,** *P.G.;* **Sabine,** *Fr.;* **Sevenbaum, Sadebaumspitzen, Sevenkraut,** *G.;* **Sabina,** *It., Sp.*

JUNIPERUS. See *Juniperus.*

Juniperus Sabina. Willd. *Sp. Plant.* iv. 852; *B. & T.* 254. This is an evergreen shrub, from three to fifteen feet high, with numerous erect, pliant branches, much subdivided, The bark of the young branches is light green, that of the trunk rough, and reddish brown. The leaves, which completely invest the younger branches, are numerous, small, erect, firm, smooth, pointed, dark green, glandular in the middle, opposite, and imbricated in four rows. The flowers are male and female on different trees. The fruit is a blackish purple berry, of an ovoid shape, marked with tubercles and the remains of the calyx and petals, and containing three seeds. The savine is a native of the south of Europe and the Levant, and is said to grow wild in the neighborhood of our northwestern lakes. The ends of the branches, and the leaves by which they are invested, are collected for medical use in the spring. When dried they fade very much in color. They are officinally described as "short, thin, sub-quadrangular branchlets; leaves in four rows, opposite, scale-like, ovate-lanceolate, more or less acute, appressed, imbricated, on the back with a shallow groove containing an oblong or roundish gland; odor peculiar, terebinthinate; taste nauseous, resinous, and bitter." *U. S.*

The tops of *Juniperus Virginiana*, or common red cedar, are sometimes substituted in the shops for savine, to which they bear so close a resemblance as to be with difficulty distinguished. The two species, however, differ in their taste and smell. In *J. Virginiana*, moreover, the leaves are sometimes ternate.

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* Wright and Luff extract the alkaloids as follows. 100 parts of sabadilla seeds are exhausted with 1 part of tartaric acid and alcohol, the alcoholic extract concentrated, freed from resinous admixture by addition of water, and then treated with soda and ether. The ethereal solution is then shaken up with aqueous tartaric acid solution, and the acid liquid again treated with soda and ether. The ethereal solution is now mixed with lignin (petroleum benzin), and allowed to evaporate spontaneously. A syrup separates out first, and then crystals of cevadine, which are drained off and recrystallized from alcohol. The residual syrup consists essentially of veratrine and cevadilline. 10 kilogrammes of seeds yielded 60–70 grains of alkaloids, from which 8 to 9 grains of pure cevadine, 5 to 6 grains of veratrine, and 2 to 3 grains of crude cevadilline can be isolated.

The tops and leaves of the savine plant have a strong, heavy, disagreeable odor, and a bitter, acrid taste. These properties, which are less striking in the dried than in the recent leaves, are owing to a volatile oil. (See *Oleum Sabinæ.*) The leaves impart their virtues to alcohol and water. Mr. C. H. Needles found in them volatile oil, gum, tannic or gallic acid, resin, chlorophyll, fixed oil, bitter extractive, lime, and salts of potassa. (*A. J. P.*, xiii. 15.)

Medical Properties and Uses. Savine is highly irritant, and supposed to have a special direction to the uterus. It has been much used in amenorrhœa and atonic menorrhagia, and occasionally as a remedy for worms. The late Professor Chapman strongly recommended it in chronic rheumatism; and it is employed in Germany, both internally and externally, in chronic gout. In overdoses it may produce dangerous gastro-intestinal inflammation, and should therefore be used with caution. In no case should it be employed when much general or local excitement exists. In pregnancy it should always be given with great caution. The dose of the fluid extract is 15 to 20 drops (0·85 to 1 C.c.); of the oil, 5 drops (0·24 C.c.). As an external irritant, savine is useful, in the form of cerate, for maintaining a discharge from blistered surfaces; but as in this country savine ointment is often feeble, either from the age of the drug or from the substitution of red cedar, it has fallen into disrepute. In powder or infusion, savine is used in Europe as an application to warts, indolent, carious, and gangrenous ulcers, psora, and tinea capitis; and the expressed juice of the fresh leaves, diluted with water, is sometimes applied to similar purposes.

Off. Prep. Ceratum Sabinæ, *U. S.;* Extractum Sabinæ Fluidum, *U. S.;* Oleum Sabinæ; Tinctura Sabinæ, *Br.;* Unguentum Sabinæ, *Br.*

SACCHARUM. *U. S.* *Sugar.*

$C_{12}H_{22}O_{11}$; 342. (SĂC′ȻHẠ-RŬM.) $C_{12}H_{11}O_{11}$; 171.

"The refined sugar of Saccharum officinarum. Linné. (*Nat. Ord.* Graminaceæ.)" *U. S.* "Pure cane sugar prepared from the juice of the stem of Saccharum officinarum." *Br.*

Saccharum Purificatum, *Br.;* Sucre, Sucre pur, Sucre de Canne, Sucre en Pains, *Fr.;* Weisser Zucker, Zucker, Rohrzucker, *G.;* Zucchero Pane, *It.;* Azucar de Pilon, Azucar refinado, *Sp.*

Gen. Ch. Calyx two-valved, involucred, with long down. *Corolla* two-valved. *Willd.*

Saccharum officinarum. Willd. *Sp. Plant.* i. 321; *Philos. Trans.* lxix. 207. The *sugar cane* is an herbaceous plant, possessing a jointed, succulent root, from which arise several shining, jointed, solid stems, from an inch to two inches in diameter, from six to twelve feet high, and containing a white and juicy pith. The color of the stem is yellow, greenish yellow, purple, or striped. The joints are about three inches apart, and give origin to the leaves, which embrace the stem at their base, are three or four feet long and about an inch wide, flat, acuminate, longitudinally striated, furnished with a white midrib, glabrous, finely dentate, and of a green color inclining to yellow. The flowers are pinkish, surrounded by a long silky down, and disposed in a large, terminal, nearly pyramidal panicle, composed of subdivided spikes, and two or three feet in length. The plant has a general resemblance to the Indian corn. Four varieties are mentioned: 1, the *common*, with a yellow stem; 2, the *purple*, with a purple stem and richer juice; 3, the *gigantic*, with a very large light-colored stem; and, 4, the *Otaheitan*, which was introduced into the West Indies from the island of Tahiti (Otaheite) by Bougainville and Bligh, and is distinguished by its greater height, the longer intervals between its joints, and the greater length of the hairs which surround the flowers.

The sugar cane is cultivated by cuttings, which are planted in rows, and which, by giving rise to successive shoots, furnish five or six crops before the plants require to be renewed. At the end of a year the plant generally flowers, and in four or five months afterwards the canes are completely ripe, at which time they have a yellowish color and contain a sweet viscid juice. The quantity of sugar which they yield is variable. According to Avequin, of New Orleans, the proportion of cane sugar in the recent stalk is about 10 per cent., of uncrystallizable sugar from 3½ to 4 per cent. Cane juice is said to contain 17 per cent. of crystallizable sugar, though not more than 9 per cent. is extracted in practice.

Among the saccharine principles distinguished by the chemist are cane sugar, or sugar properly so called, derived from the sugar cane, the beet, and the sugar maple. Its formula is $C_{12}H_{22}O_{11}$; lactose or milk sugar, and maltose, a product of the action of malt upon cereals, possessing the same formula; glucose, including dextrose or grape sugar, levulose or fruit sugar, the mixture of the two produced by the alteration of cane sugar and known as invert sugar, and that resulting from the change of starch and starch-containing cereals; arabinose from gum arabic, and inosit or muscle-sugar, both agreeing with glucose in the formula $C_6H_{12}O_6$; mannit, quercit, and pinit, which are alcohol-like compounds closely related to the true sugars. *Glucose* or *grape sugar* is conveniently obtained by spreading crystalline honey on porous tiles, dissolving what remains on their surface in alcohol, and crystallizing. The product is about one-fourth of the weight of the honey. It is also prepared from starch by the action of very weak sulphuric acid, and this industry has assumed enormous proportions in this country in the last few years. According to the statements of Prof. H. W. Wiley (*N. R.*, Sept. 1881), the daily consumption of corn for sugar- and syrup-making was at that date not far from 35,000 bushels. The term glucose is applied to the syrupy product of this process, while the name grape sugar is applied to the solid product from the same source. The process in outline is as follows. The corn is first soaked for two or three days in warm water, and is then ground on specially-prepared stones with a stream of water. The meal is next passed into a trough, the bottom of which is made of fine bolting-cloth. Here the starch is washed through and led to large tanks, where it is allowed to settle. It is next beaten up with caustic soda to separate the gluten, and the starch is again allowed to settle in long shallow troughs. The starch, washed from all adhering alkali, is next beaten up with water into a cream, and conducted into the converting tubs. These tubs are supplied with coils of copper steam piping, and are made of wood. Here the starch cream is treated with dilute sulphuric acid, and steam is allowed to bubble up through the mixture from small holes in the copper pipes. This process of conversion, which is called "open conversion," is completed in about two hours. Another method is called "close conversion." The substances are inclosed in stout copper cylinders and subjected to the action of superheated steam. This process occupies about fifteen minutes. After conversion, the acid is neutralized by marble dust and animal charcoal. Since the sulphate of calcium, which is formed in this operation, is slightly soluble, carbonate of barium has been used instead of marble dust, but its use has not become general. After neutralization, the liquid is filtered through cloth and animal charcoal, and is then conveyed to the vacuum-pan. When glucose syrup alone is desired, the process of conversion is stopped when the starch has disappeared, so that the syrup contains both glucose and dextrin, while when solid grape sugar is desired, the conversion is carried further to the change of dextrin into dextrose. Glucose can be obtained as a hydrate in small and laminated crystals from aqueous solution, and anhydrous in hard crystalline masses either from alcoholic solution or, as recently discovered by Dr. Arno Behr (*A. J. P.*, Aug. 1882, p. 397), from very concentrated aqueous solution. It is less sweet than cane sugar. It is also less soluble in water, and much more soluble in alcohol. It has the sp. gr. 1·54–1·57 when anhydrous. Strong mineral acids hardly act on grape sugar, but destroy cane sugar with facility. On the other hand, grape sugar is destroyed by alkalies, with which cane sugar forms definite compounds. Dissolved in water and subjected to prolonged ebullition, grape sugar undergoes very little alteration. Its solution rotates the plane of polarization of polarized light to the right, and is capable of undergoing the vinous fermentation directly, without passing through any intermediate state. It is characterized, also, in boiling solution, by reducing alkaline tartrate of copper, and by becoming brown by the action of the alkalies. The name of *glucosides* has been given to certain organic substances which are resolvable, by the presence of acids, or other slight chemical influence, into glucose and some other proximate principle, as in the instance of tannic acid, which is resolved into glucose and gallic acid. *Fruit sugar* or *chulariose* is an isomeric form of glucose, found in honey and the juice of fruits; an uncrystallizable mixture of dextrose and levulose (both varieties of glucose) is generated from cane sugar by solution in water or weak acids, and long boiling. Hence it is present in molasses. An aqueous solution of this sugar, like grape sugar, is susceptible of the vinous fermentation without an intermediate change. In consequence of its effect on polarized light, it has been named by the French chemists *invert sugar* (*sucre interverté*); its rotatory power being the reverse of that of the sugar from which it is produced. A solution of *cane sugar*, like that of grape sugar, has a rotating power to the right. When it ferments, it is first changed into uncrystallizable sugar, according to the reaction, $C_{12}H_{22}O_{11} + H_2O = (C_6H_{12}O_6)_2$; and, as the change proceeds, the rotating power to the right of the cane sugar gradually lessens and disappears, and is replaced by the rotating power to the left of the uncrystallizable sugar formed. *Sorbin*, discovered by M. Pelouze, is in perfectly transparent crystals, having the same taste as cane sugar, but is not susceptible of fermentation. *Lactose*, or *sugar of milk*, is now officinal. (See *Saccharum Lactis.*) *Inosit* is a sugar found in the juice of flesh. For a description of *mannit* and *glycerin*, see the articles *Manna* and *Glycerina*.

Besides the sugars enumerated, chemical writers mention *dulcit*, a substance like mannit from an unknown plant of Madagascar; *melampyrit*, from *Melampyrum nemorosum*, and other Scrophularineæ; *phycit*, obtained from *Protococcus vulgaris; quercit*, obtained from acorns; *mycose*, or the sugar of ergot; *melitose*, the peculiar sugar of Australian manna, at first thought to be grape sugar; *trehalose*, the crystallizable principle of Turkish manna; *melizitose*, in Briançon manna; *pinit*, obtained from a sugar of California, said to be derived from *Pinus Lambertiana;* and *phaseomannit*, obtained from kidney-beans before they are ripe. Of these saccharine substances, melitose, trehalose, mycose, and melizotose, though differing in some of their properties from cane sugar, agree with it in composition, and in the property of being modified by acids and transformed into sugars analogous to glucose. (See *Manna.*) (Berthelot, *Journ. de Pharm.*, Oct. 1858, p. 292.)

Cane sugar is manufactured extensively on the continent of Europe from the beet, and this industry is now growing in this country. It is also largely produced in Canada and the northern parts of the United States, from the sap of the sugar maple (*Acer saccharinum*). Cane sugar may also be obtained from cornstalks, and from the *Chinese sugar cane*, or *Sorghum saccharatum.* (See Part II.) In India, sugar is made from the sap of different species of palm. Crude *palm sugar* is called *jaggary.* But the supply of sugar from other sources is insignificant, when compared with that obtained from the sugar cane, which is extensively cultivated in Africa, the East and West Indies (especially the island of Cuba), Brazil, and some of our Southern States, particularly Louisiana.

Preparation and Purification. The canes, when ripe, are cut down close to the earth, topped, and stripped of their leaves, and then crushed between vertical iron rollers in a mill. The juice, constituting 90 per cent. of the cane, though scarcely 50 per cent. is actually obtained, is of a pale greenish color, sweet taste, and balsamic odor, and has a sp. gr. varying from 1·033 to 1·106. As it runs out it is received in suitable vessels, and, being quickly removed, is *immediately* mixed with lime, in the form of milk of lime, in the proportion of about 1 part of the earth to 800 parts of the juice, and heated in a boiler to 140° F. The exact proportion of the lime cannot be determined, as the juice varies in quality in different seasons; but the manufacturer should aim at making the liquor neutral, or very slightly alkaline. The gluten and albumen rise to the top, and form a thick scum, from underneath which the liquid is drawn off by a cock into a copper boiler, where it is concentrated by heat, the scum being carefully skimmed off as it forms. When sufficiently concentrated, the juice is transferred to shallow vessels called coolers, from which, when it assumes a granular aspect, it is drawn off into wooden vessels with perforated bottoms, the holes in which are temporarily plugged. At the end of twenty-four hours, the liquid is strongly agitated with wooden stirrers, in order to accelerate the granulation of the sugar, which is completed in six hours. The stoppers are now removed, and the syrup is allowed to drain off from the sugar, which in this state is granular, of a yellowish color, and moist. The syrup, by a new evaporation, furnishes an additional portion of sugar; and the liquid which finally remains, incapable of yielding more sugar with advantage, is called *molasses*. Sugar produced in this way is called "open pan" sugar. It is now almost completely displaced by "vacuum-pan" sugar.

In the production of raw sugars by the vacuum-pan process, the juice, after "defecation" with lime and removal of excess of lime by carbonic acid gas, is run through large filters of bone-black, and then into the vacuum-pan for concentration. The vacuum-pan is a large evaporating pan, closed above by a dome-like top, which connects with an exhausting steam-pump, so that the liquid can be concentrated under very reduced pressure. The heat is supplied by coils of steam-pipes which run through the interior of the pan. The saccharine juice is evaporated in this until it begins to crystallize, and even after this fresh portions are added, so that the crystals already formed grow by accretion of fresh material. After the crystallization is complete, the warm mixture of crystals and syrup is run into "centrifugals," to which a rapid motion of revolution is given, and the crystals so drained and dried.

Brown sugar is sometimes partially purified by boiling it with lime-water, and, after sufficient concentration, allowing the syrup to crystallize in large inverted conical vessels, pierced at the apex and plugged. The surface of the crystalline mass being covered with a thin mixture of clay and water, the plug is removed, and the water from the clay, percolating the mass, removes the colored syrup, which flows out at the hole. Sugar thus prepared approaches to the white state, and constitutes the clayed sugar of commerce brought from Cuba.

There is no doubt that a large proportion of the sugar is lost in the ordinary process of manufacture. M. Melsens, of Brussels, proposed a process, which consists in the use of bisulphite of calcium. This salt is alleged to act as an antiseptic, preventing the operation of any ferment; as an absorber of oxygen, opposing the action of that gas on the juice; as a clarifier, rendering insoluble at 100° C. (212° F.) all coagulable matters; as a bleacher of pre-existing coloring matters, and a preventive of the formation of new ones; and, lastly, as a substance furnishing a base to neutralize hurtful acids, which unite with the lime, displacing the weaker sulphurous acid. This process is now largely used, and calcium bisulphite is used in British Guiana and other sugar-producing countries in immense quantities. M. Emil Pfeiffer has proposed another refining process, which consists in the use of acid phosphate of calcium, an agent previously recommended by Brande. (See *Chem. Gaz.*, April 15, 1856.) M. Reynoso finds alumina the best defecating agent that he has employed, having succeeded by means of it in throwing down almost all impurities at the same time most adhesive and most hurtful. He adds the acid phosphate of aluminium to the cane juice, and decomposes this with lime, by which the phosphate of calcium is produced and alumina separated; and all these, with some lime in excess, cause the elimination of coloring and nitrogenous matters, so that there only remain in the liquid some of the salts which normally accompany the sugar in the juice. (*Journ. de Pharm.*, 4e sér., ii. 232.)

The refining of brown sugar forms a distinct branch of business, and the methods pursued have undergone many improvements. By the original process, the sugar was boiled with lime-water, and clarified by heating it with bullocks' blood. The clarified syrup was then strained through cloth filters, whereby it was rendered limpid. It was next transferred to a boiler, where it was subjected to ebullition until it was brought to a proper concentration; when it was allowed to cool in conical moulds, and to drain for the separation of the molasses. This last boiling required to be continued so long, that the action of the fire and air frequently decomposed the sugar to such an extent as to cause a loss of 25 per cent. in molasses. This disadvantage has led to the universal introduction of the vacuum-pan for the evaporation of sugar solutions in refining processes. This great step in advance was taken by Messrs. Philip Taylor and Howard. The former introduced the improvement of heating the syrup with great rapidity, by means of steam made to pass through a series of tubes traversing the boiler; and the latter devised the plan of causing the syrup to boil under a diminished pressure, created by a suction-pump, set in motion by a steam-engine, while it was heated by steam circulating round the boiler. In this way, the syrup was made to boil at a lower temperature, and with a diminished contact of the air; and the loss of cane sugar by change into uncrystallizable was in great measure avoided.

After the syrup is sufficiently concentrated by any one of these methods, it is transferred to coolers, where it is agitated to cause it to granulate. In this state it is poured into unglazed earthen-ware moulds of a conical shape, with a hole in the apex, which is stopped with a paper plug. The moulds are placed, with the apex downwards, above stone-ware pots, intended to receive the uncrystallizable syrup. When the mass has completely concreted, the moulds are unstopped, to allow the colored syrup to drain off. To separate the remains of this syrup, the operation called *claying* is performed. This consists in removing from the base of the loaf a layer of the sugar, about an inch thick, and replacing it with pure sugar in powder, which is covered with a mixture of pipe-clay and water of about the consistence of cream. The water gradually leaves the clay, dissolves the pure sugar, and percolates the mass as a pure syrup, removing in its progress the colored syrup. Sometimes the purification is performed without the use of clay, by allowing a saturated solution of pure sugar to percolate the loaf. When all the colored syrup is removed, the loaf is taken out of the mould and placed in stoves to dry. It now constitutes *white* or *purified sugar*. The syrup which drains from the loaves contains a considerable quantity of cane sugar, and is used in subsequent operations. This process of forming loaf-sugar by claying and displacing colored syrup by white syrup is now almost entirely replaced by the process already described under raw sugars of crystallizing in the vacuum-pan and draining with a centrifugal. The syrups of lowest quality are employed in forming inferior white sugar, from which a syrup finally drains, containing so little cane sugar as not to repay the expense of extracting it. This constitutes *sugar-house molasses.* Good brown sugar, in the process of refining, yields about 70 per cent. of white sugar. The application of animal charcoal to the refining of sugar is now very extensive.

Commercial History. *Cane sugar* was known to the ancients. It was originally obtained from India, where it was extracted from the sugar cane. About the period of the Crusades, the Venetians brought it to Europe; but at that time it was so scarce and costly as to be used exclusively as a medicine. Upon the discovery of the Cape of Good Hope and the maritime route to the East Indies, the commerce in sugar passed into the hands of the Portuguese. Subsequently, the cultivation of the cane extended to Arabia, Egypt, Sicily, Spain, and the Canaries, and finally, upon the discovery of the New World, to America, where it was pursued with the greatest success, and continues to be so. In America it is produced most abundantly in the West Indies, which supply the greater part of the consumption of Europe, little comparatively being taken thither from Brazil or the East Indies. The consumption of the United States, before the late war, was more than half supplied by Louisiana and some of the neighboring States. The crop of sugar of Louisiana, in 1847, was estimated at 240,000 hogsheads; in 1853, at 322,000, but is now relatively small as compared with that of Cuba, British Guiana, and other tropical countries.

The entire production of the world for the year 1880 was estimated to be as follows: Cane sugar from sugar cane, 2,140,000 tons, of which Cuba furnished 700,000 tons; English, Danish, and Dutch West Indies, 250,000 tons; Java, 200,000 tons; Brazil, 170,000 tons, and Louisiana, 75,000 tons; cane sugar from sugar beet, 1,317,623 tons, of which France furnished 462,259 tons; Germany, 346,646 tons; Russia and Poland, 245,000 tons; and Austria and Hungary, 153,922 tons. (Wagner, *Chem. Tech.*, 11th ed., 1880, p. 588.)

Properties. Sugar, in a pure state, is a solid of a peculiar grateful taste, permanent in the air, phosphorescent by friction, and of the sp. gr. 1·6. It forms "white, dry, hard, distinctly crystalline granules, permanent in the air, odorless, having a purely sweet taste, and a neutral reaction. Soluble in 0·5 part of water, and in 175 parts of alcohol at 15° C. (59° F.); in 0·2 part of boiling water, and in 28 parts of boiling alcohol; also in 80 parts of boiling, absolute alcohol, but insoluble in ether. The aqueous solution, saturated at 15° C. (59° F.), has the sp. gr. 1·345, and is miscible with alcohol in all proportions." *U. S.* Its solution, when thick and ropy, is called *syrup*, and when alcohol is mixed with it, the sugar is gradually deposited in crystals. An aqueous solution of sugar, kept in a warm place, has the property of corroding iron, partially immersed in it, just above the line where the surface of the liquid touches the metal; and the solution itself becomes impregnated with ferrous oxide, and of a deep red-brown color. A similar effect is produced on lead; but zinc and copper are but slightly acted on. (Dr. J. H. Gladstone, *Annals of Pharmacy*, iii. 208.) A solution of sugar possesses the property also of dissolving a large quantity of hydrate of lime, forming a compound, called *calcium saccharate.* When a concentrated syrup is gently heated, and spirit added to it, the liquid, on cooling, forms white semi-transparent crystals of hydrated sugar, having the shape of oblique four-sided prisms, and called *rock-candy.* When heated to 185° C. (365° F.), it melts into a viscid, colorless liquid, which, on being suddenly cooled, forms a transparent amorphous mass, called *barley sugar.* At a higher temperature (between 204·4° C. and 215·5° C. (400° F. and 420° F.) it loses two mols. of water, and is converted into a black porous mass, having a high lustre, called *caramel.*[*] At a still higher heat it yields combustible gases, carbonic acid, empyreumatic oil, and acetic acid; and there remains one-fourth of its weight of charcoal, which burns without residue. Sugar renders the fixed and volatile oils to a certain extent miscible with water, and forms with the latter an imperfect combination, called in pharmacy *oleo-saccharures.* When in solution, it is not precipitated by subacetate of lead, a negative property which distinguishes it from most other organic principles.

Tests. "Neither an aqueous nor an alcoholic solution of Sugar, kept in large, well-closed and completely filled bottles, should deposit a sediment on prolonged standing (abs. of insoluble salts, foreign matters, ultramarine, Prussian blue, etc.). If a portion of about 1 Gm. of Sugar be dissolved in 10 C.c. of boiling water, then mixed with 4 or 5 drops of test-solution of nitrate of silver and about 2 C.c. of water of ammonia, and quickly heated until the liquid begins to boil, not more than a slight coloration, but no black precipitate, should appear in the liquid after standing at rest for five minutes (abs. of grape-sugar and of more than a slight amount of inverted sugar)." *U. S.* Cane sugar may be distinguished from grape sugar by Trommer's test, which consists in the use of sulphate of copper and caustic potassa. If a solution of cane sugar be mixed with a solution of sulphate of copper, and potassa be added in excess, a deep blue liquid is obtained, which, on being heated, lets fall, after a time, a little red powder. A solution of grape sugar, similarly treated, yields, by heat, a copious greenish precipitate, which rapidly changes to scarlet, and eventually to dark red. Prof. Böttger finds that, when a liquid containing grape sugar is boiled with carbonate of sodium and some basic nitrate of bismuth, a gray coloration or blackening of reduced bismuth is produced. Cane sugar, similarly treated, has no effect on the test. Dr. Donaldson's test for sugar in the *animal fluids* is formed of 5 parts of carbonate of sodium, 5 of caustic potassa, 6 of bitartrate of potassium, 4 of sulphate of copper, and 32 of distilled water. A few drops of this solution being added to an animal fluid, and the mixture heated over a spirit-lamp, a yellowish green color is developed, if sugar be present. J. Horsley's test for sugar in diabetic urine is an alkaline solution of chromate of potassium, a few drops of which, boiled with the urine, will make it assume a deep sap-green color. M. J. Nicklés points out, in the tetrachloride of carbon, obtained by decomposing carbon disulphide by chlorine and aqueous vapor, a new test for distinguishing glucose and cane sugar. This test mixed with cane sugar in a glass tube, kept for some time near 100° C. (212° F.), causes a darkening of the sugar, gradually increasing till it becomes black. Glucose undergoes no such change. (*Journ. de Pharm.*, 4e sér., iii. 119.)

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[*] A coloring substance called *caramel brown*, or *sucré couleur*, is now largely manufactured from sugar by decomposing it by means of heat carefully applied. It is in the form either of a stiff paste, in which it is used for coloring leather, or in that of a syrup, for coloring liquids. Sucré couleur is now extensively manufactured abroad for coloring rum and spirituous liquors, beer and wine. It is made exclusively from starch sugar, either by a simple process of heating, or heating with addition of carbonate of soda or carbonate of ammonia. (For details, see Starch, Glucose, Starch Sugar, etc., by Wagner, translated by Frankel, 8vo, p. 344, H. C. Baird & Co., Phila.)

Action of Acids and Alkalies, etc. The mineral acids act differently on cane sugar according as they are concentrated or dilute. Strong nitric acid, with the assistance of heat, converts it into oxalic acid. (See *Oxalic Acid.*) The same acid, when weak, converts it into *saccharic acid*, confounded by Scheele with malic acid. Concentrated sulphuric acid chars it. Diluted hydrochloric acid, when boiled with cane sugar, converts it into a solid, brown, gelatinous mass. Weak sulphuric acid, by a prolonged action at a high temperature, converts cane sugar, first into uncrystallizable sugar, afterwards into grape sugar, and finally into *ulmin* and *ulmic acid.* Vegetable acids are supposed to act in a similar way. Maumené has found that cane sugar undergoes the change into uncrystallizable sugar when kept for a long time in aqueous solution, as well as when heated with acids. When the boiling with acids is prolonged for several days in open vessels, oxygen is absorbed. and, besides ulmin and ulmic acid, formic acid is generated. Soubeiran admits the change of the uncrystallizable into grape sugar, but attributes it to a molecular transformation of the sugar, independently of the action of the acid; as, according to his observation, the conversion takes place only after rest. In confirmation of his views, this chemist states that he found the same changes to be produced by boiling sugar with water alone. Not only does cane sugar change into the uncrystallizable when boiled with water, but, as clearly shown by an experiment of M. E. M. Rault, in aqueous solution, under the influence of light, at ordinary temperatures, it slowly changes into glucose; but this alteration does not take place in the dark. (*P. J. Tr.*, Jan. 1872, p. 643.)

Cane sugar unites with the alkalies and some of the alkaline earths, forming definite combinations which render the sugar less liable to change. It also unites with lead monoxide. Boiled for a long time with aqueous solutions of potassa, lime, or baryta, the liquid becomes brown, formic acid is produced, and two new acids are generated; one brown or black and insoluble in water, called *melassic acid*, the other colorless and very soluble, named *glucic acid.* Alkalies and the alkaline earths are said to lessen the rotatory power of sugar in relation to polarized light; but the sugar recovers its power when the alkali is saturated. (*Journ. de Pharm.*, 4e sér., iv. 314.)

The account above given of the action of acids and alkalies on cane sugar explains the way in which lime acts in the manufacture and refining of sugar. The acids, naturally existing in the saccharine juice, have the effect of converting the cane sugar into uncrystallizable sugar, by which a loss of the former is sustained. The lime, by neutralizing these acids, prevents that result. An excess of lime, however, must be carefully avoided; as it injures the product of cane sugar both in quantity and quality. The change in sugar which precedes fermentation, namely, the conversion of cane sugar into the uncrystallizable kind, points to the necessity of operating on the juice before that process sets in; and hence the advantage of grinding canes immediately after they are cut, and boiling the juice with the least possible delay.

Molasses is of two kinds, the West India and sugar-house. *West India molasses* is a black ropy liquid, of a peculiar odor, and sweet empyreumatic taste. When mixed with water and with the skimmings of the vessels used in the manufacture of sugar, it forms a liquor which, when fermented and distilled, yields *rum.* *Sugar-house molasses* has the same general appearance as the West India, but is thicker, and has a different flavor. Its sp. gr. is about 1·4, and it contains about 75 per cent. of solid matter. Both kinds of molasses consist of uncrystallizable sugar, and more or less cane sugar which has escaped separation in the process of manufacture or refining, and gummy and coloring matter. When the molasses from cane sugar is treated with a boiling, concentrated solution of bichromate of potassium, and boiled, a violent reaction takes place, and the liquid becomes green; but if it be adulterated with only an eighth of starch-sugar molasses, the reaction is prevented, and the color is not changed. (*Dr. G. Reich.*)

Composition. The following formulas express the composition of the different varieties of sugar so far as known. *Cane sugar*, $C_{12}H_{22}O_{11}$. Of the same composition are *lactose*, *maltose*, *mycose*, *melitose*, *melizitose*, and *trehalose*, which, as before stated, constitute a group closely analogous to cane sugar, though differing in some of their properties. The formula of *glucose* or grape sugar is $C_6H_{12}O_6$; and *uncrystallizable sugar*, also named *invert sugar*, and *levulose*, which is characterized by a left rotatory power in reference to polarized light, have the same composition. *Sorbit* and *inosit* agree also with these. The formula of *mannit* and of *dulcit* (dulcin or dulcose), the two hexatomic alcohols from which the sugars are derived chemically, is $C_6H_{14}O_6$.

Medical and Pharmaceutical Uses. The uses of sugar as an aliment and condiment are numerous. It is nutritious, but not capable of supporting life when taken exclusively as aliment, on account of the absence of nitrogen in its composition. It is a powerful antiseptic, and is used for preserving meat and fish; for which purpose it possesses the advantage of acting in a much less quantity than is requisite of common salt, and of not altering the taste or impairing the nutritious qualities of the aliment. Prof. Marchand has ascertained that a solution of sugar has no action on the teeth out of the body. It may hence be inferred that the popular notion that sugar is injurious to the teeth is founded solely upon the fact that the excessive use of sugar has a tendency to cause acid dyspepsia.

The medical properties of *sugar* are those of a demulcent; and as such it is much used in catarrhal affections, in the form of candy, syrup, etc. According to M. Provençal, it acts as a powerful antaphrodisiac, when taken in the quantity of a pound or more daily, dissolved in a quart of cold water. For an account of the supposed therapeutic power of the vapor of boiling cane juice, in bronchitis and incipient consumption, applied by living in a sugar-house, the reader is referred to the papers of Dr. S. A. Cartwright, of New Orleans, contained in the 47th and 51st volumes of the *Boston Med. and Surg. Journal.* In pharmacy, sugar is employed to render oils miscible with water, to cover the taste of medicines, to give them consistency, to preserve them from change, and to protect certain ferruginous preparations from oxidation. Accordingly, it enters into the composition of the compound infusion of roses, of several mixtures, pills, and powders, of many fluid extracts, syrups, confections, and of all the troches. *Molasses* is used for forming pills, for which it is well fitted, preserving them soft and free from mouldiness, on account of its retentiveness of moisture and antiseptic qualities.

The influence of sugar in preventing changes in organic substances may be ascribed to an extraordinary osmotic power in its solutions, by which infusoria and all other of the lower forms of life, to which fermentative processes are now generally ascribed, are almost instantly destroyed; the organism collapsing through the rapid exosmose of its fluids into the saccharine medium. All the different kinds of sugar susceptible of the alcoholic fermentation have this power. (Dr. Louis Mandl, *Archives Gén. de Méd.*, 5e sér., xvi. 49, Juillet, 1860.) Under the *Off. Prep.* only those preparations are included in which the sugar is essential from its chemical influence.

Off. Prep. of Saccharum. Ferri Carbonas Saccharata, *Br.;* Liquor Calcis Saccharatus, *Br.;* Mistura Ferri Composita, *Br.;* Pilula Ferri Carbonatis, *U. S.;* Pilula Ferri Iodidi, *Br.;* Pilulæ Ferri Iodidi, *U. S.;* Syrupus, etc.

SACCHARUM LACTIS. *U. S., Br.* *Sugar of Milk.*

$C_{12}H_{22}O_{11}.H_2O$; 360. (SĂC′ÇHA̧-RŬM LĂC′TĬS.) $C_{12}H_{11}O_{11}.HO$; 180.

"A peculiar, crystalline sugar obtained from the whey of cow's milk by evaporation, and purified by recrystallization." *U. S.* "A crystallized sugar obtained from the whey of milk by evaporation." *Br.*

Lactin, Milk Sugar; Lactose: Sucre de Lait, *Fr.;* Milchzucker, *G.*

Sugar of milk, or *lactose*, is found only in milk, of which it forms about 5 per cent. (*Boussingault.*) It is manufactured largely in Switzerland and the Bavarian Alps, as an article of food and for medicinal purposes. In preparing it, milk is first coagulated by the addition of a little dilute sulphuric acid, and the resulting *whey* is evaporated to a syrupy consistence, and set aside for several weeks, in a cool place, to crystallize. The crystals, which constitute the sugar of milk, are then decolorized by animal charcoal and repeated crystallizations.

Sugar of milk is a hard, somewhat gritty, white substance, crystallized in four-sided prisms, and possessing a slightly sweet taste and a neutral reaction. In commerce it sometimes occurs in cylindrical masses, in the axis of which is a cord, around which the crystals have been deposited. It is "soluble in 7 parts of water at 15° C. (59° F.), and in 1 part of boiling water; insoluble in alcohol, ether, or chloroform. On adding to a solution of Sugar of Milk in an equal weight of boiling water, some solution of soda, the liquid turns brownish, and on further addition of test-solution of sulphate of copper, a brick-red precipitate separates. If 1 part of Sugar of Milk be sprinkled upon 5 parts of sulphuric acid contained in a flat-bottomed capsule, the acid should acquire not more than a greenish or reddish, but no brown or brownish-black color within one hour (abs. of cane-sugar)." *U. S.* Its sp. gr. is 1·54. It is not susceptible of the vinous fermentation by the direct influence of yeast; but, after the action of dilute acids, which first convert it into a variety of glucose, it is capable of furnishing a spirituous liquor. It is well known that both mares' and cows' milk, after becoming sour, are capable of forming an intoxicating drink, by fermentation. By the action of nitric acid, sugar of milk is converted into mucic acid. When anhydrous it consists of $C_{12}H_{22}O_{11}$; when crystallized, of $C_{12}H_{22}O_{11} + H_2O$. (*Staedeler and Krause.*) These formulas make anhydrous sugar of milk isomeric with cane sugar. Fudakowski has ascertained that sugar of milk, when treated with weak sulphuric acid, is changed into two peculiar saccharine bodies; one crystallizable, and previously noticed by Pasteur (*Comptes-Rendus*, xlii. 347), the other new. The latter is more soluble in alcohol than the former, has a sweeter taste, ferments more easily, crystallizes in prisms, while the former is tabular, and has a different polarizing action. (*Journ. de Pharm.*, 4e sér., v. 479.)

Sugar of milk has been proposed by Dr. Turnbull, of England, as a non-nitrogenous article of diet in consumption and other pulmonary diseases. Dr. Ruschenberger used it with good effect as nourishment in a case of extreme irritability of stomach, following profuse loss of blood. (*Trans. of the Phila. Coll. of Phys.*, ii. 48.)

SALICINUM. *U. S.* *Salicin.*

$C_{13}H_{18}O_7$; 286. (SĂL-Ị-CĪ′NŬM.) $C_{26}H_{18}O_{14}$; 286.

"A neutral principle prepared from the bark of Salix Helix, Linné, and of other species of Salix. (*Nat. Ord.* Salicaceæ.)" *U. S.*

The discovery of salicin is claimed by Buchner, of Germany, and Fontana and Rigatelli, of Italy; but M. Leroux, of France, deserves the credit of having first accurately investigated its properties. Braconnot procured it by adding subacetate of lead to a decoction of the bark, precipitating the excess of lead by sulphuric acid, evaporating the colorless liquid which remained, adding near the end of the process a little animal charcoal previously washed, and filtering the liquor while hot. Upon cooling it deposited the salicin in a crystalline form. (*Journ. de Chimie Médicale*, Jan. 1831.) The following is the process of Merck. A boiling concentrated decoction of the bark is treated with litharge until it becomes nearly colorless. Gum, tannin, and extractive matter, which would impede the crystallization of the salicin, are thus removed from the liquid; while a portion of the oxide is dissolved in combination probably with the salicin. To separate this portion of oxide, sulphuric acid is first added, and then sulphide of barium, and the liquor is filtered and evaporated. Salicin is deposited, and may be purified by repeated solution and crystallization. (*Turner's Chemistry.*) Erdmann has given another process. Sixteen ounces of the bark are macerated for twenty-four hours in four quarts of water mixed with two ounces of lime, and the whole is then boiled for half an hour. The process is repeated with the residue. The decoctions having been mixed, and allowed to become clear by subsidence, the liquor is poured off, concentrated to a quart, then digested with eight ounces of ivory-black, filtered, and evaporated to dryness. The extract is exhausted by spirit containing 28 per cent. of alcohol, and the tincture evaporated so that the salicin may crystallize. This is purified by again dissolving, treating with ivory-black, and crystallizing. Merck obtained 251 grains from 16 ounces of the bark and young twigs of *Salix helix*, and Erdmann 300 grains from the same quantity of the bark of *Salix pentandra*. It may probably be obtained from any of the willow barks having a bitter taste. Braconnot procured it from various species of Populus, particularly *P. tremula*, or European aspen. When pure, it is in white, shining, slender crystals, inodorous, but very bitter, with the peculiar flavor of the bark. It is soluble in cold water, much more so in boiling water, soluble in alcohol, and insoluble in ether and oil of turpentine. It neutralizes neither acids nor salifiable bases, and is not precipitated by any reagent. Concentrated sulphuric acid decomposes it, receiving from it an intense and permanent bright red color, and producing a new compound called *rutulin*. It is officinally described as in "colorless or white. silky, shining crystals, permanent in the air, odorless, having a very bitter taste, and a neutral reaction. Soluble in 28 parts of water, and in 30 parts of alcohol at 15° C. (59° F.); in 0·7 part of boiling water, and in 2 parts of boiling alcohol; insoluble in ether or chloroform. When heated to about 198° C. (388·4° F.), Salicin melts, yielding a colorless liquid, and, on ignition, it emits vapors having the odor of salicylous acid, and is finally wholly dissipated. If 1 part of Salicin be agitated with 20 parts of water and 5 parts of solution of potassa, a clear, colorless solution is obtained. Cold, concentrated sulphuric acid dissolves it with a red color; the solution, after the addition of water, becomes colorless and deposits a dark red powder insoluble in water or alcohol. The aqueous solution of Salicin should not be precipitated by tannic or picric acids, nor by iodide of mercury and potassium (abs. of and difference from alkaloids)." *U. S.* It belongs to the class of glucosides, being resolved by boiling with dilute hydrochloric and sulphuric acids into grape sugar and *saligenin*, according to the reaction: $C_{13}H_{18}O_7 + H_2O = C_6H_{12}O_6 + C_7H_8O_2$. Saligenin itself is converted by further boiling with dilute acids into a resinous body, *saliretin*, $C_{14}H_{14}O_3$. Nitric acid produces with salicin at first two principles called respectively helicin and helicoidin, and afterwards picric and oxalic acids. (*Journ. de Pharm.*, xxx. 43.) Distilled with bichromate of potassium and sulphuric acid, it yields, among other products, a volatile oleaginous liquid, identical with one of the components of oil of spiræa, and recognized as *salicyl aldehyd*, $C_7H_6O_2$ (*salicylous acid*), while saligenin, $C_7H_8O_2$, is the alcohol, and salicylic acid, $C_7H_6O_3$, the acid corresponding. The synthesis of salicin has been effected by Michael (*A. J. P.*, 1879, p. 492), who obtained first helicin, and, by the action of nascent hydrogen upon this, salicin.

Medical Properties and Uses. The action of salicin upon the animal organism is not known. It is certainly rapidly absorbed, probably as salicin; but once in the blood it seems to be rapidly decomposed, the products of its change appearing in the urine fifteen to thirty minutes after the ingestion of a single dose. The elimination is partly as salicin, partly as salicylic acid, partly as a salicyluric acid, and partly as saligenin. It has been highly recommended as a substitute for salicylic acid in rheumatism by Maclagan and others, but later reports are not so favorable; and if, as believed by Senator, the activity of salicin depends upon its conversion in the blood into salicylic acid, it is plain that its action should be slower and more uncertain than that of the acid. The dose is twenty to thirty grains (1·3 to 1·95 Gm.) every 3 hours, administered in syrup or cachet. Salicin has also been used to some extent as antiperiodic, and appears to possess some controlling influence over malarial disorders, though vastly inferior to the cinchona alkaloids. One or two drachms may be given in the intermission.

SALIX. *U. S.* *Willow.*

(SĀ'LĬX.)

"The bark of Salix alba and of other species of Salix. (*Nat. Ord.* Salicaceæ.)" *U. S.*

Écorce de Saule. *Fr.;* Weidenrinde, *G.;* Corteccia di Salcio, *It.;* Corteza de Sauce, *Sp.*

Gen. Ch. MALE. *Amentum* cylindrical. *Calyx* a scale. *Corolla* none. *Glands* of the base nectariferous. FEMALE. *Amentum* cylindrical. *Calyx* a scale. *Corolla* none. *Style* two-cleft. *Capsule* one-celled, two-valved. *Seeds* downy.

This is an extensive genus, most of the species of which are possessed of similar medical properties. *S. Russelliana*, which has been introduced into this country from Europe, is said by Sir James Smith to be the most valuable species. *S. purpurea*, a European species, is stated by Lindley to be the most bitter, and *S. pentandra* is preferred by Nees von Esenbeck. Many native species are in all probability equally active with the foreign; but they have not been sufficiently tried to admit of a positive decision. The younger Michaux speaks of the root of *S. nigra*, or *black willow*, as a strong bitter, used in the country as an antiperiodic. The degree of bitterness in the bark is probably the best criterion of the value of the several species.

Salix alba. Willd. *Sp. Plant.* iv. 710; Smith, *Flor. Brit.* 1071; *B. & T.* 234. The common European or white willow is twenty-five or thirty feet in height, with numerous round spreading branches. The exstipulate leaves are alternate, upon short petioles, lanceolate, pointed, acutely serrate with the lower serratures glandular, pubescent on both sides, and silky beneath. The aments are terminal, cylindrical, and elongated, with elliptical-lanceolate, brown, pubescent scales. The stamens are two in number, yellow, and somewhat longer than the scales; the style is short; the stigmas two-parted and thick. The capsule is nearly sessile, ovate, and smooth. The white willow is now very common in this country. It flowers in April and May; and the bark is easily separable throughout the summer.

That obtained from the branches rolls up when dried into the form of a quill, from one twenty-fifth to one-twelfth of an inch in diameter, has a brown, more or less finely warty epidermis, is flexible, fibrous, and of difficult pulverization. The inner surface is brownish white, and smooth, the liber separating in thin layers. Willow bark has a feebly aromatic odor, and a peculiar bitter astringent taste. It yields its active properties to water, with which it forms a reddish brown decoction. Pelletier and Caventou found, among its ingredients, tannin, resin, a bitter yellow coloring matter, a green fatty matter, gum, wax, lignin, and an organic acid combined with magnesia. The proportion of tannin is so considerable that the bark has been used for tanning leather. The characteristic constituent of all species of willow, however, is *salicin*. The bark of the willow is feebly tonic, but is at present never employed in regular medicine.

SALVIA. *U.S.* *Sage.*

(SĂL′VĮ-Ạ.)

"The leaves of Salvia officinalis. Linné. (*Nat. Ord.* Labiatæ.)" *U. S.*

Folia (Herba) Salviæ, *P.G.;* Sauge officinale, Sauge, *Fr.;* Salbey, Salbeiblätter, *G.;* Salvia, *It., Sp.*

Gen. Ch. Corolla unequal. *Filaments* affixed transversely to a pedicel. *Willd.*

Salvia officinalis. Willd. *Sp. Plant.* i. 129; *B. & T.* 206. Common garden sage is a perennial plant, about two feet high, with a quadrangular, pubescent, branching, shrubby stem, furnished with opposite, petiolate, ovate-lanceolate, crenulate, wrinkled leaves, of a grayish green color, sometimes tinged with red or purple. The flowers are blue, variegated with white and purple; and are disposed on long terminal spikes, in distant whorls, each composed of a few flowers, and accompanied with ovate, acute, deciduous bracts. The calyx is tubular and striated, with two lips, of which the upper has three acute teeth, the under two. The corolla is tubular, bilabiate, ringent, with the upper lip concave, and the lower divided into three rounded lobes, of which the middle is the largest. The filaments are supported upon short pedicels, to which they are affixed transversely at the middle.

Sage grows spontaneously in the south of Europe, and is cultivated abundantly in our gardens. There are several varieties, differing in the size and color of their flowers, but all possessing the same medical properties. The flowering period is in June, at which time the plant should be cut, and dried in a shady place. The leaves are officinally described as "about two inches (5 cm.) long, petiolate, ovate oblong, obtuse, finely crenulate, thickish, wrinkled, grayish green, soft-hairy and glandular beneath; aromatic, bitterish, somewhat astringent." *U. S.*

Both these and the flowering summits have a strong fragrant odor, and a warm, bitterish, aromatic, somewhat astringent taste. They abound in a volatile oil. which may be obtained separate by distillation with water. Muir (*Journ. Chem. Soc.*, 37, p. 678) found it to contain a terpene boiling at 156° C. (312·8° F.), another boiling at 171° C. (339·8° F.), *salviol*, $C_{10}H_{16}O$, and ordinary camphor, $C_{10}H_{16}O$. In the fresh oil the first terpene predominates. On standing, the amount of *salviol* increases, and then the camphor. The oil from English leaves contains also a sesquiterpene, $C_{15}H_{24}$, of the boiling point 260° C. (500° F.). Sulphate of iron strikes a black color with their infusion.

Medical Properties and Uses. Sage unites slightly tonic, astringent, and aromatic properties. By the ancients it was highly esteemed; but it is at present little used internally, except as a condiment. In the state of infusion it may be given in debility of the stomach with flatulence, and is said to have been useful in checking the sweats of hectic fever. The dose of the powdered leaves is from twenty to thirty grains (1·3–1·95 Gm.). The infusion is prepared by macerating an ounce of the leaves in a pint of boiling water, of which two fluidounces (60 C.c.) may be administered at once.

Two other species of salvia—*S. pratensis* and *S. Sclarea*—are ranked among officinal plants in Europe. The latter, which is commonly called *clarry*, has been introduced into our gardens. Their medical properties are essentially the same as those of the common sage; but they are less agreeable, and are not much used. In Europe, the leaves of *S. Sclarea* are said to be introduced into wine in order to impart to it a muscadel taste. In Mexico, the ground seeds of the *S. Columbaria* are largely used, under the name of *chia*, as food; the meal is very mucilaginous. It is made into mush, which affords a good material for poultices, and when thinned with water an excellent demulcent gruel. (*P. J. Tr.*, x. 665.)

Off. Prep. Vinum Aromaticum, *U. S.*

SAMBUCUS. *U. S.* *Elder.*

(SẠM-BŪ'CŬS.)

"The flowers of Sambucus Canadensis. Linné. (*Nat. Ord.* Caprifoliaceæ.)" *U. S.*
"The fresh Flowers of Sambucus nigra. Linn. From indigenous plants." *Br.*

Sambuci Flores, *Br.;* Elder Flowers; Fleurs de Sureau, Sureau, *Fr.;* Hollunder, Fliederblumen, *G.;* Sambuco, *It.;* Sauco, *Sp.*

Gen. Ch. Calyx five-parted. *Corolla* five-cleft. *Berry* three-seeded. *Willd.*

Sambucus Canadensis. Willd. *Sp. Plant.* i. 1494; *B. & T.* 138. Our indigenous *common elder* is a shrub from six to ten feet high, with a branching stem, covered with a rough gray bark, and containing a large spongy pith. The small branches and leafstalks are very smooth. The leaves are opposite, pinnate, sometimes bipinnate, and composed usually of three or four pairs of oblong-oval, acuminate, smooth, shining, deep green leaflets, the midribs of which are somewhat pubescent. The flowers are small, white, and disposed in loose cymes, having about five divisions: the cream-colored corolla is whorl-shaped, with five stamens on the tube. The berries are small, globular, and deep purple when ripe. This shrub grows in low, moist grounds, along fences, and on the borders of small streams, in all parts of the United States, from Canada to the Carolinas, and westward as far as Texas. It flowers from May to July, and ripens its fruit early in autumn. The flowers, which are officinal, have an aromatic though rather heavy odor. The berries as well as other parts of the plant are employed, in domestic practice, for the same purposes as the corresponding parts of the European elder, to which this species bears a close affinity.

Sambucus nigra. Willd. *Sp. Plant.* i. 1495; *B. & T.* 137. The common elder of Europe differs from the American most obviously in its size, which approaches to that of a small tree. The stem is much branched towards the top, and has a rough whitish bark. The leaves are pinnate, consisting usually of five oval, pointed, serrate leaflets, four of which are in opposite pairs, and the fifth terminal. The flowers are small, whitish, and in five-parted cymes. The berries are globular, and blackish purple when ripe.*

The *flowers*, which have already been described, have a peculiar sweetish odor, which is strong in their recent state, but becomes feeble by drying. Their taste is bitterish. They yield their active properties to water by infusion, and when distilled give over a small proportion of volatile oil, which on cooling assumes a butyraceous consistence. Water distilled from them contains an appreciable portion of ammonia. The *berries* are nearly inodorous, but have a sweetish, acidulous taste, dependent on the presence of saccharine matter and malic acid. Their expressed juice is susceptible of fermentation, and forms a vinous liquid used in the north of Europe. It is colored violet by alkalies, and bright red by acids; and the coloring matter is precipitated blue by acetate of lead. The *inner bark* is without smell. Its taste is at first sweetish, afterwards slightly bitter, acrid, and nauseous. Both water and alcohol extract its virtues, which are said to reside especially in the green layer between the liber and the epidermis. According to Simon, the active principle of the inner bark of the root is a soft resin, which may be obtained by exhausting the powdered bark with alcohol, filtering the tincture, evaporating to the consistence of syrup, then adding ether, which dissolves the active matter, and finally evaporating to the consistence of a thick extract. Of this, twenty grains produce brisk vomiting and purging. (*Annal. der Pharm.*, xxxi. 262.) The bark, analyzed by Kramer, yielded an acid called by him *viburnic acid*, which has proved to be identical with *valerianic acid*, traces of volatile oil, albumen, resin, an acid sulphurous fat, wax, chlorophyll, tannic acid, grape sugar, gum, extractive, starch, pectin, and various alkaline and earthy salts. (*Chem. Gaz.*, May, 1846; from *Archiv der Pharm.*)

Medical Properties and Uses. The flowers are gently excitant and sudorific, but are seldom used. The berries are diaphoretic and aperient; and their inspissated juice has been used as an alterative in rheumatism and syphilis in doses of from one or two drachms (3·9–7·8 Gm.); also as a laxative in doses of half an ounce (15·5 Gm.) or more. The inner bark is a hydragogue cathartic, and in large doses emetic. It has been employed in dropsy, epilepsy, and as an alterative in various chronic diseases. An ounce may be boiled with two pints of water to a pint, and four fluidounces (118 C.c.) given for a dose. It is also used in vinous infusion. The leaves are not without activity, and the young leaf-buds are said to be a violent and even unsafe purgative. The juice of the root has been highly recommended in dropsy as a hydragogue cathartic, sometimes acting as an emetic, in the dose of a tablespoonful, repeated *pro re nata*. The fruits of the California species, *S. glauca* and *S. racemosa*, are said to be used as food by the Indians.

Off. Prep. Aqua Sambuci, *Br.*

SANGUINARIA. *U. S.* *Sanguinaria.* [*Bloodroot.*]

(SĂN-GUỊ-NĀ'RỊ-Ạ.)

"The rhizome of Sanguinaria canadensis, Linné (*Nat. Ord.* Papaveraceæ), collected in autumn." *U. S.*

Puccoon, Tetterwort, Indian Paint; Sanguinaire, *Fr.*; Blutwurzel, *G.*

Gen. Ch. *Calyx* two-leaved. *Petals* eight. *Stigma* sessile, two-grooved. *Capsule* superior, oblong, one-celled, two-valved, apex attenuated. *Receptacles* two, filiform, marginal. *Nuttall.*

Sanguinaria Canadensis. Willd. *Sp. Plant.* ii. 1140; Bigelow, *Am. Med. Bot.* i. 75; Barton, *Med. Bot.* i. 31; *B. & T.* 20. The *bloodroot*, or, as it is sometimes called, *puccoon*, is an herbaceous or perennial plant. The root (rhizome) is horizontal, abrupt, often contorted, about as thick as the finger, two or three inches long, fleshy, of a reddish brown color on the outside, and brighter red within. It is furnished with numerous slender radicles, and makes offsets from the sides, which succeed the old plant. From the end of the root arise the scape and leafstalks, surrounded by the large sheaths of the bud. These spring up together, the folded leaf enveloping the flower-bud, and rolling back as the latter expands. The leaf, which stands upon a long channelled petiole, is reniform, somewhat heart-shaped, deeply lobed, smooth, yellowish green on the upper surface, paler or glaucous on the under, and strongly marked by orange-colored veins. The scape is erect, round, and smooth, rising from a few inches to a foot, and terminating in a single flower. The calyx is two-leaved and deciduous. The petals, varying from seven to fourteen, but usually about eight in number, are spreading, ovate, obtuse, concave, mostly white, but sometimes slightly tinged with rose or purple. The stamens are numerous, with yellow filaments shorter than the corolla, and orange oblong anthers. The germ is oblong and compressed, with a sessile, persistent stigma. The capsule is oblong, acute at both ends, two-valved, and contains numerous oval, reddish brown seeds. The whole plant is pervaded by an orange-colored sap, which flows from every part when broken, but is of the deepest color in the root. The bloodroot is one of the earliest and most beautiful spring flowers of the United States; everywhere growing abundantly in loose, rich soils, and shady situations. After the fall of the flower, the leaves continue to grow, and, by the middle of summer, have become so large as to give the plant an entirely different aspect. Except the seeds, all parts of the plant are active.

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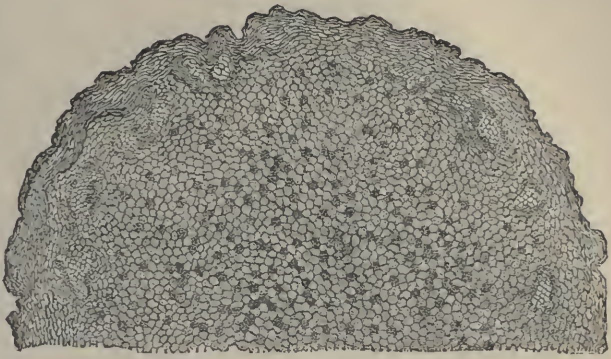
* A fungus growing on this plant, called *fungus sambuci*, had a century since some reputation in Europe as a refrigerant in ophthalmia, and has recently been revived as a remedy in the same disease. It was ascertained by Steckel, an apothecary of Northern Germany, to have an extraordinary power, when immersed in water, of absorbing that fluid, so as to increase its weight sevenfold; and, if long immersed, it is capable of taking up from 9 to 12 times its weight. It has, besides, the property of retaining the absorbed water very adhesively. This property adapts it admirably to the local treatment of conjunctivitis; and on trial it has been found successful where the ordinary applications have proved fruitless. (*Neues Repert.*, xiii. 476, 1864.)


Sanguinaria, transverse section.

The dried root is in pieces from one to three inches long, from a quarter to half an inch or more in thickness, flattened, faintly annulated, much wrinkled and twisted, often furnished with abrupt offsets and many short fibres, of a reddish brown color externally, with a spongy uneven fracture, the surface of which is at first bright orange, or whitish, with numerous small red resin-cells, but becomes of a dull brown by long exposure. The color of the powder is a brownish orange-red. Sanguinaria has a faint narcotic odor, and a bitterish very acrid taste, the pungency of which remains long in the mouth and fauces. It yields its virtues to water and alcohol. The late Dr. Dana, of New York, obtained from it an alkaloid, denominated by him *sanguinarine*, upon which the acrimony, and perhaps the medical virtues, of the root depend. It may be procured, according to Dana, by infusing the finely powdered root in hot water or diluted hydrochloric or acetic acid, precipitating with water of ammonia, collecting the precipitated matter, boiling it in water with pure animal charcoal, filtering off the water, treating the residue left upon the filter with alcohol, and finally evaporating the alcoholic solution. (*Ann. Lyc. of Nat. Hist. New York*, ii. 250.) It may also be conveniently procured by a process similar to that employed by Probst for obtaining chelerythrine from celandine. This consists in forming a strong ethereal tincture of the root, passing through this hydrochloric acid gas, drying the precipitated hydrochlorate, which is insoluble in ether, dissolving it in hot water, filtering, precipitating by ammonia, drying the precipitate, dissolving it in ether, decolorizing by animal charcoal, precipitating by means of hydrochloric acid gas, and decomposing the hydrochlorate as before. (*Chem. Gaz.*, i. 145.) Dr. James Schiel, of St. Louis, Missouri, who has determined the identity of sanguinarine with chelerythrine, gives the following as the simplest process of preparing either alkaloid. Digest the root with water strongly acidulated with sulphuric acid, precipitate with ammonia, dry the precipitate, dissolve it in ether, treat with animal charcoal, filter, and precipitate with sulphuric acid dissolved in ether. A pure sulphate is thus obtained, which may be decomposed in the ordinary method, to obtain the alkaloid. (*Silliman's Journ.*, Sept. 1855.) Sanguinarine is a white pearly substance, of an acrid taste, very sparingly soluble in water, soluble in ether, and very soluble in alcohol. With the acids it forms salts soluble in water, all of which have some shade of red, crimson, or scarlet, and form beautiful red solutions. They are acrid and pungent to the taste, particularly the hydrochlorate and acetate. From these facts it would appear that the red color and acrid properties of the bloodroot may be owing to the presence of some native salt of sanguinarine, which is decomposed by ammonia in the separation of the alkaloid. The formula of sanguinarine is $C_{17}H_{15}NO_4$. A second alkaloid has been extracted from bloodroot by Riegel, and was named by him *porphyroxine*, because of its supposed identity with an alkaloid of that name announced by Merck as present in opium. The name is now retained for the alkaloid of sanguinaria.* (*Chem. Gaz.*, iv. 198.) Mr. E. S. Wayne, of Cincinnati, has discovered a third alkaloid, which he found in the ether, after the precipitation of the sulphate of sanguinarine in the process of Dr. Schiel. It is pale red, tasteless, insoluble in water, soluble in alcohol and ether, and unites with hydrochloric and sulphuric acids to form crystallizable compounds, of a deep red color. (*A. J. P.*, xxviii. 522.) Dr. Gibb proposes for this principle the name of *puccine*. According to that writer, bloodroot contains, besides the three alkaloids referred to, *chelidonic acid*, fecula, sugar, albumen, resin, fixed oil, gum, extractive, and lignin. (*P. J. Tr.*, March, 1860.) It has since been shown, however, that puccine is not a distinct alkaloid, but sanguinarine held in solution by resin. The virtues of the root are said to be rapidly deteriorated by time. Mr. Thos. M. Newbold extracted from sanguinaria a non-volatile liquid acid (*sanguinarinic acid*) (*A. J. P.*, 1866, p. 496), which L. C. Hopp has shown to be a solution of impure citric and malic acids.

Medical Properties and Uses. Sanguinaria is an acrid emetic, with stimulant narcotic powers. In small doses it excites the stomach, and accelerates the circulation; more largely given, it produces nausea and consequent depression of the pulse; and in the full dose it occasions active vomiting. It is also expectorant, and is said to be emmenagogue. The effects of an overdose are violent emesis, a burning sensation in the stomach, tormenting thirst, faintness, vertigo, dimness of vision, and alarming prostration. (For fatal cases, see *Am. Journ. of Med. Sci.*, N. S., ii. 506.) Snuffed up the nostrils, bloodroot excites much irritation, attended with sneezing. Upon fungous surfaces it acts as an escharotic. It has been used in various diseases, but is at present very rarely employed, except as a stimulant expectorant in chronic bronchitis, or in the advanced stages of the acute disorder.

The emetic dose is from ten to twenty grains (0·65–1·3 Gm.), preferably given in pill, in consequence of the great irritation of throat produced by the powder when swallowed. The expectorant dose is from one to five grains (0·065–0·33 Gm.), repeated more or less frequently according to the effect desired, but the officinal tincture is better than the crude drug. An infusion in vinegar has been employed advantageously as a local application in obstinate cutaneous affections. Dr. Stephens, of Ceres, New York, has found the powder useful as an errhine, in coryza, combined with cloves and camphor. (*N. Y. Journ. of Med.*, N. S., iv. 358.) Mixed with chloride of zinc, and made into a paste with flour and water, it has been used by Dr. J. W. Fell as a local remedy in cancer, with asserted success.

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* This alkaloid was obtained by treating the root with water acidulated with acetic acid, precipitating the sanguinarine by ammonia, neutralizing the "wash-water" with acetic acid, precipitating by infusion of galls, digesting the precipitate previously washed and dried in an alcoholic solution of potassa, passing carbonic acid through the solution, and distilling off the alcohol. The residue was exhausted with water, the liquid evaporated, and what remained extracted by ether, which yielded it, on evaporation, in the form of a dirty white crystalline mass. By dissolving this in alcohol, decolorizing with animal charcoal, and crystallizing, it was obtained in colorless tabular crystals, without taste or smell, very sparingly soluble in water, more readily so in alcohol, and forming with the acids colorless, bitter, crystallizable salts, soluble in water. (*Chem. Gaz.*, iv. 198.)

Dr. Wm. Tully found the alkaloid *sanguinarine*, in large doses, to produce vertigo, dilatation of the pupil, a haggard expression of face, nausea, coldness of the extremities, cold sweats, and diminished frequency with irregularity of the pulse. The late Prof. R. P. Thomas, of Philadelphia, who experimented with it on himself and others, gave the following statement of its powers. In doses varying from one-twelfth to one-eighth of a grain (0·005–0·008 Gm.), it acted as an expectorant, without disturbing the stomach. One-sixth or one-fourth (0·01–0·016 Gm.) of a grain, given every two or three hours, generally produced nausea, and sometimes vomited. Half a grain (0·03 Gm.) in solution, given at intervals of ten minutes, almost invariably vomited after the second or third dose. Under the influence of one-eighth or one-sixth (0·008–0·01 Gm.) of a grain, given every three hours, for two days or more, the pulse was generally reduced from five to fifteen beats in the minute. He found no alterative effect, and none of any kind directly upon the liver. (*Proc. of Am. Med. Assoc.*, 1863, p. 219.)

Off. Prep. Acetum Sanguinariæ, *U. S.;* Extractum Sanguinariæ Fluidum, *U. S.;* Tinctura Sanguinariæ, *U. S.*

SANTALUM. *U.S.* *Red Saunders.*

(SĂN′TẠ-LŬM.)

"The wood of Pterocarpus santalinus. Linné. (*Nat. Ord.* Leguminosæ, Papilionaceæ.)" *U. S.* "The wood of Pterocarpus santalinus. Linn. From Ceylon." *Br.*

Pterocarpi Lignum, *Br.;* Red Sandal Wood; Lignum Santalinum Rubrum; Santal rouge, *Fr.;* Santelholz, Rothes Santelholz, *G.*

Gen. Ch. *Calyx* five-toothed. *Legume* falcated, leafy, varicose, girted by a wing, not gaping. *Seeds* solitary. *Willd.*

Pterocarpus santalinus. Willd. *Sp. Plant.* iii. 906; Woodv. *Med. Bot.* p. 430, t. 156; *B. & T.* 82. This is a large tree, with alternate branches, and petiolate ternate leaves, each simple leaf being ovate, blunt, somewhat notched at the apex, entire, veined, smooth on the upper surface, and hoary beneath. The flowers are yellow in axillary spikes, and have a papilionaceous corolla, of which the *vexillum* is obcordate, erect, somewhat reflexed at the sides, toothed and waved, the *alæ* spreading with their edges apparently toothed, and the *carina* oblong, short, and somewhat inflated. The tree is a native of India, attaining the highest perfection in mountainous districts, and inhabiting especially the mountains of Coromandel and Ceylon. It is said that it is everywhere rare, and that plantations of it are being formed. Its wood is the officinal *red saunders,* though there is reason to believe that the product of other trees is sold by the same name.

The wood comes in roundish or angular billets, internally of a blood-red color, externally brown from exposure, compact, heavy, and fibrous. It is kept in the shops in the state of small chips, raspings, or coarse powder.

Red saunders has little smell or taste. It imparts a red color to alcohol, ether, and alkaline solutions, but not to water; and a test is thus afforded by which it may be distinguished from some other coloring woods. The alcoholic tincture produces a deep violet precipitate with ferrous sulphate, a scarlet with mercuric chloride, and a violet with the soluble salts of lead. The coloring principle, which was separated by Pelletier, and called by him *santalin,* is of a resinous character, scarcely soluble in cold water, more so in boiling water, very soluble in alcohol, ether, acetic acid, and alkaline solutions, but slightly in the fixed and volatile oils, with the exception of those of lavender and rosemary, which readily dissolve it. It is precipitated when acids are added to the infusion of the wood, prepared with an alkaline solution. Weyermann and Haeffely have found it to possess acid properties, and give it the formula $C_{15}H_{14}O_5$. (*Ann. Ch. und Pharm.*, 74, p. 226.) The wood has no medical virtues, and is employed solely for the purpose of imparting color.

Off. Prep. Tinctura Lavandulæ Compositus, *U. S.*

SANTONICA. *U. S., Br.* *Santonica.* *Levant Wormseed.*

(SẠN-TŎN'Ị-CẠ.)

"The unexpanded flower-heads of Artemisia maritima, *var.* Stechmanniana. Besser. (*Nat. Ord.* Compositæ.)" *U. S.* "The unexpanded flower-heads of an undetermined species of Artemisia. Imported from Russia." *Br.*

European Wormseed; Santonici Semen, Semen Cynæ, Semen Contra; Flores Cinæ, *P.G.;* s. Sanctum; Barbotine, Semencine, *Fr.;* Wurmsamen, Zittwersamen, *G.*

Artemisia maritima is a small semi-shrubby perennial, from whose oblique, knotted rootstalks arise numerous leafy shoots and flowering stems. The glabrous and woody stems bear on their many branches numerous small (1 inch long) bi- to multipinnatifid leaves, whilst the leaves of the flowering stems are very minute, the upper ones simple. The flower-heads are small, numerous, $\frac{1}{10}$th of an inch long, with 12 to 18 involucral scales, and from 3 to 5 flowers. The plant varies very greatly, and several species have been made out of its varieties. The form whose floral buds are said to resemble most closely the commercial drug has been named *A. cina* by Berg and Schmidt (t. 29, c.), and *A. pauciflora* by Weber. Bentley & Trimen, 157, adopt the latter name, but the specific distinctness of the plant seems very doubtful. European wormseed is of two kinds; one called the *Aleppo, Alexandria,* or *Levant wormseed,* the other *Barbary wormseed.* The former is supposed to be the product of *Artemisia Contra,* which grows in Persia, Asia Minor, and other parts of the East. It consists in fact not of the seeds, but of the small globular unexpanded flowers of the plant, mixed with their broken peduncles, and with minute, obtuse, smooth leaves. It has a greenish color, a very strong aromatic odor increased by friction, and a very bitter disagreeable taste. The *Barbary wormseed* is thought by some to be derived from *Artemisia Judaica,* by others from the *A. Sieberi* of Besser (*A. glomerata* of Sieber), and from *A. ramosa* (C. Smith), all of which grow in Palestine and Arabia. It consists of broken peduncles, having the calyx sometimes attached to their extremity. The calyx is also sometimes separate, consisting of very small linear obtuse leaflets. The flowers are wanting, or in the shape of minute globular buds. All these parts are covered with a whitish down, which serves to distinguish this variety from the wormseed of the Levant. It is, moreover, lighter and more colored than the latter. Its smell and taste are the same. It is Levant wormseed which is the santonica of the two Pharmacopœias. It is officinally described as "nearly one-twelfth of an inch (2 mm.) long, oblong-ovoid, obtuse, smooth, somewhat glossy, grayish green, after exposure to light, brownish green, with an involucre of about eighteen, closely imbricated, glandular scales, enclosing four or five rudimentary florets; odor strong, peculiar, somewhat camphoraceous; taste aromatic and bitter." *U. S.*

Wormseed contains a volatile oil, but it owes its efficiency to a peculiar principle called *santonin.** (See *Santoninum.*) It is rarely used in this country in substance. The dose is from ten to thirty grains (0·65–1·95 Gm.), which should be repeated morning and evening for several days, and then followed by a brisk cathartic.

Off. Prep. Santoninum.

SANTONINUM. *U. S., Br.* *Santonin.*

$C_{15}H_{18}O_3$; 246. (SĂN-TỌ-NĪ'NŬM.) $C_{30}H_{18}O_6$; 246.

"A neutral principle prepared from Santonica. It should be kept in dark, amber-colored vials, and should not be exposed to light." *U. S.*

Santonine, *Fr.;* Santonin, *G.*

The U. S. Pharmacopœia of 1880 very properly omits a process for the preparation of Santonin. The process of U. S. P. 1870 will be found below.†

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* For a method of valuing santonica, by Dragendorff, see *Proc. A. P. A.*, xxvi. 229.

† "Take of Santonica, in moderately coarse powder, *forty-eight troyounces;* Lime, recently slaked, and in fine powder, *eighteen troyounces;* Animal Charcoal, in fine powder, Diluted Alcohol, Acetic Acid, Alcohol, each, *a sufficient quantity.* Digest the Santonica and Lime with twelve pints of Diluted Alcohol for twenty-four hours, and express. Repeat the digestion and expression twice with the residue, using the same quantity of Diluted Alcohol. Mix the tinctures, and reduce the mixture to eight pints by distilling off the alcohol. Then, having filtered, and evaporated to one-half, gradually add Acetic Acid until in slight excess, stirring during the addition, and set the

"Take of Santonica, bruised, *one pound* [avoirdupois]; Slaked Lime, *seven ounces* [avoird.]; Hydrochloric Acid *a sufficiency;* Solution of Ammonia *half a fluidounce;* Rectified Spirit *fourteen fluidounces;* Purified Animal Charcoal *sixty grains;* Distilled Water *a sufficiency.* Boil the Santonica with a gallon [Imperial measure] of the Water and five ounces [avoird.] of the Lime, in a copper or tinned iron vessel, for an hour, strain through a stout cloth, and express strongly. Mix the residue with half a gallon [Imp. meas.] of the Water and the rest of the Lime, boil for half an hour, strain and express as before. Mix the strained liquors, let them settle, decant the fluid from the deposit, and evaporate to the bulk of two pints and a half [Imp. meas.]. To the liquor while hot, add, with diligent stirring, the Hydrochloric Acid until the fluid has become slightly and permanently acid, and set it aside for five days that the precipitate may subside. Remove by skimming any oily matter which floats on the surface, and carefully decant the greater part of the fluid from the precipitate. Collect this on a paper filter, wash it first with cold Distilled Water till the washings pass colorless and nearly free from acid reaction, then with the Solution of Ammonia previously diluted with five fluidounces of the Water, and lastly with cold Distilled Water till the washings pass colorless. Press the filter containing the precipitate between folds of filtering paper, and dry it with a gentle heat. Scrape the dry precipitate from the filter, and mix it with the Animal Charcoal. Pour on them nine ounces of the Rectified Spirit, digest for half an hour, and boil for ten minutes. Filter while hot, wash the charcoal with an ounce of boiling Spirit, and set the filtrate aside for two days in a cool dark place to crystallize. Separate the mother-liquor from the crystals, and concentrate to obtain a further product. Collect the crystals, let them drain, redissolve them in four ounces of boiling Spirit, and let the solution crystallize as before. Lastly, dry the crystals on filtering paper in the dark, and preserve them in a bottle protected from the light." *Br.*

By the U. S. process of 1870, which was taken from Wittstein's *Pharmaceutical Chemistry*, the santonica is first exhausted by digestion with diluted alcohol, in connection with slaked lime; the latter substance being employed to combine with the santonin, and remove coloring matter which might subsequently embarrass the proceedings. The tincture thus obtained, having been reduced by the distillation of the alcohol to little more than an aqueous solution, is filtered and treated with acetic acid, in slight excess, by which the santonin is separated from the lime which holds it in solution, and, being itself insoluble, is gradually deposited in a crystalline state. The remainder of the process is intended simply to obtain the crystals free from coloring matter, and otherwise pure.

The British process, which is that of M. Mialhe somewhat modified (*P. J. Tr.*, June, 1864, p. 635), spares the expenditure of alcohol in the exhaustion of the santonica, by boiling it originally with water in connection with lime, and differs also from the preceding in precipitating the santonin by hydrochloric instead of acetic acid. The purification is effected in the same manner, except that solution of ammonia is employed in the washing, probably to remove the last trace of acid. Wormseed of Aleppo yields from 1·2 to 1·4 per cent. of santonin. (*Journ. de Pharm.*, Mars, 1864, p. 241.) It has been intimated to us that the large manufacturers of santonin, abroad, first distil off from the santonica its volatile oil, which has some commercial value in Europe; and that the process for preparing santonin is probably facilitated thereby, in consequence of an affinity of the oil for the santonin, which may render it more difficult of purification.

Properties. Santonin is in "colorless, shining, flattened, prismatic crystals, not altered by exposure to air, but turning yellow on exposure to light; odorless and nearly tasteless when first placed in the mouth, but afterward bitter, and having a

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whole aside for forty-eight hours. Place the resulting crystalline mass upon a funnel loosely stopped, wash it with water, and dry it. Next, boil the dry residue with ten times its weight of Alcohol, and having digested the tincture for several hours with Animal Charcoal, filter it while hot, and add sufficient hot Alcohol, through the filter, to wash the Charcoal thoroughly; then set it aside in a dark place to crystallize. Lastly, dry the crystals on bibulous paper in the dark, and keep them in a well-stopped bottle, protected from the light. By evaporating the mother-water, more crystals may be obtained." *U. S.* 1870.

neutral reaction. Nearly insoluble in cold water; soluble in 250 parts of boiling water, in 40 parts of alcohol at 15° C. (59°. F.), and in 3 parts of boiling alcohol; also soluble in 160 parts of ether, in 4 parts of chloroform, and in solutions of the alkalies. The alcoholic and ethereal solutions have an intensely bitter taste. When heated to 170° C. (338° F.), Santonin melts, and forms, if rapidly cooled, an amorphous mass which instantly crystallizes on coming in contact with a minute quantity of one of its solvents. At a higher temperature it sublimes, partly unchanged, in dense, white, irritating vapors, and is finally wholly dissipated. With alcoholic solution of potassa, Santonin yields a scarlet-red liquid, which gradually becomes colorless. From its solution in alkalies it is completely precipitated by supersaturating with an acid. Its solution in cold, concentrated sulphuric acid is at first colorless, then turns yellow, red, and brown. If water be added, immediately after it is dissolved in sulphuric acid, it is completely precipitated, and the supernatant liquor is not altered upon the addition of test-solution of bichromate of potassium, or of iodide of mercury and potassium (abs. of alkaloids)." *U. S.* The air has no effect upon it, but it becomes yellow on exposure to sunlight. According to M. Sestini, the santonin is changed, through the influence of light, into formic acid, an uncrystallizable substance much more soluble in alcohol and ether than santonin itself, which he calls *photosantonic acid*, and a red resinous substance. If the santonin be in alcoholic solution, after several months of exposure to sunlight, it is changed into the ethyl ether of photosantonic acid, $C_{15}H_{13}O_4(C_2H_5)_2$. In its relations to polarized light it is very strongly lævogyrate, and retains this property with acids, though losing it entirely when combined with salifiable bases. (Buignet, *Journ. de Pharm.*, Janv. 1862, p. 26.) When warmed with alkalies, santonin is changed into monobasic *santoninic acid*, $C_{15}H_{20}O_4$, while concentrated baryta-water changes it on prolonged boiling into the isomeric *santonic acid*. When santonin is heated with zinc-dust, it yields *santonol*, $C_{15}H_{18}O$. Under the influence of sulphuric acid and heat, it was said to be resolved into glucose and a new body, for which the name of *santoniretin* has been proposed, and was consequently supposed to rank with the glucosides. (Kosmann, *Journ. de Pharm.*, Août, 1860, p. 81.) Schmidt (*Journ. de Pharm.*, 4e sér., iii. 394) disproved the previously-accepted fact that santonin was a glucoside; but Hesse (*Deut. Chem. Ges. Ber.*, vi. 1280) found santonin to be the anhydride of *santoninic acid*, and prepared this acid by adding an excess of diluted hydrochloric acid to an aqueous solution of the sodium salt, and adding ether, from which the acid may be recovered by evaporation. When santoninic acid is heated to 120° C. (248° F.), it is resolved into santonin and water. It has a strongly acid reaction, and decomposes sodium and calcium carbonate. (See *Sodii Santoninas.*)

Medical Properties and Uses. The symptoms of poisoning by santonin are giddiness, mental apathy or stupor, great paleness and coldness of the surface, vomiting, profuse sweating, trembling, mydriasis, and finally loss of consciousness, with convulsions, often violent and accompanied by opisthotonos and emprosthotonos, and failure of respiration. Xanthopsia is an early and characteristic symptom. All objects appear discolored, generally yellow, but frequently also green, and sometimes blue. At the same time the urine is tinged of a yellow or green color; and so rapidly does the santonin pass, that the change of color in the urine has been observed at the end of 16 minutes.* (*Journ. de Pharm.*, Août, 1863, p. 161.) These effects are probably due to the presence of santonin in the aqueous humor and the urine. In regard to the minimum fatal dose, two grains are said to have killed a feeble child five years old, and one six or seven years old is said to have been destroyed by six grains of the acid, after suffering from hæmaturia (*Bull. Thérap.*, lxxiv. 362); four grains produced very serious symptoms in a child four years old. (*P. J. Tr.*, ix. 696.)

The santoninates are inferior to santonin, being more soluble; for the same reason the principle is preferable in its natural crystalline form to the powder. Santonin is best administered in the form of lozenges made with sugar and tragacanth (formula, *A. J. P.*, vi. 124), which, if the unbroken crystals are used, can be rendered very pleasant to the taste, so that children will eat them as candy. The dose of santonin for an adult is two to four grains (0·13 to 0·26 Gm.); for a child two years old, one-fourth to one-half grain (0·016 to 0·03 Gm.).

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* According to Dr. Walter G. Smith, the yellow color imparted to urine by santonin is distinguished from that produced by other substances by becoming purplish red on the addition of ammonia or other alkali. (*P. J. Tr.*, Dec. 1870, p. 528.) For researches upon the character of the urinary coloring matter, consult the same paper.

SAPO. *U. S.* *Soap.*

(SĀ′PŌ.)

"Soap prepared from soda and olive oil." *U. S.* "Soap made with olive oil and soda." *Br.*

Sapo Durus, *Br.;* Savon, Savon blanc, *Fr.;* Oel-Sodaseife, Seife, *G.;* Sapone duro, *It.;* Xabon, *Sp.*

SAPO MOLLIS. *Br.* *Soft Soap.*

(SĀ′PŌ MŎL′LỊS.)

"Soap made with olive oil and potash." *Br.*

Savon mou, Savon vert, Savon à Base de Potasse, *Fr.;* Schmierseife, Kaliseife, *G.*

Soaps embrace all those compounds which result from the reaction of salifiable bases with fats and oils. Fats and oils, as has been explained under the titles *Adeps* and *Olea*, consist generally of three principles, two solid, differing in fusibility, called *stearin* and *palmitin*, and one liquid, called *olein*, of which there are two varieties. Stearin is found most abundantly in fats which are firm and solid, as suet and tallow; and palmitin and olein in the oils. When the fats and oils undergo *saponification* by reaction with a salifiable base, these three principles are decomposed into oily acids peculiar to each, discovered by Chevreul, and called stearic, palmitic, and oleic acids, which unite with the base to form the soap, and into a sweet principle not saponifiable, called glycerin, which is set free. Hence it follows that stearin is a stearate, palmitin a palmitate, and olein an oleate of glyceryl, C_3H_5, the radical of the triatomic alcohol glycerin, $C_3H_5(OH)_3$, and that the fats and oils are mixtures of these three oily salts. Hence, also, it is obvious that soaps are mixed stearates, palmitates, and oleates of various bases. *Stearic acid*, $C_{18}H_{36}O_2$, is a firm white solid, like wax, fusible at 69·2° C. (157° F.), greasy to the touch, pulverizable, soluble in alcohol, very soluble in ether, but insoluble in water. In the impure state it is used as a substitute for wax in making wax candles. *Palmitic acid*, $C_{16}H_{32}O_2$, forms a white scaly mass, and melts at 62° C. (143·6° F.). *Oleic acid*, $C_{18}H_{34}O_2$, is an oily liquid, insoluble in water, soluble in alcohol and ether, lighter than water, crystallizable in needles a little below 0° C. (32° F.), and having a slight smell and pungent taste. (See *Acidum Oleicum.*) *Glycerin* is described under a separate head. (See *Glycerina.*)

Soaps are divided into the soluble and the insoluble. The soluble soaps are combinations of the oily acids with soda, potassa, and ammonia; the insoluble consist of the same acids united with earths and metallic oxides. It is the soluble soaps only that are detergent, and to which the name *soap* is usually applied. Several of the insoluble soaps are employed in pharmacy; as, for example, the soap of the monoxide of lead, or lead plaster, and the soap of lime, or lime liniment. (See *Emplastrum Plumbi* and *Linimentum Calcis.*) The two officinal soaps, here described, are of the soluble kind. One is a soda soap, made with olive oil (Castile soap), the other a potassa soap (soft soap), whilst green soap, recently made officinal, will be treated of in a separate article. (See *Sapo Viridis.*) The soap of ammonia is noticed elsewhere. (See *Linimentum Ammoniæ.*)

The consistency of the fixed alkaline soaps depends partly on the nature of the oil or fat, and partly on the alkali present. Soaps are harder the more stearate and palmitate they contain, and softer when the oleate predominates; and, as respects the alkali present, they are harder when formed with soda, and softer when containing potassa. Hence it is that of pure soaps, considered as salts, stearate of sodium is the hardest and least soluble, and oleate of potassium the softest and most soluble.

Preparation. The following is an outline of the process for making soap. The oil or fat is boiled with a solution of caustic alkali, until the whole forms a thick mass, which can be drawn out into long clear threads. After the soap is completely formed, the next step is to separate it from the excess of alkali, the glycerin, and redundant water. This is effected by adding common salt, or a very strong alkaline lye, in either of which the soap is insoluble. The same end may be attained by boiling down the solution until the excess of alkali forms a strong alkaline solution, which acts the same part in separating the soap as the addition of a similar solution. As soon as the soap is completely separated, it rises to the surface; and, when it has ceased to froth in boiling, it is ladled out into wooden frames to congeal, after which it is cut into bars by means of a wire. The soap, as first separated, is called *grain soap.* It may be purified by dissolving it in an alkaline lye, and separating it by common salt. During this process the impurities subside, and the soap combines with more water; and hence it becomes weaker, although purer and whiter. If the grain soap is not purified, it forms *marbled soap;* the colored streaks arising principally from an insoluble soap of oxidized iron. Sometimes the marbled appearance is produced by adding to the soap, as soon as it is completely separated, a fresh portion of lye, and immediately afterwards a solution of sulphate of iron. The black oxide of iron is precipitated, and gives rise to dark-colored streaks, which, by exposure to the air, become red in consequence of the conversion of the black oxide into the sesquioxide of iron. When toilet soap is required, the *grained* soap, or, as it is sometimes called, *boiled* soap, is often remelted, perfumed, and worked over by the processes of *milling*, *plaiting*, and *moulding*, whereby the soap is brought into the desired shape for popular use. The *cold process* is also used, and is preferred by many because of its simplicity and economy. The following (from *A. J. P.*, Nov. 1880) affords a good illustration of the method. A good hard soap can be easily produced if 4 pounds of olive or sweet almond oil be mixed, with 2 pounds of soda lye, of the strength 36° Baumé, and stirred until of the consistence of thick paste, when it should be poured into moulds, covered by several folds of muslin, and kept in a warm room for 20 hours. By this treatment the process of saponification is complete. When these materials are first mixed, the temperature of the mass rises, and in order to effect the entire union of ingredients so as to form the soap it is necessary that the heat thus generated should be maintained for some time: hence the necessity for covering the moulds and keeping them in a warm room. It is desirable to use oil that is slightly rancid, or, if free from rancidity, to add about 10 per cent. of oil that has become so. Oil that is perfectly sweet requires two or three days to effect saponification. Soap thus made is as hard and dry after a few days as that article generally is when several years old when made in the usual manner.*

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* The following very practical process is by W. J. Menzies. (*Chemist and Druggist*, Aug. 1880.) *On the Manufacture of Soap in small Quantities without Boiling.* Take exactly 10 lbs. of double-refined 98 per cent. caustic-soda powder (Greenbank), put it in any can or jar with 45 lbs. (4½ gallons) of water, stir it once or twice, when it will dissolve immediately and become quite hot; let it stand until the lye thus made is cold. Weigh out and place in any convenient vessel for mixing, exactly 75 lbs. of clean grease, tallow, or oil (*not* mineral oil). If grease or tallow be used, melt it slowly over the fire until it is liquid and *just warm*,—say temperature not over 37·7° C. (100° F.). If oil be used, no heating is required. Pour the lye slowly into the melted grease or oil in a small stream continuously, at the same time stirring with a flat wooden stirrer about three inches broad; continue gently stirring until the lye and grease are thoroughly combined and in appearance like honey. Do not stir too long, or the mixture will separate itself again. The time required varies somewhat with the weather and the kind of tallow, grease, or oil used; from 15 to 20 minutes will be enough. When the mixing is completed, pour off the liquid soap into any old square box for a mould sufficiently large to hold it, previously dampening the sides with water so as to prevent the soap sticking. Wrap up the box well with old blankets, or, better still, put it in a warm place until the next day, when the box will contain a block of 130 lbs. of soap, which can afterwards be cut up with a wire. Remember the chief points in the above directions, which must be exactly followed. The lye must be allowed to *cool.* If melted tallow or grease be used, it must not be more than *warm.* The *exact* weights of double-refined 98 per cent. powdered caustic soda and tallow or oil must be taken; also the lye must be stirred into the grease, *not* grease or oil added to the lye. If the grease or tallow used be not clean or *contains salt*, it must be "rendered," or purified, previous to use, that is to say, boiled with water, and allowed to become hard again to throw out the impurities. Any salt present will spoil the whole operation entirely, but discolored or rancid grease or tallow is just as good as fresh for soap-making purposes.

If the soap turn out streaky and uneven, it has not been thoroughly mixed. If very sharp to

The officinal *soap* (Sapo, *U. S.;* Sapo Durus, *Br.*) is an olive oil soda soap, made on the same general plan as that just explained.

Common Soap is also a soda soap; but, instead of olive oil, it contains concrete animal oil. This soap corresponds with the white soap of northern European countries and of the United States, and is formed usually from barilla and tallow. In Scotland it is manufactured from kelp and tallow. It was introduced into the U. S. Pharmacopœia of 1860 as the only proper soap for making opodeldoc; but, as this preparation was discarded, this variety of soap was dismissed along with it.

Soft Soap (Sapo Mollis, *Br.*) is prepared on the same general principles as hard soap; potash being employed as the alkali, and a fatty matter, rich in olein, as the oil. The French soft soap is made with the seed oils, such as rape-seed, hemp-seed, etc.; the Scotch and Irish, with fish-oil and some tallow; and our own, with refuse fat and grease. A lye of wood-ashes is the form of potash usually employed. In forming this soap it is necessary that it should continue dissolved in the alkaline solution, instead of being separated from it. Hence soft soap is a soap of potassa, completely dissolved in the solution of its alkali, which is consequently present in excess. A soap of potassa is sometimes made with a view to its conversion into a soda soap. This is effected by the addition of an equivalent quantity of common salt, which, by double composition, generates a soap of soda, and chloride of potassium in solution. After this change is effected, a further addition of salt separates the soda soap formed. Soft soap is said to be largely adulterated in France with starch, which very much improves its appearance. The fraud may be instantly detected by means of the microscope. (*Journ. de Pharm.*, 4e sér., v. 179.)

Besides the officinal soaps of the U. S. and Br. Pharmacopœias, there are many other varieties, more or less used for medicinal or economical purposes. The officinal soap of the French Codex (1837), called *amygdaline soap* (*almond oil soap*), is formed of caustic soda and almond oil, and is directed to be kept for two months exposed to the air before being used. *Starkey's soap*, also officinal in the Codex, is prepared by uniting, by trituration, equal parts of carbonate of potassium, oil of turpentine, and Venice turpentine. *Beef's marrow soap* is a fine animal oil soap, also included in the French standard of pharmacy. *Windsor soap* is a scented soda

the taste, too much soda has been taken. If soft, mild, and greasy, too little soda has been used. In either case it must now be thrown into a pan, and brought to a boil with a little more water. In the first case boiling is all that is necessary; in the other instances a very little oil or a very little more of the double-refined powdered caustic soda must be added to the water. These things will never happen, however, if the directions are exactly followed, and after the soap has been made several times with the experience thus gained, the process is extremely easy, and the result will be always a good batch of soap. Beef tallow makes the hardest soap, mutton fat a rather softer soap; of oils, cotton-seed is the cheapest and best, but the soap is much softer, lathering very freely indeed. Ordinary household fat or dripping will make a nice soap, and in many places can be obtained at a very trifling cost and in exchange for goods sold. Such grease, however, must be carefully examined for *salt*, which it often contains. It will be evident that any smaller quantity of soap can be made at a time, according to the above directions, by taking the ingredients in exact proportion. It is not advisable to make more than double the quantity prescribed, as it is difficult to work more by hand. By making successive batches, however, a single person can make two tons of soap in a day simply with apparatus (pans, etc.) obtainable in any household.

By adding a few drops of essential oil just when the mixing is completed, a toilet soap is produced. Oil of mirbane (artificial almond oil) is the cheapest, but the perfume is not nearly so pleasant as real almond oil, citronella, or oil of cloves. If made with clean grease or tallow or light-colored oil, the soap produced is quite white.

Sometimes a little coloring matter will make soap *sell* better, although of no better quality. Half an ounce of bichromate of potash dissolved in the *lye* will give a green color; 1 lb. of palm oil melted with the tallow or oil, a yellow color; or a good brown can be got by burning ½ lb. of sugar in a saucepan until black, then dissolving it in a pint of water, and adding it to the melted tallow before mixing.

A *very cheap* and good jelly soft soap can be made with the above soap. Take 5 lbs. of the hard soap, crush it down or cut it up into as small pieces as possible; put this into a pan or boiler with 10 gallons of water if a strong hard tallow soap; if an oil soap, only half the quantity of water (5 gallons); just bring it to a boil, and stir well, to thoroughly dissolve all the pieces of hard soap; pour or ladle it into any can, tub, or barrel that is tight, and leave it to cool for two or three days. This will give about 80 lbs. of jelly soft soap at an exceedingly small cost. Of course, if made from colored and scented hard soap it will be a colored and scented jelly soap. This is a good way of working up the scraps and bits of soap after cutting up. It can be sold with a good profit at a very low figure, and often as a substitute for regular soft soap. It is a *very different* article, however, from a *real* potash soft soap, which should invariably be used for washing woollens. It is possible to produce this real potash soft soap in the cold by a process somewhat similar to the above.

soap, made of one part of olive oil and nine parts of tallow. *Eau de luce* (*aqua luciæ*) is a kind of liquid soap, formed by mixing a tincture of oil of amber and balsam of Gilead with water of ammonia. *Transparent soap* is prepared by saponifying kidney fat with soda free from foreign salts, drying the resulting soap, dissolving it in alcohol, filtering and evaporating the solution, and running it into moulds when sufficiently concentrated. The soap is yellow or yellowish brown, and preserves its transparency after desiccation. The German transparent soap always contains a large quantity of cocoanut-oil soap. *Palm soap* is prepared from soda and palm oil, to which tallow is added to increase its firmness. If it be wanted white, the palm oil may be bleached by heat, bichromate of potassium with sulphuric acid, chlorine, or exposure to the sun. This soap has a yellowish color, and the agreeable odor of violets derived from the oil. *Soap balls* are prepared by dissolving soap in a little water, and then forming it with starch into a mass of the proper consistence. *Common yellow soap* (*rosin soap*) derives its peculiarities from an admixture of rosin and a little palm oil with the tallow employed; the oil being added to improve its color. Silicate of sodium has, to some extent, been substituted for rosin, as more economical. (*A. J. P.*, 1863, p. 466.) Large quantities of lard oil (nearly pure olein) are manufactured into soap.*

All the varieties of soap, except a few of the fancy sort, and the olive oil soaps, are manufactured in the United States. The latter are imported from France, Italy, and Spain.

Properties. Soap, whatever may be its variety, has the same general properties. Its aspect and consistence are familiar to every one. Its smell is peculiar, and its taste slightly alkaline. It is somewhat heavier than water, and therefore sinks in that liquid. Exposed to heat it quickly fuses, swells up, and is decomposed. It is soluble in water, and more readily in hot than in cold. Potassa soaps and those containing oleic acid are far more soluble than the soda soaps, especially those in which the stearates and palmitates predominate. Acids, added to an aqueous solution of soap, combine with the alkali, and set free the oily acids, which, being diffused through the water, give it a milky appearance. Its decomposition is also produced by metallic salts, which invariably give rise to insoluble soaps. Soap is soluble in cold, and abundantly in boiling alcohol. This solution constitutes the *tincture of soap*, and forms a very convenient test for discovering lime in natural waters. As the tincture sometimes gelatinizes, it is proposed by M. Bjorklund to remedy this inconvenience by employing soap in the nascent state, that is, containing a large proportion of water. (*Journ. de Pharm.*, 4e sér., ii. 179, 1865.) The efficacy of soap as a detergent depends upon its power of rendering grease and other soiling substances soluble in water, and therefore capable of being removed by washing. The chief adulterations in soap are lime, gypsum, heavy spar, steatite, and pipe-clay. When adulterated with these substances, it will not be entirely soluble in alcohol. According to Dr. Riegel, glue is an occasional adulteration in Spanish soap, discoverable also by its insolubility in alcohol. The same impurity is sometimes found in other soaps. Soap is officinally described as "a white or whitish solid, hard, yet easily cut when fresh, having a slight peculiar odor free from rancidity, a disagreeable, alkaline taste and an alkaline reaction. Readily soluble in water and in alcohol. When cut into thin slices and dried to a constant weight at a temperature of 110° C. (230° F.), it should not lose more than 34 per cent. of its weight (abs. of an undue amount of water). A four per cent. alcoholic solution should not gelatinize on cooling (abs. of animal fats). 100 parts of soap, when dissolved in alcohol, should not leave more than 3 parts of insoluble matter (limit of carbonate of sodium, etc.), and at least 2 parts of this residue should be soluble in water (limit of silica and other accidental impurities). The aqueous solution of Soap should remain unaffected on the addition of solution of hydrosulphuric acid (abs. of metals)." *U. S.*

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* Upon the supposition that the detergent properties of soap depend exclusively on the alkali it contains, and is consequently proportionate to the quantity of that ingredient, a mode of estimating the relative value of soaps has been suggested by R. Graeger, based on the molecular weight of the fatty constituent; those soaps being the strongest, of which the acid has the lowest combining number. (See *A. J. P.*, 1861, p. 355.)

Olive oil soda soap (Sapo), otherwise called *Castile* or *Spanish soap*, is a hard soap, and is presented under two principal varieties, the white and the marbled. *White Castile soap*, when good, is of a pale grayish white color, incapable of giving an oily stain to paper, devoid of rancid odor or strong alkaline qualities, and entirely soluble both in water and alcohol. It should not feel greasy, nor grow moist, but, on the contrary, should become dry by exposure to the air, without exhibiting any saline efflorescence. This variety of soap contains about 21 per cent. of water. Sometimes it contains a larger proportion of water, with which the soap is made to combine by the manufacturer, with the fraudulent intention of increasing its weight. Soap, thus adulterated, is known by its unusual whiteness, and by its suffering a great loss of weight in a dry air. The proportion of water may be ascertained by introducing the soap into a saturated solution of chloride of sodium, and boiling; when the soap, nearly free from water, concretes into a solid mass. *Marbled Castile soap* is harder, more alkaline, and more constant in its composition than the other variety. It contains about 14 per cent. of water. Having less water than the white Castile, it is a stronger and more economical soap, but at the same time less pure. The impurity arises from the veins of marbling, consisting of ferruginous matter, as already explained. Soap made with animal fat, with the probable addition of silicate of sodium, has been sold for Castile soap. The Italian brands of Castile soap which have been so largely used in past years are rapidly depreciating in quality; they are now chiefly made from cotton-seed oil and other substitutes for olive oil. The finest Castile soap is at present (1882) imported from Spain.

Animal oil soda soap (*Sapo Vulgaris*) is a hard soap, of a white color, inclining to yellow. It is made from tallow and caustic soda. This soap possesses the same general properties as the olive oil soda soap.

Soft soap (*Sapo Mollis*), as made in this country, is semi-fluid, slippery, capable of being poured from one vessel to another, and of a dirty brownish yellow color. This soap always contains an excess of alkali, which causes it to act more powerfully as a detergent than hard soap. It also contains the glycerin of the fatty matters, which is always separated from hard soap. In the Br. Pharmacopœia it is directed to be made from olive oil and potash. That made in France has a greenish color and the consistence of soft ointment, and is composed of hempseed oil and potash. It is called, in the French Codex, *savon vert*. Sometimes it is manufactured from the dregs of olive oil. (See *Sapo Viridis.*)

Composition. It has been already explained that soap consists of certain oily acids united with an alkali. As olive oil is a compound of olein with palmitin and small quantities of the ethers of other fatty acids, so the officinal "soap" is a mixed oleate and palmitate of sodium. The former officinal "common soap" is principally a stearate of sodium; and "soft soap," as defined in the Br. Pharmacopœia, is a mixed palmitate and oleate of potassium. The following table from Roscoe & Schorlemmer gives an excellent view of the composition of commercial soap.

	Fatty Acids.	Potash, K_2O.	Soda, Na_2O.	Water.	Salt and other Admixtures.
Hard Soaps.					
Old Mottled Soap	81·25	1·77	8·55	8·43	......
New Tallow Soap	61·0	......	8·4	28·8	2·3
Marseilles Soap	67·0	......	7·8	21·2	4·0
Palm-oil Soap, yellow	65·2	......	9·8	19·9	1·1
do. bleached	61·2	......	9·7	24·8	1·3
Tallow Soap	42·8	......	8·8	39·1	......
Cocoanut-oil Soap (Marine Soap)	22·0	......	4·5	73·5	......
Palm-oil Soap	49·6	......	8·0	35·4	1·1
Soft Soaps.					
Common Soft Soap	42·8	9·1	......	48·0	......
London Soft Soap	45·0	8·5	......	46 5	......
Belgian Green Soap	36·7	7·0	......	57·0	......

Incompatibles. Soap is decomposed by all the acids, earths, and earthy and metallic salts. Acids combine with the alkali, and set free the oily acids of the soap; the earths unite with the oily acids and separate the alkali; while the earthy and metallic salts give rise, by double decomposition, to an insoluble soap of their base, and a saline combination between their acid and the alkali of the soap. Hard waters, in consequence of their containing salts of lime, decompose and curdle soap. They may be rendered soft, and fit for washing, by adding sufficient carbonate of sodium or of potassium to precipitate all the lime.

Medical Properties. Soap possesses the properties of a laxative, antacid, and antilithic. It is seldom given alone, but frequently in combination with rhubarb, the astringency of which it has a tendency to correct. Thus combined, it is often administered in dyspepsia, attended with constipation and torpor of the liver. As it is readily decomposed by the weakest acids, which combine with the alkali, it often proves useful in acidity of the stomach, and has been recommended as a remedy in the uric acid diathesis; but it possesses no power to dissolve calculi, as was once supposed. Externally, soap is a stimulating discutient, and as such has been used by friction in sprains and bruises. The late Dr. A. T. Thomson found much benefit to result from rubbing the tumid abdomen of children in mesenteric fever, morning and evening, with a strong lather of soap. For the cure of itch, Dr. Schubert recommends a mixture of soft soap and salt, in the proportion of eight ounces of the former to four of the latter, dissolved in a quart of water. With this solution, previously warmed, the patient is to be rubbed, night and morning, until a cure is effected, which generally takes place in three days. M. Thenard recommends a solution of soap as an infallible remedy against the bug (*punaise*, Fr.), which, as well as the egg, is destroyed by a hot solution made by boiling together one part of soap with fifty parts of water. (*Journ. de Pharm.*, 3e sér., xxviii. 280.) In constipation of the bowels, particularly when arising from hardened fæces in the rectum, a strong solution of soap, especially of soft soap, forms a useful enema. When the latter is used, two tablespoonfuls may be dissolved in a pint of warm water. In pharmacy, soap is frequently employed for the purpose of giving a proper consistence to pills; but care must be taken not to associate it with a substance which may be decomposed by it. It is also an ingredient in some liniments and plasters. In toxicology it is used as a counter-poison for the mineral acids, and should always be resorted to, in poisoning by these agents, without a moment's delay, and its use continued until magnesia, chalk, or the bicarbonate of sodium or of potassium can be obtained. The mode of administration, in these cases, is to give a teacupful of a solution of soap, made by dissolving it in four times its weight of water, every three or four minutes, until the patient has taken as much as he can swallow. The dose of soap is from five grains to half a drachm (0·33–1·95 Gm.), given in pill.

Off. Prep. of Hard Soap. Emplastrum Cerati Saponis, *Br.;* Emplastrum Resinæ, *Br.;* Empl. Saponis; Extractum Colocynthidis Compositum; Linimentum Potassii Iodidi cum Sapone, *Br.;* Linimentum Saponis; Linimentum Terebinthinæ, *Br.;* Pilulæ Aloes, *U. S.;* Pil. Aloes Barbadensis, *Br.;* Pil. Aloes et Asafœtidæ; Pil. Aloes Socotrinæ, *Br.;* Pil. Asafœtidæ, *U. S.;* Pil. Cambogiæ Composita, *Br.;* Pil. Opii, *U. S.;* Pil. Rhei, *U. S.;* Pil. Rhei Comp., *Br.;* Pil. Saponis Comp.; Pil. Scillæ Comp.

Off. Prep. of Soft Soap. Linimentum Terebinthinæ, *Br.*

SAPO VIRIDIS. *U. S.* *Green Soap.*

(SĀ'PŌ VĬR'Ị-DĬS.)

"Soap prepared from potassa and fixed oils." *U. S.*

This variety of soft soap is now officinal. Its introduction was made necessary on account of its extensive use in dermatological practice. It is usually imported from Germany, and has received the name of "*German soft soap.*" Mr. E. B. Shuttleworth has furnished the following process for its preparation. "In a clean pot or dish, preferably of iron or copper, and capable of containing at least three times the quantity, put one part by weight of linseed oil; heat gently, and add, in two portions, three parts in all, by measure, of liquor potassæ, U. S. P. or B. P., providing either come up to the standard requiring 5·8 and 5·84 per cent. of hydrate of potassa. Boil quietly and stir frequently until the mass becomes clear, which, with four ounces of oil and twelve ounces (fluid) of liquor, will require about one hour, and with ten pounds of oil about five hours. If, during the process, the mass becomes too thick to stir easily, add a little water. Allow the soap to become cool, but, before it sets, work in the coloring matter, which must be previously prepared by boiling finely-powdered indigo with water until the color is formed into a thin paste. Twenty grains of indigo, boiled with one and a half ounces of water until the mixture is reduced to about one drachm, will answer for the soap from four ounces of oil. The soap must not be too hot, nor must it be reboiled after adding the coloring matter, or the green will be destroyed." (*Canad. Pharm. Journ.*, June, 1878.) It is said that the best green soap is made from hempseed oil, but there is no doubt that it is made from a great variety of stock, and, as usually imported, varies greatly in its properties. For most of the uses to which it is put, it should have a decided alkaline reaction, and contain at least 5 per cent. of free hydrate of potassium. (See also paper by Herman Betz, *A. J. P.*, Feb. 1878.)

Properties. It is officinally described as "a soft, greenish yellow, unctuous jelly, having a peculiar odor, which should be free from rancidity, and an alkaline reaction. Soluble in water and in alcohol, without leaving more than a small residue of insoluble matter. When dried at 100° C. (212° F.) to constant weight, Green Soap should not lose more than 40 per cent. of its weight (abs. of an undue amount of water), and the residue should not yield anything to warm benzol (abs. of free fats). The residue left from the alcoholic solution should be almost entirely soluble in water; and the insoluble matter finally remaining should neither effervesce with acids (abs. of insoluble carbonates), nor, after being boiled with water and cooled, should it become blue on the addition of a drop of test-solution of iodine (abs. of starch)." *U. S.*

Medical Properties. Sapo viridis is used almost exclusively in the treatment of eczema rubrum, although sometimes applied to other diseases of the skin; it acts as a powerful detergent stimulant, removing the exudation, and affecting the nutrition of the part. After a thorough rubbing with its tincture, in which form it is best used, the diseased skin must be well washed, and oxide of zinc or other bland ointment applied.

Off. Prep. Tinctura Saponis Viridis, *U. S.*

SARSAPARILLA. *U. S.* *Sarsaparilla.*

(SÄR-SA-PA-RĬL'LA.)

"The root of Smilax officinalis, Kunth, Smilax medica, Schlechtendal et Chamisso, and of other undetermined species of Smilax. (*Nat. Ord.* Smilaceæ.)" *U. S.* "The dried root of Smilax officinalis. Humb. and Bonpl. Native of Central America, imported from South America." *Br.*

Sarsæ Radix, *Br.;* Jamaica Sarsaparilla; Radix Sarsaparillæ, *P.G.;* Salsepareille, *Fr.;* Sarsaparille, Sarsaparilla, *G.;* Salsapariglia, *It.;* Zarzaparilla, *Sp.*

Gen. Ch. MALE. *Calyx* six-leaved. *Corolla* none. FEMALE. *Calyx* six-leaved. *Corolla* none. *Styles* three. *Berry* three-celled. *Seeds* two. *Willd.*

In the present state of our knowledge, it is impossible to decide with positiveness from what species the several commercial varieties of the drug are respectively derived. This much is certain, that they do not proceed from the same plant. Of the many species belonging to this genus, few possess any medicinal power; and Hancock states that of the six or eight which he found growing in the woods of Guiana, only one presented in any degree the sensible properties of the genuine sarsaparilla, the rest being insipid and inert. The root (rhizome) of *Smilax China*, a native of China and Japan, has been employed under the name of *China Root* for similar purposes with the officinal sarsaparilla. As it occurs in commerce, it is in pieces from three to eight inches long and an inch or two thick, usually somewhat flattened, more or less knotty, often branched, of a brownish or grayish brown color externally, whitish or of a light flesh-color internally, without odor, and of a taste flat at first, but afterwards very slightly bitterish and somewhat acrid, like that of sarsaparilla. The root of *Smilax aspera* is said to be employed in the south of Europe as a substitute for sarsaparilla; but it has little reputation. The East India sarsaparilla, which was at one time referred to this species of smilax, is the product of *Hemidesmus Indicus.** (See *Hemidesmus.*) All of the species of smilax are climbing or trailing plants, with prickly stems; a character expressed in the name of the medicine, which is derived from two Spanish words (*zarza parilla*), signifying a small thorny vine.

There is good reason for believing that much of the sarsaparilla of commerce is yielded by two species, *S. medica* and *S. officinalis.* Humboldt, and much more recently Warszewicz, collected the latter species, with roots agreeing in all respects with Jamaica sarsaparilla of commerce, on the Magdalena River in New Granada. The plant is said also to be cultivated in Jamaica. (*Flückiger and Hanbury.*) Schride has proved that the Vera Cruz sarsaparilla is the root of *S. medica. S. syphilitica* and *S. papyracea* have been claimed as sarsaparilla plants, but are botanically imperfectly known and of very doubtful value.

S. officinalis. Humb. and Bonpl. *Plant. Æquinoct.* i. 271; *B. & T.* 289. In this species the stem is twining, angular, smooth, and prickly; the young shoots are unarmed; the leaves ovate-oblong, acute, cordiform, five- or seven-nerved, coriaceous, smooth, twelve inches long and four or five broad, with footstalks an inch long, smooth, and furnished with tendrils. The young leaves are lanceolate-oblong, acuminate, and three-nerved. Large quantities of the root are said to be sent down the Magdalena River to Mompox and Carthagena.

S. medica. Schlechtendahl, *Linnæa*, vi. 47; Carson, *Illust. of Med. Bot.* ii. 51, pl. 95; *B. & T.* 290. This species has an angular stem, armed with straight prickles at the joints, and a few hooked ones in the intervals. The leaves are smooth, bright green on both sides, shortly acuminate, five-nerved, with the veins prominent beneath. They vary much in form, the lower being cordate, auriculate-hastate; the upper cordate-ovate. In the old leaves, the petiole and midrib are armed with straight subulate prickles. The inflorescence is an umbel of from eight to twelve flowers, with a smooth axillary peduncle, and pedicels about three lines long.

The medicinal species of Smilax grow in Mexico, Guatemala, and the warm latitudes of South America. The roots are very long and slender, and originate in great numbers from a common head or rhizome, from which the stems of the plant rise. The whole root with the rhizome is usually dug up, and as brought into market exhibits not unfrequently portions of the stems attached, sometimes several inches in length. The commercial sarsaparillas are conveniently divided into the mealy and non-mealy sarsaparillas. The first class comprises especially the Honduras, Guatemala, and Brazilian varieties; the second the Jamaica, Mexican, and Guayaquil sarsaparillas.

Honduras Sarsaparilla (Fig. 1) is the variety most used in this country. It is brought from the Bay of Honduras, and comes in bundles two or three feet long, composed of several roots folded lengthwise and secured in a compact form by a few circular turns. These are packed in bales imperfectly covered with skins, each bale containing one hundred pounds or more. The roots are usually connected at one extremity in large numbers in a common head, to which portions of the stems are also attached. In some bundles are many small fibres, either lying loose, or still adhering to the roots. The color of the roots externally is a dirty grayish or reddish brown; and the cortical portion beneath the epidermis often appears amylaceous when broken.

The *Jamaica* or *red sarsaparilla* of foreign writers is little known by that name in the United States. The island of Jamaica is merely its channel of exportation to Europe; and it is probably derived originally from Central America. It does not materially differ in properties from Honduras sarsaparilla; its chief peculiarity being the reddish color of the epidermis, which is also sometimes found in that variety. It is said also to yield a larger proportion of extract, and to contain less starch. As found in commerce, it is in bundles from twelve to eighteen inches long, by four or five in thickness, consisting of long slender roots folded up, with numerous radical fibres attached.

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* Under the name of *Raiz de china de Mexico*, the Mexican Pharmacopœia recognizes the root of the *S. rotundifolia* as diaphoretic and depurative, but, according to Prof. Maisch, this reference is incorrect. (See *A. J. P.*, 1879, p. 326.)

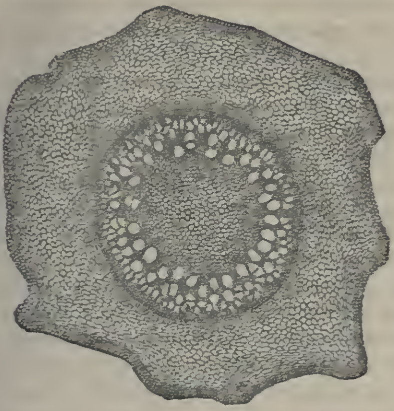

FIG. 1.—Honduras Sarsaparilla.

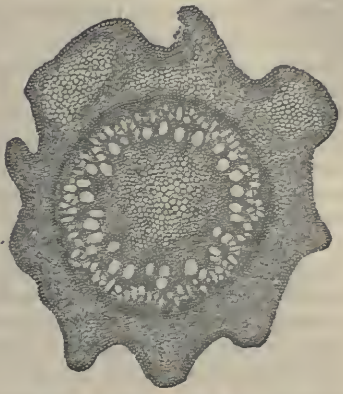

FIG. 2.—Rio Negro Sarsaparilla.

The *Mexican* or *Vera Cruz sarsaparilla* (Fig. 3) comes in large, rather loose bales, weighing about two hundred pounds, bound with cords or leather thongs, and usually containing the roots folded upon themselves, and separately packed. These, as in the Honduras sarsaparilla, consist of a head or caudex with numerous

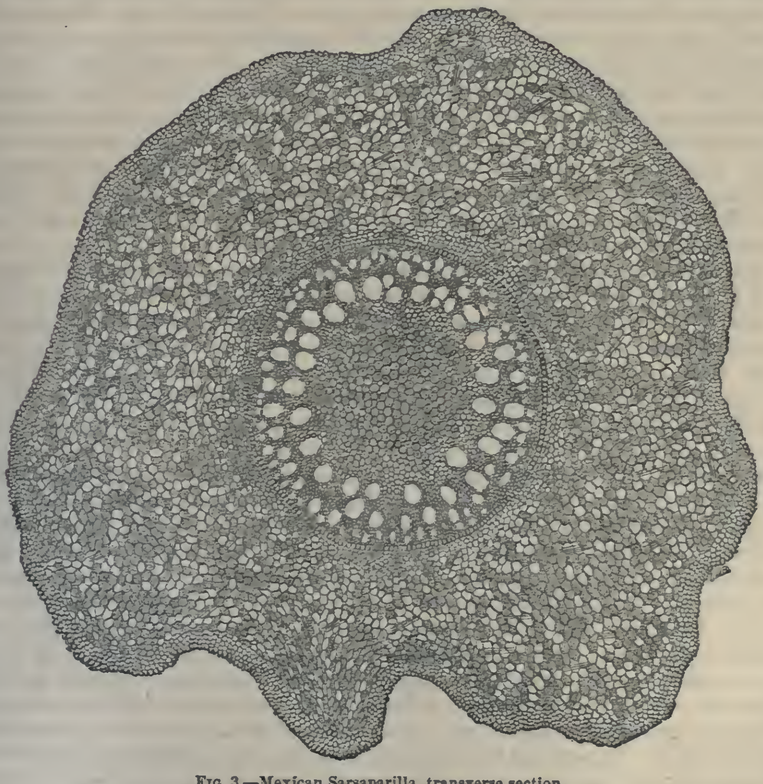

FIG. 3.—Mexican Sarsaparilla, transverse section.

long radicles, which, however, are somewhat smaller than in that variety, and have a thinner bark. They are often also much soiled with earth. This variety was formerly little esteemed; but, from the acrid taste which it possesses, it is probably of equal value to the other kinds. It is probably derived from *Smilax medica.*

Another variety is the *Caraccas sarsaparilla*, brought in large quantities from La Guayra. It is in oblong packages, of about one hundred pounds, surrounded with broad strips of hide, which are connected laterally with thongs of the same material, leaving much of the root exposed. The roots, as in the last variety, are separately packed, but more closely and carefully. The radicles are often very amylaceous internally, in this respect resembling the following.

The *Brazilian* (Fig. 2), or, as it is called in Europe, the *Lisbon* or *Para sarsaparilla*, is not very plentiful in commerce. It comes from the ports of Para and Maranham, in cylindrical bundles of from three to five feet in length, by about a foot in thickness, bound about by close circular turns of a very flexible stem, and consisting of unfolded roots, destitute of caudex (rhizome) and stems, and having few radical fibres. It was also shown in the Brazilian exhibit in the Centennial Exhibition, neatly cut and tied into bundles about a foot long and eight inches in diameter. It is the variety of which Hancock speaks as celebrated throughout South America by the name of *sarsa of the Rio Negro*, and is considered the most valuable variety of the drug. It is distinguished by the amylaceous character of its interior structure, and has considerable acrimony. It was said by Martius to be derived from *Smilax syphilitica;* but Dr. Hancock considers that portion of it which comes from the Rio Negro, and is shipped at Para, as the product of an undescribed species, certainly not *S. syphilitica.* According to Richard, it has been ascertained to be the product of the *S. papyracea* of Poiret. (See *A. J. P.*, xv. 277.)

The variety described by Professor Bentley under the name of *Guatemala sarsaparilla* was collected in the province of Sacatapeques, about ninety miles from the sea. It is in cylindrical bundles about two feet eight inches long by four inches in diameter, composed of separate roots, arranged in parallel order, without rootstalk, and bound together by a few turns of the flexible stem of a monocotyledonous plant. The bundles resemble the Brazilian in arrangement, but are much less compact. It is amylaceous, has considerable acrimony, and is probably one of the most efficient varieties. Professor Bentley ascribes it to *S. papyracea.* For a particular description of the root, see *P. J. Tr.*, xii. 472.

Guayaquil Sarsaparilla, according to Mr. Spruce, grows in valleys on the western slopes of the Equatorial Andes. It is usually not in bundles, but carelessly packed in bales. "The rhizome and a portion of the stem are often present, the latter being round and prickly. The root is dark, large and coarse-looking, with a good deal of fibre. The bark is furrowed, rather thick, and not mealy in the slenderer portions of the root, which is near the rootstalk; but, as the root becomes stout, so its bark becomes smoother, thicker, and amylaceous, exhibiting when cut a fawn-colored or pale yellow interior."

Properties. The dried sarsaparilla roots are several feet in length, about the thickness of a goose-quill, cylindrical, more or less wrinkled longitudinally, flexible, and composed of a thick exterior cortical portion, covered with a thin easily separable epidermis, of an inner layer of ligneous fibre, and of a central pith. The epidermis is of various colors, generally ash-colored, grayish brown, or reddish brown, and sometimes very dark. It is composed of several rows of elongated flattened cells, with their walls thickened by secondary deposits. The cortical portion is in some specimens whitish, in others brown, and not unfrequently of a pink or rosy hue. It is occasionally white, brittle, and almost powdery like starch. It is formed of a loose parenchymatous tissue, whose cells are often loaded with starch and raphides. Between it and the woody centre is a circle of small cells, which form the so-called nucleus sheath. The woody part is usually very thin, and composed of longitudinal fibres, which allow the root to be split with facility through its whole length. Its vascular bundles contain pitted ducts and prosenchymatous cells. Scattered vascular bundles sometimes occur in the central medulla, which is composed of large medullary cells.

Sarsaparilla in its ordinary state is nearly or quite inodorous, but in decoction acquires a decided and peculiar smell. To the taste it is mucilaginous and very slightly bitter, and, when chewed for some time, produces a disagreeable acrid impression, which remains long in the mouth and fauces. "The thick, woody, knotty rhizome, if present, should be removed." *U. S.* The root is efficient in proportion as it possesses this acrimony, which is said by some authors to be confined to the cortical portion; while the ligneous fibre and medullary matter are insipid and inert. Hancock avers that all parts are equally acrid and efficacious. The truth is probably between the two extremes; and, as in most medicinal roots, it must be admitted that the bark is more powerful than the interior portions, while these are not wholly inactive. The virtues of the root are communicated to water cold or hot, but are impaired by long boiling. They are extracted also by diluted alcohol. According to Hancock, the whole of the active matter is not extracted by water. He observes in his paper upon sarsaparilla, published in the *London Medico-Botanical Transactions*, when speaking of the sarsaparilla from Para and the Rio Negro, "After exhausting half a pound of this sort by two digestions, boiling, and pressure, I added to the dregs half a pint of proof spirit, and digested this with a gentle heat for a few hours in a close vessel; then affusing hot water to the amount of that taken off from the first boiling, and pressing again, I procured by the last operation about four pints of an infusion which possessed the acrid properties of the sarsa in a much higher degree even than that obtained by the first decoction with simple water." It appears that in South America it is the custom to prepare sarsaparilla by digestion in wine or spirit, or by infusion in water with additions which may produce the vinous fermentation and thus add alcohol to the menstruum. The same result, as to the superior efficacy of alcohol as a solvent of the acrid principle of sarsaparilla, has been obtained by the French experimentalists. It has been suggested that sarsaparilla, the virtues of which are admitted to be impaired by long boiling, might also be injured by the degree of heat applied in the water or steam bath. But the contrary appears to have been proved by Prof. J. F. Judge, of Cincinnati. (*Proc. A. P. A.*, 1873, p. 595.)

According to M. Thubeuf, sarsaparilla contains—1, a peculiar crystalline substance, which is probably the active principle of the root, 2, a coloring substance, 3, resin, 4, starch, 5, lignin, 6, a thick, aromatic fixed oil, 7, a waxy substance, and, 8, chloride and nitrate of potassium. It is said also to contain a minute proportion of volatile oil, and Batka found gum, bassorin, albumen, gluten and gliadine, lactic and acetic acids, and various salts. The proportion of starch is large. Chatin found iodine in Honduras sarsaparilla; but Dr. Winckler, not having succeeded in detecting this principle in any one root, thinks it probable that the specimen examined by Chatin had been exposed to sea-water. (*Pharm. Centralbl.*, May 7, 1852.)

Parillin. (*Smilacin. Pariglin. Salseparin. Parillinic acid.*) The crystalline principle in which the virtues of sarsaparilla reside is now called *parillin.* It was first discovered by Dr. Palotta, who described it in 1824 under the name of *pariglin.* Subsequently, M. Folchi supposed that he had found another principle, which he called *smilacin.* In 1831, M. Thubeuf announced the discovery of a new substance in sarsaparilla which he named *salseparine*, from the French name of the root. Finally, Batka, a German chemist, towards the end of 1833, published an account of a principle which he had discovered in the root, and which, under the impression that it possessed acid properties, he called *parillinic acid.* M. Poggiale, however, has shown that these substances are identical, though procured by different processes. Prof. Flückiger recommends the preparation of *parillin* by exhausting the crushed root with warm alcohol, and distilling the tincture until the residue weighs one-sixth of the root. It is then gradually mixed with one and a half times its weight of water, and after several days the liquid is decanted from the light yellow precipitate, which is then mixed with about half its volume of alcohol, transferred to a filter, and washed with alcohol of 20 or 30 per cent. Parillin is less soluble in weak than in strong alcohol or water. The yield was 0·18 and 0·19 per cent. *Parillin* is white, inodorous, almost tasteless in the solid state, but bitter, acrid, and nauseous when dissolved in alcohol or water. It is very slightly soluble in cold water, but more readily in boiling water, without crystallizing on cooling. It is very soluble in alcohol, especially at the boiling temperature. Ether and the volatile oils also dissolve it. Its aqueous solution has the property of frothing very much by agitation. According to Flückiger, concentrated sulphuric acid yields a yellow solution, which, on absorbing moisture, gradually turns cherry-red; warm diluted sulphuric acid colors parillin greenish, then red, and finally brown; phosphoric acid has a similar reaction, but the color is more green-yellow. The aqueous solution is precipitated by alcoholic solution of lead acetate, by lead subacetate, and by tannin, and when warmed reduces alkaline copper tartrate, but does not react with other tests for sugar until after it has been boiled with a dilute acid, when the solution acquires a green fluorescence. This is best observed if a trace of parillin is dissolved in warm concentrated sulphuric acid, and disappears on dilution with water or on neutralizing with ammonia. Parillin is not sternutatory; its acrid taste is best observed in alcoholic solution. (See *A. J. P.*, xii. 245.) The solutions of parillin are without acid or alkaline reaction. By treatment with dilute mineral acids, parillin is resolved into *parigenin* and sugar. M. Poggiale found parillin both in the cortical and medullary part of the root, but most largely in the former. Palotta gave it internally in doses varying from two to thirteen grains (0·13 to 0·85 Gm.), and found it to produce nausea, and to diminish the force of the circulation. It is probably the principle upon which sarsaparilla depends chiefly, if not exclusively, for its remedial powers.

The sarsaparilla of the shops is apt to be nearly if not quite inert, either from age, or from having been obtained from inferior species of Smilax. This inequality of the medicine, with the improper modes of preparing it long in vogue, has probably contributed to its variable reputation. The only criterion of good sarsaparilla to be relied on is the taste. If it leave a decidedly acrid impression in the mouth after having been chewed for a short time, it may be considered efficient; if otherwise, it is probably inert.

Medical Properties and Uses. Few medicines have undergone greater changes of reputation. About the middle of the sixteenth century it was introduced into Europe as a remedy for the venereal complaint, in which it had been found very useful in the recent Spanish settlements in the West Indies. After a time it fell into disrepute, and was little employed till about a century ago, when it was again brought into notice by Sir William Fordyce and others, as a useful adjuvant and corrigent of mercury in lues venerea. Since that period very different opinions have been entertained of it. Some, among whom was Dr. Cullen, considered it wholly inert; others, on the contrary, have had the most unbounded confidence in its powers. The probable cause of much of this discrepancy has been already mentioned. Experience, both among regular practitioners and empirics, would seem to have placed its efficacy beyond reasonable doubt. Its most extensive and useful application is to the treatment of secondary syphilis and syphiloid diseases, and that shattered state of the system which sometimes follows the imprudent use of mercury in these affections. It is also employed, though with less obvious benefit, in chronic rheumatism, scrofulous affections, certain cutaneous diseases, and other depraved conditions of health. Its mode of action is less evident than its ultimate effects. It is said to increase the perspiration and urine; but, allowing it to do so, the effect is too slight to explain its remedial influence; and even that which is produced has been ascribed by some to the medicines with which it is generally associated, or the liquid in which it is exhibited. In this ignorance of its precise *modus operandi*, we call it an alterative, as those medicines are named which change existing morbid actions without obvious influence over any of the functions.

Sarsaparilla may be administered in the form of infusion, decoction, syrup, or fluid extract. A beer made by fermenting an infusion of the drug with molasses is said to be a popular remedy in South America.* The smoke of sarsaparilla has been highly recommended in asthma. (*Journ. de Pharm.*, xviii. 221.)

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* The following is a formula recommended by Hancock. "Take of Rio Negro sarsa, bruised, 2 lb.; bark of guaiac, powdered, 8 oz.; raspings of guaiac wood, anise seeds, and liquorice root, each 4 oz.; mezereon, *bark of the root*, 2 oz.; treacle [molasses], 2 lb.; and a dozen bruised cloves; pour upon these ingredients about four gallons of boiling water, and shake the vessel thrice a day. When fermentation has well begun, it is fit for use, and may be taken in the dose of a small tumblerful twice or thrice a day." This formula is worthy of attention; but the bark of guaiacum, which is not kept in the shops, might be omitted, or replaced by the wood.

Off. Prep. Decoctum Sarsæ, *Br.;* Decoctum Sarsæ Compositum, *Br.;* Decoctum Sarsaparillæ Compositum, *U. S.;* Extractum Sarsaparillæ Fluidum, *U. S.;* Extractum Sarsaparillæ Fluidum Compositum, *U. S.;* Extractum Sarsæ Liquidum, *Br.;* Syrupus Sarsaparillæ Compositum, *U. S.*

SASSAFRAS. *U. S.* *Sassafras.*

(SĂS'SẠ-FRĂS.)

"The bark of the root of Sassafras officinale. Nees. (*Nat. Ord.* Lauraceæ.)" *U. S.*

SASSAFRAS MEDULLA. *U. S.* *Sassafras Pith.*

(SĂS'SẠ-FRĂS MẸ-DŬL'LẠ.)

"The pith of Sassafras officinale. Nees. (*Nat. Ord.* Lauraceæ.)" *U. S.* "The dried root of Sassafras officinale. Nees, Laurineæ. From North America." *Br.*

Sassafras Radix, *Br.;* Sassafras, *Fr., G.;* Sassafras, Sassafrasso, *It.;* Sassafras, *Sp.*

Gen. Ch. Diœcious. *Calyx* six-parted, membranous; segments equal, permanent at the base. MALES. *Fertile stamens* nine, in three rows, the three inner with double-stalked distinct glands at the base. *Anthers* linear, four-celled, all looking inwards. FEMALES, with as many sterile stamens as the males, or fewer; the inner often confluent. *Fruit* succulent, placed on the thick fleshy apex of the peduncle, and seated in the torn unchanged calyx. *Lindley.*

Sassafras officinale. Nees, *Laurin.* 488.—*Laurus Sassafras.* Willd. *Sp. Plant.* ii. 485; Bigelow, *Am. Med. Bot.* iii. 142; Michaux, *N. Am. Sylv.* ii. 144. This is an indigenous tree, of middling size, rising in favorable situations from thirty to fifty feet, with a trunk about a foot in diameter. In the Southern States it is sometimes larger, and in the northern parts of New England is little more than a shrub. The bark of the stem and large branches is rough, deeply furrowed, and grayish; that of the extreme branches or twigs is smooth and beautifully green. The leaves, which are alternate, petiolate, and downy when young, vary much in their form and size even upon the same tree. Some are oval and entire, others have a lobe on one side; but the greater number are three-lobed. Their mean length is four or five inches. The flowers, which appear before the leaves, are small, of a pale greenish yellow color, and disposed in racemes which arise from the branches below the leaves, and have linear bracts at their base. The corolla is divided into six oblong segments. The male flowers have nine stamens; the hermaphrodite, which are on a different plant, have only six, with a simple style. The fruit is an oval drupe, about as large as a pea, of a deep blue color when ripe, and supported on a red pedicle, enlarged at the extremity into a cup for its reception.

The sassafras is common throughout the United States, and extends into Mexico. The fresh flowers have a slightly fragrant odor, and almost all parts of the plant are more or less aromatic. The best time for collecting the pith is after the occurrence of frost in autumn; and the same is the case also with the bark of the root. The wood of the root is brownish white, the bark spongy and divisible into layers.

1. *Sassafras Pith.* This is in slender cylindrical pieces, very light and spongy, with a mucilaginous taste, and in a slight degree the characteristic flavor of the sassafras. It abounds in a gummy matter, which it readily imparts to water, forming a limpid mucilage, which, though ropy and viscid, has much less tenacity than that of gum arabic, and will not answer as a substitute in the suspension of insoluble substances. It differs also from solutions of ordinary gum, in remaining limpid when added to alcohol. This mucilage is much employed as a soothing application in inflammation of the eyes, and forms an agreeable and useful drink in dysenteric, catarrhal, and nephritic diseases. It may be prepared by adding a drachm of the pith to a pint of boiling water.

2. *Bark of Sassafras Root.* As found in the shops, this is usually in small irregular fragments, sometimes invested with a brownish epidermis, sometimes partially or wholly freed from it, of a reddish or rusty cinnamon hue, very brittle, and presenting when freshly broken a lighter color than that of the exposed surfaces. The living bark is nearly white, but becomes colored, on exposure, immediately after collection. Its odor is highly fragrant, its taste sweetish and gratefully aro-

matic. These properties are extracted by water and alcohol. According to Dr. Reinsch, the bark contains a heavy and light volatile oil, camphorous matter, fatty matter, resin, wax, a peculiar decomposition product of tannic acid called *sassafrid*, tannic acid, gum, albumen, starch, lignin, and salts. The sassafrid bears some analogy to cinchonic red, and like it appears to be a derivative of the tannin, which exists in much larger proportion in the fresh bark than in that long kept. (Procter, *A. J. P.*, 1866, p. 490.) Owing to its volatile oil and tannic acid, the bark of sassafras root is an aromatic stimulant and astringent. It is used almost exclusively as an adjuvant to other more efficient medicines, the flavor of which it improves; while it renders them more cordial to the stomach. The volatile oil may be used as an aromatic.

Off. Prep. of the Pith. Mucilago Sassafras, *U. S.*

Off. Prep. of the Bark of the Root, or of the Root. Decoctum Sarsæ Compositum, *Br.;* Decoctum Sarsaparillæ Compositum, *U. S.;* Extractum Sarsaparillæ Fluidum Compositum, *U. S.;* Oleum Sassafras, *U. S.*

SCAMMONIÆ RADIX. *Br.* *Scammony Root.*

(SCẠM-MŌ′NỊ-Æ RĀ′DĬX.)

"The dried Root of Convolvulus Scammonia. Linn. From Syria and Asia Minor." *Br.*

SCAMMONIUM. *U. S., Br.* *Scammony.*

(SCẠM-MŌ′NỊ-ŬM.)

"A resinous exudation from the root of Convolvulus Scammonia. Linné. (*Nat. Ord.* Convolvulaceæ.)" *U. S.* "A gum-resin obtained by incision from the living root of Convolvulus Scammonia (Linn.), chiefly from Asia Minor." *Br.*

Scammonée, *Fr.;* Scammonium, *G.;* Scamonea, *It.;* Escamonea, *Sp.*

Gen. Ch. Corolla campanulate. *Styles* one. *Stigmas* two, linear-cylindrical, often revolute. *Ovary* two-celled, four-seeded. *Capsule* two-celled. *Lindley.*

Convolvulus Scammonia. Willd. *Sp. Plant.* i. 845; *B. & T.* 187; Carson, *Illust. of Med. Bot.* ii. 14, pl. 62. This species of Convolvulus has a perennial, tapering root, from three to four feet long, from nine to twelve inches in circumference, branching towards its lower extremity, covered with a light gray bark, and containing a milky juice. The stems are numerous, slender, and twining, extending sometimes fifteen or twenty feet upon the ground, or on neighboring plants, and furnished with smooth, bright green, arrow-shaped leaves, which stand alternately upon long footstalks. The flowers are placed in pairs, or three together, upon the peduncles, which are round, axillary, solitary, and of nearly twice the length of the leaf. The plant is a native of Syria, Anatolia, and certain islands of the Archipelago. No part is medicinal except the root, which was found by Dr. Russell to be a mild cathartic. It is recognized in the Br. Pharmacopœia, being used for the extraction of resin.[*]

Scammony is collected, according to Russell, in the following manner. In the month of June, the earth is cleared away from about the root, the top of which is cut off obliquely about two inches from the origin of the stems. The milky juice which exudes is collected in shells, or other convenient receptacle, placed at the most depending part of the cut surface. A few drachms only are collected from each root. The juice from several plants is put into any convenient vessel, and concretes by time. In this state it constitutes genuine scammony, but is very seldom exported. It is generally prepared for the market by admixture, while it is yet soft, with the expressed juice of the stalks and leaves, with wheat flour, chalk, ashes, fine sand, etc.; and it has been supposed that scammony sometimes consists wholly or in great part of the expressed juice of the root, evaporated to dryness by exposure to the sun, or by artificial heat. According to Landerer, the roots from which the juice has been collected are in some places boiled with water in copper vessels, and the extract added to the juice, not so much with the purpose of adulteration, as under the impression that it favorably modifies the action of the drug. Scammony is exported chiefly from Smyrna, though small quantities are said to be sent out of the country at Alexandretta, the seaport of Aleppo. Dr. Pereira was informed by a merchant who had resided in Smyrna, that it is brought upon camels in a soft state into that city, and afterwards adulterated by individuals called scammony makers. The adulteration appears to be conducted in conformity with a certain understood scale, more or less foreign matter being added according to the price. The materials employed are chiefly chalk and some kind of flour or meal. Very little comparatively is exported perfectly pure. We obtain scammony either directly from Smyrna, or indirectly through some of the Mediterranean ports.*

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[*] Not having had an opportunity of examining the root of the scammony plant, we copy from Dr. Otto Berg, Professor in Berlin (Buchner's *Neues Repertorium*, xiii. p. 448). The dried root, as it occurs in commerce, is in cylindrical pieces a foot or more in length, about three-fourths of an inch thick, of a pure brown externally, wrinkled in drying, with here and there slender branches, with a head at top, and at the lower end with the cut surface coarsely fibrous; the head being sometimes provided with the remains of the stems from half a line to two lines thick. The surface when the root is cut transversely is roundish or rarely elliptical, and pale brown within. The bark of the root is thin, of a dirty whiteness with dark resinous points. The wood consists of compressed, generally separate, pale brown, coarsely porous, usually subdivided fibres, parted by a parenchyma similar to the bark. For the microscopic structure of the root, see Dragendorff's *Jahresbericht*, 1875, p. 73.

The name of *Aleppo scammony* was formerly given to the better kinds of the drug, and of *Smyrna scammony* to those of inferior quality; the distinction having probably originated in some difference in the character of the scammony obtained at these two places. But no such difference now exists; as scammony is brought from Smyrna of every degree of purity. It has been customary, in this country, to designate the genuine drug of whatever quality as Aleppo scammony; while the name of Smyrna scammony has been given to a spurious article manufactured in the south of France, and to other factitious substitutes. It is quite time that these terms should be altogether abandoned. We shall treat of the drug under the heads of genuine and factitious scammony.

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* An interesting account of the collection and preparation of scammony in Anatolia, in the vicinity of Smyrna, has been communicated by Mr. S. H. Maltass to the *London Pharmaceutical Journ. and Trans.* (xiii. 264). The juice is collected in the same manner as described by Russel in reference to Syria. The product, however, of each plant is somewhat less. In some districts, according to Maltass, ten plants produce only a drachm of scammony; in others the average from each root is a drachm; and in a good soil a plant four years old will yield two drachms. The juice received in the shells is mixed with another portion scraped from the cut surface of the root; and this mixture is the pure or *lachryma scammony.* Only a small quantity of this is taken to Smyrna; the greater part being adulterated by the peasants before it reaches the markets. Sometimes the juice is worked up with a decoction of the roots, in which case it is black, heavier than the preceding, and not so easily broken. Sometimes they add a calcareous earth, in a proportion varying from 10 to 150 per cent. The kind thus prepared is usually kept for some time in Smyrna, and is apt to ferment, so as to become porous and lose its gloss. It is in irregular lumps, and is the kind usually sold in London as *lachryma scammony.* Another kind sold in London in rough lumps, and probably under the same name, is prepared in the interior of the country by mixing the juice with wheat starch, ashes, earthy matters, gum arabic or tragacanth, and sometimes wax, yolk of egg, pounded scammony roots and leaves, flour, or resin. A kind much used in Great Britain is prepared by the Jews in Smyrna, and is in the form of cakes as described in the text. It is of two qualities. The *first quality* is prepared by mixing *skilip* (which is an inferior kind of scammony prepared at Anjora, and consists of from 30 to 40 per cent. of juice and 60 to 70 of starch) with 60 per cent. of inferior scammony from the neighborhood of Smyrna; the *second quality*, by mixing *skilip* with about 30 per cent. of the latter kind, and adding about 10 per cent. of gum arabic and black-lead. The *first quality* contains about 50 per cent. of resin, the *second* about 30 per cent. For an account of specimens of scammony sent by Mr. Maltass from Smyrna, see a paper by Mr. D. Hanbury in *P. J. Tr.* (xiii. 268).

Prof. Ch. Boulier, of Algiers, gives the following account of the collection of scammony in the northwestern parts of Anatolia. The plant is not cultivated, but grows wild in rocky places covered with brushwood. At the flowering period, about the end of June and beginning of July, the peasants go forth in search of localities among the mountains where it is most abundant, and, having satisfied themselves on this point, return home, provide themselves with the requisite implements, and set out for the place of collection. Clearing away the brushwood and stems, the peasant digs deeply around the root, then cuts off the top obliquely, and affixes a mussel-shell to the root so as to receive the juice as it flows from the dependent part. He then passes on to other plants, upon which he operates in like manner. After a time he returns upon his steps, and empties the shells successively into a tinned copper vessel. Next day he goes over the same ground, and scrapes by a knife from the cut surface the juice which has in the mean time flowed out and partially concreted. This he mixes with that previously collected, and, when his vessel is full, takes it to some neighboring market, where it is bought up and sent to the wholesale druggists at Constantinople and Smyrna. The juice reaches the market in a pasty state, and whitish like cheese except where exposed to the air. It is in these centres of trade, or on its way from the collectors, that the drug undergoes the various sophistications to which it is subjected,—the peasant himself being honest, and seldom disposed to adulterate. (*Ibid.*, April, 1860, p. 521.)

Genuine Scammony. This is sent into commerce in drums or boxes, and is either in irregular lumps, in large solid masses of the shape of the containing vessel into which it appears to have been introduced while yet soft, or in circular, flattish or plano-convex cakes. It seldom reaches us in an unmixed state. Formerly small portions of pure scammony were occasionally to be met with in Europe, contained in the shells in which the juice was collected and dried. This variety, denominated *scammony in shells*, is now scarcely to be found. The pure drug is called *virgin scammony.* It is in irregular pieces, often covered with a whitish-gray powder, friable and easily broken into small fragments between the fingers, with a shining grayish green fracture soon passing into greenish black, and exhibiting under the microscope minute air-cells, and numerous gray semi-transparent splinters.* It is easily pulverized, affording a pale ash-gray powder. When rubbed with water it readily forms a milky emulsion. It has a rather strong, peculiar odor, compared to that of old cheese. The taste is feeble at first, and afterwards somewhat acrid, but without bitterness. It gives no evidence, when the requisite tests are applied, of the presence of starch or carbonate of calcium, leaves but a slight residue when burned, and yields about 80 per cent. of its weight to ether. Considerable quantities of what is called virgin scammony have been imported into this country since the drug-law went into operation; but, though some specimens are tolerably pure, the drug, on the whole, falls far short of the proper standard. Dr. E. R. Squibb examined many specimens, and found the proportion of resin to vary from 25 to 79·7 per cent.; only two or three, out of more than 30 examined, approaching the latter degree of purity within 10 per cent. (*A. J. P.*, Jan. 1863, p. 51.)†

The officinal description and tests for scammony are as follows. "In irregular, angular pieces or circular cakes, greenish gray or blackish, internally porous, and of a resinous lustre, breaking with an angular fracture; odor peculiar, somewhat cheese-like; taste slightly acrid; powder gray or greenish gray. When triturated with water, Scammony yields a greenish emulsion; it does not effervesce on the addition of diluted hydrochloric acid, and the decoction, when cold, does not assume a blue color on the addition of test-solution of iodine. Ether dissolves at least seventy-five per cent. of it; and, when the ether has been evaporated, the residue, dissolved in hot solution of potassa, is not precipitated by diluted sulphuric acid." *U. S.*

The form of scammony chiefly found in our markets is that in circular cakes. These are sometimes flattish on both sides, but generally somewhat convex on one side and flat on the other, as if dried in a saucer, or other shallow vessel. They are from four to six inches in diameter, and from half an inch to an inch and a half or even two inches thick in the centre. As found in the retail shops, they are often in fragments. They are hard and heavy, with a faintly shining roughish fracture; and when broken exhibit in general a structure very finely porous, sometimes almost compact, and in a very few instances cavernous. Their color externally is a dark ash or dark olive, or slate color approaching to black; internally somewhat lighter and grayish, with an occasional tinge of green or yellow, but deepening by exposure. The small fragments are sometimes slightly translucent at the edges. The mass, though hard, is pulverizable without great difficulty, and affords a light gray powder. It imparts to water with which it is triturated a greenish milky appearance. The smell is rather disagreeable, and similar to that of the pure drug. The taste, very slight at first, becomes feebly bitterish and acrid. This kind of scammony is never quite pure, and much of it is considerably adulterated. In some of the cakes carbonate of calcium is the chief impurity; in others the adulterating substance is probably meal, as evidences of the presence of starch and lignin are afforded; and in others again both these substances are found. Christison discovered in the chalky specimens from 15 to 38 per cent. of carbonate of calcium; in the amylaceous, from 13 to 42 per cent. of impurity. It was probably to the flat, dark-colored, compact, difficultly pulverizable, and more impure cakes that the name of *Smyrna scammony* was formerly given. These have been erroneously ascribed by some to *Periploca Secamone*, a plant growing in Egypt.

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* According to Maltass, the purest scammony has a reddish black fracture, unless it has been mixed with water in its preparation, in which case it is black and very glossy. (*P. J. Tr.*, xiii. 266.)

† Dr. Squibb gives the following description of the drug imported as *virgin scammony.* "It generally occurs in soldered square tin boxes, containing 25 to 28 pounds each. Occasionally, however, it is in round wooden boxes or drums of a similar capacity. The scammony is in irregular, rough and fissured masses of various sizes, sometimes porous, but commonly solid, hard, and semi-resinous, having a tough dull fracture. It is of a very dark grayish green color internally, often nearly black, but more of an ash color externally. It is rarely dry enough to be pulverulent, yet still more rarely too moist to be rubbed into coarse powder, and it generally loses 6 per cent. in drying sufficiently to make a fine powder." (*A. J. P.*, Jan. 1863, p. 49.)

Scammony is ranked among the gum-resins. It is partially dissolved by water, much more largely by alcohol and ether, and almost entirely, when pure, by boiling diluted alcohol. Its active ingredient is resin, which constitutes from 80 to 90 per cent. of pure dry scammony. (See *Resina Scammonii.*) The gum-resin has been analyzed by various chemists with varying results; as the character of the specimens examined is insufficiently determined by the terms Aleppo and Smyrna scammony, employed to designate them. The resin is now known to be identical with that found in the root of the Mexican *Ipomœa orizabensis*, known in commerce as male jalap; and the name *jalapin* is given to it. (See *Jalapa.*) Bouillon-Legrange and Vogel obtained, from 100 parts of Aleppo scammony, 60 of resin, 3 of gum, 2 of extractive, and 35 of insoluble matter; from the same quantity of Smyrna scammony, 29 parts of resin, 8 of gum, 5 of extractive, and 58 of vegetable remains and earthy substances. It is obvious that both the specimens upon which they operated were very impure. Marquart found in pure scammony (*scammony in shells*) 81·25 per cent. of resin, 3·00 of gum with salts, 0·75 of wax, 4·50 of extractive, 1·75 of starchy envelopes, bassorin, and gluten, 1·50 of albumen and lignin, 3·75 of ferruginous alumina, chalk, and carbonate of magnesium, and 3·50 of sand. Christison found different specimens of pure scammony to contain, in 100 parts, from 77 to 83 parts of resin, from 6 to 8 of gum, from 3·2 to 5 of lignin and sand, and from 7·2 to 12·6 of water, with occasionally a little starch, probably derived accidentally from the root, and not in sufficient quantity to cause a cold decoction of the gum-resin to give a blue color with iodine. Mr. Hanbury, of London, found 91·1 per cent. of resin in the purest scammony in shells. As already stated, scammony is seldom quite pure as found in commerce. Much of it contains not more than 50 per cent. of the resin, some not more than 42 per cent., and the worst varieties as little as 10 per cent., or even less. Sometimes the cakes are of good quality on the outside, and inferior within. It has been suggested, in this uncertainty as to the strength of the scammony of the shops, whether it might not be best to abandon its internal use altogether, and to employ only the resin, which is of uniform strength. Indeed, the resin has been officinally substituted for the gum-resin in that important preparation, the compound extract of colocynth.

Factitious Scammony. Montpellier Scammony. Much spurious scammony is manufactured in the south of France, said by Guibourt to be made from the expressed juice of *Cynanchum Monspeliacum*, incorporated with various resins, and other purgative substances. M. Thorel, however, a pharmaceutist of Avallon, denies that this plant is employed in its preparation. (*Journ. de Pharm.*, xx. 107.) It has been occasionally imported into the United States and sold as Smyrna scammony. It is usually in flat semicircular cakes, four or five inches in diameter, and six or eight lines thick, blackish both externally and within, very hard, compact, rather heavy, of a somewhat shining and resinous fracture, a feeble balsamic odor wholly different from that of genuine scammony, and a very bitter nauseous taste. When rubbed with the moistened finger it becomes dark gray, unctuous, and tenacious. We have seen another substance sold as Smyrna scammony, which was obviously spurious, consisting of blackish, circular, flat cakes, or fragments of such cakes, rather more than half an inch thick, very light, penetrated with small holes, as if worm-eaten, and when broken exhibiting an irregular, cellular, spongy texture. Dr. Pereira described a factitious substance sold as *Smyrna scammony*, which was in circular flat cakes about half an inch thick, blackish, and of a slaty aspect, breaking with difficulty, of a dull, black fracture, and of the sp. gr. 1·412. Moistened and rubbed it had the smell of guaiac; the adulteration was also detected by chemical tests.

Medical Properties and Uses. Scammony is an energetic cathartic, apt to occasion griping, and sometimes operating with harshness. It was known to the ancient Greek physicians, and was much employed by the Arabians, who not only gave it as a purgative, but also applied it externally for the cure of various cutaneous diseases. It may be used in all cases of torpid bowels, when a powerful impression is desired; but, on account of its occasional violence, it is seldomed administered, except in combination with other cathartics, the action of which it promotes, while its own harshness is mitigated.* It should be given in emulsion with mucilage, sugar, almonds, liquorice, or other demulcent; and its disposition to gripe may be counteracted by the addition of an aromatic. The dose is from five to fifteen grains (0·33–1 Gm.) of pure scammony, from ten to thirty (0·65–1·95 Gm.) of that commonly found in the market.

Off. Prep. of the Root. Scammoniæ Resina, *Br.*

Off. Prep. of Scammony. Confectio Scammonii, *Br.;* Pilula Colocynthidis Comp., *Br.;* Pulvis Scammonii Comp., *Br.;* Resina Scammonii, *U. S.*

SCILLA. *U. S., Br.* *Squill.*

(SÇĬL'LẠ—sĭl'lạ.)

"The sliced bulb of Urginea Scilla. Steinheil. (*Nat. Ord.* Liliaceæ.)" *U. S.* "The sliced and dried bulb of Urginea Scilla. Steinheil. From the Mediterranean coast." *Br.*

Bulbus Scillæ, *P.G.;* Squills; Squille, Scille, *Fr.;* Meerzwiebel, *G.;* Scilla, *It.;* Cebolla albarrana, *Sp.*

Urginea Scilla. Steinheil. *B. & T.* 281.—*Scilla maritima.* Willd. *Sp. Plant.* ii. 125. This is a perennial plant, with fibrous roots proceeding from the bottom of a large bulb, which sends forth several long, lanceolate, pointed, somewhat undulated, shining, deep green leaves. From the midst of the leaves a round, smooth, succulent flower-stem rises, from one to three feet high, terminating in a long, close spike of whitish flowers. These are destitute of calyx, and stand on purplish peduncles, at the base of each of which is a linear, twisted, deciduous floral leaf. The squill grows on the sea-coast of Spain, France, Italy, Greece, and the other countries bordering on the Mediterranean. The bulb is the officinal portion. It is generally dried for use, but is sometimes imported in the recent state packed in sand.

Properties. The fresh bulb is pear-shaped, usually larger than a man's fist, sometimes as large as the head of a child, and consists of fleshy scales attenuated at their edges, closely applied over each other, and invested by exterior scales so thin and dry as to appear to constitute a membranous coat. There are two varieties, distinguished as the *red* and *white squill.* In the former, the exterior coating is of a deep reddish brown color, and the inner scales have a whitish rosy or very light pink epidermis, with a yellowish white parenchyma; in the latter, the whole bulb is white. They do not differ in medicinal virtue. The bulb abounds in a viscid, very acrid juice, which causes it to inflame and even excoriate the skin when much handled. By drying, this acrimony is very much diminished, with little loss of medicinal power. The bulb loses about four-fifths of its weight in the process. Vogel found 100 parts of fresh squill to be reduced to 18 by desiccation. The process is somewhat difficult, in consequence of the abundance and viscidity of the juice. The bulb is cut into thin transverse slices, and the pieces dried separately by artificial or solar heat. The outer and central scales are rejected, the former being dry and destitute of activity, the latter too fleshy and mucilaginous.

Dried squill, as found in our shops, is in irregular oblong pieces, often more or less contorted, of a dull yellowish white color with a reddish or rosy tint, sometimes entirely white, slightly diaphanous, brittle and pulverizable when perfectly dry, but often flexible from the presence of moisture, for which they have a great affinity. Occasionally a parcel will be found consisting of vertical slices, some of which adhere together at the base. The odor is very feeble, the taste bitter, nauseous, and acrid.

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* *Triplex Pills.* Dr. J. W. Francis, of New York City, employed a combination of purgatives which afterwards became very well known as triplex pills. The original formula, obtained through Dr. E. R. Squibb, is as follows. Powdered Scammony, Powdered Socotrine Aloes, Blue Mass, of each 1 *troyounce;* Croton Oil, 20 *minims;* Oil of Caraway, 1½ *fluidrachms;* Tincture of Aloes and Myrrh, 2 *fluidrachms;* mix well, and make into 400 pills. The usual aperient or laxative dose is one pill at bedtime, until the natural condition is restored. (*Proc. A. P. A.*, 1872, p. 223.)

The virtues of squill are extracted by water, alcohol, and vinegar. It was analyzed by Vogel, by M. J. H. Marais, by Lebourdais, by Tilloy, by Merck, and lastly by Schmiedeberg (*Zeit. Physiol. Chem.*, 111, 112), whose results, though varying considerably, give us the following information. The bitter principle not yet prepared in a state of purity is *scillitin.* Merck, however, obtains three compounds of this class: *scillipikrin*, *scillitoxin*, and *scillin.* Jarmersted (*Arch. Exper. Path.*, 11, 22) obtained a glucoside which he called *scillaïn*, but which seems to be identical with scillitoxin. Schmiedeberg (*loc. cit.*) found a peculiar carbohydrate or mucilage, which he calls *sinistrin*, $C_6H_{10}O_5$, which is not affected by saliva or diastase, but is changed by dilute sulphuric acid into a mixture of lævulose and optically inactive sugar, both fermentable. The bulbs of *Scilla maritima* also yield a slightly colored liquid oil of unpleasant odor when distilled in a current of steam. (*Husemann's Pflanzenstoffe*, 2d ed., p. 406.) Examined by the microscope, the bulb is seen to be pervaded by innumerable minute acicular crystals, consisting of inorganic salts, chiefly, according to M. Marais, carbonate of calcium, with a little chloride of calcium. (*Ibid.*) Water distilled from it had neither taste nor smell, and was drunk by Vogel to the amount of six ounces without effect.

When kept in a dry place, squill retains its virtues for a long time; but if exposed to moisture it soon becomes mouldy.

Medical Properties and Uses. Squill is expectorant, diuretic, and in large doses emetic and purgative. In overdoses it has been known to occasion hypercatharsis, strangury, bloody urine, and fatal inflammation of the stomach and bowels. The Greek physicians employed it as a medicine; and it has retained to the present period a deserved popularity. As an expectorant, it is used both in cases of deficient and of superabundant secretion from the bronchial mucous membrane; in the former case usually combined with tartar emetic or ipecacuanha, in the latter frequently with the stimulant expectorants. In both instances it operates by stimulating the vessels of the lungs; and it should not be used when there is a high grade of inflammation, with arrested secretion. In dropsical diseases it is much employed, especially in connection with digitalis. A remarkable case of greatly enlarged spleen, which was entirely removed in three weeks under the use of fifteen drops of tincture of squill, five times a day, is recorded by Dr. Hennigké. (*Ann. de Thérap.*, 1867, p. 91.) On account of its great uncertainty and occasional harshness, it is very seldom prescribed as an emetic, except in infantile croup or catarrh, in which it is usually given in the form of syrup. When given in substance it is most conveniently administered in the form of pill. The dose, as a diuretic or expectorant, is one or two grains (0·065–0·13 Gm.) repeated two or three times a day, and gradually increased till it produces slight nausea or evinces its action upon the kidneys or lungs. From six to twelve grains (0·4–0·8 Gm.) will generally vomit. The vinegar and syrup of squill are officinal, and are much used. An *acetic extract* has been prepared by Mr. F. D. Niblett, by digesting a pound of squill with three fluidounces of acetic acid and a pint of distilled water, with a gentle heat, for forty-eight hours, then expressing, and, without filtration, evaporating to a proper consistence. One grain is equal to about three of the powder. (*P. J. Tr.*, xii. 133.)

Off. Prep. Acetum Scillæ; Extractum Scillæ Fluidum, *U. S.;* Pilula Ipecacuanhæ cum Scilla, *Br.;* Pilulæ Scillæ Compositæ; Syrupus Scillæ Compositæ, *U. S.;* Tinctura Scillæ.

SCOPARIUS. *U. S.* *Broom.*

(SCO̤-PĀ′RI̤-ŬS.)

"The tops of Sarothamnus Scoparius. Koch. (*Nat. Ord.* Leguminosæ, Papilionaceæ.)" *U. S.* "The fresh and dried tops of Sarothamnus Scoparius. Wimmer. From indigenous plants." *Br.*

Scoparii Cacumina, *Br.;* Broom-Tops; Herba Scoparii; Genêt à balais, *Fr.;* Gemeine Besenginster, Besenginster, Pfriemenkraut, *G.;* Scoparia, *It.;* Retama, *Sp.*

Gen. Cytisus, Linn. The two superior calyx teeth connate or free, the three inferior connate into a lip. *Stamens* all coalescent into a closed tube. *Leaves* one- to three-foliate. *Fruit* unarmed or spinescent. *Seeds* strophiolate.

Sarothamnus is a section of this genus, which does not seem to be entitled to the rank of a genus. It is distinguished by its short, broad, divaricate, denticulate calyx lip, its broad petals, and especially by its elongated, strongly incurved or circinate style. The last character is of course the most important, but, as there is a regular gradation of species between the typical long-styled *C. Scoparius* and the shortest-styled *Cytisus*, the character does not warrant the formation of a genus.

Sarothamnus Scoparius. Koch.—*Cytisus Scoparius.* De Cand. *Prodrom.* ii. 154; *B. & T.* 70.—*Spartium Scoparium.* Willd. *Sp. Plant.* iii. 933. This is a common European shrub, cultivated in our gardens, from three to eight feet high, with numerous straight, pentangular, bright green, very flexible branches, and small, oblong, downy leaves, usually ternate, but on the upper part of the plant sometimes simple. The flowers are numerous, papilionaceous, large, showy, of a golden yellow color, and solitary upon short axillary peduncles. The seeds are contained in a compressed legume, which is hairy at the sutures.

The whole plant has a bitter nauseous taste, and, when bruised, a strong peculiar odor. The tops of the branches are the officinal portion. They are "in thin, flexible twigs, pentangular, winged, nearly smooth, tough, usually free from leaves; of a peculiar odor when bruised; disagreeably bitter." *U. S.* The seeds are said to be used sometimes, and to be as active as the tops. Water and alcohol extract their active properties. According to Cadet de Gassicourt, the flowers contain volatile oil, fatty matter, wax, chlorophyll, yellow coloring matter, tannin, a sweet substance, mucilage, albumen, and lignin. Dr. Stenhouse has separated from them two principles, one of which, called *scoparin*, $C_{21}H_{22}O_{10}$, he believes to be the diuretic principle, and the other, an alkaloid, *sparteine*, $C_{15}H_{26}N_2$, to be narcotic. The former is in stellate crystals, easily dissolved by boiling water and alcohol, and is obtained by purifying a yellow gelatinous substance deposited upon the evaporation of the decoction. It may be given in the dose of four or five grains. The latter was obtained by distillation from the mother-waters of the scoparin. It is a colorless liquid, having a peculiar bitter taste, and all the properties of a volatile alkaloid. It is colorless, but becomes brown by exposure to light; it has at first an odor of aniline, but this is altered by rectification. It readily neutralizes acids and forms crystallizable salts, which are extremely bitter. (See *P. J. Tr.*, June 28, 1879.) It appears to have narcotic properties.

Medical Properties and Uses. Broom is diuretic and cathartic, and in large doses emetic, and has been employed with great advantage in dropsical complaints, for which it was recommended by Meade, Cullen, and others. Cullen prescribed it in the form of decoction, made by boiling half an ounce of the fresh tops in a pint of water down to half a pint, of which he gave a fluidounce (30 C.c.) every hour till it operated by stool or urine. It is a domestic remedy in Great Britain, but is seldom used in this country. The seeds may be given in powder, in the dose of ten or fifteen grains (0·65–1 Gm.).

Off. Prep. Decoctum Scoparii, *Br.;* Succus Scoparii, *Br.*

SCUTELLARIA. *U. S.* *Scutellaria.* [*Scullcap.*]

(SCU̇-TẸL-LĀ'RỊ-Ạ.)

"Scutellaria lateriflora. Linné. (*Nat. Ord.* Labiatæ.)" *U. S.*

Hoodwort, Madweed; Scutellaire, *Fr.;* Helmkraut, *G.*

Gen. Ch. Calyx bilabiate; lips entire; mouth closed by a helmet-shaped lid after the corolla falls. *Corolla* bilabiate, upper lip vaulted, lower dilated, convex; tube of the corolla bent.

Several species of Scutellaria have attracted attention. *Scutellaria galericulata*, or common *European scullcap*, which also grows wild in this country, has a feeble, somewhat alliaceous odor, and a bitterish taste. It has been employed in intermittents, and externally in old ulcers. Another indigenous species, the *S. integrifolia*, of which *S. hyssopifolia*, Linn., is considered by some as a variety, is intensely bitter, and might probably be found useful as a tonic.

Scutellaria lateriflora. Willd. *Sp. Plant.* iii. 172; Gray, *Manual of the Bot. of North. U. S.*, p. 315. This is an indigenous perennial herb, with a stem erect, much branched, quadrangular, smooth, and one or two feet high. The leaves are ovate, acute, dentate, subcordate upon the stem, opposite, and supported upon long petioles. The flowers are small, of a pale blue color, and disposed in long, lateral, leafy racemes. The tube of the corolla is elongated, the upper lip concave and entire, the lower three-lobed. The plant grows in moist places by the sides of ditches and ponds in all parts of the Union.

The dried tops are officinally described "as about twenty inches (50 cm.) long, smooth; stem quadrangular, branched; leaves opposite, petiolate, about two inches (5 cm.) long, ovate-lanceolate or ovate-oblong, serrate; flowers in axillary, one-sided racemes, with a pale blue corolla and a two-lipped calyx, closed in fruit, the upper lip helmet-shaped; odor slight; taste bitterish." *U. S.* To the senses scullcap does not indicate, by any peculiar taste or smell, the possession of medicinal virtues. It is even destitute of the aromatic properties which are found in many of the labiate plants. When taken internally, it produces no very obvious effects, and probably is of no remedial value, although at one time it was esteemed as a remedy in hydrophobia. It is also used by some practitioners as a nervine in neuralgic and convulsive affections, chorea, delirium tremens, and nervous exhaustion from fatigue or over-excitement. (*A. J. P.*, xxiii. 370; *N. J. Med. Rep.*, v. 13; *Med. and Surg. Rep.*, March 19, 1870.)

The so-called *scutellarine* is not a pure proximate principle. It is prepared by mixing a concentrated tincture with water, precipitating by alum, and then washing and drying, and given in doses varying from one to three or four grains (0·065–0·20 or 0·26 Gm.). The fluid extract is used in the dose of one to two fluidrachms (3·75–7·5 C.c.).

Off. Prep. Extractum Scutellariæ Fluidum, *U. S.*

SENEGA. *U. S.* *Senega.*

(SĔN'Ẹ-GẠ.)

"The root of Polygala Senega. Linné. (*Nat. Ord.* Polygalaceæ.)" *U. S.* "The dried root of Polygala Senega. Linn. From North America." *Br.*

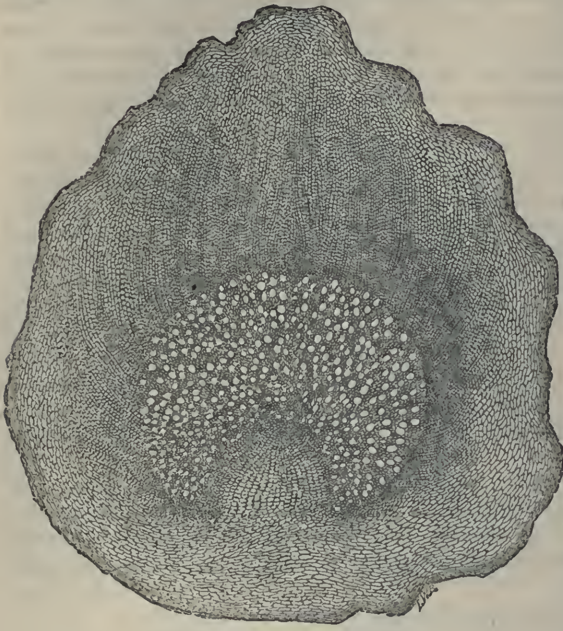
Senegæ Radix, *Br.;* Senega Root, Senega Snakeroot; Polygale de Virginie, *Fr.;* Klapperschlangenwurzel, Senegawurzel, *G.;* Poligala Virginiana, *It.*

Gen. Ch. *Calyx* five-leaved, with two leaflets wing-shaped and colored. *Legume* obcordate, two-celled. *Willd.*

Besides *P. Senega*, two other species have attracted some attention in Europe—*P. amara* and *P. vulgaris*—as remedies in chronic pectoral affections; but, as they are not natives of this country, and are never used by practitioners here, they do not merit particular notice.

Polygala-Senega. Willd. *Sp. Plant.* iii. 894; Bigelow, *Am. Med. Bot.* ii. 97; Barton, *Med. Bot.* ii. 111; *B. & T.* 29. This unostentatious plant has a perennial branching root, from which several erect, simple, smooth, round, leafy stems annually rise, from nine inches to a foot in height. The stems are occasionally tinged with red or purple below, but are green near the top. The leaves are alternate or scattered, lanceolate, pointed, smooth, bright green on the upper surface, paler beneath, and sessile or supported on very short footstalks. The flowers are small and white, and form a close spike at the summit of the stem. The calyx is their most conspicuous part. It consists of five leaflets, two of which are wing-shaped, white, and larger than the others. The corolla is small and closed. The capsules are small, much compressed, obcordate, two-valved and two-celled, with two oblong-ovate, blackish seeds, pointed at one end.

The *Polygala senega* grows in almost all parts of the United States east of the Rocky Mountains. It is collected for market in Kentucky and the States west and southwest of it; and also in Wisconsin and the Northwestern States. It formerly was much more abundant to the eastward, and as there it has been almost exterminated, so in the west the process is going on. It exists in two varieties: the typical *P. Senega* and the variety *latifolia*, which is distinguished by its height (10 to 20 inches) and its very large, ovate or ovate-lanceolate leaves, which taper towards each end, and attain a length of four inches. The root of commerce seems to be obtained from both varieties. It is brought into market in bales weighing from fifty to four hundred pounds.



Senega, transverse section, magnified.

Properties. As the root occurs in the shops,* it is of various sizes, from that of a straw to that of the little finger, presenting a thick knotty head, which exhibits traces of the numerous stems. It is tapering, branched, variously twisted, often marked with crowded annular protuberances, and with a projecting keel-like line, extending along its whole length. The epidermis is corrugated, transversely cracked, of a yellowish brown color in the young roots, and brownish gray in the old. In the smaller branches the color is a lighter yellow. The bark is thick, hard, and resinous, and whitish in its interior; it contains the active principles of the root. The central portion is ligneous, white, and quite inert, and should be rejected in the preparation of the powder. The color of this is gray. On microscopic examination the bark is seen to be composed of—1st, an outer layer, composed of a series of tubular cells; 2d, a middle layer of thin-walled, parenchymatous cells; 3d, an inner layer containing bast-cells. The keel is produced by the excessive development of this last layer of bark upon one side. There is no medulla. The odor of senega is peculiar, strong in the fresh root, but faint in the dried. The taste is at first sweetish and mucilaginous, but after chewing becomes somewhat pungent and acrid, leaving a peculiar irritating sensation in the fauces. These properties, as well as the medical virtues of the root, are extracted by boiling water and by alcohol. Diluted alcohol is an excellent solvent. The root was analyzed by Gehlen, Peschier of Geneva, Feneulle of Cambray, Dulon d'Astafort, Folchi, and Trommsdorff, and subsequently by M. Quevenne. The *senegin* of Gehlen, probably the same as the polygalic acid of Quevenne, seems to be the active principle of the root. Quevenne also found another principle, which he named *virgineic acid*, but the existence of which is doubtful. The virtues of senega appear to reside chiefly, if not exclusively, in the acrid principle called *senegin* or *polygalic* acid, which seems to be closely analogous to saponin. Quevenne obtained it pure by the following process. Powdered senega is exhausted by alcohol of 33°, and so much of the alcohol is distilled off as to bring the resulting tincture to the consistence of syrup. The residue is treated with ether in order to remove the fatty matter. The liquid upon standing deposits a precipitate, which is separated by filtration and is then mixed with water. To the turbid solution thus formed alcohol is added, which facilitates the production of a white precipitate, consisting chiefly of polygalic acid. The liquid is allowed to stand for several days, that the precipitate may be fully formed. The supernatant liquid being decanted, the precipitate is drained upon a filter, and, being removed while yet moist, is dissolved by the aid of heat in alcohol of 36°. The solution is boiled with purified animal charcoal, and filtered while hot. Upon cooling, it deposits the principle in question in a state of purity. Thus obtained, polygalic acid is a white powder, inodorous, and of a taste at first slight, but soon becoming pungent and acrid, and producing a very painful sensation in the throat. It is fixed, unalterable in the air, inflammable, soluble in water slowly when cold and rapidly with the aid of heat, soluble in all proportions in boiling absolute alcohol, which deposits most of it on cooling, quite insoluble in ether and in the fixed and volatile oils, and possessed of the properties of reddening litmus and neutralizing the alkalies. M. Quevenne found it, when given to dogs, to occasion vomiting, and much embarrassment in respiration, and in large quantities to destroy life. Dissection exhibited evidences of inflammation of the lungs; and frothy mucus was found in the stomach, œsophagus, and superior portion of the trachea, showing the tendency of this substance to increase the mucous secretion, and explaining in part the beneficial influence of senega in croup. (*Journ. de Pharm.*, xxii. 449, and xxiii. 227.) M. Bolley confirms the opinion of Quevenne as to the strong analogy between polygalic acid or senegin and saponin, if not their absolute identity, and considers them both as glucosides, resolvable by hydrochloric acid into glucose and a peculiar substance called *sapogenin.* Rochleder (*Chem. Centralbl.*, 1867, p. 925) confirms this view of their identity, and gives the formula $C_{32}H_{54}O_{18}$ to the compound. According to the researches of Trommsdorff and Schneider, senegin is contained solely in the bark, the woody tissues being inert.

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* The senega which is described above is the officinal drug, and is often known in commerce as *Southern Senega*. *Northern Senega*, *false* or *large Senega* of the trade, is much larger, sometimes lighter in color. The knot at the top of the root is often three inches in diameter, and the root itself ten inches long and a half-inch in diameter. It is more fleshy and much less contorted than the Southern Senega. In many of the roots the keel line is rudimental or altogether absent. Prof. Maisch believes that it is probably yielded by the *Polygala Boykinii*, Nuttall. This is not, however, a Northern species, and Messrs. J. U. and C. G. Lloyd seem to have proved that the large senega is gathered chiefly, if not solely, in Wisconsin. A fresh plant obtained by the Messrs. Lloyd direct from first dealers proved to be a variety of *P. Senega*, intermediate between the typical form and *latifolia*. This large senega is, therefore, in all probability the genuine drug, owing its physical properties to an exuberance born of a favoring climate and extremely fertile soil. (*A. J. P.*, 1881, p. 480.)

From the experiments of M. Quevenne, it also appears that senega yields its virtues to water, cold or hot, and to boiling alcohol, and that the extracts obtained by means of these liquids have the sensible properties of the root. But, under the influence of heat, a portion of the acrid principle unites with the coloring matter and coagulated albumen, and thus becomes insoluble in water; and the decoction, therefore, is not so strong as the infusion, if time is allowed, in the formation of the latter, for the full action of the menstruum. In forming an aqueous extract, the infusion should be prepared by percolation; as it is thus most concentrated, and consequently requires less heat in its evaporation. In preparing the infusion, the temperature of the water, according to M. Quevenne, should not exceed 104° F.

The roots of *Panax quinquefolium*, or ginseng, were at one period frequently mixed with the senega, but are easily distinguishable by their shape and taste. Other roots, supposed to be those of *Gillenia trifoliata* and *Asclepias vincetoxicum*, L. (*P. J. Tr.*, ix. 411), have been observed in parcels of senega: they are readily distinguished from the genuine root by their different physical characteristics.

Medical Properties and Uses. Senega is a stimulating expectorant and diuretic, and in large doses emetic and cathartic. It appears, indeed, to excite more or less all the secretions, proving occasionally diaphoretic and emmenagogue, and increasing the flow of saliva. Its action, however, is especially directed to the lungs; and its expectorant virtues are those for which it is chiefly employed. It was introduced into practice about a century ago by Dr. Tennant, of Virginia, who recommended it as a cure for the bite of the rattlesnake, and in various pectoral complaints. As an expectorant it is employed in cases not attended with acute inflammatory action, or in which the inflammation has been in great measure subdued. It is peculiarly useful in chronic catarrhal affections, the secondary stages of croup, and in peripneumonia notha. By Dr. Archer, of Maryland, it was recommended in the early stages of croup; but it is now seldom given, unless in combination with squill and an antimonial, as in the *Syrupus Scillæ Compositus.* Employed so as to purge and vomit, it has proved useful in rheumatism; and some cases of dropsy are said to have been cured by it. It has also been recommended in amenorrhœa.

The dose of powdered senega is from ten to twenty grains (0·65–1·3 Gm.); but the medicine is never used in substance. The dose of the syrup is one or two fluidrachms (3·75–7·5 C.c.), of the abstract, from one to three grains (0·065–0·20 Gm.). Polygalic acid may be employed in the dose of from the fourth of a grain to a grain (0·016–0·065 Gm.), and may be administered either in pill or in powder, or dissolved in hot water, with the addition, in any of its forms, of gum and sugar to obtund its acrimony. A formula for its preparation was published by Professor Procter. (*A. J. P.*, 1860, p. 150.)

Off. Prep. Abstractum Senegæ, *U. S.;* Extractum Senegæ Fluidum, *U. S.;* Infusum Senegæ, *Br.;* Syrupus Scillæ Compositus, *U. S.;* Syrupus Senegæ, *U. S.;* Tinctura Senegæ, *Br.*

SENNA. *U. S.* *Senna.*

(SĔN′NẠ.)

"The leaflets of Cassia acutifolia, Delile (Alexandria Senna), and of Cassia elongata, Lémaire-Lisancourt (India Senna). (*Nat. Ord.* Leguminosæ, Cæsalpinieæ.)" *U. S.* SENNA ALEXANDRINA. *Alexandrian Senna. Br.* "The leaflets of Cassia lanceolata, Lamarck; and Cassia obovata, Colladon. Imported from Alexandria; carefully freed from the flower pods and leafstalks of the same, and from the flowers and fruit of Solenostemma Argel, *Hayne.*" *Br.* SENNA INDICA. *Tinnivelly Senna.* "The leaflets of Cassia elongata, Lemaire. From plants cultivated in Southern India." *Br.*

Folia Sennæ; Feuilles de Séné, Séné, *Fr.;* Sennesblätter, *G.;* Senna, *It., Port.;* Sen, *Sp.*

CASSIA. See *Cassia Fistula.*

The plants which yield senna belong to the genus Cassia, of which several species contribute to furnish the drug. These were confounded together by Linnæus in a single species, which he named *Cassia Senna.* Since his time the subject has been more thoroughly investigated, especially by Delile, who accompanied the French expedition to Egypt, and had an opportunity of examining the plant in its native country. Besides the officinal species, it is probable that *C. lanceolata* of Forskhal, and *C. Æthiopica* of Guibourt, contribute towards commercial senna.

1. *Cassia acutifolia.* Delile, *Flore d' Egypte*, lxxv. tab. 27, f. l.—*C. senna β.* Linn. —*C. lanceolata.* De Candolle. Carson, *Illust. of Med. Bot.* i. 34, pl. 27.—*C. lenitiva.* Bisch.—*Senna acutifolia.* Batka. This is described as a small undershrub, two or three feet high, with a straight, woody, branching, whitish stem; but, according to Landerer, the senna plant attains the height of eight or ten feet in the African deserts. The leaves are alternate and pinnate, with glandless footstalks, and two small narrow pointed stipules at the base. The leaflets, of which from four to six pairs belong to each leaf, are almost sessile, oval-lanceolate, acute, oblique at their base, nerved, from half an inch to an inch long, and of a yellowish green color. The flowers are yellow, and in axillary spikes. The fruit is a flat, elliptical, obtuse, membranous, smooth, grayish brown, bivalvular legume, about an inch long, and half an inch broad, scarcely if at all curved, and divided into six or seven cells, each containing a hard, heart-shaped, ash-colored seed. *C. acutifolia* grows wild in great abundance in Upper Egypt, Nubia, Sennaar, and other parts of Africa. This species furnishes the greater part of the variety known in commerce by the name of Alexandria senna..

Cassia elongata. Lemaire. *Journ. de Pharm.* vii. 345; Fée, *Journ. de Chim. Méd.* vi. 232; Carson, *Illust. of Med. Bot.* i. 36, pl. 29.—*C. angustifolia.* Vahl. This name was conferred by M. Lemaire upon the plant from which the India senna of commerce is derived. The botanical description was completed by M. Fée from dried specimens of the leaves and fruit found by him in unassorted parcels of this variety of senna. Dr. Wallich afterwards succeeded in raising the plant from seeds found in a parcel of senna taken to Calcutta from Arabia; and it has been described by Dr. Royle, Wight & Arnott, and Dr. Lindley. As usually grown, it is annual; but with care it may be made to live through the year, and then assumes the character of an undershrub. It has an erect, smooth stem, and pinnate leaves, with from four to eight pairs of leaflets. These are nearly sessile, lanceolate, obscurely mucronate, oblique at the base, smooth above and somewhat downy beneath, with the veins turned inwards so as to form a wavy line immediately within the edge of the leaflet. The most striking character of the leaflet is its length, which varies from an inch to twenty lines. The petioles are without glands; the stipules minute, spreading, and semi-hastate. The flowers are bright yellow, and arranged in axillary and terminal racemes, rather longer than the leaves. The legume is oblong, membranous, tapering abruptly at the base, rounded at the apex, and an inch and a half long by somewhat more than half an inch broad. This plant is a native of the southern parts of Arabia. It has been said also to grow in the interior of India, and is cultivated at Tinnevelly for medical use.

Cassia obovata. Colladon, *Monographie des Casses.* The stem of this species is rather shorter than that of *C. acutifolia*, rising to the height of only a foot and a half. The leaves have from five to seven pairs of leaflets, which are obovate, very obtuse, sometimes mucronate. The flowers are in axillary spikes, of which the peduncles are longer than the leaves of the plant. The legumes are very much compressed, curved almost into the kidney form, of a greenish brown color, and covered with a very short down, which is perceptible only by the aid of a magnifying glass. They contain from eight to ten seeds. This species grows wild in Syria, Egypt, and Senegambia, and is said to have been cultivated successfully in Italy, Spain, and the West Indies. It grows wild abundantly in some parts of Jamaica. (*P. J. Tr.*, Sept. 1867, p. 143.) It is said to be no longer gathered for senna, although its leaflets and pods can frequently be met with in Alexandrian senna.

C. lanceolata of Forskhal, found by that author growing in the deserts of Arabia, is admitted by Lindley and others as a distinct species. Some difference, however, of opinion exists upon this point. De Candolle considered it a variety of the *C. acutifolia* of Delile, from which it differs chiefly in having leaflets with glandular petioles; and, as Forskhal's description preceded that of Delile, he designated the species by the name of *C. lanceolata.* Forskhal's plant has been supposed by some to be the source of the India or Mocha senna; but the leaflets in this variety are much longer than those of *C. lanceolata*, from which the plant differs also in having no gland on the petiole. Niebuhr informs us that he found the Alexandria senna growing in the Arabian territory of *Abuarish*, whence it is taken by the Arabs to Mecca and Jedda. This is probably the *C. lanceolata* of Forskhal. It is highly probable that this species is the source of a variety of senna which has been brought to this market under the name of Mecca senna.

Cassia Æthiopica of Guibourt (*C. ovata* of Merat), formerly confounded with *C. acutifolia*, is considered by Dr. Lindley a distinct species. It grows in Nubia, Fezzan to the south of Tripoli, and probably, according to Guibourt, throughout Ethiopia. It is from this plant that the *Tripoli senna* of commerce is derived.

Several varieties of this valuable drug are known in commerce. Of these, four have been received in America,—the Alexandria, the Tripoli, the India, and the Mecca senna,—but only two are recognized by the Pharmacopœia.

1. ALEXANDRIA SENNA. Though the name of this variety is derived from the Egyptian port at which it is shipped, it is in fact gathered very far in the interior. The Alexandria senna does not consist exclusively of the product of one species of Cassia. The history of its preparation is not destitute of interest. The senna plants of Upper Egypt yield two crops annually, one in spring and the other in autumn. They are gathered chiefly in the country beyond Syene. The natives cut the plants, and, having dried them in the sun, strip off the leaves and pods, which they pack in bales, and send to Boulak, in the vicinity of Cairo, the great entrepôt for this article of Egyptian commerce. This senna from Upper Egypt, consisting chiefly though not exclusively of the product of *C. acutifolia*, was here formerly mixed with the leaflets of *C. obovata*, brought from other parts of Egypt, and even from Syria, with the leaves of *Cynanchum oleæfolium* (*C. Argel* of Delile, *Solenostemma Argel*, Hayne), known commonly by the name of *argel* or *arguel*, and sometimes with

those of *Tephrosia Apollinea* of De Candolle, a leguminous plant growing in Egypt and Nubia. According to M. Royer, the proportions in which the three chief constituents of this mixture were added together were five parts of *C. acutifolia*, three of *C. obovata*, and two of *Cynanchum*. Thus prepared, the senna was again packed in bales, and transmitted to Alexandria. But at present there is no such uniformity in the constitution of Alexandria senna; and, though the three chief ingredients may still sometimes be found in it, they are not in the same fixed proportions; and not unfrequently the Cynanchum leaves are wholly wanting. This variety of senna is often called in French pharmaceutic works *séné de la palthe*, a name derived from an impost formerly laid upon it by the Ottoman Porte.

A parcel of Alexandria senna, as it was formerly brought to market, consisted of the following ingredients:—1, the leaflets of *C. acutifolia*, characterized by their acute form, and their length, almost always less than an inch; 2, the leaflets of *C. obovata*, known by their rounded very obtuse summit, which is sometimes furnished with a small projecting point, and by their gradual diminution in breadth towards their base; 3, the pods, broken leafstalks, flowers, and fine fragments of other parts of one or both of these species; 4, the leaves of *Cynanchum oleæfolium*, which are distinguishable by their length, almost always more than an inch, their greater thickness and firmness, the absence of any visible lateral nerves on their under surface, their somewhat lighter color, and the regularity of their base. In this last character they strikingly differ from the genuine senna leaflets, which, from whatever species derived, are always marked by obliquity at their base, one side being inserted in the petiole at a point somewhat lower than the other, and at a different angle. Discrimination between this and the other ingredients is of some importance, as the Cynanchum must be considered an adulteration. It is said by the French writers to produce hypercatharsis and much irritation of the bowels, but was found by Christison and Mayer to occasion griping and protracted nausea, with little purgation. The flowers and fruit of the Cynanchum were also often present, the former white and in small corymbs, the latter an ovoid follicle rather larger than an orange-seed. Besides the above constituents of Alexandria senna, it occasionally contained leaflets of genuine senna, much longer than those of the acutifolia or obovata, equalling in this respect the Cynanchum, which they also somewhat resembled in form. They were distinguishable, however, by their greater thinness, the distinctness of their lateral nerves, and the irregularity of their base. The leaflets and fruit of *Tephrosia Apollinea*, which have been an occasional impurity in this variety of senna, may be distinguished, the former by their downy surface, their obovate-oblong, emarginate shape, their parallel unbranched lateral nerves, and by being usually folded longitudinally; the latter, by its dimensions, being from an inch to an inch and a half long, and only two lines broad. As now imported, Alexandria senna is often quite free from the leaves of Cynanchum, and may have few or none of the leaflets of obovate senna. It is probably brought directly to Alexandria from Upper Egypt, without having undergone intermixture at Boulak or other intervening place. In Europe, this senna is said to have been sometimes adulterated with the leaflets of *Collutea arborescens*, or bladder senna, and the leaves of *Coriaria myrtifolia*, a plant of Southern Europe, said to be astringent and even poisonous. An account of these plants is given in Part II. The leaflets of the Coriaria are ovate-lanceolate, grayish green with a bluish tint, and are readily known, when not too much broken up, by their strongly-marked midrib, and two lateral nerves running from the base nearly to the summit. Another addition to Alexandria senna has been detected by M. Lacroix, of Macon, in France, in the leaves of the *Globularia Turbith* (*Globularia alypura*, Linn.), which seem to have taken the place of the *Colutea arborescens*, because more closely resembling the senna leaflet. The leaves of the Globularia are spatulate, much enlarged towards the upper end, rounded at the extremity, but always terminating in a short sharp point. Besides, they are brown, thick, firm, and hard to the touch; while those of the Colutea are green, very thin, and soft. They have an acrid, very bitter taste, but are without nauseous odor. They are asserted to be cathartic, but milder than senna, and capable of being substituted for it in twice the dose. (*Journ. de Pharm.*, 4e sér., i. 413.)

2. TRIPOLI SENNA. Genuine Tripoli senna consists in general exclusively of the leaflets of one species of Cassia, formerly considered as a variety of *C. acutifolia*, but now admitted to be distinct, and named *C. Æthiopica.* The leaflets, however, are much broken up; and it is probably on this account that the variety is usually less esteemed than the Alexandrian. The aspect given to it by this state of comminution, and by the uniformity of its constitution, enables the eye at once to distinguish it from the other varieties of senna. The leaflets, moreover, are shorter, less acute, thinner, and more fragile than those of *C. acutifolia* in Alexandria senna; and their nerves are much less distinct. The general opinion at one time was that it was brought from Sennaar and Nubia to Tripoli in caravans; but it is reasonably asked by M. Fée, how could it be afforded at a cheaper price than the Alexandrian, if thus brought on the backs of camels a distance of eight hundred leagues through the desert? It is probably collected at Fezzan, immediately south of Tripoli.

3. INDIA SENNA. This variety is in Europe sometimes called *Mocha senna*, probably because obtained originally from that port. It derives its name of India senna from the route by which it reaches us. Though produced in Arabia, it is brought to this country and Europe from Calcutta, Bombay, and possibly other ports of Hindostan. It consists of the leaflets of *Cassia elongata*, with some of the leafstalks and pods intermixed. The eye is at once struck by the great length (about two inches) and comparative narrowness of the leaflets, so that the variety may be readily distinguished. The pike-like shape of the leaflet has given rise to the French name of *séné de la pique.* Many of the leaflets have a yellowish, dark brown, or blackish color, probably from exposure after collection; and the variety has commonly in mass a characteristic dull tawny hue. It is generally considered inferior in purgative power. Leaflets of a senna resembling the Indian were brought by Dr. Livingstone from Southern Africa, where the plant grows abundantly. (*P. J. Tr.*, xvii. 499.)

A variety of India senna has reached this country, which is the produce of Hindostan, being cultivated at Tinnevelly, and probably other places in the south of the Peninsula. The plant was originally raised from seeds obtained from the Red Sea, and is the same as that from which the common India senna is derived. The drug is exported from Madras to England, where it is known by the name of *Tinnevelly senna.* It is a fine unmixed variety, consisting of unbroken leaflets, from one to two or more inches long, and sometimes half an inch in their greatest breadth, thin, flexible, and of a fine green color. Mr. T. B. Groves, however, states as the result of his experiments that Tinnevelly senna contains only two-thirds as much of the active principle as does the Alexandrian. (*P. J. Tr.*, Oct. 1868. p. 202.)

4. MECCA SENNA. After the publication of the fifth edition of this Dispensatory, a variety of senna was imported under the name of *Mecca senna*, consisting of the leaflets, pods, broken stems, and petioles of a single species of Cassia. The leaflets were oblong-lanceolate, on the average longer and narrower than those of *C. acutifolia*, and shorter than those of *C. elongata.* The variety in mass had a yellowish or tawny hue, more like that of India than that of Alexandria senna. May it not have been the product of the *C. lanceolata* of Forskhal? We might infer so from the name, and from the character of the leaflet. Landerer, however, speaks of a valuable variety of senna, characterized by the large size of the leaflets, and sold under the name of Mecca senna, which he says comes from the interior of Africa.

Commercial senna is prepared for use by picking out the leaflets, and rejecting the leafstalks, the small fragments, and the leaves of other plants. The pods are also rejected by some apothecaries; but they possess considerable cathartic power, though said to be milder than the leaves.

Properties. The odor of senna is faint and sickly; the taste slightly bitter, sweetish, and nauseous. Water and diluted alcohol extract its active principles. Pure alcohol extracts them but imperfectly. (Bley and Dissel, *Pharm. Centralbl.*, Feb. 1849, p. 126.) The leaves are said to yield about one-third of their weight to boiling water. The infusion is of a deep reddish brown color, and has the odor and taste of the leaves. When exposed to the air for a short time, it deposits a yellowish insoluble precipitate, supposed to result from the union of extractive matter with oxygen. The nature of this precipitate, however, is not well understood. Decoction also produces some change in the principles of senna, by which its medicinal virtues have been supposed to be impaired; but some experiments of B. Heerlein would seem to show that this opinion is incorrect. An extract prepared by boiling down an infusion, redissolving the residue, and again boiling down to a solid consistence, was found to operate actively in a dose equivalent to a drachm of the leaves. (*Pharm. Centralbl.*, 1851, p. 909.) To diluted alcohol it imparts the same reddish brown color as to water; but rectified alcohol and ether, digested upon the powdered leaves, become of a deep olive-green.

Lassaigne and Feneulle first isolated a substance to which they gave the name of *cathartin*, but it proved to be a mixture; Bley and Diesel (*Pharm. Centralbl.*, 1849, p. 126) isolated a yellow coloring matter, which they called *chrysoretin*, but which Martius identified as *chrysophan;* Ludwig (*Arch. Pharm.* (2), 119, p. 42, and 190, p. 69) obtained two bitter principles, *sennapicrin* and *sennacrol*, the first insoluble, the second soluble in ether; but the active purgative principle was first discovered in 1866 by Dragendorff and Kubly (*Vierteljahr. prakt. Pharm.*, 16, pp. 96 and 337), who found it to be a glucoside of weak acid character, and named it *cathartic acid.* Mr. Thos. B. Groves, in 1868 (*P. J. Tr.*, 1869, p. 196), unaware of Dragendorff and Kubly's discovery, isolated the same principle, and found for it the same reactions. Its formula is given as $C_{180}H_{96}N_2SO_{82}$, and by boiling its alcoholic solution with acids it yields *cathartogènic acid* and sugar. It is insoluble in water, strong alcohol, and ether, but its saline compounds with the alkalies and earth are readily dissolved. Its ammonia salt is precipitated by the salts of silver, tin, mercury, copper, and lead; but tannin, the antimonial salts, and the yellow and red prussiates have no effect on it. Alkalies with heat decompose it. It is prepared by partially precipitating with alcohol a watery infusion of senna, concentrating to a syrupy consistence *in vacuo*, filtering, treating the filtrate with a large proportion of absolute alcohol, and repeatedly dissolving in water, and precipitating by alcohol the precipitate thus obtained. It is purified by submitting it, dissolved in moderately strong hydrochloric acid, to dialysis on a diaphragm of parchment paper, cathartic acid having strong collodial properties. Mr. Groves found that cathartate of ammonium purged moderately in the dose of 3¾ grains, with considerable griping; and that of certain mixed cathartates 7½ grains purged violently with much griping and sickness, and continued to act through most of a day. He considers 4 grains as a fair dose. It should be given in connection with an aromatic and a saline cathartic. The cathartate of magnesium is soluble. The salts of this acid in watery solution are decomposed and rendered inert by long exposure to heat in contact with the air. (Groves, *P. J. Tr.*, Oct. 1868, pp. 200–1.) The same chemists found chrysophanic acid in small proportions, the two substances, *sennacrol* and *sennapicrin*, previously mentioned, and a peculiar non-fermentable saccharine principle, with the formula $C_{21}H_{44}O_{19}$, which they have named *catharto-mannit.* (*Journ. de Pharm.*, 4e sér., v. 475.)

Some recent results of experiments on the properties of senna which more particularly concern the pharmaceutist, are noted in a paper contained in the *Journ. de Pharmacie* (Janv. 1874, p. 80), and require to be stated here, because they tend to fix certain points which are left undetermined in the above statement. An extract made by evaporating in the air a watery infusion of senna possesses but partially the purgative properties of the leaves. If the extract be redissolved in a large quantity of water, and the solution be again evaporated, the extract now obtained will be quite inert. It follows that a prolonged decoction of senna destroys its cathartic powers. The presence of an alkali in the decoction increases the rapidity of the destruction. An infusion of senna in lime-water, heated to the boiling point, and then deprived of lime by a stream of carbonic acid, becomes inert. An infusion of senna, made to boil after the addition of caustic potassa, and then neutralized by an acid, is also inert. The mineral acids destroy the purgative powers of senna, but less energetically than the alkalies; the vegetable acids exercise the same power but feebly. Concentrated alcohol does not dissolve the active principle, which is soluble in cold water. It was Heerlein who first determined the complete want of purgative power in the pure alcoholic extract of senna. Nevertheless, this extract possesses, in a high degree, the odor and taste of senna, and, taken internally, without purging, imparts a deep yellow color to the urine, which the alkalies change to red. The leaves exhausted by alcohol have all their purgative effect, but lose the power of affecting the urine so that an alkaline solution shall color it red. These facts prove that chrysophanic acid is not the purgative principle of senna. The fact that alcohol removes the odor and taste of senna, without affecting its purgative action, may sometimes be advantageously applied in cases in which the taste of senna is extremely offensive. Mr. L. Siebold, after experimenting with senna leaves washed with alcohol, arrived at the following conclusions. 1. Strong spirit does not remove any of the active principle (cathartic acid) from senna leaves. 2. The therapeutic action of cathartic acid is assisted by one or more of the constituents yielded by senna to strong spirit, though the latter produce no purgative effect when taken alone. 3. Senna exhausted by alcohol is a reliable and pleasant purgative, but somewhat weaker in its action than the unexhausted leaves.

Incompatibles. Many substances produce precipitates with the infusion of senna; but it does not follow that they are all medicinally incompatible; as they may only remove inert ingredients. Cathartic acid is precipitated by infusion of galls and solution of subacetate of lead. Acetate of lead and tartarized antimony, which disturb the infusion, have no effect upon the solution of this substance.

Medical Properties and Uses. Senna was first used as a medicine by the Arabians. It was noticed in their writings as early as the ninth century; and the name itself is Arabic. It is a prompt, efficient, and very safe purgative, well calculated for fevers and febrile complaints, and other cases in which a decided but not violent impression is desired. A disadvantage is that it is apt to produce severe griping. This effect, however, may be obviated by combining with the senna some aromatic, and some one of the alkaline salts, especially bitartrate of potassium, tartrate of potassium, or sulphate of magnesium. The explanation which attributes the griping property to the oxidized extractive, and its prevention by the saline substances to their influence in promoting the solubility of that principle, is not satisfactory. The purgative effect of senna is considerably increased by combination with bitters; a fact noticed by Cullen, and abundantly confirmed by subsequent experience. The decoction of guaiac is said to exert a similar influence. Senna yields one or more of its principles to the urine; as, from twenty to thirty minutes after it has been taken, this secretion acquires the property of being reddened by ammonia. (*Journ. de Pharm.*, Août, 1863, p. 161.) Senna taken by nurses is said to purge sucking infants, and an infusion injected into the veins operates as a cathartic. The dose of senna in powder is from half a drachm to two drachms (1·95–7·8 Gm.); but the drug is never prescribed in this form. In the officinal preparations, "Tinnevelly senna may be used in place of Alexandria senna." *Br.*

Off. Prep. Confectio Sennæ; Extractum Sennæ Fluidum, *U. S.;* Infusum Sennæ, *Br.;* Infusum Sennæ Compositum, *U. S.;* Mistura Sennæ Composita, *Br.;* Pulvis Glycyrrhizæ Compositus, *U. S.;* Syrupus Sarsaparillæ Compositus, *U. S.;* Syrupus Sennæ, *U. S.;* Tinctura Sennæ, *Br.*

SERPENTARIA. *U. S.* *Serpentaria.* [*Virginia Snakeroot.*]

(SËR-PẸN-TĀ'RỊ-Ạ.)

"The rhizome and rootlets of Aristolochia Serpentaria, Linné, and of Aristolochia reticulata, Nuttall. (*Nat. Ord.* Aristolochiaceæ.)" *U. S.* "The dried rhizome of Aristolochia Serpentaria. Linn." *Br.*

Serpentariæ Radix, *Br.;* Serpentary Root; Couleuvrée de Virginie, Serpentaire de Virginie, *Fr.;* Virginianische Schlangenwurzel, *G.;* Serpentaria Virginiana, *It.*, *Sp.*

Gen. Ch. *Calyx* none. *Corolla* one-petalled, ligulate, ventricose at the base. *Capsules* six-celled, many-seeded, inferior. *Willd.*

Many species of Aristolochia have been employed in medicine. The roots of all of them are tonic and stimulant; and their supposed possession of emmenagogue properties has given origin to the name of the genus. *A. Clematitis*, *A. longa*, *A. rotunda*, and *A. Pistolochia* are still retained in many officinal catalogues of the continent of Europe, where they are indigenous. The root of *A. Clematitis* is very long, cylindrical, as thick as a goose-quill or thicker, variously contorted, beset with the remains of the stems and radicles, of a grayish brown color, a strong peculiar odor, and an acrid bitter taste; that of *A. longa* is spindle-shaped, from a few inches to a foot in length, of the thickness of the thumb or thicker, fleshy, very brittle, grayish externally, brownish yellow within, bitter, and of a strong disagreeable odor when fresh; that of *A. rotunda* is tuberous, roundish, heavy, fleshy, brownish on the exterior, grayish yellow internally, and similar to the preceding in odor and taste; that of *A. Pistolochia* consists of numerous slender yellowish or brownish fibres, attached to a common head, and possessed of an agreeable aromatic odor, with a taste bitter and somewhat acrid. Many species of Aristolochia growing in the West Indies, Mexico, and South America have attracted attention for their medicinal properties; and some, like our own snakeroot, have acquired the reputation of antidotes for the bites of serpents. In the East Indies, *A. Indica* is employed for similar purposes with the European and American species; and the Arabians are said by Forskhal to use the leaves of *A. sempervirens* as a counter-poison. We have in the United States six species, of which four—*A. serpentaria*, *A. hirsuta*, *A. hastata*, and *A. reticulata*—contribute to furnish the snakeroot of the shops.

Aristolochia Serpentaria. Willd. *Sp. Plant.* iv. 159; Bigelow, *Am. Med. Bot.* iii. 82; Barton, *Med. Bot.* ii. 41; *B. & T.* 246. This species of Aristolochia is an herbaceous plant, with a perennial root, which consists of numerous slender fibres proceeding from a short horizontal caudex. Several stems often rise from the same root. They are about eight or ten inches in height, slender, round, flexuose, jointed at irregular distances, and frequently reddish or purple at the base. The leaves are oblong-cordate, acuminate, entire, of a pale yellowish green color, and supported on short petioles at the joints of the stem. The flowers proceed from the joints near the root, and stand singly on long, slender, round, jointed peduncles, which are sometimes furnished with one or two small scales, and bend downwards so as nearly to bury the flower in the earth or decayed leaves. There is no calyx. The corolla is purple, monopetalous, tabular, swelling at the base, contracted and curved in the middle, and terminating in a labiate border with lanceolate lips. The anthers—six or twelve in number—are sessile, attached to the under part of the stigma, which is roundish, divided into six parts, and supported by a short fleshy style upon an oblong, angular, hairy, inferior germ. The fruit is an hexangular, six-celled capsule, containing several small flat seeds.

Serpentaria Rhizome, transverse section.

The plant grows in rich shady woods, throughout the Middle, Southern, and Western States, abounding in the valley of the Ohio, and in the mountainous regions of our interior. It flowers in May and June. The root is collected in Western Pennsylvania and Virginia, in Ohio, Indiana, and Kentucky, and is brought eastward chiefly by the routes of Wheeling and Pittsburg. As it reaches Philadelphia, it is usually in bales containing about one hundred pounds, and is often mixed with the leaves and stems of the plant, and with adhering dirt.

A. hirsuta. Muhlenberg, *Catalogue*, p. 81; Bridges, *A. J. P.* xiv. 121. In Muhlenberg's Catalogue this species was named without being described; and botanists, supposing from the name that it was identical with *A. tomentosa*, generally confounded the two plants. But they are entirely distinct. A description of *A. hirsuta* in the handwriting of Muhlenberg, and a labelled specimen of the plant, in the possession of the Academy of Natural Sciences of this city, have been found to correspond with a dried specimen from Virginia. *A. tomentosa* is a climbing plant, growing in Louisiana on the banks of the Mississippi, and ascending to the summit of the highest trees. It has a thick, creeping root, entirely different in shape from that of the officinal species, though possessed of an analogous odor. *A. hirsuta* has a root like that of *A. Serpentaria*, consisting of a knotty caudex, sending out numerous slender simple fibres, sometimes six inches in length. From this arise several jointed, flexuose, pubescent stems, less than a foot high, with one or two pubescent bracts, and several large roundish-cordate leaves, of which the lower are obtuse, the upper abruptly acuminate, and all pubescent on both sides and at the margin. From the joints near the root originate from one to three solitary peduncles, each bearing three or four leafy bracts and one flower. The peduncles, bracts, and corolla are all hairy. This species grows in Virginia, and perhaps other parts of the Western and Southern States. It probably contributes to the serpentaria of commerce, as its leaves have been found in bales of the drug.

A. hastata. Nuttall, *Gen. of N. Am. Plants*, p. 200.—*A. sagittata.* Muhl. *Catal.* This species, if indeed it can be considered a distinct species, differs from *A. Serpentaria* in having hastate, acute, somewhat cordate leaves, and the lip of the corolla ovate. It flourishes on the banks of the Mississippi, in the Carolinas, and elsewhere. Its root scarcely differs from that of the officinal plant, and is frequently mixed with it, as proved by the presence of the characteristic leaves of *A. hastata* in the parcels brought into market.

A. reticulata. Nuttall; Bridges, *A. J. P.* xvi. 118; Carson, *Illust. of Med. Bot.* ii. 32, pl. 77. This plant was probably first observed by Mr. Nuttall; as a specimen labelled "*A. reticulata*, Red River," in the handwriting of that botanist, is contained in the Herbarium of the Academy of Natural Sciences of Philadelphia. From a root, similar to that of *A. Serpentaria*, numerous short, slender, round, flexuose, jointed stems arise, usually simple, but sometimes branched near the root. The older stems are slightly villous, the young densely pubescent. The leaves, which stand on very short villous petioles, are round or oblong-cordate, obtuse, reticulate, very prominently veined, and villous on both sides, especially upon the veins. From the lower joints of the stem four or five hairy, jointed peduncles proceed, which bear small leafy villous bracts at the joints, and several flowers on short pedicels. The flowers are small, purplish, and densely pubescent, especially at the base end on the germ. The hexangular capsule is deeply sulcate. This species grows in Louisiana, Texas, Arkansas, and the Indian Territory west of that State.

Bales of a variety of serpentaria were some years since brought to Philadelphia, which is certainly the product of this species; as specimens of all parts of the plant have been found in the bales, and the roots, which differ somewhat from those before known, are homogeneous in character. One of these bales was brought from New Orleans, and was said to have come down the Red River, and to have been collected by the Indians. The chief difference between this and ordinary Virginia snakeroot is in the size of the radicles, which are much thicker and less interlaced in the new variety. Each root has usually a considerable portion of one or more stems attached to the caudex. The color is yellowish. The odor and taste are scarcely if at all distinguishable from those of common serpentaria; and there is no doubt that the root is equally effectual as a medicine. From a chemical examination by Mr. T. S. Wiegand, it appears to have the same constituents, and to differ only in containing a rather larger proportion of gum, extractive, and volatile oil.

Properties. Virginia snakeroot is officinally described as "about one inch (25 mm.) long, thin, bent; on the upper side with approximate, short stem-remnants; on the lower side with numerous, thin, branching rootlets about four inches (10 cm.) long; dull yellowish brown, internally whitish; the wood-rays of the rhizome longest on the lower side; odor aromatic, camphoraceous; taste warm, bitterish, and camphoraceous. The rootlets of *Aristolochia reticulata* are coarser, longer, and less interlaced than those of *Aristolochia Serpentaria.*" *U. S.* The color, which in the recent root is yellowish, becomes brown by time. That of the powder is grayish. Examined microscopically (see cut), the rhizome is seen to have only a moderately thick bark, composed chiefly of small-celled liber tissue; the woody tissue is formed of reticulated or punctated vessels and long prosenchymatous cells; the medulla is situated to the upper side of the centre, and has its cells large and thin-walled. The root yields all its virtues to water and alcohol, producing with the former a yellowish brown infusion, with the latter a bright greenish tincture, rendered turbid by the addition of water. Chevallier found in the root volatile oil, a yellow bitter principle, soluble in water and alcohol, resin, gum, starch, albumen, lignin, and various salts. Bucholz obtained from 1000 parts, 5 of a green, fragrant volatile oil, 28·5 of a yellowish green resin, 17 of extractive matter, 181 of gummy extract, 624 of lignin, and 144·5 of water. The active ingredients are probably the volatile oil, and the yellow bitter principle of Chevallier, which that chemist considers analogous to the bitter principle of quassia; alkaline solution of cupric tartrate shows, moreover, the presence of a glucose sugar. The volatile oil passes over with water in distillation, rendering the liquid milky, and impregnating it with the odor of the root. Dr. Bigelow states that the liquid, on standing, deposits small crystals of camphor.

The roots of *Spigelia Marilandica* are sometimes found associated with serpentaria. They may be distinguished by the absence of the bitter taste, and, when the stem and foliage are attached, by the peculiar character of these parts. (See *Spigelia.*) We have seen the young roots of *Polygala Senega* mixed with serpentaria. Independently of their difference in odor and taste, they may be distinguished by being simple, and by a projecting line running from one end to the other of the root. Another adulteration has been detected by Mr. P. S. Milleman, of Chicago, who found, in a parcel, a large quantity of "golden seal" (*Hydrastis Canadensis*). The rhizomes, with rootlets attached, were from a quarter of an inch to an inch in length, and about one-eighth of an inch in diameter. (*A. J. P.*, 1874, p. 516.)

Medical Properties and Uses. Serpentaria is a stimulant tonic, acting also as a diaphoretic or diuretic, according to the mode of its application. Too largely taken, it occasions nausea, griping pains in the bowels, sometimes vomiting and dysenteric tenesmus. In exanthematous diseases in which the eruption is tardy or has receded, and the grade of action is low, it is thought to be useful by promoting the cutaneous affection. It has been recommended in intermittent fevers, and may be serviceable as an adjunct to quinine. It is sometimes given in dyspepsia. The dose of fluid extract is 20 minims to half a fluidrachm (1·25 to 1·9 C.c.).

Off. Prep. Extractum Serpentariæ Fluidum, *U. S.;* Tinctura Cinchonæ Composita; Tinctura Serpentariæ.

SEVUM. *U. S.* *Suet.*

(SĒ′VŬM.)

"The internal fat of the abdomen of Ovis Aries, Linné (*Class*, Mammalia; *Order*, Ruminantia), purified by melting and straining. Suet should be kept in well-closed vessels impervious to fat. It should not be used after it has become rancid." *U. S.* "The internal Fat of the abdomen of the sheep, Ovis Aries, Linn., purified by melting and straining." *Br.*

Sevum Præparatum, *Br.;* Prepared Suet; Sebum, *P. G.;* Sebum Ovillum; Mutton-Suet; Suiff, Graisse de Mouton, *Fr.;* Hammelstalg, Talg, *G.;* Grasse duro, *It.;* Sebo, *Sp.*

Suet is the fat of the sheep, taken chiefly from about the kidneys. It is prepared by cutting the fat into pieces, melting it with a moderate heat, and straining it through linen or flannel. In order to avoid too great a heat, the crude suet is sometimes purified by boiling it in a little water. Mutton suet is of a firmer consistence, and requires a higher temperature for its fusion, than any other animal fat. It is very white, sometimes brittle, inodorous, of a bland taste, insoluble in water, and nearly so in alcohol. Boiling alcohol, however, dissolves it, and deposits it upon cooling. It consists, according to Chevreul, of stearin, palmitin, and olein. The principles are described under the *Fixed Oils* (page 493). It is officinally described as "a white, smooth, solid fat, nearly inodorous, gradually becoming rancid on exposure to air, having a bland taste, and a neutral reaction. Soluble in 44 parts of boiling alcohol, in about 60 parts of ether, and slowly soluble in 2 parts of benzin. From its solution in the latter, kept in a stoppered flask, it slowly separates in a crystalline form on standing. It melts between 45° and 50° C. (113° and 122° F.), and congeals between 37° and 40° C. (98·6° and 104° F.)." *U. S.*

Off. Prep. Emplastrum Cantharidis, *Br.;* Unguentum Hydrargyri; Unguentum Picis Liquidæ, *U. S.*

SINAPIS. *Br.* *Mustard.*

(SỊ-NĀ'PĬS.)

"The seeds of Sinapis nigra, Linn., and Sinapis alba, Linn.; also the seeds reduced to powder, mixed." *Br.*

SINAPIS ALBA. *U. S.* *White Mustard.*

(SỊ-NĀ'PĬS ĂL'BẠ.)

"The seed of Sinapis alba. Linné." *U. S.* (*Brassica alba*, Hooker filius et Thompson. *Nat. Ord.* Cruciferæ, Siliquosæ.)

Semen Vincæ; Yellow Mustard Seed; Moutarde blanche, *Fr.;* Weisser Senf, *G.*

SINAPIS NIGRA. *U. S.* *Black Mustard.*

(SỊ-NĀ'PĬS NĪ'GRẠ.)

"The seed of Sinapis nigra, Linné, Brassica nigra, Koch. (*Nat. Ord.* Cruciferæ, Siliquosæ.)" *U. S.*

Semen Sinapis, *P.G.;* Moutarde noire (grise), Moutarde, *Fr.;* Senfsamen, Schwarzer Senf, *G.;* Senapa, *It.;* Mostaza, *Sp.*

Gen. Ch. Calyx spreading. *Corolla* with straight claws. *Glands* between the shorter stamens and pistil, and between the longer stamens and calyx. *Willd.*

Sinapis nigra. Willd. *Sp. Plant.* iii. 555; *B. & T.* 22. Common or black mustard is an annual plant, with a stem three or four feet in height, divided and subdivided into numerous spreading branches. The leaves are petiolate and variously shaped. Those near the root are large, rough, lyrate-pinnate, and unequally toothed; those higher on the stem are smooth, and less lobed; and the uppermost are entire, narrow, smooth, and dependent. The flowers are small, yellow, with a colored calyx, and stand closely together upon peduncles at the upper part of the branches. The pods are smooth, erect, nearly parallel with the branches, quadrangular, furnished with a short beak, and occupied by numerous seeds.

Sinapis alba. B. & T. 23. The white mustard is also annual. It is rather smaller than the preceding species. The lower leaves are deeply pinnatifid, the upper sublyrate, and all irregularly toothed, rugged, with stiff hairs on both sides and pale green. The flowers are in racemes, with yellow petals, and linear, green calycine leaflets. The pods are spreading, bristly, rugged, roundish, swelling in the position of the seeds, ribbed, and provided with a very long ensiform beak.

Both plants are natives of Europe and cultivated in our gardens; and *S. nigra* has become naturalized in some parts of this country. Their flowers appear in June. The seeds are kept in the shops, both whole and in the state of very fine powder, as prepared by the manufacturers for the table.

The *Sinapis* (*Brassica*) *juncea*, L., is extensively grown in India, and its seeds are largely exported to Europe. The same plant is also cultivated in Southern Russia. The mustard flour which the seeds yield is of a very fine yellow, and affords on distillation the oil of black mustard.

Black mustard seeds are officinally described as "about one twenty-fifth of an inch (1 mm.) in diameter, almost globular, with a circular hilum; testa blackish brown, finely pitted, hard; embryo oily, with a curved radicle, and two cotyledons, one folded over the other; inodorous when dry, but when moist, of a pungent, penetrating, irritating odor; taste pungent and acrid." *White mustard seeds* are much larger, of a yellowish color, and less pungent taste. Both afford a yellow powder, which has a somewhat unctuous appearance, and cakes when compressed.

This is commonly called *flour of mustard*, or simply *mustard*, and is prepared by crushing and pounding the seeds, and then sifting them; the purest flour being obtained by a second sifting. Both the black and the white seeds are used in its preparation. It is often adulterated with wheat flour colored by turmeric, to which red pepper is added to render the mixture sufficiently hot. The skin of white mustard seeds contains a mucilaginous substance, which is extracted by boiling water. When bruised or powdered, both kinds impart their active properties wholly to water, but in a very slight degree to alcohol. They yield upon pressure a fixed oil, called *oil of mustard*, of a greenish yellow color, little smell, and a mild not unpleasant taste; and the portion which remains is even more pungent than the unpressed seeds. The fixed oil of mustard consists of the glycerin compounds of stearic, oleic, and *erucic* or *brassic* acid, $C_{22}H_{42}O_2$, a homologue of oleic acid. Small quantities of still another acid, *sinapoleic*, $C_{20}H_{38}O_2$, occur in the fixed oil of both black and white mustard, and of *behenic* acid, $C_{22}H_{44}O_2$, in black mustard. The oil-cake, remaining after the expression of the oil, has been sold in England as a substitute for flaxseed and other oil-cakes, used as food for cattle, for which the mustard oil-cake is altogether unsuitable, on account of its highly irritant properties.

It has been long known that black mustard seeds yield by distillation with water a very pungent volatile oil, containing sulphur. Guibourt conjectured, and Robiquet and Boutron proved, that this oil does not pre-exist in the seeds, but is produced by the action of water. Hence the absence or very slight degree of odor in the seeds when bruised in a dry state, and their pungency when water is added. It seemed reasonable to suppose that the reaction in this case was similar to that exercised by water upon bitter almonds (see *Amygdala Amara*); and this has been proved to be the fact by the experiments of Simon, Bussy, Boutron, and Frémy. The composition and peculiar decompositions of black mustard oil have already been described. (See *Oleum Sinapis Volatile.*)

A principle was extracted by Dr. Will from white mustard seed, with the aid of alcohol. It has been named *sinalbin*, and has the formula $C_{30}H_{44}N_2S_2O_{16}$. It is decomposed, after the analogy of sinigrin (myronate of potassium), into sulphocyanate of acrinyl, C_8H_7NSO, sulphate of sinapine, $C_{16}H_{25}NSO_9$, and sugar, $C_6H_{12}O_6$, an albuminoid substance being formed at the same time. "The sulphocyanate of acrinyl (C_8H_7NSO) is a very active principle, oily, insoluble in water, not volatile. It may be obtained by causing ether to act on the product of the decomposition of sinalbin. Treated by an alkali and then neutralized by an acid, it colors the perchloride of iron red." (*Journ. de Pharm.*, Avril, 1872, p. 327.)

Medical Properties and Uses. Mustard seeds swallowed whole operate as a laxative, and have acquired some reputation as a remedy in dyspepsia, and other complaints attended with torpid bowels and deficient excitement. The white seeds are preferred, and are taken in the dose of a tablespoonful (15·5 Gm.) once or twice a day, mixed with molasses, or previously softened and rendered mucilaginous by immersion in hot water. They probably act in some measure by mechanically stimulating the bowels. The powder, commonly called simply mustard, in the quantity of one or two teaspoonfuls (7·8 to 3·9 Gm.), is an efficient and prompt stimulant emetic, especially valuable in narcotic poisoning. As a condiment mustard acts as a stimulant to the gastric mucous membrane, and by virtue of this stimulant action it will sometimes relieve obstinate hiccough. But mustard is most valuable as a rubefacient. Mixed with water in the form of a cataplasm, and applied to the skin, it very soon produces redness with burning pain, which in less than an hour usually becomes insupportable. When a speedy impression is not desired, especially when the sinapism is applied to the extremities, the powder should be diluted with an equal portion of rye meal or wheat flour. Care should be taken not to allow the application to continue too long, as vesication with obstinate ulceration, and even sphacelus, may result. This caution is particularly necessary when the patient is insensible, and the degree of pain can afford no criterion of the sufficiency of the action. The volatile oil is powerfully rubefacient, and capable of producing speedy vesication, but certainly is less controllable than is the mustard poultice. For external application as a rubefacient, 30 drops of the oil may be dissolved in a fluidounce of alcohol, or 6 or 8 drops in a fluidrachm of almond or olive oil. (See *Linimentum Sinapis Compositum.*) To form a *sinapism* it has been recommended to mix 20 drops of the volatile oil with 3·5 drachms of glycerin and 5 drachms of starch. It has been given internally in colic, two drops being incorporated with a six-ounce mixture, and half a fluidounce (15 C.c.) given for a dose. In overdoses it is highly poisonous, producing gastro-enteric inflammation, and probably perverting the vital processes by pervading the whole system. Its odor is perceptible in the blood, and it is said to impart the smell of horseradish to the urine. A *spirit of mustard* may be prepared by macerating, for two hours, 250 parts of powdered black mustard with 500 parts of cold water, then adding 120 parts of alcohol of 86 per cent., and distilling over 120 parts of spirit.

Off. Prep. of Mustard. Cataplasma Sinapis, *Br.;* Charta Sinapis, *U. S.;* Oleum Sinapis, *Br.*

Off. Prep. of Oil of Mustard. Linimentum Sinapis Compositum, *U. S.*, *Br.*

SODIUM. *Sodium.*

(sō′dị-ŭm.)

Sodium, *Fr.;* Natrium, Natronmetall, *G.;* Sodio, *It.*, *Sp.*

Sodium is a peculiar metal, forming the radical of the alkali soda. It was discovered by Sir H. Davy in 1807, who obtained it in small quantity by decomposing the alkali by the agency of galvanic electricity. It was afterwards procured in much larger quantities by Gay-Lussac and Thenard, by bringing the alkali in contact with iron turnings heated to whiteness. The iron became oxidized, and the metallic radical of the soda was liberated. Since the discovery of a mode for obtaining aluminium in bars, by Deville, in 1854, the process for procuring sodium, which is the decomposing agent, has been very much improved and cheapened. Sodium is now obtained on a large scale by igniting an intimate mixture of dry carbonate of soda, coal, and chalk.

Sodium is a soft, malleable, ductile solid, of a silver-white color. It possesses the metallic lustre in a high degree, when protected from the action of the air, by which it is quickly tarnished and oxidized. Its sp. gr. is 0·97, fusing point 95.6° C. (204° F.), atomic weight 23, and symbol Na. Its chemical affinities resemble those of potassium, but are less energetic. Like potassium, it has a strong attraction for oxygen. When thrown upon cold water it instantly fuses into a globule without inflaming, and traverses the surface in different directions with rapidity; on warm water it inflames. In both cases the water is decomposed, hydrogen is liberated, and sodium hydrate generated. Like potassium also, if exposed with a bright surface to the air, it undergoes a slow combustion, which renders it luminous in the dark. It combines with oxygen to form the monoxide, Na_2O, and a peroxide, Na_2O_2. This latter oxide is always formed when the metal is burned in the open air.

Sodium is a constituent of a number of important medicinal preparations, and is briefly described in this place as an introduction to these compounds. Its monoxide only is salifiable, and reacts with water to form the alkali soda, which, united to acids, gives rise to a numerous class of compounds, called salts of soda. These are characterized by communicating to the blowpipe flame a rich yellow color, and by not being precipitable by any reagent, except the metantimoniate of potassium. Monoxide of sodium consists of one atom of sodium 23, and one of oxygen $16 = 39$. This reacts with water to form sodium hydrate (caustic soda), $Na_2O + H_2O = (NaOH)_2$. It appears that the salts of sodium, long theoretically presumed to be isomorphous with those of lithium, have been proved to be so by a comparison of the crystals of the hyposulphites of the two alkalies. (*Journ. de Pharm.*, 4e sér., iv. 72.)

The officinal combinations containing sodium are caustic soda, chloride of sodium, the solutions of soda and chlorinated soda, the acetate, arseniate, benzoate, bicarbonate, borate, bromide, carbonate, chlorate, hypophosphite, hyposulphite, iodide, nitrate, phosphate, pyrophosphate, salicylate, santoninate, sulphate, sulphite, and sulphocarbolate of sodium, and the tartrate of potassium and sodium. The description of some of these combinations will immediately follow; and the remainder will be noticed under their respective titles.

SODA. *U.S.* *Soda.*

NaHO; 40. (SŌ'DA.) NaO, HO; 40.

"Soda should be kept in well-stopped bottles made of hard glass." *U. S.*

Soda Caustica, *Br.;* Caustic Soda, Sodium Hydrate; Natrum Causticum, s. Hydricum; Soude caustique, *Fr.;* Natron, Aetznatron, *G.*

"Take of Solution of Soda *two pints.* Boil down the solution rapidly, in a silver or clean iron vessel, until there remains a fluid of oily consistence, a drop of which when removed on a warmed glass rod solidifies on cooling. Pour the fluid on a clean silver or iron plate, or into moulds, and, as soon as it has solidified, break it in pieces, and preserve it in stoppered green-glass bottles." *Br.*

The solution of Soda, being a solution of the caustic alkali, yields it on evaporation in the solid state. Metallic vessels are used in consequence of the chemical action of soda on earthen-ware or porcelain, and the product is directed to be kept in green glass bottles, because these resist its action better than those of white glass. This is usually poured into cylindrical moulds to harden, as is caustic potassa, or allowed to solidify in mass, and broken into irregular fragments.

Soda is made commonly, as the corresponding compound caustic potash is, by the decomposition of sodium carbonate in solution by quick-lime.* (See *Liquor Sodæ.*) It may also be purified from carbonate, and from lime salts and other impurities, as the potassa is purified by treatment with alcohol, which dissolves the alkali, but leaves the salts insoluble.† (See *Sodii Carbonas*, page 1321.)

Chemically pure caustic soda can now be made with commercial success from metallic sodium. The sodium is oxidized in water, using small pieces in succession, and keeping the temperature from rising too high. Caustic soda so obtained is free from chloride and sulphate of sodium, and from alumina, silica, and oxide of iron. (*A. J. P.*, xlii. 50.) Klas Lindroth obtains a soda, containing a mere trace of carbonate and chloride, by evaporating the solution of impure soda until it has a sp. gr. of 1·375, and allowing it to crystallize at a temperature of 17° F. (*A. J. P.*, xliv. 106.)

It is officinally described as "a white, hard, opaque solid, generally in form of fibrous pieces, or of white cylindrical pencils, deliquescent in moist air, but in dry air becoming dry and efflorescent, odorless, having an intensely acrid and caustic taste, and a strongly alkaline reaction. Soluble in 1·7 part of water at 15° C. (59° F.), and in 0·8 part of boiling water; very soluble in alcohol. When heated nearly to a red heat, it melts, forming an oily liquid. At a strong red heat, it is slowly volatilized unchanged. Its aqueous solution dropped into solution of tartaric acid, so that the latter remains in excess, produces neither a precipitate nor cloudiness. An aqueous solution of Soda should be colorless (abs. of organic matter), and, after being supersaturated with nitric acid, should not be more than slightly clouded on the addition of test-solution of nitrate of silver (limit of chloride), or of chloride of barium (limit of sulphate). Dropped into an acid, it should not produce more than a faint effervescence of isolated bubbles (limit of carbonate). If Soda be dissolved in 2 parts of water and the solution dropped into alcohol, not more than a slight precipitate should make its appearance (limit of silica or of carbonate). To neutralize 2·0 Gm. of Soda should require not less than 45 C.c. of the volumetric solution of oxalic acid (corresponding to at least 90 per cent. of absolute hydrate of sodium)." *U. S.*

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* For a series of papers upon the manufacture of soda upon a large scale, see *Chemical News*, April, 1873, pp. 181, 183; May, 1874, pp. 210, 225, 327; July, 1874, p. 31; Feb. 1875, p. 87; March, 1875, pp. 103, 134; April, p. 160.

† A method of preparing soda directly from common salt, through the agency of lead or its oxide, has been proposed in England by Mr. S. Rowbotham. The chloride of sodium is either fused with metallic lead, or mixed with the oxide and water, and allowed to stand till decomposition takes place, the whole being kept moist with steam. The salt abandons its chlorine to the lead; and the caustic soda resulting from the oxidation of the sodium is extracted by lixiviation. The lead is recovered for future use by exposing the chloride to oxygen with heat. (*Chem. News*, May 24, 1867, p. 266.) This plan, it is now stated, first originated with Lord Dundonald in 1794, and was carried on on a large scale by Mr. W. Losh, in 1790.

As prepared by the British process, caustic soda is in grayish white fragments, opaque, brittle, and extremely corrosive. It is deliquescent, very soluble in water, soluble in alcohol, and possessed of all the alkaline properties of potassa, from which it differs in imparting a yellow color to flame, and in not giving in solution a yellow precipitate with platinic chloride or a crystalline precipitate with tartaric acid in excess. When heated it melts, and at an intense heat evaporates. Though deliquescent, like potassa, it does not, like that alkali, become permanently liquid, but forms a paste, which after a time effloresces. The difference in this respect between the two alkalies is owing to the circumstance that, while both are converted into carbonates by uniting with the carbonic acid of the air, potassa forms a deliquescent, and soda an efflorescent salt. It is apt to contain 20 or 25 per cent. of water and impurities originating from the carbonate of sodium used in preparing the solution from which it is made; and the presence of these is recognized by the Br. Pharmacopœia, when it states that the aqueous solution, acidulated with nitric acid, gives a scanty white precipitate with nitrate of silver and chloride of barium, indicating the existence of a chloride and sulphate or carbonate. According to the same authority, it leaves scarcely any sediment when dissolved in water, and 40 grains require for neutralization about 900 grain-measures of the *volumetric solution of oxalic acid.* The officinal volumetric assay permits the presence of 10 per cent. of impurities. (See *Potassa.*) If the solution be colored brown by sulphuretted hydrogen or hydrosulphate of ammonium, the presence of lead may be suspected, derived probably from the glass vessels in which it has been kept. It is used externally as a caustic in the same manner as potassa, when cast into sticks. It has the advantage of being less deliquescent, and is probably milder.* It may be used also for making the solution of soda extemporaneously. (See *Liquor Sodæ.*)

Off. Prep. Liquor Sodæ, *U. S.*

SODÆ CITRO-TARTRAS EFFERVESCENS. *Br.* *Effervescent Citro-tartrate of Soda.*

(SŌ′DÆ CI′TRỌ-TÄR′TRĂS ĔF-FẸR-VĔS′CẸNṢ.)

"Take of Bicarbonate of Soda, in powder, *seventeen ounces;* Tartaric Acid, in powder, *eight ounces;* Citric Acid, in powder, *six ounces.* Mix the powders thoroughly, place them in a dish or pan of suitable form, heated to between 200° and 220°, and when the particles of the powder begin to aggregate, stir them assiduously until they assume a granular form; then, by means of suitable sieves, separate the granules of suitable and most convenient size, and preserve the preparation in well-closed bottles." *Br.*

The object of this combination is to furnish in a convenient and portable form the citrate and tartrate of sodium. As the water has been driven off by heat, no reaction takes place until dissolved in water, when the two acids combine with the soda of the bicarbonate to produce tartrate and citrate of sodium, and the carbonic acid escapes with brisk effervescence. It is in this form that the preparation is intended to be used. The salts combine laxative with refrigerant properties, which adapt them to the febrile state, while the carbonic acid renders them acceptable to the stomach, and will often check nausea and vomiting when existing. The dose is one or two drachms (3·9–7·8 Gm.), which may be taken in a small wineglassful or more of water, and repeated occasionally as required.

SODÆ VALERIANAS. *Br.* *Valerianate of Soda.*

(SŌ′DÆ VẠ-LĒ-RỊ-Ā′NĂS.)

Natrum Valerianicum, Valerianas Sodicus (Natricus); Valérianate de Soude, *Fr.;* Baldriansaures Natron, *G.*

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* *London Paste.* The formula used at the London Throat Hospital for preparing this caustic is as follows. Take of caustic soda and unslaked lime equal parts. Reduce to a fine powder in a warm mortar, and mix intimately. Keep in well-closed bottles, and when required for use take as much as is sufficient. It is recommended for destroying enlarged tonsils or the elongated uvula, where treatment with the "guillotine" or scissors is objected to. This preparation resembles the Vienna Paste, but is preferable in consequence of its being less liable to spread beyond the limits of application. Soda being used instead of potash, and water in place of alcohol, the operation is much less painful. (*N. R.*, Aug. 1878.)

"Take of Amylic Alcohol (Fousel Oil) *four fluidounces* [Imperial measure]; Bichromate of Potash *nine ounces* [avoirdupois]; Sulphuric Acid *six fluidounces and a half* [Imp. meas.]; Solution of Soda *a sufficiency;* Distilled Water *half a gallon* [Imp. meas.]. Dilute the Sulphuric Acid with ten fluidounces of the Water, and dissolve the Bichromate of Potash in the remainder of the Water with the aid of heat. When both liquids are cold, mix them with the Fousel Oil in a matrass, with occasional brisk agitation, until the temperature of the mixture has fallen to about 90°. Connect the matrass with a condenser, and distil until about half a gallon of liquid has passed over. Saturate the distilled liquid accurately with the Solution of Soda, remove any oil which floats on the surface, evaporate till watery vapor ceases to escape, and then raise the heat cautiously so as to liquefy the salt. When the product has cooled and solidified, break it into pieces, and immediately put it into a stoppered bottle." *Br.*

The Valerianate of Sodium was dismissed from the U. S. Pharmacopœia in the revision of 1870. The British process consists of two steps: first, the artificial formation of valerianic acid, and, secondly, the saturation of this acid with caustic soda. By distilling fusel oil with a mixture of sulphuric acid and bichromate of potassium, valerianic acid is formed, and passes over with water. The change is effected by the oxidizing agency of the chromic acid of the bichromate; for when the amyl alcohol of the fusel oil loses two atoms of hydrogen by oxidation, and gains one of oxygen, it is converted into valerianic acid. Thus, $C_5H_{12}O + O_2 = C_5H_{10}O_2 + H_2O$. (See *Potassii Bichromas* and *Alcohol Amylicum.*) The distillate, by exact saturation with the solution of caustic soda, is converted into a solution of valerianate of sodium, which, by the application of heat until the water is driven off, and the residual matter is partially liquefied, furnishes, on cooling, the concrete salt. The small portion of oil that floats on the surface of the solution is valerianate of amyl, $C_5H_{11},C_5H_9O_2$.

Properties. Valerianate of sodium is a deliquescent, very soluble salt, in snow-white masses, having the disagreeable odor of valerianic acid, and a taste at first styptic, but afterwards sweetish. When heated to 140·5° C. (285° F.), it fuses without loss of acid, and, upon cooling, concretes into a white solid. The salt, as officinally ordered, is in the form produced by fusion. Its formula is $NaC_5H_9O_2$. It is little used medically, having been originally introduced into the Dublin Pharmacopœia in 1850 for the sole purpose of forming, by double decomposition, the valerianates of iron, quinine, and zinc, and retained in the Br. Pharmacopœia for the preparation of the last-mentioned salt. It may, however, be given as a nervous stimulant in the dose of from one to five grains (0·065–0·33 Gm.).

Off. Prep. Zinci Valerianas, *Br.*

SODII ACETAS. *U. S.* *Acetate of Sodium.*

$NaC_2H_3O_2 . 3H_2O$; 136. (SŌ′DỊ-Ī Ạ-CĒ′TĂS.) $NaO, C_4H_3O_3, 6HO$; 136.

"Acetate of Sodium should be kept in well-stopped bottles." *U. S.*

Sodæ Acetas, *Br.;* Acetate of Soda, $NaO,C_4H_3O_3 + 6HO$; Natrum Aceticum, *P.G.;* Acetas Sodicus (natricus), Terra Foliata Tartari Crystallisata, Terra Foliata Tartari; Açétate de Soude, *Fr.;* Essigsaures Natron, *G.;* Acetato di Soda, *It.*

Acetate of sodium may be easily prepared by adding crystals of carbonate of sodium to acetic acid until it is neutralized, filtering, concentrating the solution, and crystallizing. It is prepared in the large way in the manufacture of crude pyroligneous acid, for the purpose of being decomposed, so as to yield the officinal acetic acid, by the action of sulphuric acid. The steps of the process by which it is made from the crude acid have been given under *Acidum Aceticum* (page 26).

Properties. It is officinally described as in "large, colorless, transparent, monoclinic prisms, efflorescent in dry air, odorless, having a saline, bitter taste, and a neutral or faintly alkaline reaction. Soluble in 3 parts of water, and in 30 parts of alcohol at 15° C. (59° F.); in 1 part of boiling water and in 2 parts of boiling alcohol. When heated, the salt melts, and on further heating loses all its water (39·7 per cent.), and falls into a white powder. At a higher temperature this powder again melts, and, at red heat, it is decomposed with the evolution of empyreumatic, inflammable vapors, leaving a blackened residue of an alkaline reaction, which imparts to a non-luminous flame an intense yellow color, not appearing more than transiently red when observed through a blue glass. On adding sulphuric acid to a concentrated solution of the salt, and heating, vapor of acetic acid is evolved. A solution of the salt is rendered deep red by ferric chloride, and, on boiling, a red precipitate is formed. A two per cent. aqueous solution of the salt, acidulated with acetic acid, should yield no precipitate, or at most only a faint opalescence, on the addition of test-solution of nitrate of silver (limit of chloride), or of chloride of barium (limit of sulphate). If a solution of the salt, acidulated with nitric acid, is evaporated to dryness, the residue should be completely soluble in water (abs. of silica), and the solution should remain unaffected by hydrosulphuric acid or sulphide of ammonium (abs. of metals), and should yield no precipitate, or at most only a trace, on the addition of test-solution of carbonate of sodium (limit of alkaline earths). Fragments of the salt added to acetic acid, should produce no effervescence (abs. of carbonate), and, when sprinkled upon colorless concentrated sulphuric acid, should not impart to it any color (abs. of organic impurities). If 3·4 Gm. of Acetate of Sodium be ignited until gases cease to be evolved, the alkaline residue should require for complete neutralization 25 C.c. of the volumetric solution of oxalic acid (corresponding to 100 per cent. of pure Acetate of Sodium)." *U. S.* Acetate of sodium, when crystallized, consists of one acetic acid radical 59, one atom of sodium 23, and 3 mols. of water 54 = 136.

Medical Properties and Uses. Acetate of sodium is diuretic, but is very rarely used as a medicine. The dose is from a scruple to two drachms (1·3–7·8 Gm.). It is employed principally to yield acetic acid by the action of sulphuric acid.

In prescribing this salt, the fact, first noticed by M. Violette, should not be forgotten, that a mixture of equal parts of it and nitrate of potassium, if heated, explodes with great violence. (*N. R.*, April, 1873, p. 347.)

Pharm. Uses. In preparing Ferri Arsenias, *Br.;* Ferri Phosphas, *Br.;* Syrupus Ferri Phosphatis, *Br.*

Off. Prep. Acidum Aceticum Glaciale, *Br.* 1864.

SODII ARSENIAS. *U. S.* *Arseniate of Sodium.*

$Na_2 HAsO_4 . 7H_2 O$; 311·9. (SŌ′DỊ-Ī ẠR-SĒ′NỊ-ĂS.) $2NaO, HO, AsO_5 . 14HO$; 311·9.

"Arseniate of Sodium should be kept in well-stopped vials." *U. S.*

Sodæ Arsenias, *Br.;* Natrum Arsenicum, Arsenias Natricus (Sodicus); Arseniate of Soda; Arséniate de Soude, *Fr.;* Arsensaures Natron, *G.*

"Take of Arsenious Acid *ten ounces* [avoirdupois]; Nitrate of Soda *eight ounces and a half* [avoird.]; Dried Carbonate of Soda *five ounces and a half* [avoird.]; Boiling Distilled Water *thirty-five* [*fluid*]*ounces.* Reduce the dry ingredients separately to fine powder, and mix them thoroughly in a porcelain mortar. Put the mixture into a large clay crucible, and cover it with the lid. Expose to a full red heat, till all effervescence has ceased, and complete fusion has taken place. Pour out the fused salt on a clean flagstone, and as soon as it has solidified, and while it is still warm, put it into the boiling Water, stirring diligently. When the salt has dissolved, filter the solution through paper, and set it aside to crystallize. Drain the crystals, and having dried them rapidly on filtering paper, enclose them in stoppered bottles." *Br.**

This was first made officinal by the Br. Pharmacopœia of 1864, and by the U. S. Pharmacopœia in 1870. In the process, the arsenious acid is converted into arsenic acid at the expense of the nitric acid of the nitrate of sodium, and then combines with the soda of both salts, carbonic acid and nitrous fumes being given off. The reaction seems to be as follows:

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* "Take of Arsenious Acid, in fine powder, *two troyounces;* Nitrate of Sodium, in fine powder, *eight hundred and sixteen grains;* Dried Carbonate of Sodium, in fine powder, *five hundred and twenty-eight grains;* Distilled Water, boiling hot, *half a pint.* Having mixed the powders thoroughly, put the mixture into a large clay crucible, and cover it with the lid. Expose it to a full red heat until effervescence has ceased, and complete fusion has taken place. Pour the fused salt on a porcelain slab, and, as soon as it has solidified, and while it is still warm, put it into the hot water, and stir until it is dissolved. Filter the solution, and set it aside to crystallize. Drain the crystals, and, having dried them rapidly on filtering paper, keep them in a well-stopped bottle." *U. S.* 1870.

$$As_2O_3 + 2NaNO_3 + Na_2CO_3 + H_2O = (Na_2HAsO_4)_2 + N_2O_3 + CO_2.$$

According to Mr. Higgins, the gases emitted in this process contain more or less arsenic; an inconvenience which may be avoided by first dissolving the arsenious acid in a solution of caustic soda, and then adding the nitrate. The calcination should be performed in a reverberatory furnace. The gases which escape up the chimney are now free from arsenic, and consist only of ammonia and nitrous vapors. (*Journ. de Pharm.*, 4e sér., ii. 177.)

Properties. Arseniate of sodium is in "colorless, transparent, prismatic crystals, slightly efflorescent in dry air, odorless, having a mild, feebly alkaline taste, and a faintly alkaline reaction. Soluble in 4 parts of water, and very slightly soluble in alcohol at 15° C. (59° F.); very soluble in boiling water, and soluble in 60 parts of boiling alcohol. When gently heated, the salt loses 28·8 per cent. of its weight (water of crystallization), and, if further heated to near 148° C. (298·4° F.), it loses the remainder of its water (11·5 per cent.). A fragment of the salt imparts to a non-luminous flame an intense yellow color, not appearing more than transiently red when observed through a blue glass. The aqueous solution of the salt yields a white precipitate with test-solutions of chloride of barium, chloride of calcium, or sulphate of zinc, and a brick-red precipitate with test-solution of nitrate of silver, all of which precipitates are soluble in nitric acid. The cold, aqueous solution of the salt, acidulated with hydrochloric acid, should not at once produce a yellow precipitate or assume a yellow color, on the addition of solution of hydrosulphuric acid (abs. of arsenite)." *U. S.*

"A solution of 10 grains of the residue, treated with 53 grain-measures of the *volumetric solution of soda*, continues to give a precipitate with the *volumetric solution of nitrate of silver* until 1613 grain-measures of the latter have been added." (*Br.*) In this test the soda is added in order that, by the decomposition of the nitrate of silver, one additional atom of silver may be furnished, so as, with the two atoms given up in exchange for the two atoms of soda of the arseniate of sodium, to make up the three atoms necessary for the formation of the arseniate of silver (Ag_3AsO_4). The precipitate is arseniate of silver, and the quantity precipitated should be equivalent to 6·16 grains of arsenic acid. The aqueous solution of arseniate of sodium gives white precipitates with chloride of barium, chloride of calcium, and sulphate of zinc (arseniates of barium, calcium, and zinc), and a brick-red precipitate with nitrate of silver (arseniate of silver).

Anhydrous arseniate of sodium has the composition Na_2HAsO_4; in crystals it sometimes contains 12 mols. of water, equal to 53·73 per cent. of its weight. According to the officinal formula, this salt also crystallizes with 7 mols. of water, or 40·39 per cent. If the temperature of a solution of the salt is kept at 30° C. (86° F.), crystals are deposited which contain 4 mols. of water. J. Lefort examined 10 different samples of the salt, obtained from as many different sources, and found their water of crystallization to vary from 44·05 to 57·45 per cent. (*Journ. de Pharm. et Chim.*, 1880, 487; *N. R.*, Aug. 1880.)

In medical properties this salt agrees with the other preparations of arsenic (see *Acidum Arseniosum*), and may be employed for the same purposes. The dose of the crystallized salt is stated at from one-twelfth to one-third of a grain (0·005–0·02 Gm.); but it is generally prescribed in the form of solution. (See *Liquor Sodii Arseniatis.*) *Pearson's arsenical solution* is an aqueous solution of arseniate of sodium, containing one grain of the salt in a fluidounce, and therefore much weaker than the officinal solution. This preparation is considerably used on the continent of Europe in the form of bath, for which it is preferred to arsenious acid or the arsenites. M. Guéneau de Mussy recommends it strongly, administered in this way, in nodose rheumatism, or rheumatic gout, using it alone in the more acute forms of the disease, and combined with carbonate of sodium in the chronic. He uses from half a drachm to two or three drachms (1·95 to 7·8 or 11·65 Gm.) of the arseniate to each bath, beginning with the smaller quantity, and gradually increasing. (*Ann. de Thérap.*, 1865, p. 270.)

Off. Prep. Ferri Arsenias, *Br.;* Liquor Sodii Arseniatis, *U. S.;* Liquor Sodæ Arseniatis, *Br.*

SODII BENZOAS. *U.S.* *Benzoate of Sodium.*

$NaC_7 H_5 O_2. H_2 O$; 162. (SŌʹDỊ-Ī BĔNʹZỌ-ĂS.) $NaO, C_{14} H_5 O_3. 2HO$; 162.

"Benzoate of Sodium should be kept in well-stopped bottles." *U. S.*

This is a new officinal salt. It has been used of late years on account of its supposed therapeutical value in phthisis. It is easily made by adding benzoic acid to a concentrated hot solution of sodium carbonate or bicarbonate until effervescence ceases, and allowing the solution to cool and crystallize.

Properties. It is officinally described as "a white, semi-crystalline or amorphous powder, efflorescent on exposure to air, odorless or having a faint odor of benzoin, of a sweetly-astringent taste free from bitterness, and having a neutral reaction. Soluble in 1·8 parts of water, and in 45 parts of alcohol at 15° C. (59° F.); in 1·3 parts of boiling water, and in 20 parts of boiling alcohol. When heated, the salt melts, emits vapors having the odor of benzoic acid, then chars and finally leaves a blackened residue of an alkaline reaction, which imparts to a non-luminous flame an intense yellow color, not appearing more than transiently red when observed through a blue glass. On mixing an aqueous solution of the salt with a dilute solution of ferric sulphate, a flesh-colored precipitate is produced. If the benzoic acid be separated from the salt by precipitating it with diluted nitric acid, and thoroughly washed, it should respond to the tests of purity mentioned under *Acidum Benzoicum.*" *U. S.*

Medical Properties. This salt has been employed by MM. Socquet and Bonjean, in conjunction with silicate of soda and other substances, as a remedy in gout and rheumatism, for the purpose of eliminating uric acid. For the complicated formula proposed, including colchicum and aconite, see *A. J. P.*, 1857, p. 314. Benzoate of sodium has also been highly commended in puerperal fever, and in tuberculosis. (*Brit. Med. Journal*, ii. 1879, 498–982.) The dose is set down at from one to two drachms (3·9–7·8 Gm.) a day.

SODII BICARBONAS. *U. S.* *Bicarbonate of Sodium.*

$NaHCO_3$; 84. (SŌʹDỊ-Ī BĪ-CÄR-BŌʹNĂS.) $NaO, HO, 2CO_2$; 84.

Sodæ Bicarbonas, *Br.;* Natrum Bicarbonicum, *P.G.;* Natrum Carbonicum Acidulum, Bicarbonas Sodicus; Bicarbonate of Soda, Sodium Hydrocarbonate, Acid Sodium Carbonate; Bicarbonate de Soude, Sel digestive de Vichy, *Fr.;* Doppeltkohlensaures Natron, *G.*

Two kinds of Bicarbonate of Sodium are still officinal,—one, which is known by the title of this article, and which, to comply with the officinal test, must not have more than one per cent. of impurity, and the other, "commercial bicarbonate," which must contain at least 95 per cent. of pure bicarbonate. To obtain a salt which will comply with the officinal test it will be necessary to purify the commercial salt, and the process of the U. S. Pharmacopœia 1870 will be found as serviceable as any to accomplish this purpose. It is as follows: "Take of Commercial Bicarbonate of Sodium, in powder, *sixty-four troyounces;* Distilled Water *six pints.* Introduce the powder into a suitable conical glass percolator, cover it with a piece of wet muslin, and pour the Water gradually upon it. When the liquid has ceased to drop, or when the washings cease to precipitate a solution of sulphate of magnesium, remove the Bicarbonate of Sodium from the percolator, and dry it on bibulous paper, in a warm place." *U. S.* 1870.

The preparation of the commercial salt will be described under *Sodii Bicarbonas Venalis.* The purified bicarbonate is officinally described as "a white, opaque powder, permanent in the air, odorless, having a cooling, mildly saline taste, and a slightly alkaline reaction. Soluble in 12 parts of water at 15° C. (59° F.), and insoluble in alcohol. It is decomposed by hot water. When heated to about 70° C. (158° F.), the salt begins to lose moisture and carbonic acid gas, and, on continued heating, loses about 37 per cent. in weight. At a red heat, the anhydrous residue melts; and a fragment of the salt imparts an intense yellow color to a non-luminous flame. The aqueous solution, on being heated, disengages carbonic acid, and finally contains carbonate of sodium. A one per cent. solution of the salt, supersaturated with nitric acid, should yield at most only a slight opalescence with test-solution of nitrate of silver (limit of chloride), or chloride of barium (limit of sulphate). On heating a small quantity of the salt with solution of soda, no ammoniacal vapor should be given off. If 2 Gm. of the salt be dissolved, with very gentle agitation, in 30 C.c. of cold water, and the solution added to a cold solution of 0·3 Gm. of mercuric chloride in 6 C.c. of water, only a white cloud, but neither a red precipitate nor a red color should make its appearance within three minutes (abs. of more than about three per cent. of carbonate). To neutralize 4·2 Gm. of Bicarbonate of Sodium should require not less than 49·5 C.c. of the volumetric solution of oxalic acid (corresponding to at least 99 per cent. of Bicarbonate of Sodium)." *U. S.* "Twenty grains neutralize 16·7 grains of citric acid, or 17·8 grains of tartaric acid. Eighty-four grains, exposed to a red heat, leave 53 of an alkaline residue, which require for neutralization 1000 grain-measures of the *volumetric solution of oxalic acid.*" *Br.* This is almost the precise proportion of carbonate of sodium which two mols. of the bicarbonate should yield when deprived of water and half its carbon dioxide, according to the reaction: $2NaHCO_3 = Na_2CO_3 + H_2O + CO_2$. But the article furnished by the British manufacturers very rarely comes up to the requirements of their Pharmacopœia. The presence of carbonate may be known by a decided alkaline taste and reaction, by a cold solution of the salt yielding a precipitate with sulphate of magnesium, and by a solution in 40 parts of water affording, without agitation, an orange-colored or reddish brown precipitate with corrosive sublimate. The pure bicarbonate is not precipitated by platinic chloride, nor, when treated with nitric acid in excess, by chloride of barium or nitrate of silver. The non-action of these tests shows the absence of salts of potassa, and of sulphates and chlorides. The incompatibles of this salt are the same as those elsewhere mentioned of the carbonate, except sulphate of magnesium in the cold, which decomposes the carbonate, but not the bicarbonate.

Off. Prep. Mistura Rhei et Sodæ; Pulveres Effervescens Compositus, *U. S.;* Sodæ Citro-tartras Effervescens, *Br.;* Trochisci Sodii Bicarbonatis, *U. S.;* Trochisci Sodæ Bicarbonatis, *Br.*

SODII BICARBONAS VENALIS. *Commercial Bicarbonate of Sodium.*

$NaHCO_3$; 84. (SŌ′DỊ-Ī BĪ-CĂR-BŌ′NĂS VẸ-NĀ′LĬS.) NaO, HO, CO_2; 84.

Large quantities of Bicarbonate of Sodium were formerly imported from Great Britain (but 8199 kegs were imported in 1881); at the present time it is made, of excellent quality, by the Pennsylvania Salt Manufacturing Co., at Natrona, Pa., and at Greenwich Point, Philadelphia. In the Pharmacopœia of 1860 a process for making bicarbonate of sodium was given, but it has since been abandoned, as the salt can be made much more economically on the large scale. The process consists of treating crystallized carbonate of sodium, contained in suitable chambers, with carbon-dioxide gas until the carbonate has taken up another molecule of carbon-dioxide. It is formed by the union of neutral carbonate, Na_2CO_3, with carbon dioxide gas, CO_2, in the presence of water, H_2O, according to the following reaction: $Na_2CO_3 + CO_2 + H_2O = (HNaCO_3)_2$; two molecules of the bicarbonate being generated. The necessary water is obtained through the liberation of the water of crystallization of the carbonate; in fact, provision has to be made for the escape of the excess by placing the crystals upon perforated bottoms.

We are informed that bicarbonate of sodium is also prepared in breweries, in the same manner as bicarbonate of potassium or sal aëratus, by placing the carbonate in suitable vessels over the fermenting beer in the vats, so as to be constantly immersed in an atmosphere of carbonic acid. It is sold under the same name as the analogous salt of potassa, but is usually distinguished as the *soda sal aëratus.* Artus has given a process for obtaining bicarbonate of sodium, similar to that of Wöhler for forming the corresponding salt of potassa. (See *Potassii Bicarbonas.*)

In this process, the effloresced carbonate, mixed with half its weight of freshly-ignited and finely-powdered charcoal, is saturated by a stream of carbonic acid, derived from the fermentation of sugar. The presence of the charcoal greatly promotes the absorption. (*Pharm. Centralb.*, 1843, p. 254.)

Properties. Bicarbonate of sodium is in opaque, porous masses, made up of numerous aggregated crystalline grains, having a snow-white color. These masses are reduced to powder. It is permanent in the air, and slightly alkaline to the taste and to turmeric paper. It is soluble in thirteen parts of cold water, and corresponds in physical properties and reactions of identity to the preceding. (See *Sodii Bicarbonas.*) "A one per cent. aqueous solution of the salt, acidulated with nitric acid, should not yield an immediate precipitate with test-solution of nitrate of silver (limit of chloride), or of chloride of barium (limit of sulphate). If a portion of the salt be agitated with a quantity of water insufficient to dissolve it, the cold filtrate should not yield more than a slight precipitate with a concentrated solution of sulphate of magnesium (limit of carbonate). To neutralize 4·2 Gm. of the salt should require not less than 47·5 C.c. of the volumetric solution of oxalic acid (corresponding to at least 95 per cent. of Bicarbonate of Sodium)." *U. S.* When the solution is exposed to heat, the salt gradually parts with carbonic acid, and, at the temperature of 100° C. (212° F.), is converted into sesquicarbonate. At a red heat, the second equivalent of carbonic acid is expelled, and the anhydrous carbonate is left. More or less carbonate of sodium is always present in the commercial bicarbonate. Its presence may be known by a decided alkaline taste and reaction, and by a cold solution of the salt yielding a precipitate with sulphate of magnesium. The pure bicarbonate is not precipitated by platinic chloride. The incompatibles of this salt are the same as those elsewhere mentioned of the carbonate, except sulphate of magnesium in the cold, which decomposes the carbonate, but not the bicarbonate.

Medical Properties. This salt has the general medical properties of the carbonate, but, from its mild taste and less irritating qualities, proves more acceptable to the palate and stomach. It is often resorted to in calculous cases characterized by excess of uric acid. The continued use of the carbonate, in these cases, is liable to induce phosphatic deposit, after the removal of the uric acid. According to D'Arcet, who made the observation at the springs of Vichy, this objection does not apply to the bicarbonate, especially when taken in carbonic acid water; for this salt, by its superabundant acid, has the power of maintaining the phosphates in solution, even after the alkali has caused the uric acid to disappear. The same remark is applicable to the bicarbonate of potassium. Bicarbonate of sodium has been given in infantile croup, with apparent advantage in promoting the expulsion of the false membrane, in the dose of a grain every five minutes, dissolved in milk and water. Dr. Lemaire has proposed it as an antiphlogistic remedy in the treatment of pneumonia, membranous angina, and croup, supposing it to act on the principle of removing from the blood the excess of fibrin, which exists in that liquid in inflammation. Its utility in membranous angina has been confirmed by M. Marchal (de Calvi). According to M. Jeannel, the use of bicarbonate of sodium lessens the sugar in the urine of diabetic patients. The dose for an adult is from ten grains to a drachm (0·65–3·9 Gm.), and is taken most conveniently in a glass of carbonic acid water. When given in angina, fifteen grains (1 Gm.) may be administered every half-hour in a tablespoonful of water.

Pharm. Uses. In the preparation of Aqua Acidi Carbonici.

SODII BISULPHIS. *U. S.* *Bisulphite of Sodium.*

$NaHSO_3$; 104. (SŌ′DI-Ī BĪ-SŬL′PHIS.) $NaO, HO, 2SO_2$; 104.

"Bisulphite of Sodium should be kept in well-stopped bottles." *U. S.*

This is a new officinal salt. It is prepared by thoroughly saturating a concentrated solution of sodium carbonate or bicarbonate with sulphurous acid gas, and collecting the crystals which form upon the cooling of the liquid. As found in commerce, it usually contains hyposulphite and sulphate of sodium, is not reliable, and will not respond to the officinal tests: even when kept in well-stopped bottles it will readily lose its crystalline character, and the quantity of sulphurous acid gradually diminishes. The more stable sulphite is generally preferred. (See *Sodii Sulphis.*)

Properties. It is officinally described as in "opaque, prismatic crystals, or a crystalline or granular powder, slowly oxidized and losing sulphurous acid on exposure to air, having a faint, sulphurous odor, a disagreeable, sulphurous taste, and an acid reaction. Soluble in 4 parts of water, and in 72 parts of alcohol at 15° C. (59° F.); in 2 parts of boiling water, and in 49 parts of boiling alcohol. When strongly heated, the salt decrepitates and is converted into sulphur and sulphate of sodium. A small fragment of the salt imparts to a non-luminous flame an intense yellow color, not appearing more than transiently red when observed through a blue glass. On adding hydrochloric acid to an aqueous solution of the salt, sulphurous vapors are evolved, and the solution does not become cloudy (difference from hyposulphite). A one per cent. aqueous solution of the salt, acidulated with hydrochloric acid, should not yield more than a faint cloudiness with test-solution of chloride of barium (limit of sulphate). If 0·26 Gm. of the salt be dissolved in 10 C.c. of water, and a little gelatinized starch added, at least 45 C.c. of the volumetric solution of iodine should be required before a permanent blue tint appears after stirring (corresponding to at least 90 per cent. of pure Bisulphite of Sodium)." *U. S.*

Medical Properties. The medical properties are those of the sulphites generally.

SODII BORAS. *U. S.* *Borate of Sodium.*

$Na_2B_4O_7.10H_2O$; 382. (SŌ'DI-Ī BŌ'RĂS.) $NaO, 2BO_3.10HO$; 191.

Borax, *Br., P.G.;* Natrum Biboricum (Biboracicum), Boras Sodicus; Borate de Soude, Borax, *Fr.;* Borax, Borsaures Natron, *G.;* Borace, *It.;* Borax, *Sp.;* Boorak, *Arab.*

Borax was known to the ancients; but its chemical nature was first ascertained by Geoffroy in 1732. It exists native, and may be obtained by artificial means. It occurs in several localities in Europe, in Peru, and in beds, associated with borate of calcium, in the district of Iquique, in the republic of Ecuador. This mineral (*boronatrocalcite*), which has become an article of commerce, and is considerably used as a substitute for borax, contains, according to T. L. Phipson, 34 per cent. of water, 11·95 of soda, 14·45 of lime, 34·71 of boric acid, 1·34 of chlorine, 1·10 of sulphuric acid, 0·60 of silica, and 2 of sand, and may be considered as a compound essentially of one mol. of crystallized borate of sodium and two mols. of borate of calcium, with two mols. of water. (*Chem. News*, 1861, p. 183.) It is said also to contain usually some iodine and bromine. (*G. Sims.*) Borax is found abundantly in certain lakes of Thibet and Persia, from which it is obtained by spontaneous evaporation. The impure borax, called in commerce *tincal*, or *crude borax*, concretes on the borders of these lakes. As thus obtained, it is in the form of crystalline masses which are sometimes colorless, sometimes yellowish or greenish, and always covered with an earthy coating, greasy to the touch, and having the odor of soap. The greasy appearance is derived from a fatty matter, saponified by soda. The tincal is transferred to the seaports of India, especially Calcutta, from which it is exported to this country in chests. Besides Indian tincal, there is another commercial variety of borax which comes from China, and which is partially refined. Both varieties require to be purified before being used in medicine or the arts.

An abundant source of borax has been developed within the limits of the United States. The existence of a borax lake in California was first made known by Dr. J. A. Veatch, who visited it in September, 1856, and, upon examining its waters, found borax among its constituents. The borax lake is a small offset of a large sheet of water, called *Clear Lake*, which is situated in the midst of a volcanic region, about 36 miles from the Pacific, and about 100 miles north of San Francisco. The smaller lakelet is separated from the larger by a low ridge of volcanic materials loosely massed together. It is of variable dimensions according to the season, being sometimes dry, at other times filled with water to the extent of about a mile in length and half a mile in breadth. In September, 1863, the water, being analyzed by Mr. G. E. Moore, was found to contain in a gallon 2401·56 grains of solid matter, of which about one-half was common salt, one-quarter carbonate, and the remainder chiefly borate of sodium, equivalent to 535·08 grains of the crystallized biborate to the gallon. The borax, being the least soluble of the saline constituents, from time to time, as the water becomes saturated, crystallizes out, and is deposited at the bottom of the lake, where it has accumulated in large quantities. The crystals of borax, from the minutest speck up to a diameter of two or three inches, intermixed with blue mud, form a layer at the bottom of the lake of variable thickness, but 18 inches in one place that was examined. This deposit forms an apparently inexhaustible supply of borax, for as fast as removed in one place it is deposited in another by crystallization from the water, which, supplied from the volcanic regions around, promises to continue furnishing the borax for an indefinite period. Already the lake has supplied large quantities of borax to commerce. Iron coffer-dams are sunk to the bottom of the lake, the water pumped out, and the mixed mud and crystals removed. The crystals are picked out, and the earth, which is strongly impregnated with borax, is lixiviated, and the solution thus obtained evaporated in boilers till crystals form. Immense quantities have been obtained from these deposits. The importation of borax, which formerly amounted to from 600,000 to 1,000,000 pounds annually, has practically ceased, and the American product has been largely exported.

Purification. The method of refining borax was originally possessed as a secret by the Venetians and Dutch, but is now practised in several European countries. The process pursued in France, as reported by Robiquet and Marchand, is as follows. The tincal is placed in a large wooden vessel, and covered to the depth of three or four inches with water; in which state it is allowed to remain for five or six hours, being agitated from time to time. Slaked lime is now added, in the proportion of 1 part to 400 of the impure salt; and the whole, being thoroughly mixed, is allowed to remain at rest till the succeeding day. The salt is next separated by means of a sieve, the crystals being crumbled between the hands, and placed so as to drain. The object of this treatment is to separate the soapy matter, with which the lime forms an insoluble soap; and at the same time sulphate and chloride of sodium are removed, with only a minute loss of the borax. The borax being drained is next dissolved, by the assistance of heat, in two and a half times its weight of water, and the solution treated with one-fiftieth of its weight of chloride of calcium, in order to complete the separation of the soapy matter; after which it is strained through a coarse bag. The liquor is then concentrated by heat, and run into wooden vessels, lined with lead, having the shape of an inverted quadrangular pyramid. If care be taken that the cooling proceed very gradually, distinct crystals will be obtained, such as are found in commerce; otherwise, crystalline crusts will be formed. The Chinese borax is purified in a similar manner, but, being less impure than the common tincal, does not require to be washed.

Preparation of Artificial Borax. Large quantities of borax are now made for the European market by the direct combination of *native boric acid* with soda. The acid is found abundantly in the crater of Vulcano, one of the Lipari Islands, but principally in a volcanic region of Tuscany, occupying a space of ten or twelve miles. Within this region are found numerous hillocks and fissures, the latter of which emit hot aqueous vapor, containing boric acid and certain gases. Around one or several of these fissures a circular basin of masonry is built, which is filled with water and called a lagoon. By the jets of vapor constantly breaking through it, the water becomes gradually impregnated with boric acid and heated. A series of such lagoons are made to communicate with each other on the declivity of a hill, and the lowest to discharge itself into a reservoir, where the solution is allowed to rest and deposit mechanical impurities. From this reservoir the solution is made to pass into leaden evaporating pans, heated by the natural vapor, where it receives sufficient concentration to fit it for being conducted into wooden tubs, where it is allowed to cool and crystallize. The crude acid, thus obtained, contains, on an average, 84 per cent. of boric acid, the impurities consisting chiefly of alum, the double sulphate of ammonium and magnesium, and sulphate of calcium. The seven works in the neighborhood of Castel-nuovo in Tuscany, belonging to Count Larderel, were producing, in 1878, over 3 millions of kilogrammes. Vulcano yielded 4000 kilogrammes of boric acid yearly. The crude acid is converted into borax by dissolving it to saturation in a solution of carbonate of sodium, heated by steam; and the liquor, after boiling, is allowed to stand for ten or twelve hours. It is then drawn off into wooden vessels lined with lead, where it crystallizes. The impure crystals, thus obtained, are refined by dissolving them in water heated by steam, adding carbonate of sodium to the solution, and crystallizing. The merit of introducing the process for obtaining artificial borax belongs to Cartier and Payen, who succeeded in establishing its manufacture in France. According to Dr. Veatch, boric acid exists in the sea-water on the coast of California.

Another method of neutralizing the Italian boric acid is now in practice in England. Instead of combining the acid and alkali in solution, the manufacturer mixes the acid in a solid state with a proper proportion of soda ash, and exposes the mixture to the heat of a reverberatory furnace; provision being made for the collection of a large quantity of ammonia, which is always present in the crude acid, and escapes during the process. The remaining operations are similar to those performed in the preparation of carbonate of sodium from the cake. (*A. J. P.*, 1867, p. 339.)

Properties. Borax is a white salt, occurring in "colorless, transparent, shining, monoclinic prisms, slightly efflorescent in dry air, odorless, having a mild, cooling, sweetish, afterward somewhat alkaline taste, and an alkaline reaction. Soluble in 16 parts of water at 15° C. (59° F.), and in 0·5 part of boiling water; insoluble in alcohol. At 80° C. (176° F.) it is soluble in 1 part of glycerin. When heated, the powdered salt begins to lose water, then melts, on further heating swells up and forms a white porous mass, which, at a red heat, fuses to a colorless glass, with complete loss of water of crystallization (47·1 per cent.). A fragment of the salt imparts an intense yellow color to a non-luminous flame. The saturated aqueous solution, on the addition of sulphuric acid, deposits shining crystalline scales, which impart a green color to the flame of alcohol. The aqueous solution should not effervesce with acids (abs. of carbonate), and should not be precipitated nor be rendered cloudy by test-solution of carbonate of sodium (abs. of alkaline earths), nor be affected by hydrosulphuric acid (abs. of metals). A one per cent. solution, strongly acidulated with nitric acid, should not be rendered turbid by the addition of a few drops of test-solution of chloride of barium (limit of sulphate), or nitrate of silver (limit of chloride)." *U. S.* Above a red heat it melts into a limpid liquid, which, after cooling, concretes into a transparent solid, called *glass of borax*, much used as a flux in assays with the blowpipe. Borax has been found, in the English market, adulterated to the extent of 20 per cent. with phosphate of sodium. This may be detected by exposing the suspected borax to the heat of a drying room for a few hours, when the phosphate, if present, will effloresce, and may be picked out.

Borax has the property of rendering cream of tartar very soluble in water, and forms a combination with it called *soluble cream of tartar*, which is sometimes used in medicine. This preparation attracts moisture from the air, and is soluble in its own weight of cold, and half its weight of boiling water. (See *Potassii Bitartras.*) R. F. Fairthorne states that borax is more soluble in water if sugar has been added to it. (*A. J. P.*, March, 1881.) Soluble cream of tartar may be made by substituting boric acid for the borax. *Boric acid soluble cream of tartar* was directed by the French Codex of 1837, and was made by the following formula. Four hundred parts of cream of tartar and 100 of the acid are dissolved in a silver basin, at the boiling temperature, in 2400 parts of water. The solution is kept boiling until the greater part of the water is consumed. The fire is then moderated, and the solution continually stirred while the evaporation proceeds. When the matter has become very thick, it is removed by portions, which are flattened in the hand, completely dried by the heat of a stove, powdered, and kept in well-stopped bottles. This form of soluble cream of tartar is more soluble than that made with borax. According to M. E. Robiquet, in order to obtain soluble cream of tartar, made with boric acid, of good quality, it is necessary to use a large quantity of water, and to boil for a long time. By proceeding thus, the boric acid undergoes a molecular modification, equivalent to a change from the crystallized to the vitreous condition, and a preparation, readily and totally soluble in cold water, is insured. The product should not be powdered, but kept in large grains. (*Journ. de Pharm.*, xxi. 197.)

Composition. Borax has the formula $Na_2B_4O_7 + 10H_2O$. It ordinarily crystallizes in prisms, and contains ten mols. of water (*prismatic borax*); but a variety of the salt exists, which crystallizes in octohedrons, and contains only five mols. of water (*octohedral borax*). The latter is obtained in the artificial production of borax, by crystallizing from a concentrated solution at a temperature between 60°–80° C. (140°–176° F.). When a solution of borax is evaporated at 100° C. (212° F.), the salt is left as a transparent, amorphous, brittle mass, containing four mols. of water. (*Schweitzer.*)

Boric acid may be obtained artificially by decomposing a hot saturated solution of borax with sulphuric acid, which unites with the soda to form sulphate of sodium, and sets free the acid. As thus obtained it is in white, shining, scaly crystals, characterized by the property of imparting a light green color to the flame of burning alcohol. Boric acid has the formula H_3BO_3, and is now officinal.* (See *Acidum Boricum.*) *Boron* is a non-metallic element, which, like carbon, exists in three allotropic states, called amorphous, graphitoidal, and crystallized boron, representing severally charcoal, graphite, and diamond. Crystallized boron is very brilliant, and of different colors, from garnet-red to a nearly colorless honey-yellow. Its density is 2·68, and hardness very great. Wöhler and Deville distinguish three varieties of crystals, containing from 2 to 4 per cent. of carbon; and one specimen, in addition to carbon, about 7 per cent. of aluminium. The hardest variety was as hard as diamond. (See *Chem. Gaz.*, Aug. 1, 1857, p. 281.)

Medical Properties. We have no knowledge as to the action of large quantities of borax upon the human organism, when taken internally. Its influence is, however, probably a very feeble one, as Cyon has found that in daily doses of three drachms it has no effect upon dogs. It is supposed to exercise a specific influence over the uterus, promoting menstruation, facilitating parturition, and favoring the expulsion of the placenta, and has been used in dysmenorrhœa. Dr. Binswanger considers borax as the best remedy that can be used in nephritic and calculous complaints dependent on an excess of uric acid. It possibly may act in such cases as an alkali, the soda of the salt neutralizing the uric acid occurring in the urine, and the boric acid being set free. The dose is from thirty to forty grains (1·95–2·6 Gm.). When brought in contact with a mucous membrane, borax exerts a peculiar detergent, mild stimulant or alterative action. In infantile diarrhœa, unattended by lesions of the intestinal mucous membrane, Mr. Bouchut has found borax peculiarly efficacious, given in the form of enema, made by dissolving from two to five drachms in four fluidounces of water. It is a very useful remedy in aphthous and other ulcerations of the mouth, and is employed in hoarseness of public speakers, a lump of it being allowed slowly to dissolve in the mouth. Concentrated solutions of it are occasionally applied with asserted good results in scaly diseases of the skin, and in pruritus not only of the external portions of the body, but also of the urethra and vagina. From the experiments of M. Dumas and M. Schnatzles, it appears that borax has the property of destroying the microscopic vegetable and animal organisms upon which fermentation and putrefaction depend, and consequently of preventing these processes, or of suspending and altogether arresting them, when already begun. Thus, a strong solution of borax added to a saccharine solution containing yeast, prevents alcoholic fermentation, by destroying the vitality of the yeast plant; and in a similar manner, in meats and other putrescible food, in great measure it prevents putrefaction by destroying the infusoria and other microscopic bodies which occasion or support the process. (*P. J. Tr.*, April, 1874, p. 846.) Borax is a powerful antiseptic. According to the experiments of Bucholz, 0·75 per cent. of it is enough to prevent the development of bacteria. It has also been used in antiseptic surgery, the advantages being claimed for it that it is inodorous, unirritating, and not poisonous. Wounds dressed in a dry manner with a lint which has been prepared by previously wetting with a hot saturated solution of borax and drying, are said to do extremely well. Borax is used in the arts for soldering metals, its effect being to keep the surfaces clean, which it does because of the power possessed by borax glass of dissolving metallic oxides. It is said also to have come into use, in some places, in washing clothes, as a substitute for or an addition to soap, which it resembles in its effects, while it does not disturb the colors. It is used in very small proportion.

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* *Reactions of Boric Acid.* From the researches of M. C. Tissier, it appears that boric acid, in boiling solution, is capable of dissolving the monoxides of calcium, magnesium, manganese, iron, cobalt, nickel, zinc, and cadmium, but not those of copper, lead, or tin, nor the sesquioxides of aluminium, chrome, or iron. In other words, it dissolves the monoxides of all the metals which decompose water in the presence of acids, and is without action on those of other metals, as well as on all the higher oxides, such as sesquioxides and dioxides. It dissolves only one of the insoluble metallic sulphides, namely, the sulphide of manganese. (*Journ. de Pharm.*, Juillet, 1858, p. 98.)

Off. Prep. Glycerinum Boracis, *Br.;* Mel Boracis, *Br.*

SODII BROMIDUM. *U.S.* *Bromide of Sodium.*

NaBr; 102·8. (SŌ′DỊ-Ī BRŌ′MỊ-DŬM.) NaBr; 102·8.

"Bromide of Sodium should be kept in well-stopped bottles." *U. S.*

This is a new officinal salt. It contains a larger proportion of bromine than bromide of potassium, on account of the lower atomic weight of sodium, bromide of sodium containing 77·62 per cent., whilst bromide of potassium contains 67·13 per cent. of bromine. It is a trifle more soluble in water and alcohol. It may be made by the same process that is employed for bromide of potassium, substituting carbonate of sodium for carbonate of potassium. According to M. Castelhaz, it is best made by transforming bromine into bromide of ammonium, separating any iodine present as iodide by crystallization from the mother-waters, and decomposing the bromide of ammonium with carbonate of sodium. The solution should be evaporated by heating carefully. (*A. J. P.*, xlii. 509.)

Properties. "Small, colorless or white, monoclinic crystals, or a crystalline powder, permanent in dry air, odorless, having a saline, slightly bitter taste, and a neutral or faintly alkaline reaction. Soluble in 1·2 part of water, and in 13 parts of alcohol at 15° C. (59° F.); in 0·5 part of boiling water, and in 11 parts of boiling alcohol. When heated to a dull red heat, the salt melts without losing weight. At a full red heat, it is slowly volatilized without decomposition. A fragment of the salt imparts to a non-luminous flame an intense yellow color, not appearing more than transiently red when observed through a blue glass. If disulphide of carbon be poured into a solution of the salt, then chlorine water added drop by drop, and the whole agitated, the disulphide will acquire a yellow or yellowish brown color without a violet tint. If diluted sulphuric acid be dropped on a portion of the salt, the latter should not at once assume a yellow color (abs. of bromate). If 1 Gm. of the salt be dissolved in 10 C.c. of water, some gelatinized starch added, and then a few drops of chlorine water be carefully poured on top, no blue zone should make its appearance at the line of contact of the two liquids (abs. of iodide). On adding to 1 Gm. of the salt, dissolved in 20 C.c. of water, 5 or 6 drops of test-solution of nitrate of barium, no immediate cloudiness or precipitate should make its appearance (limit of sulphate). If 3 Gm. of the well-dried salt be dissolved in distilled water to 100 C.c., and 10 C.c. of this solution be treated with a few drops of test-solution of bichromate of potassium, and then volumetric solution of nitrate of silver be added, not more than 29·8 C.c. of the latter should be consumed before the red color ceases to disappear on stirring (abs. of more than 3 per cent. of chloride). 1 Gm. of the salt, when completely precipitated by nitrate of silver, yields, if perfectly pure, 1·824 Gm. of dry bromide of silver." *U. S.*

Medical Properties. The medical properties of bromide of sodium are very similar to those of the bromide of potassium (see *Potassii Bromidum*), except that it is less powerful in its action and much less depressant to the circulation. It is usually given in combination with the bromide of potassium, in doses of from one-half drachm to two drachms (1·95 to 7·8 Gm.).

SODII CARBONAS. *U.S.* *Carbonate of Sodium.*

$Na_2CO_3.10H_2O$; 286. (SŌ'DI̤-Ī CÄR-BŌ'NĂS.) $NaO, CO_2. 10HO$; 143.

Sodæ Carbonas, *Br.;* Carbonate of Soda, Sal Soda, Washing Soda; Natrum Carbonicum Crudum, *P.G.;* Carbonas Sodicus, Sal Sodæ; Carbonate de Soude, *Fr.;* Einfach Kohlensaures Natron, Kohlensaures Natron, Soda, *G.;* Carbonato di Soda, *It.;* Carbonato de Soda, *Sp.*

Before entering upon the consideration of the carbonate of sodium, we shall speak generally of the sources of the alkali soda. These may be divided into the natural and the artificial. The natural sources are the minerals of native soda, and certain marine plants which yield the alkali in their ashes; the artificial are certain salts which furnish it by chemical decomposition.

Native soda, sometimes called *natron*, is found chiefly in Hungary, Egypt, and South America, and exists, in these countries, either in the earth of the surface, which often exhibits a saline efflorescence, or in solution in small lakes, from which it is extracted by taking advantage of the drying up of the water during the heats of summer. The native soda from Egypt, called *trona*, is a *sesquicarbonate;* while that from South America is less carbonated. Native soda, in the form of sesquicarbonate, has been found in a soda lake in the territory of the Nizam, in Hindostan. Dr. Barth, in his *Travels in Africa*, states that natron is largely collected on the shores of Lake Tsad, and in some other localities in Negroland or Central Africa. (*Am. ed.*, 1857, i. 312, and ii. 63–8.) A similar product exists abundantly in low places along the sea-coast of Arabia, near Aden. (R. Haines, *P. J. Tr.*, July, 1863.) It is also brought now from the soda lakes of Wyoming Territory.

Impure soda, derived from the ashes of plants growing on the surface or borders of the sea, is called barilla or kelp, according to the character of the plants incinerated. Barilla is obtained from several vegetables, principally belonging to the genera *Salsola*, *Salicornia*, and *Chenopodium.* In Spain, Sicily, and some other countries, these plants are cultivated for the purpose of yielding soda by their combustion. When ripe, they are cut down, dried, and burnt in heaps. The ashes form a semi-fused, hard, and compact saline mass, which is broken up into fragments by means of pickaxes, and thrown into commerce. Kelp, called *varec* in France, is procured by the incineration of various kinds of sea-weeds, principally the algæ and fuci, which grow on the rocky coasts of many countries. The Orkneys and Hebrides, and the rocky coasts of Wales, Scotland, and Ireland furnish large quantities of these weeds. The plants are fermented in heaps, then dried, and afterwards burnt to ashes in ovens roughly made of brick or stone and built in the ground. The alkali in the ashes melts, and forms the whole into a solid mass. When cold, it is broken up with iron instruments into large heavy masses, in which state it is found in commerce. About twenty-four tons of sea-weeds produce one ton of kelp.

Barilla, when of good quality, is in hard, dry, porous, sonorous, grayish blue masses, which become covered with a saline efflorescence on exposure. It possesses a peculiar odor and an alkaline taste. *Spanish barilla* contains from 25 to 40 per cent. of carbonated alkali; the residue being made up of sulphate of sodium, sulphide and chloride of sodium, carbonate of calcium, alumina, silica, oxidized iron, and a small portion of charcoal which has escaped combustion. Before the introduction of artificial soda, barilla formed the source of the crystallized carbonate employed in medicine. At present it is principally used in the manufacture of soap.

Kelp is in hard, vesicular masses, of a dark gray, bluish or greenish color, sulphurous odor, and acrid, caustic taste. It is still less pure than barilla, containing only from 5 to 8 per cent. of carbonated soda; the rest being made up of a large proportion of the sulphates of sodium and potassium, and the chlorides of potassium and sodium, a small quantity of iodide of sodium, and insoluble and coloring matters. Large quantities of kelp were formerly manufactured in Great Britain and the neighboring islands, particularly the Orkneys; but the demand and production have greatly fallen off since the introduction of artificial soda. At present kelp is used principally in the manufacture of iodine. (See *Iodinium.*)

Artificial Soda. This is made from common salt by two steps: first, by converting the salt by sulphuric acid into sulphate of sodium, and, secondly, by decomposing the sulphate by carbonate of calcium and charcoal at a high temperature, so as to yield carbonate of sodium. The chemical reactions may be summarized as follows: $2NaCl + H_2SO_4 = Na_2SO_4 + 2HCl$, $Na_2SO_4 + CaCO_3 + C_4 = Na_2CO_3 + CaS + (CO)_4$. The sulphate, first dried, is mixed with its own weight of ground limestone, and half its weight of small coal, ground and sifted, and the whole is heated in a reverberatory furnace, where it fuses and forms a black mass called *black ash*, *soda ball*, or *British barilla*. The coal, at the temperature employed, converts the sulphate of sodium into sulphide of sodium. This reacts with the limestone, so as to form sulphide of calcium and carbonate of sodium (Na_2S and $CaCO_3 = CaS$ and Na_2CO_3). Black ash contains from 36 to 45 per cent. of alkali, imperfectly carbonated on account of the high heat used; the remainder being principally sulphide of calcium, caustic lime, sodium chloride, calcium sulphite, and coaly matter. It is next digested in warm water, which takes up the alkali and other soluble matters, and leaves the insoluble impurities, called *soda waste*, which is now largely utilized in the manufacture of hyposulphite of sodium. (*Chem. News*, Sept. 28, 1861, p. 174.) The solution is evaporated to dryness, and the mass obtained is calcined with one-fourth of its weight of sawdust, in order to convert the alkali fully into carbonate, by means of the carbonic acid resulting from the combustion of the sawdust. The product is redissolved in water, and the solution evaporated to dryness. The alkali, in this stage of its purification, contains about 50 per cent. of carbonate of sodium, and is called *soda-ash*. It is brought to the state of crystallized carbonate of sodium, by dissolving it in water, straining the solution, evaporating it to a pellicle, and setting it aside to crystallize.

The process here described, for obtaining soda from common salt, was discovered in 1784 by Leblanc; and the first manufactory for procuring it on a large scale was established in 1790, near Paris, by Leblanc and Dizé. The process is pursued on an immense scale in Great Britain, especially at Liverpool and Glasgow, and produces soda so cheaply that barilla and kelp are nearly superseded as sources of the alkali.

A process for manufacturing artificial soda from sulphate of sodium has been proposed by M. Emile Kopp, and has been successfully carried into operation on a large scale, near Manchester, England. It consists in decomposing the sulphate by sesquioxide of iron and coal. The advantages claimed for this process are that the whole of the sulphur of the sulphate may be recovered, instead of being lost in the waste sulphide of calcium of the old process, and that it is more independent of the skill of the workmen.

Within the last decade a process has been put in practice which has given so much satisfaction in its results as to be likely to rival, if not to supersede, the hitherto unequalled process of Leblanc. It is designated as the *ammonia-soda* process, and is based on the fact that when carbon-dioxide is passed into a solution of common salt in aqueous ammonia, a double decomposition occurs, and the slightly soluble bicarbonate of soda is precipitated: $NH_3 + CO_2 + NaCl + H_2O = HNaCO_3 + NH_4Cl$. From the mother-liquor containing the sal-ammoniac, if deemed advisable, the ammonia may be withdrawn by the action of lime, and serve in the renewal of the operation. The bicarbonate of sodium is reduced by heat to the carbonate, and the carbonic acid thus obtained serves to convert the ammonia into the bicarbonate of ammonia necessary in the proceeding.

The reaction between the bicarbonate of ammonium and common salt, upon which the process was founded, had been noticed by M. Turck as long as thirty years before it was carried into practical operation with advantageous results. At present, according to Prof. Hofmann, it is the only process which threatens a serious competition with that of Leblanc; and already it has been adopted by some of the largest factories of soda in Great Britain and various parts of the continent of Europe. The advantages of this method are that the common salt is directly transformed into carbonate of sodium, that in the precipitation sodium is the only metal thrown down, and that the preparation is therefore remarkably pure, that it is entirely exempt from the compounds of sulphur, that the amount of product is very large, that the apparatus used in the process is very simple, that there is a great saving of fuel and of labor, and, finally, that no unwholesome gases are diffused in the atmosphere, interfering with the health of the workmen and the community. An objectionable point in the process is the loss of the chlorine of the common salt, which, in the reproduction of the ammonia, becomes useless chloride of calcium.

In reference to the foregoing process, MM. Schloesing and Rolland have observed that, in the double decomposition between bicarbonate of ammonium and chloride of sodium, a certain portion only, about two-thirds, undergoes the change. This is explained by M. Bauer, who finds that the reaction is limited by another in an inverse direction. Thus, if bicarbonate of ammonium and chloride of sodium yield bicarbonate of sodium and chloride of ammonium (hydrochlorate of ammonia): these, put together, inversely yield bicarbonate of ammonium and chloride of sodium. An equilibrium is thus established, and the mixture preserves a constant composition, at the point where the two reactions take place at the same time. (*Journ. de Pharm. et de Chim.*, Sept. 1874, p. 255.)

Another source of this carbonate has lately been found in *cryolite*, a mineral existing in great abundance on the coast of Greenland, and largely imported into this country by a manufacturing company which enjoys to a certain extent a monopoly of the mineral under the Danish authorities. Cryolite consists mainly of a double fluoride of aluminium and sodium, containing in 100 parts 13 of aluminium, 34 of sodium, and 53 of fluorine. Carbonate of sodium is obtained by heating cryolite with lime, whereby fluoride of calcium is formed, while the sodium and aluminium combine to form an aluminate of soda, a weak salt, which is dissolved out by lixiviation. The soda is converted into carbonate by passing carbonic acid under pressure through the solution; and the alumina, separated from the soda, becomes insoluble, and is deposited. (*A. J. P.*, Jan. 1868, p. 71.) Cryolite is also largely used in Denmark and Germany in the preparation of carbonate of sodium and of aluminium, the latter of which is employed in the manufacture of alum and aluminium.

Besides the preparation of carbonate of sodium, cryolite is employed for other important purposes. Its only known locality, at least in large amount, is Greenland, where it is found in the southwest coast, near Cape Farewell, existing in beds, of which one is said to be 80 feet thick and 300 long. It is imported by the "Pennsylvania Salt Company" into Philadelphia in immense quantities. It is a handsome mineral, hard, brittle, and translucent, sometimes almost transparent, but generally of a frosty whiteness which has probably suggested its name of *cryolite* or *kryolite*, from the Greek *κρύος*, frost. Though homogeneous in great degree, it exhibits here and there in its substance dark spots, sometimes mere specks, sometimes of considerable size, which appear to be crystalline centres of substances mixed with it at the time of solidification, such as galena, carbonate of iron, copper and iron pyrites, etc. It is employed in the making of soap, in the preparation of sulphate of aluminium, and in the formation of a beautiful variety of glass, which is made by melting one part of it with from two to four parts of pure silex. (Evan T. Ellis, *Proc. A. P. A.*, 1867.)

The different kinds of impure carbonate of sodium, whether barilla, kelp, or soda-ash, being exceedingly variable in composition, it is important to have a ready method of determining the quantity of real carbonated alkali which they contain. The mode in which this is done, by means of an instrument called an alkalimeter, has been already explained. (See page 1161.) These various forms of carbonated soda are largely consumed in dyeing and bleaching, and in the manufacture of soap and glass. In reference to "the English commercial test," see *A. J. P.*, Sept. 1870, p. 447. The following are descriptions of the different grades of artificial soda, known under the names of British barilla, and soda-ash.

British barilla, so called to distinguish it from Spanish barilla, which has its source in the ashes of maritime plants, is a blackish brown substance, becoming darker by exposure to the air. When broken it exhibits an imperfect metallic lustre, and a close striated texture. Its taste is alkaline and caustic. By exposure to a moist atmosphere it becomes covered with a yellow efflorescence, and quickly falls to powder, with disengagement of heat and sulphuretted hydrogen; at the same time increasing in weight by the absorption of carbonic acid and water.

Soda-ash is in white or gray compact masses, and contains about half its weight of foreign salts, consisting principally of chloride of sodium and sulphate of sodium.

Properties. The carbonate occurs in "large, colorless, monoclinic crystals, rapidly efflorescing in dry air and falling into a white powder, odorless, having a sharp, alkaline taste, and an alkaline reaction. Soluble in 1·6 parts of water at 15° C. (59° F.), in 0·09 part at 38° C. (100·4° F.), and in 0·25 part of boiling water; insoluble in alcohol. When heated to about 35° C. (95° F.), the salt melts; on further heating, all the water (62·9 per cent.) gradually escapes, and, at a red heat, the anhydrous residue fuses. A fragment of the salt imparts an intense yellow color to a non-luminous flame. The aqueous solution strongly effervesces on the addition of an acid. The aqueous solution should be free from suspended or colored impurities, and, after being supersaturated with nitric acid, should not yield more than a trifling precipitate with test-solution of nitrate of silver (limit of chloride), or of chloride of barium (sulphate). The aqueous solution should remain unaffected by hydrosulphuric acid, either before or after being supersaturated with hydrochloric acid (abs. of metals). A solution of the salt acidified by the last-named acid, when supersaturated with ammonia and boiled, should not yield a gelatinous precipitate (alumina). To neutralize 7·15 Gm. of Carbonate of Sodium should require not less than 49 C.c. of the volumetric solution of oxalic acid (corresponding to at least 98 per cent. of pure, crystallized Carbonate of Sodium." *U. S.* This salt presents an anomaly in solubility, as ascertained by M. Henri Loewel: it is more soluble in water at 36·1° C. (97° F.) than at its boiling point. Carbonate of sodium is insoluble in alcohol. The most usual impurities in it are sulphate of sodium and common salt, which may be detected by converting it into a nitrate, and testing separate portions of this severally with chloride of barium and nitrate of silver.* Common salt is seldom entirely absent, but good specimens are free from sulphate of sodium. When badly prepared it is liable to contain sulphide of sodium, which may be detected by the production of the smell of sulphuretted hydrogen upon dissolving the salt in water. Carbonate of sodium is incompatible with acids, which decompose it with effervescence, acidulous salts, lime-water, chloride of ammonium, and earthy and metallic salts. When crystallized it contains ten mols. of water. It is thus perceived that this salt, when crystalized, contains nearly two-thirds of its weight of water; but the quantity actually present in it, as found in commerce, is variable, being dependent on the extent to which it may have undergone efflorescence. To obtain pure carbonate of sodium for the purpose of a test, Dr. J. Lawrence Smith, of Louisville, Ky., recommends that oxalate of sodium should be prepared from the common carbonate, and then decomposed by heat.†

Medical Properties and Uses. Soda is the natural alkali of the blood, and its carbonate, unless taken in very great excess, has no other effect upon the system than to render the secretions abnormally alkaline. As a simple alkaline remedy it is superior to potassium, in that it does not depress or modify the general systemic actions. It is given principally in diseases attended with acidity of the stomach; such as gout, uric acid gravel, and certain forms of dyspepsia. It is also employed with advantage, internally and externally, in skin diseases, especially those of a papulous and scaly character. A lotion suitable for these cases may be formed by dissolving from two to three drachms of the carbonate in a pint of water. For a bath, from eight to sixteen ounces of the salt may be dissolved in the necessary quantity of water. A suitable ointment may be made by mixing from eight to sixty grains with an ounce of lard, according to the character of the affection. Carbonate of sodium is given in doses of from ten grains to half a drachm (0·65–1·95 Gm.), either in powder, or dissolved in some bitter infusion. In consequence of the variable state in which it exists in commerce, as to the amount of water of crystallization which it contains, the dose cannot be indicated with precision. It is on this account that the salt is most conveniently administered in the dried state, which admits of its being given in the pilular form. (See *Sodii Carbonas Exsiccatus.*) When taken in an overdose, it acts as a corrosive poison. The best antidotes are the fixed oils, acetic acid, and lemon-juice.

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* For a method of determining the precise quantity of the sulphate in a special case, see *Journ. de Pharm.*, Août, 1873, p. 124.

† Dr. Smith gives the following particular description of the method employed by him. 63 grammes of oxalic acid and 143 grammes of ordinary carbonate of sodium are dissolved with heat, in 200 cubic centimeters of distilled water; the solution is distilled, filtered if necessary, and, when it cools, the solution of oxalic acid, just hot enough to prevent crystallization, is added by degrees, with stirring. It is expected that the solution, when completed, shall have a slight alkaline reaction. Shortly after the operation is finished, the oxalate of sodium will be in a great measure precipitated. The whole is then allowed to stand till completely cool; the supernatant liquid is decanted, a little distilled water added, and the lumps of crystals that may have formed are broken up by a stirrer, thrown on a six-inch filter over a Bunsen aspirator, washed with about half a litre of distilled water, and allowed to dry. The quantity of dry oxalate produced is 30 grammes. In this state it may be kept in a dry bottle till wanted for use in forming carbonate of sodium. It is then projected, little by little, into a platinum capsule, over a good-sized Bunsen burner. After being strongly heated, the oxalate is changed by the decomposition of the oxalic acid into the carbonate, and, if the heat be high enough to fuse the salt, about 23 grammes of the fused carbonate will be obtained. Fused or not, this is dissolved in water, filtered, evaporated to dryness, dehydrated over a naked flame, and granulated by stirring while hot. (*A. J. P.*, 1875, p. 31.)

Off. Prep. Liquor Sodæ; Liquor Sodæ Chloratæ, *U. S.*, *Br.;* Magnesiæ Carbonas, *Br.;* Magnesiæ Carbonas Levis, *Br.;* Massa Ferri Carbonatis, *U. S.;* Pilulæ Ferri Compositæ, *U. S.;* Soda Tartarata, *Br.;* Sodæ Bicarbonas, *Br.;* Sodæ Carbonas Exsiccata, *Br.;* Sodii Carbonas Exsiccatus, *U. S.;* Sodæ Phosphas, *Br.;* Zinci Carbonas, *Br.*

SODII CARBONAS EXSICCATUS. *U. S.* *Dried Carbonate of Sodium.*

(SŌ′DI̩-Ī CĂR-BŌ′NȦ̆S ĔX-SI̩C-CĀ′TŬS.)

Sodæ Carbonas Exsiccata, *Br.;* Natrum Carbonicum Siccum, *P.G.;* Dried Carbonate of Soda; Carbonate de Soude sec, *Fr.;* Getrocknete Soda, *G.*

"Carbonate of Sodium, *two hundred parts*, To make *one hundred parts.* Break the salt into small fragments, allow it to effloresce by exposure to warm air for several days, then expose it to a temperature of about 45° C. (113° F.), until it has been converted into a white powder weighing *one hundred parts.* Pass the powder through a sieve and preserve it in well-stopped bottles." *U. S.*

"Take of Carbonate of Soda *eight ounces.* Expose the Carbonate of Soda in a porcelain capsule to a rather strong sand heat, until the liquid which first forms is converted into a dry cake, and, having rubbed this to powder, enclose it in a stoppered bottle." *Br.*

Carbonate of Sodium contains ten molecules of water of crystallization, and, when heated, readily undergoes aqueous fusion. Upon continuing the heat, the water is driven off, and a white porous mass remains, which is easily reduced to powder. Dried carbonate of sodium is in the form of a white powder, and differs in nothing from the crystallized, except in being devoid of water of crystallization. (See *Sodii Carbonas.*) "To neutralize 2·65 Gm. of Dried Carbonate of Sodium should require not less than 36·3 C.c. of the volumetric solution of oxalic acid (corresponding to at least 72·6 per cent. of anhydrous carbonate of sodium)." *U. S.*

Medical Properties and Uses. This preparation was introduced into practice by Dr. Beddoes, who extolled its virtues in calculous complaints. It is applicable to the cure of such affections only when dependent on a morbid secretion of uric acid. Its advantage over the common carbonate is that it admits of being made into pills, in consequence of being in the dried state. As the water of crystallization forms more than half of the carbonate, the dose of the dried salt must be reduced in proportion. From five to fifteen grains (0·33–1 Gm.) may be given three times a day, in the form of pill prepared with soap and aromatics. For the medical properties of this salt, see *Sodii Carbonas.*

Off. Prep. Sodii Arsenias, *U. S.;* Sodæ Arsenias, *Br.;* Sodæ Bicarbonas, *Br.*

SODII CHLORAS. *U. S.* *Chlorate of Sodium.*

$NaClO_3$; 106·4. (SŌ′DI̩-Ī CHLŌ′RĂS.) NaO, ClO_5; 106·4.

This new officinal salt is usually prepared by Wittstein's process, which consists in first preparing sodium bitartrate by adding a strong solution containing 9·5 parts of tartaric acid to a hot aqueous solution of 9 parts of sodium carbonate. The hot solution is mixed with one in which 8 parts of potassium chlorate have been dissolved. Potassium bitartrate separates, whilst sodium chlorate remains in solution. The filtered solution is evaporated and crystallized. If desired of absolute purity, it may be recrystallized from an alcoholic solution. Owing to the facility with which this salt parts with its oxygen, the following officinal cautionary direction should be borne in mind. "Chlorate of Sodium should be kept in well-stopped bottles, and should not be triturated with readily oxidizable or combustible substances." *U. S.* Accidents have occurred from triturating it with sulphur, sugar, etc.

Properties. It is officinally described as in "colorless, transparent tetrahedrons of the regular system, permanent in dry air, odorless, having a cooling, saline taste, and a neutral reaction. Soluble in 1·1 parts of water, and in 40 parts of alcohol at 15° C. (59° F.); in 0·5 part of boiling water, and in 43 parts of boiling alcohol. When heated, the salt melts and afterward gives off a portion of its oxygen, finally leaving a residue of a neutral reaction completely soluble in water. A fragment of this residue imparts to a non-luminous flame an intense yellow color, not appearing more than transiently red when observed through a blue glass; and its aqueous solution, acidulated with nitric acid, yields, with test-solution of nitrate of silver, a white precipitate soluble in ammonia. The aqueous solution of the salt should not produce a white, crystalline precipitate on the addition of a saturated solution of bitartrate of sodium (abs. of potassium). A dilute, aqueous solution should yield no precipitate with test-solution of chloride of barium (sulphate), or of oxalate of ammonium (calcium), and at most only a faint cloudiness with test-solution of nitrate of silver (limit of chloride)." *U. S.*

Medical Properties. Chlorate of sodium has medical properties similar to those of the chlorate of potassium, whilst its greater solubility permits the use of stronger solutions. Dr. Traill Green commends its local use in aphthous sore mouth, erysipelas, and as a bath (containing one or two ounces) in advanced scarlatina

SODII CHLORIDUM. *U. S., Br.* *Chloride of Sodium.*

$NaCl$; 58·4. (SŌ′DỊ-Ī ȻHLŌ′RỊ-DŬM.) $NaCl$; 58·4.

Natrium Chloratum Purum, *P.G.;* Chloruretum Sodicum, Sal Commune, s. Culinare; Table Salt; Sodium Chloride, Muriate of Soda, Sea Salt, Common Salt; Chlorure de Sodium, Hydro-chlorate de Soude, Sel commun, Sel de Cuisine, Sel marin, *Fr.;* Chlornatrium, Kochsalz, *G.;* Salt, *Dan., Sw.;* Chloruro di Sodio, Sal commune, *It.;* Sal, *Sp.*

This mineral production, so necessary to mankind, is universally distributed over the globe, and is the most abundant of the native soluble salts. Most animals have an instinctive relish for it; and, from its frequent presence in the solids and fluids of the animal economy, it may be supposed to perform an important part in assimilation and nutrition.

Natural State. Common salt exists in nature, either in the solid state or in solution. In the solid state, called *rock salt*, *fossil salt*, and *sal gemmæ*, it is often found forming extensive beds, and even entire mountains, from which it is extracted in blocks or masses by mining operations. Its geological position is very constant, it occurring almost invariably in secondary formations, associated with clay and gypsum. In solution it occurs in certain springs and lakes, and in the waters of the ocean. The principal salt mines are found in Poland, Hungary, and Russia; in various parts of Germany, particularly the Tyrol; in Cheshire, England; in Spain; in various parts of Asia and Africa; in the island of St. Domingo;* and in Peru, and other countries of South America. With the exception of a remarkable bed of rock salt in the island of Petite Anse, in Vermilion Bay, on the coast of Louisiana, there are in the United States no salt mines east of the Rocky Mountains; but there are numerous salt springs, which either flow naturally, or are produced artificially by sinking wells to various depths in places where salt is known to exist.† These are found principally in Missouri, Kentucky, Illinois, Ohio, Michigan, Pennsylvania, Virginia, West Virginia, and New York. In the last-mentioned State the springs are the most productive; the chief ones being situated at Salina, Montezuma, and Galen. In Virginia an important salt region exists, extending fifteen miles on both sides of the Great Kanawha River, and in Michigan in the counties of Huron, Bay, and Saginaw extensive salt wells are worked. In this latter State the production of salt for the year 1880 was 2,676,588 barrels, and the present manufacturing capacity of the State is put at 3,150,000 barrels. Rock salt is always transparent or translucent; but it often exhibits various colors, such as red, yellow, brown, violet, blue, etc., which are supposed to be derived from iron and manganese.

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* This deposit is on the south side of the island, and is said to form a mountain 6 miles long, from half a mile to a mile broad, and from 400 to 500 feet high. The salt in its crude state contains 96·79 per cent. of pure chloride of sodium. (*A. J. P.*, Sept. 1865, p. 395.)

† *Rock salt in Nevada.* In an extract from a letter dated at Virginia City, in Nevada, it is said that near Carson River, in that State, a basin of common salt had been discovered, five miles square in extent, and fourteen feet in thickness. The salt is said to be very pure, hard, and as clear as crystal, and capable of being mined with great facility.

Extraction. Mines of salt are worked in two ways. When the salt is pure, it is merely dug out in blocks and thrown into commerce. When impure, it is dissolved in water, and extracted afterwards from the solution by evaporation. When the salt is naturally in solution, the mode of extraction depends upon the strength of the brine, and the temperature of the place where it is found. When the water contains from 14 to 15 per cent. of the salt, it is extracted by evaporation in large iron boilers. If, however, it contains only 2, 3, 4, or 5 per cent., the salt is obtained in a different manner. If the climate is warm, it is procured by spontaneous evaporation, effected by the heat of the sun; if temperate, by a peculiar mode of evaporation, to be mentioned presently, and the subsequent application of artificial heat.

Sea-water is a weak saline solution, containing 2·7 per cent. of common salt, which is extracted by the agency of solar heat in warm countries. Salt thus obtained is called *bay salt.* The extraction is conducted in Europe principally on the shores of the Mediterranean, the waters of which are salter than those of the open ocean. The mode in which it is performed is by letting the sea-water into shallow dikes, lined with clay, and capable, after having been filled, of being shut off from the sea. In this situation the heat of the sun gradually concentrates the water, and the salt is deposited. In temperate climates, weak brines are first concentrated in buildings called *graduation houses.* These are rough wooden structures open on the sides, ten or eleven yards high, five or six wide, and three or four hundred long, and containing an oblong pile of brushwood somewhat smaller than the building itself. The brine is pumped up into troughs full of holes, placed above the brushwood, upon which it is allowed to fall, and in its descent becomes minutely divided. This operation, by greatly increasing the surface of the brine, promotes its evaporation; and, being repeated several times, the solution is at last brought to the requisite degree of strength to permit of its final concentration in iron boilers by artificial heat.

Properties. Chloride of sodium is white, without odor, and of a peculiar taste called saline. It is usually crystallized in cubes; but by hasty evaporation it often assumes the form of hollow quadrangular pyramids, or hopper-shaped crystals, consisting of an aggregation of cubes. It is officinally described as in "white, shining, hard, cubical crystals, or a crystalline powder, permanent in the air, odorless, having a purely saline taste, and a neutral reaction. Soluble in 2·8 parts of water at 15° C. (59° F.), and in 2·5 parts of boiling water; almost insoluble in alcohol. When heated, the salt decrepitates; at a red heat it melts, and at a still higher temperature it is slowly volatilized with partial decomposition. A fragment of the salt imparts to a non-luminous flame an intense yellow color, not appearing more than transiently red when observed through a blue glass. The aqueous solution, acidulated with nitric acid, yields, with test-solution of nitrate of silver, a white precipitate soluble in ammonia. An aqueous solution of the salt should yield no precipitate or cloudiness on the addition of test-solution of carbonate of sodium (alkaline earths), chloride of barium (sulphate), or hydrosulphuric acid or sulphide of ammonium (metals). If 2 Gm. of the salt be digested with 20 Gm. of alcohol, the cold and filtered alcoholic solution evaporated to dryness, the residue dissolved in water, a little gelatinized starch added, and subsequently chlorine water, drop by drop, no colored tint should make its appearance at the line of contact of the two liquids (abs. of iodide or bromide). 1 Gm. of Chloride of Sodium, when completely precipitated by nitrate of silver, should yield 2·450 Gm. of dry chloride of silver." *U. S.* When pure, it undergoes no change in the air; but, when contaminated with chloride of magnesium, as not unfrequently happens, it is deliquescent. Exposed to a gradually increasing heat, it first decrepitates from the presence of interstitial moisture, next melts, and finally volatilizes in white fumes with but partial decomposition. (Mulder, *Journ. de*

Pharm. et de Chim., 4e éd., iii. 390.) It is decomposed by several of the acids, particularly sulphuric and nitric, which disengage vapors of hydrochloric acid; by carbonate of potassium with the assistance of heat; and by nitrate of silver and mercurous nitrate. In contact with iron, in the presence of air and moisture, it undergoes decomposition. (*Chem. News*, June, 1869, p. 298.) It is decomposed by steam excessively heated, with the escape of hydrochloric acid and an alkaline residue. (*Chem. News*, June 4, 1875, p. 243.)

Several varieties of common salt are distinguished in commerce; as *stoved salt*, *fishery salt*, *bay salt*, etc.; but they are characterized by the size and compactness of the grains, and not by any difference in composition.

Composition. Common salt, in its pure state, consists of one atom of chlorine 35·4, and one of sodium 23 = 58·4. It contains no water of crystallization. The common salt of commerce, besides pure chloride of sodium, contains, generally speaking, insoluble matter, and usually more or less of the sulphates of calcium and magnesium, and chlorides of calcium and magnesium. When pure, it is not precipitated by carbonate of sodium, chloride of barium, or ferrocyanide of potassium. Chloride of calcium is generally present in very small amount; but the chloride of magnesium sometimes amounts to 28 parts in 1000. Sulphate of calcium is usually present; constituting variously from 1 to 23½ parts in 1000; and sulphate of magnesium is sometimes present and sometimes absent. To separate the earths, a boiling solution of carbonate of sodium must be added, as long as any precipitate is formed. The earths will fall as carbonates, and must be separated by filtration, and the sulphate of sodium and chloride of sodium, resulting from the double decomposition, will remain in solution. The sulphate of sodium may then be decomposed by the cautious addition of chloride of barium, which will generate chloride of sodium and insoluble sulphate of barium.

Medical Properties. Chloride of sodium, in small doses, acts as a stimulant tonic and anthelmintic; in larger ones as a purgative and emetic. It certainly promotes digestion, and the almost universal animal appetency for it proves it to be a salutary stimulus in health. From the experiments of Prof. Bucheim, it appears that common salt quickly passes into the blood, and is thrown off in greater part, in six hours, by the kidneys. The portion not found in the urine and fæces is probably appropriated to the uses of the economy. According to the experiments of M. Plouviez, made upon himself, at intervals, during twenty-five months, a saline regimen has the effect of increasing the weight and strength of the body. He began with a teaspoonful daily, which he increased to a tablespoonful, continuing to take this dose for a period of three or four months. The regimen appeared to produce plethora. The blood, analyzed while under the full effects of the salt, was found to contain more of the corpuscles and salts, but less of the albumen and water.

Common salt has been used with good effect by a number of practitioners as a remedy in intermittent fever. This practice is said to have been long followed in Hungary. In 1850 it was brought to the notice of the profession by M. Scelle-Mondezert, of Charenton, on whose results M. Piorry reported favorably. Since then the power of common salt as an antiperiodic has been attested by Dr. Lattimore, of New York, Dr. Hutchinson, of Brooklyn, Dr. Moroschkin, of Russia, and others. In some cases, observed by M. Piorry, the spleen rapidly diminished in size. It is not alleged to be equal to quinine. The dose is from eight to twelve drachms (31·1–46·6 Gm.), given in divided doses during the apyrexia. It is best administered in mucilage of slippery elm, or in coffee.

On the sudden occurrence of hæmoptysis, common salt is usefully resorted to as a styptic, in the dose of a teaspoonful (3·9 Gm.) taken dry, and often proves successful in stopping the flow of blood. Externally applied in solution it is stimulant, and may be used either locally or generally. Locally, it is sometimes employed as a fermentation in sprains and bruises; and as a general external application it forms the salt-water bath, a valuable remedy as a tonic and excitant in depraved conditions of the system, especially when occurring in children. A pound of salt, dissolved in four gallons of water, forms a solution of about the strength of sea-water, and suitable for a bath. The dose, as a tonic, is from ten grains to a drachm (0·65–

3·9 Gm.); as a cathartic, from two drachms to half an ounce (7·8–15·5 Gm.). In doses of from half an ounce to an ounce (15·5–31·1 Gm.), dissolved in four or five times its weight of water, it frequently proves a prompt and efficient emetic, invigorating rather than depressing the powers of the system. It is frequently used as a clyster, in the quantity of from one to two tablespoonfuls in a pint of water.

The uses of common salt in domestic economy as a condiment and antiseptic are well known. In pharmacy it is employed to prepare chlorine, hydrochloric acid, chloride of ammonium, calomel, and corrosive sublimate. It is also used to form sulphate of sodium, with a view to its conversion into carbonate of sodium.

Off. Prep. Acidum Hydrochloricum, *Br.;* Hydrargyri Perchloridum, *Br.;* Hydrargyri Subchloridum, *Br.*

SODII HYPOPHOSPHIS. *U. S.* *Hypophosphite of Sodium.*

$NaH_2PO_2.H_2O$; 106. (SŌ′DI-Ī HȲ-PO-PHŎS′PHĬS.) NaO, 2HO, PO. 2HO; 106.

"Hypophosphite of Sodium should be kept in well-stopped bottles." *U. S.*

Sodæ Hypophosphis, *Br.;* Natrum Hypophosphorosum, Hypophosphis Sodicus; Hypophosphite of Soda; Hypophosphite de Soude, *Fr.;* Unterphosphorigsaures Natron, *G.*

Hypophosphite of sodium is prepared by mixing solutions of hypophosphite of calcium and crystallized carbonate of sodium, in the proportion of six ounces of the former dissolved in four pints of water, to ten of the latter in one and a half pints. Double decomposition takes place, with the formation of carbonate of calcium and hypophosphite of sodium, of which the latter is held in solution, and the former precipitated. After filtration to separate the carbonate of calcium, the solution is evaporated to a pellicle, and then stirred constantly till the salt granulates, the heat being continued. If required quite pure, the granulated salt is dissolved in officinal alcohol; and the liquid, having been evaporated to a syrupy consistence, is set aside to crystallize.

Sometimes the hypophosphite of sodium explodes with violence during the evaporation of its solution. This was ascribed to the use of too high a heat; but the same accident has occurred when the heat was applied by means of a water-bath. (See *A. J. P.*, 1860, p. 87.) In a communication of Mr. Tuson to the *Chemical News* (No. 31, p. 46), it is stated that, though he had superintended the manufacture of large quantities of the hypophosphites of calcium and of sodium, he had never witnessed anything like an explosion; but the heat employed in evaporation had never approached 100° C. (212° F.); and this is probably the true explanation. Caution, therefore, should be observed to evaporate at a low temperature.

Properties. Hypophosphite of sodium occurs in "small, colorless or white, rectangular plates, or a white, granular powder, deliquescent on exposure to air, odorless, having a sweetish, saline taste, and a neutral reaction. Soluble in 1 part of water, and in 30 parts of alcohol at 15° C. (59° F.); in 0·12 part of boiling water, and in 1 part of boiling alcohol. When heated in a dry test-tube, the salt loses water, then evolves a spontaneously-inflammable gas (phosphoretted hydrogen), burning with a bright, yellow flame. A fragment of the salt imparts to a non-luminous flame an intense yellow color, not appearing more than transiently red when observed through a blue glass. On triturating or heating the salt with an oxidizing agent, the mixture will explode. The aqueous solution yields, with test-solution of nitrate of silver, a white precipitate, which rapidly turns brown and black; and, when acidulated with hydrochloric acid, and added to excess of test-solution of mercuric chloride, it first produces a white precipitate of calomel, and, on further addition, metallic mercury separates. The aqueous solution of the salt should not effervesce on the addition of an acid (abs. of carbonate), and should not be precipitated nor be rendered cloudy by test-solution of oxalate of ammonium (abs. of calcium), nor by a saturated solution of bitartrate of sodium (abs. of potassium). After being acidulated with hydrochloric acid, it should not produce a white precipitate or cloudiness with test-solution of chloride of barium (sulphate). On mixing the aqueous solution with test-solution of magnesium, not more than a slight cloudiness should make its appearance (limit of phosphate)." *U. S.*

Hypophosphorous acid consists of one atom of phosphorus, two of oxygen, and three of hydrogen, of which, however, only one is replaceable by metal. It has a strong affinity for oxygen, and acts therefore as a powerful deoxidizing agent, as is shown by its reducing silver and mercury from their salts. The solubility of hypophosphite of sodium is increased by the addition of hypophosphorous acid. As the soluble salts of mercury and silver are reduced by the hypophosphites, they are of course incompatible with hypophosphite of sodium in prescriptions. With the hypophosphite of calcium, all the soluble sulphates and carbonates produce precipitates.

Medical Properties and Uses. Attention was first directed to the use of the hypophosphites in the treatment of phthisis by Dr. Churchill, of Paris. The weight of testimony appears to be opposed to the first favorable impressions; and, though some cases may have seemed to be benefited, yet great care must be taken not to allow a reliance on the hypophosphites to interfere with the use of remedies known to be efficient, as cod-liver oil and supporting measures generally. Dr. J. D. Brown, of the Albany City Hospital, has found the hypophosphites highly useful in diseases attended with the loss of nerve-power, and in many of the complaints of infancy connected with the scrofulous diathesis and defect in the osseous system. (*Boston Med. and Surg. Journ.*, lxxiii. 412, Dec. 21, 1865.) The dose of either of the hypophosphites may be from ten to thirty grains (0·65–1·95 Gm), three times a day.

Off. Prep. Syrupus Hypophosphitum.

SODII HYPOSULPHIS. *U. S.* *Hyposulphite of Sodium.*

$Na_2 S_2 O_3. 5H_2 O$; 248. (SŌ'DỊ-Ī HȲ-PỌ-SŬL'PHĬS.) $NaO, S_2 O_2. 5HO$; 124.

"Hyposulphite of Sodium should be kept in well-stopped bottles." *U. S.*

Natrum Subsulfurosum (Hyposulfurosum), *P.G.;* Hyposulphis Sodicus; Hyposulphite de Soude, Sulfite sulfuré de Soude, *Fr.;* Unterschwefligsaures Natron, *G.*

This salt is used in the United States and British Pharmacopœias as a test, and for the formation of the *Volumetric Solution of Hyposulphite of Soda.* It is readily prepared, according to Walchner, by mixing a pound of dry carbonate of sodium, in fine powder, with five ounces of sulphur, heating the mixture gradually in a porcelain vessel until the sulphur melts, and stirring the agglutinated mass, still kept hot, in order that every portion of it may come in contact with the air. The sulphide of sodium, first formed, is thus converted into sulphite of sodium. This is dissolved in water, and the filtered solution, being boiled with sulphur, becomes one of hyposulphite of sodium, from which, after filtration and concentration, the salt is deposited in crystals. It may be obtained also by digesting the solution of sulphite of sodium, at a high temperature but short of ebullition, with finely divided sulphur. Hyposulphurous acid exists only in combination; and its salts were formerly considered simply as sulphuretted sulphites. The true hyposulphurous acid, according to theory, would be H_2SO_2, while $H_2S_2O_3$ is more properly *thiosulphuric* acid, as it differs from sulphuric acid by the replacement of one oxygen atom by one sulphur atom. Inasmuch as Schützenberger has recently discovered the true hyposulphurous acid, H_2SO_2, exact chemical usage would demand that we give the distinguishing name thiosulphuric to what was formerly called hyposulphurous. Schützenberger himself called the newly-discovered acid *hydrosulphurous*, but this is not characteristic, and the correct name for the officinal hyposulphite of sodium would be *thiosulphate of sodium.*

Properties. It is officinally described as in "large, colorless, transparent, monoclinic prisms or plates, efflorescent in dry air, odorless, having a cooling, somewhat bitter and sulphurous taste, and a neutral or faintly alkaline reaction. Soluble in 1·5 part of water at 15° C. (59° F.), and in 0·5 part of boiling water, in the latter case with partial decomposition; insoluble in alcohol. When rapidly heated to about 50° C. (122° F.), the salt melts; when slowly heated until it is effloresced, and afterward to 100° C. (212° F.), it loses all its water (36·3 per cent.), and at a low red heat it is decomposed. A fragment of the salt imparts to a non-luminous flame an intense yellow color, not appearing more than transiently red when observed through a blue glass. The aqueous solution dissolves chloride or oxide of silver, and discharges the color of solution of iodized starch and of solution of iodine. Sulphuric acid added to the solution gives rise to the odor of burning sulphur and causes a white precipitate of sulphur (difference from bisulphite and sulphite)."

U. S. Its solution dissolves chloride of silver and all other insoluble compounds of that metal, except the sulphide, and that resulting from the decomposition of a silver salt by light. Though without action on iodide of potassium, it dissolves iodine, decomposes iodic acid with the liberation of iodine, and destroys the blue color of iodide of starch. (*Brande and Taylor.*) In dissolving iodine it forms with it iodide of sodium and tetrathionate of sodium; as represented by the formula $2(Na_2S_2O_3) + I_2 = (NaI)_2 + Na_2S_4O_6$. It dissolves also sulphate and iodide of lead, and sulphate of calcium much more freely than water. (*Journ. de Pharm.*, Avril, 1864, p. 363.) Its relations to iodine render it valuable as a means of estimating the quantity of free iodine, for which purpose it is used in the Pharmacopœias in the form of a *volumetric solution.* In consequence of its peculiar solvent properties, it is much used in photography. The photographers employ it for the purpose of dissolving the unchanged iodide or bromide of silver from the plate, after the action of the light, and thus fixing the image already formed. It is also largely used as an "antichlor" in the paper manufacture to free the paper pulp from the excess of chlorine used in the bleaching. The following are the officinal tests. "A solution of the salt in 80 parts of water should not be rendered cloudy by a few drops of test-solution of chloride of barium (abs. of sulphate), and a concentrated solution should not effervesce when added to diluted acetic acid (abs. of carbonate). A solution of 2 Gm. of the salt in 10 Gm. of water, agitated for a short time with 1 Gm. of iodine, should yield a colorless liquid, with at most only a faint, white opalescence (corresponding to about 98 per cent. of pure Hyposulphite of Sodium)." *U. S.* One of the most delicate tests is that of iodine with starch. The blue color produced by the mixture of very small quantities of these two substances in solution is instantly discharged by a solution containing a trace of the hyposulphite. Mr. M. Carey Lea has discovered a test in ruthenium. When a solution of a salt of this metal, made alkaline with ammonia, is boiled with the hyposulphite, it gradually becomes rose-colored, and ultimately of a rich carmine, which in strong solution becomes almost black; and then, if diluted, the shade is magnificent, rivalling the aniline red in richness. (*Am. Journ. of Sci. and Arts*, Sept. 1867, p. 222.)

Medical Properties. Hyposulphite of sodium is a very powerful poison to fungi and other low organic forms. Consequently, when added to fermenting mixtures, it arrests the process of change. This led Dr. G. Polli to suggest its use in certain diseases supposed to be dependent on a fermentation or zymosis in the blood. The theory has seemed plausible to many practitioners, and the remedy has been extensively administered in pyæmia and the so-called zymotic disorders and allied affections. Although individual experiences corroborating the early successes of Polli have been reported, the general professional verdict is unmistakably adverse. The hyposulphite seems not to be without influence upon the human system. When taken internally it appears to have deoxidizing powers, probably through the passage of the hyposulphurous into sulphuric acid. It has been found, in its action on the urine, to diminish urea and increase uric acid, to increase the sulphates, and to cause the presence of sugar and oxalic acid in the urine. (Kletzinsky, *Ann. de Thérap.*, 1860, p. 109.) With a view to its poisonous influence on the sarcina ventriculi which attends yeasty vomiting, it has been employed in that complaint; and, as a local application, it may be used in all the parasitic affections of the skin and mouth. It may be given in the dose of from ten to twenty grains (0·65–1·3 Gm.), three times a day, simply dissolved in water, or in the form of syrup. For external use a drachm may be dissolved in a fluidounce of water. As the effects of this salt proceed from its acid constituent, other hyposulphites may be employed for the same purposes; and *hyposulphite of calcium* has been recommended. For the mode of preparing the latter salt, see *A. J. P.*, 1863, p. 223.

SODII IODIDUM. *U. S.* *Iodide of Sodium.*

NaI; 149·6. (SŌ′DỊ-Ī Ī-ŎD′Ị-DŬM.) NaI; 149·6.

"Iodide of Sodium should be kept in well-stopped bottles." *U. S.*

Natrum Iodatum; Iodure de Sodium, *Fr.;* Jodnatrium, *G.*

This iodide may be prepared either by treating a solution of caustic soda with iodine, or by double decomposition between iodide of iron and carbonate of sodium, precisely as iodide of potassium is obtained by the corresponding processes for that salt. As only small quantities are likely to be wanted as a medicine, the latter process is preferable; being more easily conducted on a small scale.

Properties. It is a very soluble white salt, crystallizing in anhydrous cubes from a hot solution, and in oblique rhombic prisms, with two mols. of water, by spontaneous evaporation. It is officinally described as in "minute, colorless or white, monoclinic crystals, or a crystalline powder, deliquescent on exposure to air, odorless, having a saline and slightly bitter taste, and a neutral or faintly alkaline reaction. Soluble in 0·6 part of water and in 1·8 part of alcohol at 15° C. (59° F.); in 0·3 part of boiling water, and in 1·4 parts of boiling alcohol. At a dull red heat, the salt melts without losing weight. At a full red heat, it is slowly volatilized with partial decomposition. A fragment of the salt imparts to a non-luminous flame an intense yellow color, not appearing more than transiently red when observed through a blue glass. If disulphide of carbon be poured into a solution of the salt, then chlorine water added drop by drop, and the whole agitated, the disulphide of carbon will acquire a violet color. The aqueous solution of the salt, mixed with gelatinized starch, and afterward with diluted hydrochloric acid, should not at once acquire a blue color (abs. of iodate). If 1 Gm. of the salt be dissolved in 10 C.c. of water of ammonia, then shaken with a solution of 1·2 Gm. of nitrate of silver in 20 C.c. of water, and the filtrate be supersaturated with 7 C.c. of nitric acid, no cloudiness should make its appearance within ten minutes (abs. of more than about 0·5 per cent. of chloride or bromide). On adding to 1 Gm. of the salt, dissolved in 20 C.c. of water, 5 or 6 drops of test-solution of nitrate of barium, no immediate cloudiness or precipitate should make its appearance (limit of sulphate). 1 Gm. of the powdered and dried salt, when completely precipitated by nitrate of silver, yields, if perfectly pure, 1·566 Gm. of dry iodide of silver." *U. S.*

Medical Properties. Iodide of sodium has the same therapeutic effects and is used in the same diseases as iodide of potassium. It is said to be better borne than the latter iodide. In Italy it has been used with remarkable success in constitutional syphilis. The dose is twenty grains (1·3 Gm.), gradually increased to forty (2·6 Gm.), three times a day, dissolved in three fluidounces (90 C.c.) of water. (See Prof. Procter's paper on the preparation of this iodide, in *A. J. P.*, July, 1854, p. 305.) At the suggestion of Prof. Gross, it was employed by Dr. John J. Black, at the Philadelphia Hospital, as a substitute for iodide of potassium in the treatment of syphilitic affections, and seemed to be not less efficacious than that medicine, while producing none of its unpleasant effects. (*Am. Journ. of Med. Sci.*, July, 1865, p. 87.)

SODII NITRAS. *U. S.* *Nitrate of Sodium.*

$NaNO_3$; 85. (SŌ'DỊ-Ī NĪ'TRĂS.) NaO, NO_5; 85.

"Nitrate of Sodium should be kept in well-stopped bottles." *U. S.* "A native salt, purified by crystallization from water." *Br.*

Sodæ Nitras, *Br.;* Nitrate of Soda, Cubic Nitre; Natrum Nitricum, *P.G.;* Nitras (Azotas) Sodicus, Nitrum Cubicum; Azotate (Nitrate) de Soude, Nitre cubique, Nitrate de Chili, *Fr.;* Chilisalpeter, *G.*

This salt, called also *cubic nitre*, was recognized as officinal in 1870. Nitrate of sodium is imported from South America, where it is found naturally in the desert of Atacama and elsewhere in Peru, forming beds of vast extent. Attempts were made between 1820 and 1830 to export it to England and the United States; but the cargoes were unsalable. Soon afterwards, however, its value became known; so that at present large quantities are exported from Peru, being consumed in the manufacture of sulphuric and nitric acids, and as a fertilizer. The salt has been found also largely in Brazil, in the province of Bahia, near the river San Francisco. (*A. J. P.*, Nov. 1861, p. 502.) For a particular account of the nitrate of sodium deposits of Peru, see *Ibid.*, March, 1862, p. 263; also *Potassii Nitras*, page 1180.

The crude salt, as it comes from Peru, is in saline lumps, rather soft and friable, and damp on the surface. It is distinguished into varieties according to its color and state of aggregation, as *white compact*, *yellow*, *gray compact*, *gray crystalline*, *white crystalline*, and varies very much in purity, containing from 85 to only 20 per cent. of the pure salt. Some of the varieties contain iodine. The impurities consist of common salt, sulphate and carbonate of sodium, and chloride of calcium. Occasionally borate of calcium, associated with borate of sodium, is found under the beds of the nitrate.

Arrangements have been made for treating the crude nitrate so as to deliver it to commerce in a state of great purity. Exposure of the mineral to an open fire, which seems to have been first employed, has been entirely superseded by mechanical methods aided by steam, to prepare it for the subsequent steps of solution, crystallization, and desiccation. The Peruvian nitre, prepared by the "Nitre Association of Tarapaca," the province in which the mineral exists, never contains more than 0·5 or 0·667 per cent. of impurities. It is white, pearly, dry, and light, and does not require to be refined for the practical uses to which it is applied. (Thiercelin, *Journ. de Pharm.*, Juin, 1868, p. 439.)

Properties. Nitrate of sodium, when pure, is in "colorless, transparent, rhombohedral crystals, slightly deliquescent in damp air, odorless, having a cooling, saline and slightly bitter taste, and a neutral reaction. Soluble in 1·3 parts of water at 15° C. (59° F.), and in 0·6 part of boiling water; scarcely soluble in cold, but soluble in 40 parts of boiling alcohol. When heated to about 312° C. (594° F.), the salt melts, and, on further heating, it is decomposed, giving off oxygen and leaving a residue which emits nitrous vapors on the addition of sulphuric acid. Thrown upon red hot coals, the salt deflagrates. A fragment of the salt imparts to a non-luminous flame an intense yellow color, not appearing more than transiently red when observed through a blue glass. The aqueous solution of the salt should remain unaffected by hydrosulphuric acid or sulphide of ammonium (abs. of metals), also by carbonate of ammonium (abs. of alkaline earths), or a saturated solution of bitartrate of sodium (abs. of potassium). If previously acidulated with nitric acid, it should yield no precipitate or cloudiness with test-solution of nitrate of barium (sulphate), and at most only a faint opalescence with test-solution of nitrate of silver (limit of chloride). On adding to a solution of the salt a few drops of solution of hydrosulphuric acid, then some gelatinized starch, and carefully pouring a few drops of chlorine water on top, no blue zone should make its appearance at the line of contact of the two liquids (abs. of iodide). If 1 Gm. of Nitrate of Sodium be heated with 1 Gm. of concentrated sulphuric acid, and the mixture be kept at a red heat until it ceases to lose weight, the residue should weigh 0·835 Gm." *U. S.* Like nitrate of potassium, it deflagrates when thrown on the fire, but is distinguished by giving rise to an orange-yellow flame, and by the rhomboidal shape of its crystals, those of nitre being long six-sided prisms. According to the Br. Pharm., it evolves ruddy fumes when warmed in a test-tube with sulphuric acid and copper wire.

Medical Uses. This salt has been praised as a remedy in dysentery by two German physicians, Drs. Velsen and Meyer, given in the quantity of from half an ounce to an ounce (15·5–31·1 Gm.) in the course of the day, dissolved in gum-water, or other mucilaginous liquid. It has been used with success in the same disease by Dr. Rademacher, of Vienna, who recommends it in a number of other diseases having nothing in common. (*Ann. de Thérap.*, 1854.) Dr. J. B. Brown also bears very similar emphatic testimony. (*Charleston Med. Journ.*, May, 1854, p. 398.)

Off. Prep. Sodæ Arsenias, *Br.*

SODII PHOSPHAS. *U. S.* *Phosphate of Sodium.*

$Na_2HPO_4.12H_2O$; 358. (SŌ'DI-Ī PHŎS'PHĂS.) $2NaO, HO, PO_5.24HO$; 358.

"Phosphate of Sodium should be kept in well-stopped bottles, in a cool place." *U. S.*

Sodæ Phosphas, *Br.*; Medicinal Tribasic Phosphate of Sodium, Phosphate of Soda; Natrum Phosphoricum, *P.G.*; Phosphas Sodicus (Natricus), Sal Mirabile Perlatum; Phosphate de Soude, *Fr.*; Phosphorsaures Natron, *G.*

A process for this salt is no longer officinal; that of U. S. P. 1870 will be found in the foot-note.*

"Take of Bone Ash, in powder, *ten pounds* [avoirdupois]; Sulphuric Acid *fifty-six fluidounces;* Distilled Water *four gallons and a half* [Imperial measure], or *a sufficiency;* Carbonate of Soda *sixteen pounds* [avoird.], *or a sufficiency.* Place the Bone Ash in a capacious earthenware or leaden vessel, pour on the Sulphuric Acid, and stir with a glass rod until the whole powder is thoroughly moistened. After twenty-four hours, add gradually and with constant stirring a gallon [Imp. meas.] of the Water; digest for forty-eight hours, adding Distilled Water from time to time to replace what has evaporated. Add another gallon [Imp. meas.] of the Water, stirring diligently, digest for an hour, filter through calico, and wash what remains on the filter with successive portions of Distilled Water, till it has almost ceased to have an acid reaction. Concentrate the filtrate to a gallon, let it rest for twenty-four hours, and filter again. Heat the filtrate to near the boiling point, add the Carbonate of Soda previously dissolved in two gallons [Imp. meas.] of the Water, till it ceases to form a precipitate, and the fluid has acquired a feeble alkaline reaction. Filter through calico, evaporate the clear liquor till a film forms on the surface, and set it aside to crystallize. More crystals will be obtained by evaporating the mother-liquor, a little Carbonate of Soda being added if necessary to maintain its alkalinity. Dry the crystals rapidly, and without heat, on filtering paper placed on porous bricks, and preserve them in stoppered bottles." *Br.*

The incombustible part of bones is obtained by burning them to whiteness, and consists of neutral phosphate of calcium, called bone-phosphate, associated with some carbonate of calcium, etc. (See *Os Ustum.*) When this is mixed with sulphuric acid, the carbonate of calcium is entirely decomposed, giving rise to effervescence. The phosphate of calcium undergoes partial decomposition; the greater part of the lime, being detached, precipitates as sulphate of calcium, while the phosphoric acid, set free, combines with the undecomposed portion of the phosphate, and remains in solution as an acid phosphate of calcium, holding dissolved a small portion of the sulphate of calcium. In order to separate the acid phosphate from the precipitated mass of sulphate of calcium, boiling water is added to the mixture, the whole is strained, and the sulphate washed as long as acid phosphate is removed, which is known by the water passing through in an acid state. The different liquids which have passed the strainer, consisting of the solution of acid phosphate of calcium, are mixed and allowed to stand; and by cooling a portion of sulphate of calcium is deposited, which is got rid of by decantation. The bulk of the liquid is now reduced by evaporation, and, in consequence of the diminution of the water, a fresh portion of sulphate of calcium is deposited, which is separated by subsidence and decantation as before. The acid phosphate of calcium solution, being heated, is now saturated by means of a hot solution of carbonate of sodium. The carbonic acid is liberated with effervescence, and the alkali, combining with the *excess* of acid of the acid phosphate, produces a phosphate of sodium; while the acid phosphate of calcium, by the loss of its excess of acid, becomes the neutral phosphate and precipitates. The phosphate of calcium is separated by a new filtration; and the filtered liquor, which is a solution of phosphate of sodium, is evaporated so as to crystallize.

In the U. S. process of 1870, the calcined bone is to the acid as 10 to 6; in the Br. process as 10 to 6½ nearly. The proportion recommended by Berzelius is as 10 to 6·66. The acid, in the officinal process, is added to the calcined bone in the concentrated state, and afterwards diluted with more or less water. In the process given by Berzelius it is first diluted with twelve times its weight of water. All the writers state that phosphate of sodium crystallizes more readily by allowing its solution to be slightly alkaline; and a remarkable fact is, that a neutral solution, when it crystallizes, leaves a supernatant liquid which is slightly acid and uncrystallizable. Hence it is necessary, after getting each successive crop of crystals, to render the mother-water neutral or slightly alkaline, before it will furnish an additional quantity.

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* *Sodii Phosphas.* "Take of Bone, calcined to whiteness and in fine powder, *one hundred and twenty troyounces;* Sulphuric Acid *seventy-two troyounces;* Carbonate of Sodium, Water, each, *a sufficient quantity.* Mix the powder with the Sulphuric Acid in an earthen vessel; then add eight pints of Water, and, having stirred the mixture thoroughly, digest for three days, occasionally adding a little Water to replace that which is lost by evaporation, and frequently stirring the mixture. At the expiration of that time, pour in eight pints of boiling Water, and strain through muslin, gradually adding more boiling Water until the liquid passes nearly tasteless. Set by the strained liquor that the dregs may subside, and, having poured off the clear solution, boil it down to eight pints. To the concentrated liquid, poured off from the newly formed dregs and heated in an iron vessel, add by degrees Carbonate of Sodium, previously dissolved in hot Water, until effervescence ceases, and the phosphoric acid is completely saturated; then filter the liquid, and set it aside to crystallize. Having removed the crystals, add, if necessary, a small quantity of Carbonate of Sodium to the liquid, so as to render it slightly alkaline; then alternately evaporate and crystallize, so long as crystals are produced. Lastly, keep the crystals in a well-stopped bottle." *U. S.*

M. Funcke, a German chemist, has given the following cheap and expeditious method for obtaining phosphate of sodium. To the powdered calcined bone, diffused in water, sufficient diluted sulphuric acid is added to decompose all the carbonate of calcium which it contains. When the effervescence ceases, the matter is treated with nitric acid, which dissolves the phosphate of calcium, and leaves the sulphate. The nitric solution of the phosphate is then treated with sulphate of sodium, equal in quantity to the bone employed; and after the reaction is completed, the nitric acid is recovered by distillation. In consequence of a double decomposition, sulphate of calcium and phosphate of sodium are formed, the latter of which is separated by water, and crystallized in the usual manner.

Properties. The medicinal phosphate of sodium is in "large, colorless, transparent, monoclinic prisms, speedily efflorescing and becoming opaque on exposure to air, odorless, having a cooling, saline and feebly alkaline taste, and a slightly alkaline reaction. Soluble in 6 parts of water at 15° C. (59° F.), and in 2 parts of boiling water; insoluble in alcohol. When heated to about 40° C. (104° F.), the salt melts, yielding a clear liquid, and, on continued heating to near 100° C. (212° F.), it loses all its water of crystallization (60·3 per cent.). A fragment of the salt imparts to a non-luminous flame an intense yellow color, not appearing more than transiently red when observed through a blue glass. The aqueous solution of the salt yields, with test-solution of magnesium, a white, crystalline precipitate soluble in acids. The aqueous solution should not effervesce on the addition of an acid (abs. of carbonate). Acidified with hydrochloric acid, it should remain unaffected by hydrosulphuric acid or sulphide of ammonium (abs. of metals); and, when acidified with nitric acid, it should not yield more than a faint cloudiness with test-solution of nitrate of barium (limit of sulphate), or nitrate of silver (limit of chloride). If 1 Gm. of Phosphate of Sodium be completely precipitated by test-solution of magnesium, the washed, dried, and ignited precipitate should weigh 0·31 Gm." *U. S.* Before the blowpipe it first undergoes the aqueous fusion, and afterwards, at a red heat, melts into a globule of limpid glass, which becomes opaque on cooling. It is liable to adulteration, sometimes containing carbonate of sodium, from this salt having been added in excess in its preparation; in which case it will effervesce with acids. If it contain sulphate of sodium, or any other soluble sulphate, the precipitate caused by chloride of barium will be a mixture of sulphate and phosphate of barium, and will not be totally soluble in nitric acid. Dr. A. B. Lyons found a specimen which consisted almost entirely of sulphate of sodium. (*A. J. P.*, 1875, p. 371; see also *N. R.*, April, 1877.) Chloride of barium will detect carbonate of sodium also, by producing a precipitate (carbonate of barium), soluble with effervescence in nitric acid. If a chloride be present, the *yellow* precipitate caused by nitrate of silver will be a mixed one of chloride and phosphate of silver, not entirely soluble in the same acid. The salt is incompatible with soluble salts of lime, with which it gives a precipitate of phosphate of calcium, and with neutral metallic solutions. It is found in several of the animal secretions, particularly the urine. For an elaborate article upon the methods of determining the percentage of phosphates present in a substance, see *Chem. News*, Oct. 1874, p. 200.

The medicinal phosphate of sodium is one of the three sodium salts of tribasic phosphoric acid, H_3PO_4. In this salt two of the three replaceable hydrogen atoms have been replaced by sodium, so that its formula is HNa_2PO_4, which then crystallizes out with 12 mols. of water. Its complete formula is then $HNa_2PO_4 + 12H_2O$. When gently heated, it loses its water of crystallization; and at a red heat the salt is converted into *pyrophosphate of sodium*, $Na_4P_2O_7$. (See *Sodii Pyrophosphas.*)

Medical Properties and Uses. Phosphate of sodium was introduced into practice, about the year 1800, by the late Dr. Pearson, of London. In doses of one to two ounces (31·1–62·2 Gm.) it is a mild purgative, and, from its pure saline taste, is well adapted to the cases of children, and of persons of delicate stomach. In smaller doses it has been considerably used, generally in connection with other phosphates, to meet any real or supposed deficiency of phosphorus or of phosphates in the system, and for this purpose it is well adapted by its ready solubility. But from the observations of Dr. Wm. Stephenson, of Edinburgh, recently published, there is reason to believe that this salt, in small doses, especially in children, exercises an extraordinary influence upon the hepatic secretion. In infantile cases, with white or green stools, with diarrhœa, and sometimes with jaundice, Dr. Stephenson has found these evidences of deficient or disordered bile to yield quickly to small doses of phosphate of sodium, the passages assuming their healthy yellow color, and the attendant disease generally disappearing. The dose is from three or four to ten grains (0·20 or 0·26–0·65 Gm.) for children, according to the age, and is best administered with their food, especially milk, and may be repeated whenever there is occasion to give food. Though the experience of Dr. Stephenson has been mainly confined to children, yet he has also tried the remedy in adults presenting similar indications, and with encouraging results. In these cases he recommends from 20 to 40 grains (1·3–2·6 Gm.) to be given, dissolved in water, after meals. (*Edin. Med. Journ.*, Oct. 1867, p. 336.) These statements of Dr. Stephenson are confirmed by the experience of Dr. H. C. Wood, at least in regard to children.

Off. Prep. Ferri Phosphas; Ferri Pyrophosphas, *U. S.;* Syrupus Ferri Phosphatis, *Br.*

SODII PYROPHOSPHAS. *U. S.* *Pyrophosphate of Sodium.*

$Na_4 P_2 O_7 . 10H_2 O$; 446. (SŌ′DỊ-Ī PȲ-RỌ-PHŎS′PHĂS.) $2NaO, PO_5 . 10HO$; 223.

This is a new officinal salt. It is prepared by heating sodium phosphate in a suitable vessel to redness. When sodium phosphate is subjected to a temperature of 44° C. (111·2° F.), it melts in its water of crystallization; if the heat is increased to 100° C. (212° F.), all of the water is dispelled, and but 40 per cent. of the original weight remains; at 300° C. (572° F.), it is converted into the tetrabasic phosphate or pyrophosphate. By dissolving this residue in water, filtering, and crystallizing, the salt may be obtained.*

Properties. It is officinally described as in "colorless, translucent, monoclinic prisms, permanent in the air, odorless, having a cooling, saline and feebly alkaline taste, and a slightly alkaline reaction. Soluble in 12 parts of water at 15° C. (59° F.), and in 1·1 part of boiling water; insoluble in alcohol. When heated, the salt loses its water of crystallization (40·36 per cent.); at a higher temperature it fuses, and, on cooling, concretes to a crystalline mass. A fragment of the salt imparts to a non-luminous flame an intense yellow color, not appearing more than transiently red when observed through a blue glass. Its aqueous solution yields, with excess of test-solution of nitrate of silver, a white precipitate and a neutral filtrate. The aqueous solution of the salt should not effervesce on the addition of an acid (abs. of carbonate). Acidified with hydrochloric acid, it should remain unaffected by hydrosulphuric acid or sulphide of ammonium (abs. of metals), and, when acidified with nitric acid, it should not yield more than a faint opalescence with test-solution of nitrate of barium (limit of sulphate), or nitrate of silver (limit of chloride)." *U. S.*

Medical Properties. The action of this salt upon the human economy is probably that of the phosphate. It was introduced into the Pharmacopœia on account of its use in the process for pyrophosphate of iron.

SODII SALICYLAS. *U. S.* *Salicylate of Sodium.*

$2NaC_7 H_5 O_3 . H_2 O$; 338. (SŌ′DỊ-Ī SĂL-Ị-CȲL′ĂS.) $NaO, HO, C_{14} H_4 O_4 . HO$; 169.

This salt was introduced into the U. S. Pharmacopœia at the revision of 1880.

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* This salt has been highly recommended for removing ink-stains from colored cotton fabrics. It is said to remove the stains slowly without affecting the other colors.

It is prepared by mixing 100 parts of pure salicylic acid with sufficient water to form a paste, and then with 104 parts of pure crystallized carbonate of sodium (uneffloresced) in a glass or porcelain vessel; carbonic acid gas will be evolved, and salicylate of sodium will remain in solution. The liquid may be strained through thoroughly-washed muslin if found necessary, and heated in a capsule until the carbonic acid gas is expelled. If alkaline to litmus paper, enough salicylic acid must be added to be slightly in excess, and the solution is then evaporated at a low heat to dryness. If the acid is not in excess, the salt will not be white, but gray or lead-colored.*

Properties. Pure salicylate of sodium is in "small, white, crystalline plates, or a crystalline powder, permanent in the air, odorless, having a sweetish, saline and mildly alkaline taste, and a feebly acid reaction. Soluble in 1·5 part of water, and in 6 parts of alcohol at 15° C. (59° F.); very soluble in boiling water, and in boiling alcohol. When heated, the salt gives off inflammable vapors and leaves an alkaline residue amounting to between 30 and 31 per cent. of the original weight, which effervesces with acids, and imparts to a non-luminous flame an intense yellow color, not appearing more than transiently red when observed through a blue glass. On supersaturating the aqueous solution with sulphuric acid, a bulky, white precipitate is obtained, which is soluble in boiling water, from which it crystallizes on cooling; also soluble in ether, and striking an intense, violet color with ferric salts. The aqueous solution should be colorless and should not effervesce on the addition of acids (abs. of carbonate). Agitated with about 15 parts of concentrated sulphuric acid, the salt should not impart color to the acid within fifteen minutes (abs. of foreign organic matter). If a solution of 1 Gm. of the salt in a mixture of 50 C.c. of alcohol and 25 C.c. of water be acidulated with nitric acid, the filtered solution should yield no precipitate nor be rendered turbid on the addition of a few drops of test-solution of chloride of barium (abs. of sulphate), or of nitrate of silver (abs. of chloride)." *U. S.*

Medical Properties. The action of salicylate of sodium upon the economy, and its therapeutic use, are precisely those of salicylic acid, except that the salt is not locally irritating, and, being soluble, is more rapidly absorbed. When salicylic acid is administered, it is probably converted into salicylate of sodium as fast as it is taken into the blood. One drachm contains forty-eight grains of the acid. The dose is from a half to one drachm (2–4 Gm.), administered in aromatized solution.

SODII SANTONINAS. *U. S.* *Santoninate of Sodium.*

(SŌ′DI̦-Ī SĂN-TO̦-NĪ′NĂS.)

$2NaC_{15}H_{19}O_4.7H_2O$; 698. $NaO, HO, C_{30}H_{18}O_6.7HO$; 349.

"Santoninate of Sodium should be kept in dark amber-colored, well-stopped vials, and should not be exposed to light." *U. S.*

This is a new officinal salt. It is also officinal in the Pharmacopœia Germanica.

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* Dr. Hager (*N. R.*, Nov. 1879) has furnished the following table, whereby, in the absence of the crystallized salicylate of sodium, the salt may be prepared *in solution*, by using the following proportions, in parts by weight, of salicylic acid and bicarbonate of sodium.

To make of Sodium Salicylate	Take of		To make of Sodium Salicylate	Take of		To make of Sodium Salicylate	Take of		To make of Sodium Salicylate	Take of	
	Salicylic Acid	Bicarbonate of Sodium		Salicylic Acid	Bicarbonate of Sodium		Salicylic Acid	Bicarbonate of Sodium		Salicylic Acid	Bicarbonate of Sodium
4	3·3	2·0	11	9·0	5·5	18	14·7	9·0	25	20·4	12·5
5	4·1	2·5	12	9·8	6 0	19	15·5	9 5	26	21·2	13·0
6	4·9	3·0	13	10·6	6·5	20	16·3	10·0	27	21·11	13·5
7	5·7	3·5	14	11·4	7·0	21	17·2	10·5	28	22·9	14·0
8	6·5	4·0	15	12·2	7·5	22	18·0	11·0	29	23·7	14·5
9	7·4	4·5	16	13·1	8·0	23	18·8	11·5	30	24·5	15·0
10	8·2	5·0	17	13·9	8·5	24	19·6	12·0			

It may be prepared by adding santonin to a hot solution of caustic soda as long as it is dissolved; if the liquid is allowed to evaporate slowly, the crystals of santoninate of sodium are obtained.*

Properties. It is officinally described as in "colorless, transparent, tabular, rhombic crystals, slowly colored yellow by exposure to light, slightly efflorescent in dry air, odorless, having a mildly saline and somewhat bitter taste, and a slightly alkaline reaction. Soluble in 3 parts of water, and in 12 parts of alcohol at 15° C. (59° F.), in 0·5 part of boiling water, and in 3·4 parts of boiling alcohol. When heated to 100° C. (212° F.), until it ceases to lose weight, the salt loses 18 per cent. of its weight (water of crystallization). At a higher heat it chars and finally leaves an alkaline residue, which imparts an intense yellow color to a non-luminous flame. The aqueous solution, on the addition of hydrochloric acid, deposits a crystalline precipitate which is soluble in chloroform, and which yields, with alcoholic solution of potassa, a scarlet-red liquid gradually becoming colorless. A five per cent. aqueous solution of the salt should not be precipitated nor be rendered turbid by test-solution of carbonate of sodium (abs. of alkaline earths), nor by picric or tannic acids (abs. of alkaloids)." *U. S.*

Medical Properties. This salt may possibly be sometimes used by oculists for an effect upon the eye, but ought never to be employed as a vermifuge, and ought not to have been made officinal. It is more easily absorbed than santonin in crystals, and therefore much more dangerous to the patient and much less destructive to intestinal worms. It must be remembered that serious poisoning from santonin has frequently occurred, notwithstanding its difficulty of absorption. Medicine inside the alimentary canal is, so long as it stays there, outside of the economy, and so soon as it is taken into the blood-vessels is incapable of directly affecting parasites in the bowels. The introduction of troches of santoninate of soda as a substitute for those of santonin is, to speak mildly, a very unfortunate mistake.

Off. Prep. Trochisci Sodii Santoninatis, *U. S.*

SODII SULPHAS. *U. S.* *Sulphate of Sodium.*

$Na_2 SO_4 . 10H_2 O$; 322. (SŌ′DỊ-Ī SŬL′PHĂS.) $NaO, SO_3 . 10HO$; 161.

"Sulphate of Sodium should be kept in well-stopped bottles." *U. S.*

Sodæ Sulphas, *Br.;* Sulphate of Soda; Natrum Sulfuricum, *P.G.;* Sulfas Sodicus (Natricus), Sal mirabile Glauberi; Vitriolated Soda, Glauber's Salt; Sulfate de Soude, Sel de Glauber, *Fr.;* Schwefelsaures Natron, Glaubersalz, *G.;* Sulfato di Soda, *It.;* Sulfato de Soda, Sal de Glaubero, *Sp.*

Sulphate of sodium, in small quantities, is extensively diffused in nature, and is obtained artificially in several chemical operations. It exists in solution in many mineral springs, among which may be mentioned those of Cheltenham and Carlsbad; and it is found combined with sulphate of calcium, constituting a distinct mineral. Many ponds containing this salt are found in the country between Santa Fé and the head-waters of the Arkansas, and on the route to the Rocky Mountains. The water in one of these ponds forms a solution so highly concentrated that, in dry weather, the salt crystallizes on the surface to the depth of several inches, so as to have the appearance of limpid ice. (*A. J. P.*, xii. 110.) A large deposit of Glauber's salt has been found in the Caucasus, not far from Tiflis. It is about 10 feet below the surface, and was penetrated 5 feet, and probably extended much deeper. There are, besides, in the same region, various lakelets containing the same salt in solution. (*N. R.*, Oct. 1872, p. 151.) As an artificial product, it is formed in the processes for obtaining hydrochloric acid and chlorine, and in the preparation of chloride of ammonium from sulphate of ammonium and common salt. It may also be procured from sea-water, in which its ingredients are present.

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* *Albuminate of Santonin and Sodium.* Prof. Pavesi prepares this as follows: 1 part of santonin, 4 parts of sodium bicarbonate, and 2 parts of dried soluble albumen are warmed with a sufficient quantity of water at 60° to 70° until all are dissolved, and then evaporated to dryness at a very gentle heat. The albuminate of santonin and sodium forms brilliant white scales, soluble in water. The mineral acids precipitate santonin and albumen, with disengagement of carbonic acid. The reasons for which Pavesi gives the preference to this combination over the use of santonin alone are the following. The after-effects of santonin, among others, that of yellowness of vision, are entirely obviated; the preparation is not decomposed in the stomach, because the bicarbonate of sodium in the combination retains the santonin in solution, the coagulation of the albumen is prevented, gently purgative sodium salts are introduced into the body, and finally, by the disengagement of a small quantity of carbonic acid, an active digestion is produced. It is not at all probable that these assertions are correct, but more extended research is justifiable.

Immense quantities of sulphate of sodium are made by decomposing common salt by sulphuric acid, in the manufacture of soda-ash and carbonate of sodium; and, so far from the generated hydrochloric acid being a product of much value, its absorption in a convenient way, so as to avoid the nuisance of its escape into the atmosphere in a gaseous state, is an object of importance to the manufacturer. (See *Acidum Hydrochloricum.*) MM. Thomas, Dellisse, and Boucard have proposed a new process for preparing sulphate of sodium, by double decomposition between chloride of sodium and sulphate of iron. This process avoids the production of hydrochloric acid vapors, and is said to furnish a cheap salt.

The residue of the process for obtaining chlorine, by the action of sulphuric acid and manganese dioxide on common salt, is a mixture of sulphate of sodium and manganous sulphate. Large quantities of this residue are formed in manufacturing chlorinated lime (bleaching powder); and the sulphate of sodium in it, roughly purified, supplies a part of the consumption of this salt in making soda-ash and carbonate of sodium.

The process for obtaining chloride of ammonium from sulphate of ammonium and common salt forms another source of sulphate of sodium. By double decomposition, sulphate of sodium and chloride of ammonium are formed; and by exposing the mixed salts to heat, the chloride of ammonium sublimes, and the sulphate of sodium remains behind. (See *Ammonii Chloridum.*)

Properties. Sulphate of sodium is in "large, colorless, transparent, monoclinic prisms, rapidly efflorescing on exposure to air, and ultimately falling into a white powder, odorless, having a cooling, saline and somewhat bitter taste, and a neutral reaction. Soluble in 2·8 parts of water at 15° C. (59° F.), in 0·25 part of water at 33° C. (91·4 F.), and in 0·4 part of boiling water; insoluble in alcohol. When heated to about 30° C. (86° F.), the salt melts, and, on further heating, gradually loses all its water (55·9 per cent.). At a red heat, the anhydrous salt melts without decomposition. A fragment of the salt imparts to a non-luminous flame an intense yellow color, not appearing more than transiently red when observed through a blue glass. The aqueous solution yields, with test-solution of chloride of barium, a white precipitate insoluble in nitric acid. The aqueous solution of the salt should not effervesce on the addition of an acid (abs. of carbonate), and should not be affected by hydrosulphuric acid or sulphide of ammonium (abs. of metals). A dilute, aqueous solution, acidulated with nitric acid, should yield no precipitate, or, at most, only a slight one, on the addition of test-solution of nitrate of silver (limit of chloride), nor should it give off alkaline vapors when heated with soda (abs. of ammonia). 1 Gm. of Sulphate of Sodium, when completely precipitated by chloride of barium, should yield 0·723 Gm. of dry sulphate of barium." *U. S.* When recently prepared, it is beautifully transparent; but by exposure to the air it effloresces, and the crystals become covered with an opaque white powder. By long exposure it undergoes complete efflorescence, and falls into powder with loss of more than half its weight. A supersaturated solution of sulphate of sodium will remain without crystallizing at ordinary temperatures, even though containing several times the weight of the salt that will be dissolved at the same degree of heat. But the solution instantly forms into a crystalline mass upon adding to it a fragment of the same salt crystallized, or other substances that have been exposed to the air, or upon abruptly placing it in contact with the air. M. D. Gernez appears to have proved that in each instance the cause of crystallization is the same, namely, sulphate of sodium containing 10 mols. of water; and where the crystal itself is not added, the result is owing to sulphate of sodium existing in the air. (See *A. J. P.*, Sept. 1865, p. 379.) Subjected to heat, it dissolves in its water of crystallization, then dries, and afterwards by the application of a red heat melts with the loss of 55½ per cent. of its weight. M. Coppet has ascertained that there are two varieties of the anhydrous sulphate; one in which the salt is deprived of its water at ordinary temperature, the other in which the desiccation is effected at a heat above that of 33° C.

(91·4° F.). The two differ in their relation to the crystallization of the salt; the former causing immediate crystallization when thrown into a supersaturated solution, the second not. (*Journ. de Pharm.*, 1874, p. 36.) Occasionally it contains an excess of acid or alkali, which may be discovered by litmus or turmeric paper. Common salt may be detected by sulphate of silver; a salt of iron by ferrocyanide of potassium. This salt is not subject to adulteration. It is incompatible with carbonate of potassium, chloride of calcium, the salts of barium, acetate and subacetate of lead, and with nitrate of silver if the solutions are strong. It consists of two atoms of sodium combined with the group SO_4 characteristic of sulphates, and crystallized with 10 mols. of water, $Na_2SO_4 + 10H_2O$; mol. wt. 322.

Medical Properties and Uses. Sulphate of sodium, in doses of from half an ounce to an ounce (15·5–31·1 Gm.), is an efficient cathartic; in smaller doses, an aperient and diuretic. When in an effloresced state, the dose must be reduced one-half, on account of its having lost about one-half of its weight in water. Prof. Bucheim has ascertained, by experiment, that the ingestion of this salt causes an increase of sulphates in the urine, especially if its purgative action be delayed or prevented by other medicines. These results were not affected by the quantity of water taken with the salt. Sulphate of sodium is much less used than formerly, having been almost entirely superseded by sulphate of magnesium, which is less disagreeable to take. Its nauseous taste, however, may be disguised by the admixture of a little lemon-juice or cream of tartar, or the addition of a few drops of sulphuric acid. It is an ingredient in the artificial Cheltenham salt. (See Part II.) An application of sulphate of sodium has been made by M. D. de Luca, of Naples, who has found it remarkably efficient in removing stains or opacity of the cornea, which he supposes it to do by its property of dissolving albumen, which in a coagulated state is the frequent cause of the opacity. He employed at first a cold saturated solution of the salt, but, not finding it to act with the desired rapidity, he substituted the powdered crystals, letting fall pinches of the powder on the globe of the eye; the head being placed horizontally. Under this treatment the stains of the cornea begin to disappear in a few days. The application may be made twice a day. The patient experiences an agreeable feeling of coolness, as the salt dissolves in the liquids of the eye. (*Journ. de Pharm. et de Chim.*, Sept. 1867, p. 188.) The only use of sulphate of sodium in the arts is to make carbonate of sodium, and as an ingredient in some kinds of glass. It has no officinal preparations.

SODII SULPHIS. *U. S.* *Sulphite of Sodium.*

$Na_2 SO_3 . 7H_2 O$; 252. (SŌ′DI̦-Ī SŬL′PHĬS.) $NaO, SO_2 \cdot 7HO$; 126.

"Sulphite of Sodium should be kept in well-stopped bottles, in a cool place." *U. S.*

Natrum Sulfurosum, Sulfis Sodicus (Natricus); Sulfite de Soude, *Fr.;* Schwefligsaures Natron, *G.*

This salt may be prepared by passing sulphurous acid gas into a solution of carbonate of sodium, and evaporating out of contact of the air. The sulphurous acid unites with the soda of the carbonate, to form the sulphite of sodium, and the carbonic acid escapes. After sufficient concentration, the solution is allowed to cool, and the salt crystallizes. A better way, however, is to dissolve a convenient weight of carbonate of sodium in a small quantity of water, then pass the sulphurous acid gas through the solution until completely saturated, and acid sulphite of sodium is formed. The addition of an equal weight of carbonate of sodium forms a solution of the neutral sulphite, which is to be evaporated and crystallized.

Properties. Sulphite of sodium is in "colorless, transparent, monoclinic prisms, efflorescent in dry air, odorless, having a cooling, saline and sulphurous taste, and a neutral or feebly alkaline reaction. Soluble in 4 parts of water at 15° C. (59° F.), and in 0·9 part of boiling water; only sparingly soluble in alcohol. When gently heated, the salt melts, then loses its water (50 per cent.), and at a red heat it is decomposed and leaves a residue having an alkaline reaction. A fragment of the salt imparts to a non-luminous flame an intense yellow color, not appearing more than transiently red when observed through a blue glass. Addition of diluted hydrochloric acid to the aqueous solution gives rise to the odor of burning sulphur, and the solution does not become cloudy (difference from hyposulphite). A one per cent. aqueous solution of the salt, strongly acidulated with hydrochloric acid, should yield no precipitate, or at most only a white cloudiness, on the addition of a few drops of test-solution of chloride of barium (limit of sulphate). If 0·63 Gm. of the salt be dissolved in 25 C.c. of water, and a little gelatinized starch added, at least 45 C.c. of the volumetric solution of iodine should be required, before a permanent blue tint appears after stirring (corresponding to at least 90 per cent. of pure Sulphite of Sodium)." *U. S.* Sulphuric acid added to the solution gives rise to a smell of burning sulphur, owing to the escape of sulphurous acid; and the liquid remains transparent, indicating the absence of lime. Sulphite of sodium consists of two atoms of sodium combined with the group SO_3, characteristic of sulphites, and crystallized with 7 mols. of water, $Na_2SO_3 + 7H_2O$; mol. wt. 252. The salt should be kept in bottles well stopped; as it gradually changes on exposure into sulphate of sodium.

Medical Uses. Sulphite of sodium has been used in cases of yeasty vomiting with remarkable success. The matter vomited in these cases contains two microscopic fungi, called sarcina ventriculi and torula cerevisiæ. The remedy was first used at the suggestion of Prof. Graham, of London, who supposed that the sulphurous acid, necessarily extricated from the salt in the stomach by the acid of the yeasty matter, would destroy the parasites. Sulphite of sodium is sometimes used locally, especially in that species of aphthous sore mouth which is attributed to a parasitic vegetable. The wash may be made of a drachm of the salt to a fluidounce of water. It is said that the solution acts with surprising rapidity, a single application of it sometimes removing the disease in 24 hours. Dr. Astrié, an Italian physician, has proposed this salt as a remedy for the constitutional effects of mercury, when used in excess, on the ground that it has the power of rendering the metal soluble. The dose of sulphite of sodium is a drachm (3·9 Gm.) three times a day. It has also been largely given internally as an antizymotic (see *Sodii Hyposulphis*), but without general success. According to M. Carey Lea (*Am. Journ. Med. Sci.*, Jan. 1865), it is partially converted in the system into a sulphate and partially escapes with the urine unchanged.

SODII SULPHOCARBOLAS. *U. S.* *Sulphocarbolate of Sodium.*

(SŌ′DỊ-Ī SŬL-PHỌ-CÄR′BỌ-LĂS.)

$NaC_6H_5SO_4$. $2H_2O$; 232. $NaO, C_{12}H_5O.2SO_3.4HO$; 232.

Sodium Sulphophenate; Sulfophénate de Soude, *Fr.;* Phenylschwefelsaures Natron, *G.*

This new officinal salt may be made by mixing equal parts of pure carbolic acid and strong sulphuric acid, whereby *sulphocarbolic acid*, $C_6H_5HSO_4$, is produced. The mixed liquids must be subjected to a temperature of 55° C. (131° F.) for several days, and then twenty parts of water should be added. Two parts of barium carbonate are mixed with the liquid, a little at a time, carefully graduating the quantity until effervescence ceases. The liquid is now allowed to stand to permit the precipitation of the barium sulphate, and any carbonate which might be present, and the liquor filtered. The solution of *barium sulphocarbolate* is decomposed by adding sodium carbonate until precipitation ceases, when the liquid is filtered from the barium carbonate, and the sodium sulphocarbolate may be obtained by evaporating the filtrate and crystallizing.

Properties. The U. S. Pharmacopœia describes this salt as in "colorless, transparent, rhombic prisms, permanent in the air, odorless or nearly so, having a cooling, saline, somewhat bitter taste, and a neutral reaction. Soluble in 5 parts of water, and in 132 parts of alcohol at 15° C. (59° F.); in 0·7 part of boiling water and in 10 parts of boiling alcohol. When heated, the salt loses its water and becomes a white powder. At a higher temperature it emits inflammable vapors having the odor of carbolic acid, and leaves a residue amounting to 36 per cent. of the original weight, the filtered solution of which, acidulated with nitric acid, produces a white precipitate with test-solution of chloride of barium. A fragment of the salt imparts an intense yellow color to a non-luminous flame. The dilute, aqueous solution of the salt is colored violet by test-solution of ferric chloride. A one per cent. aqueous solution of the salt should not at once be rendered turbid or precipitated by test-solution of chloride of barium (limit of sulphate)." *U. S.*

Medical Properties. The sulphocarbolates have been introduced into medicine with the idea that they would unite the properties of sulphuric and carbolic acids. It is, however, probable that they are inert; but future experiment and clinical study can alone give us positive information.

SPIGELIA. *U.S.* *Spigelia.* [*Pinkroot.*]

(SPỊ-ǤĒ′LỊ-Ạ.)

"The rhizome and rootlets of Spigelia marilandica. Linné. (*Nat. Ord.* Loganiaceæ.)" *U. S.*

Spigélie du Maryland, *Fr.;* Marylandische Spigelie, Spigelie, *G.;* Spigelia, *It.*

Gen. Ch. Calyx five-parted. *Corolla* funnel-shaped, border five-cleft, equal. *Capsule* didymous, two-celled, four-valved, many-seeded. *Nuttall.*

Two species of Spigelia have attracted attention as anthelmintics, *S. anthelmia* of South America and the West Indies, and *S. Marilandica* of this country. The former is an annual plant, used only in the countries where it grows; the latter is much employed both in this country and in Europe.

Spigelia Marilandica. Willd. *Sp. Plant.* i. 825; Bigelow, *Am. Med. Bot.* i. 142; Barton, *Med. Bot.* ii. 75; *B. & T.* 180. The *Carolina pink* is an herbaceous plant with a perennial root, which sends off numerous fibrous branches. The stems, several of which rise from the same root, are simple, erect, four-sided, nearly smooth, and from twelve to twenty inches high. The leaves are opposite, sessile, ovate-lanceolate, acuminate, entire, and smooth, with the veins and margins slightly pubescent. Each stem terminates in a spike, which leans to one side, and supports from four to twelve flowers with very short peduncles. The calyx is persistent, with five long, subulate, slightly serrate leaves, reflexed in the ripe fruit. The corolla is funnel-shaped, and much longer than the calyx, with the tube inflated in the middle, and the border divided into five acute, spreading segments. It is of a rich carmine color externally, paler at the base, and orange-yellow within. The edges of the segments are slightly tinged with green. The stamens, though apparently very short, and inserted into the upper part of the tube between the segments, may be traced down its internal surface to the base. The anthers are oblong, heart-shaped; the germ superior, ovate; the style about the length of the corolla, and terminating in a linear fringed stigma projecting considerably beyond it. The capsule is double, consisting of two cohering, globular, one-celled portions, with many seeds.

Spigelia, transverse section.

The plant is a native of our Southern and Southwestern States, being seldom found north of the Potomac. It grows in rich soils on the borders of woods, and flowers from May to July. The root is the only part recognized in the Pharmacopœias. The drug was formerly collected in Georgia and the neighboring States by the Creek and Cherokee Indians, who disposed of it to the white traders. The whole plant was gathered and dried, and came to us in bales or casks. After the emigration of the Indians, the supply of spigelia from this source very much diminished, and it has now nearly if not quite ceased. The consequence was for a time a great scarcity, and an increase in the price of the drug; but a new source of supply was opened from the Western and Southwestern States, and it is now again plentiful. As we receive spigélia at present, it consists chiefly if not exclusively of the root, without the stems and leaves. We have been informed that most of it comes in casks or bales from St. Louis by the way of New Orleans. That contained in casks is to be preferred, as less liable to be damp and mouldy.

Properties. Pinkroot consists of numerous slender, branching, crooked, wrinkled fibres, from three to six inches long, attached to a knotty head or caudex, which exhibits traces of the stems of former years. It is brownish or yellowish brown externally, of a faint, peculiar smell, and a sweetish, slightly bitter, not very disagreeable taste. On microscopic examination the middle layer is seen to be very well developed and the nucleus sheath wanting. Its virtues are extracted by boiling water. The root, analyzed by M. Feneulle, yielded a fixed and volatile oil, a small quantity of resin, a bitter substance supposed to be the active principle, a mucilaginous saccharine matter, albumen, gallic acid, the malates of potassium and calcium, etc., and woody fibre. The principle upon which the virtues of the root are thought to depend is brown, of a bitter nauseous taste, like that of the purgative matter of the leguminous plants, and, when taken internally, produces vertigo and a kind of intoxication. An analysis of the root by Dr. R. H. Stabler yielded as results a bitter uncrystallizable principle upon which the virtues of the medicine are supposed to depend, a little volatile oil, tannic acid, inert extractive, wax, resin, lignin, and salts of soda, potassa, and lime. Stabler finds that the active principle is acrid and bitter, soluble in water and alcohol, insoluble in ether, not volatilizable without change, uncrystallizable, neutral, and deliquescent. W. L. Dudley (*Am. Chem. Journ.*, vol. i. p. 150), on the contrary, finds that the active principle of spigelia is a volatile alkaloid. He gets it by distilling the ground root with milk of lime over a paraffin bath, and collecting the distillate in hydrochloric acid. After evaporation to dryness, the residue is taken up with alcohol and crystallized out of solution. He compares the reactions of this alkaloid, which he calls *spigeline*, with those of nicotine, conine, and lobeline. Spigeline yields a brownish red precipitate with a solution of iodine in iodide of potassium, a white crystalline precipitate with potassio-mercuric iodide, and a white flocculent precipitate with metatungstic acid.

The stalks of the dried plant are oval below the first pair of leaves. and then become obscurely four-sided. The leaves, when good, have a fresh greenish color, and an odor somewhat like that of tea. In taste they resemble the root, and afforded to M. Feneulle nearly the same principles. The quantity, however, of the bitter substance was less, corresponding with their inferior efficacy. This circumstance should cause their rejection from the shops; as the inequality in power of the two portions of the plant would lead to uncertainty in the result, when they are both employed.

The roots are sometimes mixed with those of other plants, particularly of a small vine which twines round the stem of the Spigelia. These are long, slender, crooked, yellowish, thickly set with short capillary fibres, and much smaller and lighter-colored than the pinkroot. They should be separated before the latter is used. It is said to be adulterated with a product called in the markets *East Tennessee pinkroot*, the botanical origin of which is unknown. (*A. J. P.*, 1875, p. 134.) The activity of spigelia is somewhat diminished by time.

Medical Properties and Uses. Pinkroot is generally considered among the most powerful anthelmintics. In the ordinary dose it usually produces little sensible effect on the system; more largely given it acts as a cathartic, though unequal and uncertain in its operation; in overdoses it excites the circulation, and determines to the brain, giving rise to vertigo, dimness of vision, dilated pupils, spasms of the facial muscles, and sometimes even to general convulsions. Spasmodic movements of the eyelids have been observed among the most common attendants of its narcotic action. The death of two children, who expired in convulsions, was attributed by Dr. Chalmers to the influence of spigelia. The narcotic effects are said to be less apt to occur when the medicine purges, and to be altogether obviated by combining it with cathartics. The danger from its employment cannot be great; as it is in very general use in the United States, both in regular and domestic practice, and we never hear at present of serious consequences. Its effects upon the nervous system have been erroneously conjectured to depend on other roots sometimes mixed with the genuine. The vermifuge properties of spigelia were first learned from the Cherokee Indians. They were made known to the medical profession by Drs. Lining, Garden, and Chalmers, of South Carolina.

It may be given in substance or infusion. The dose of the powdered root, for a child three or four years old, is from ten to twenty grains (0·65–1·3 Gm.), for an adult from one to two drachms (3·9–7·8 Gm.), to be repeated morning and evening for several days successively, and then followed by a brisk cathartic. The practice of preceding its use by an emetic has been generally abandoned. It is frequently given in combination with calomel. The infusion, however, is a more common form of administration. It may be made by infusing half a troyounce of the root in a pint of boiling water. It is usually combined with senna or some other cathartic, to insure its action on the bowels. A preparation generally kept in the shops, and much prescribed by physicians, under the name of *worm tea*, consists of pinkroot, senna, manna, and savine, mixed together, in various proportions, to suit the views of different individuals. Spigelia is also very often given in the form of fluid extract.

Off. Prep. Extractum Spigeliæ Fluidum, *U. S.*

SPIRITUS. *Spirits.*

(SPĬR'Ị-TŬS.)

Alcoolats, *Fr.;* Geiste, *G.*

Spirits, as the term is here used, are alcoholic solutions of volatile principles formerly in general procured by distillation, but now frequently prepared by simply dissolving the volatile principle in alcohol or diluted alcohol. The distilled spirits are prepared chiefly from aromatic vegetable substances, the essential oils of which rise with the vapor of alcohol, and condense with it in the receiver. Some of the oils, however, will not rise at the temperature of boiling alcohol, but may be distilled with water. In this case, it is necessary to employ diluted alcohol or proof spirit, with the water of which the oil comes over in the latter part of the process. As the proof spirit of commerce is often impregnated with foreign matters, which give it an unpleasant flavor, it is better to use alcohol which has been carefully rectified, and to dilute it with the due proportion of water, as directed by the U. S. Pharmacopœia. In preparing the spirits, care should be taken to avoid the color and empyreumatic flavor arising from the decomposition of the vegetable matter by heat. Sufficient water must, therefore, be added to cover the vegetable matter after the alcohol shall have been distilled; and, as a general rule, the heat should be applied by means of a water-bath, or of steam. The aromatic should be macerated for some days with the alcohol, before being submitted to distillation; as the oil, being thus dissolved, rises more readily with the spirituous vapor than when confined in the vegetable tissue.

The aromatic spirits are used chiefly to impart a pleasant odor and taste to mixtures, and to correct the nauseating and griping effects of other medicines. They serve also as carminatives in flatulent colic, and agreeable stimulants in debility of the stomach.

There have been four additions to this class in the revision of the U. S. P. 1880—*Spiritus Ætheris, Spiritus Aurantii, Spiritus Gaultheriæ,* and *Spiritus Odoratus.*

SPIRITUS ÆTHERIS. *U.S., Br. Spirit of Ether.*

(SPĬR'Ị-TŬS Æ'THẸ-RĬS—ē'thẹ-rĭs.)

Spiritus Æthereus, s. Liquor Anodynus Mineralis Hoffmanni, *P.G.;* Ether hydrique (sulfurique) alcoolisé, Liqueur anodine d'Hoffmann, *Fr.;* Hoffmann'sche Tropfen, *G.*

"Ether, *thirty parts* [or four fluidounces]; Alcohol, *seventy parts* [or eight and a half fluidounces]. To make *one hundred parts* [or twelve and a half fluidounces]. Mix them." *U. S.*

"Take of Ether *ten fluidounces;* Rectified Spirit *one pint* [Imperial measure]. Mix. The specific gravity 0·809." *Br.*

This preparation is merely ether, diluted with twice its volume of alcohol. It is a new officinal. The corresponding preparation of the German Pharmacopœia contains less ether; being made of 1 part of ether to 3 parts of alcohol, both by weight. Prepared with materials of proper strength, its sp. gr. is 0·809. *Br.* Its medical properties are similar to those of ether. The dose is from one to three fluidrachms (3·75–11·25 C.c.), given with a sufficient quantity of sweetened water.

Off. Prep. Tinctura Lobeliæ Ætherea, *Br.*

SPIRITUS ÆTHERIS COMPOSITUS. *U. S.* *Compound Spirit of Ether. Hoffmann's Anodyne.*

(SPĬR'Ị-TŬS Æ'THẸ-RĬS CỌM-PŎṢ'Ị-TŬS.)

Liqueur nervine de Bang, *Fr.;* Zusammengesetzter Ætherweingeist, *G.*

"Stronger Ether, *thirty parts* [or half a pint]; Alcohol, *sixty-seven parts* [or one pint]; Ethereal Oil, *three parts* [or five fluidrachms], To make *one hundred parts.* Mix them." *U. S.*

This preparation is an alcoholic solution of ether, impregnated with heavy oil of wine. In the formula, determinate quantities of ether, alcohol, and oil are taken, the ether having half the volume of the alcohol. In the last revision of the British Pharmacopœia, this preparation was omitted; unfortunately, we think, as there is scarcely a doubt that the influence of the ether, as a composing medicine in nervous disorder, is much increased by the oil of wine.

Compound spirit of ether is a colorless volatile liquid, having a burning, slightly sweetish taste, and the peculiar odor of ethereal oil. If it has an empyreumatic odor, it has been badly prepared. Its sp. gr. is 0·815, according to the U. S. Pharmacopœia of 1870; the present officinal preparation contains a little less oil of wine. When pure, it is wholly volatilized by heat, and devoid of acid reaction. It becomes milky on being mixed with water, owing to the precipitation of the ethereal oil; but this change does not prove its goodness, as the same property may be given to the spirit of ether by the addition of various fixed oils. This sophistication may be detected by mixing the suspected preparation with water, drawing a piece of paper over the surface of the liquid to absorb the oily globules, and exposing the paper to heat. If the globules are fixed oil, the greasy stain will remain; if ethereal oil, the stain will disappear. When fixed oils are used to adulterate this preparation, the milkiness is generally too great, and not like the translucent, leaden milkiness of the genuine article. (*Dr. Squibb.*) "It gives only a slight cloudiness with chloride of barium. When a few drops are burned on glass or porcelain, there is no visible residue, but the surface will be left with an acid taste and reaction. A pint of water, by the admixture of forty drops, is rendered slightly opalescent." *U. S.* 1870.

It is much to be regretted that our manufacturing chemists do not follow the Pharmacopœia in making Hoffmann's anodyne. In rectifying crude ether, the distillation is continued as long as the ether comes over of the proper specific gravity; after which, the manufacturer has been in the habit of changing the receiver, and obtaining an additional distillate, consisting of ether and alcohol, impregnated with a little ethereal oil. Now it is this second distillate, variously modified by the addition of alcohol, ether, or water, so as to make it conform in taste, smell, opalescence, etc., to a standard preparation, kept by the manufacturer, that is sold as Hoffmann's anodyne. Nothing could be more uncertain in its results than a proceeding like this; and we cannot be surprised that the medicine, as obtained from different apothecaries, varies very much in properties, and often disappoints the expectations of the physician. The chief excuse for the departure from the officinal directions is the costliness of the ethereal oil; but were this much greater than it really is, the excuse would not be valid; and it cannot be justified, on any principle of morality, to sell under the officinal title a preparation which has no claim to it whatever.

Medical Properties. This preparation is intended as a substitute for the anodyne liquor of Hoffmann, which it closely resembles when properly prepared. In addition to the stimulating and antispasmodic qualities of the ether which it contains, it possesses anodyne properties, highly useful in nervous irritation, and in want of sleep from this cause. These additional virtues are probably derived from the officinal oil of wine, which is a more important substance than is generally supposed. Mr. Brande believes that the only effect of it, in the preparation under notice, is to alter the flavor of the ether. In this opinion he is certainly in error. The late Drs. Physick and Dewees of this city found the officinal oil of wine, dissolved in alcohol, very efficacious in certain disturbed states of the system, as a tranquillizing and anodyne remedy. Such indeed are the generally admitted effects of Hoffmann's anodyne, when made with a due admixture of the ethereal oil. This preparation is on many occasions a useful adjunct to laudanum, to prevent the nausea which is excited by the latter in certain habits. The dose is from thirty minims to one or two fluidrachms (1·0–3·75 or 7·5 C.c.), given in water sweetened with sugar.

SPIRITUS ÆTHERIS NITROSI. *U. S., Br.* *Spirit of Nitrous Ether.*

(SPĬR'Ị-TŬS Æ'THẸ-RĬS NĪ-TRŌ'SĪ.)

" An alcoholic solution of Ethyl Nitrite [$\mathbf{C_2H_5.NO_2}$; **75.**—C_4H_5O,NO_3; 75], containing 5 per cent. of the crude Ether." *U. S.*

Spiritus Nitri Dulcis, *Br.;* Sweet Spirit of Nitre; Spiritus Nitrico æthereus; Ether azoteux alcoolisé, Liqueur anodine nitreuse, *Fr.;* Versüsster Salpetergeist, *G.*

" Nitric Acid, *nine parts* [or four and a half ounces av.]; Sulphuric Acid, *seven parts* [or three and a half ounces av.]; Alcohol, Distilled Water, each, *a sufficient quantity.* Add the Sulphuric Acid gradually to *thirty-one parts* [or eighteen fluidounces] of Alcohol. When the mixture has cooled, transfer it to a tubulated retort connected with a well-cooled condenser, to which a receiver, surrounded by broken ice, is connected air-tight, and which is further connected, by means of a glass tube, with a small vial containing water, the end of the tube dipping into the latter. Now add the Nitric Acid to the contents of the retort, and, having introduced a thermometer through the tubulure, heat rapidly, by means of a water-bath, until strong reaction occurs and the temperature reaches 80° C. (176° F.). Continue the distillation at that temperature, and not exceeding 82° C. (180° F.), until the reaction ceases. Disconnect the receiver, and immediately pour the distillate into a flask containing *sixteen parts* [or half a pint] of ice-cold Distilled Water. Close the flask and agitate the contents repeatedly, keeping down the temperature by immersing the flask occasionally in ice water. Then separate the ethereal layer and mix it immediately with *nineteen times* its weight of alcohol. Keep the product in small, glass-stoppered vials, in a dark place, remote from lights or fire." *U. S.*

" Take of Nitric Acid *three fluidounces* [Imperial measure]; Sulphuric Acid *two fluidounces* [Imp. meas.]; Copper, in fine wire (about No. 25), *two ounces* [avoirdupois]; Rectified Spirit *a sufficiency.* To one pint of the Spirit add gradually the Sulphuric Acid, stirring them together; then add in the same way, two and a half fluidounces of the Nitric Acid. Put the mixture into a retort or other suitable apparatus, into which the Copper has been introduced, and to which a thermometer is fitted. Attach now an efficient condenser, and applying a gentle heat, let the Spirit distil at a temperature commencing at 170°, and rising to 175°, but not exceeding 180°, until twelve fluidounces have passed over and been collected in a bottle kept cool, if necessary, with ice-cold water; then withdraw the heat, and having allowed the contents of the retort to cool, introduce the remaining half-ounce of Nitric Acid, and resume the distillation as before, until the distilled product has been increased to 15 fluidounces. Mix this with two pints of the Rectified Spirit, or as much as will make the product correspond to the tests of specific gravity and percentage of ether separated by chloride of calcium. Preserve it in well-closed vessels." *Br.*

The officinal spirit of nitrous ether is a mixture of nitrous ether or ethyl nitrite, $C_2H_5NO_2$, and alcohol (rectified spirit). Nitrous ether is always generated by the reaction of nitric acid with alcohol; and it matters not whether the alcohol be mixed with nitric acid directly, or with the materials for generating it, namely, nitre and sulphuric acid. In the U. S. Pharmacopœia of 1850 the requisite nitric acid was obtained by using the materials for generating it, namely, nitrate of potassium and sulphuric acid; for details of the process, see U. S. D., 14th ed., p. 1445.

In the 1860 U. S. process, which was modelled after the plan of Dr. Squibb, the nitric acid and alcohol were directly mixed in a retort containing pieces of glass to facilitate ebullition and prevent concussion, and arrangements were made for applying heat by means of a water-bath, so that it might be diminished when necessary to repress the violence of the reaction, and increased when this required invigoration. The liquid condensed in the receiver was mixed with carbonate of potassium, and again distilled in order to free it from the acid which had come over with the nitrous ether, and, being too strong with ether to meet the purposes required, was diluted with alcohol, and thus brought to the state of *spirit* of nitrous ether. It was a great improvement over the formula of earlier Pharmacopœias, and had the merit of insuring a preparation of definite strength. But in the Pharmacopœia of 1870 the British process was substituted as even better than it.

The present U. S. process differs from those formerly officinal in several particulars. Copper is no longer used. The use of this metal originated with Prof. Redwood, under the impression that the nitrous radical was liberated by and enabled to unite more readily with the ethyl of the alcohol, to form ethyl nitrite. Our experience is that upon the small scale the copper served a useful purpose in controlling and moderating the reaction, but excellent results have been obtained by substituting broken glass, and we have obtained quite as large a yield of the peculiar ether when the copper was omitted. The nitric acid is now not added in two portions, but the whole quantity is mixed with the sulphuric acid and alcohol at first. This is an improvement, in our opinion. The greatest change is, however, in purifying the distillate by agitating it with ice-cold distilled water, separating the ethereal layer and mixing it with alcohol, so that the finished product shall contain 5 per cent. by weight of the crude ethyl nitrite. It is very doubtful, in our opinion, whether anything is removed by the agitation with cold water excepting some of the alcohol. As aldehyd and hydrocyanic acid are both soluble in ethyl nitrite, and as alcohol must be added subsequently, the advantage of the separation of the nitrous ether in this way is not very apparent, and when it is considered that ethyl nitrite is soluble in water and more soluble in alcohol, considerable of the most valuable portion of the distillate must be wasted by being dissolved in the cold water. A thoroughly effective method of separating ethyl nitrite from its solution in alcohol and water is yet to be discovered. Some manufacturers agitate the distillate with a saturated solution of calcium chloride to separate the nitrite of ethyl, and the British Pharmacopœia uses this method as a test. The most that can be said for the process of separation adopted at the last revision is, that the amount of crude ethyl nitrite present in the finished preparation is *approximately* determined. R. F. Fairthorne has prepared Spirit of Nitrous Ether without the use of a retort or still. (*A. J. P.*, 1880, p. 7.)

The present British formula rejects the nitrite of sodium formerly used, but retains the principle of presenting the ingredients to each other in the form in which they are to exist in the spirit when produced; the ether resulting from the action of sulphuric acid on alcohol, and the nitrous acid from that of the copper on the nitric acid, uniting to form nitrous ether, which, having been distilled over, is then brought to the state of spirit of nitrous ether by admixture with about three volumes of alcohol. The Br. process proved, in practice, so satisfactory as to have been adopted into the U. S. Pharmacopœia of 1870. Prof. Attfield says that "the junior students were always able to make a satisfactory preparation by following the directions of that formula." (*P. J. Tr.*, Sept. 1868, p. 156.) Mr. Alfred E. Tanner states that he has never been able to obtain more than eleven instead of fifteen fluidounces of distillate, and that the strength of the preparation is not sufficient to answer the British officinal tests. He further affirms that the sweet spirit of nitre sent out by most British wholesale manufacturers does not come up to the officinal standard, but contains only 5 per cent. of nitrous ether, and that the preparation keeps best when about this strength. (*P. J. Tr.*, Dec. 1870, p. 463.)

Theory of the Production of Nitrous Ether, etc. One mol. of nitric acid, by reacting with one mol. of alcohol, forms one mol. of nitrous acid, one mol. of *aldehyd*, and one mol. of water. Thus $HNO_3 + C_2H_6O = HNO_2 + C_2H_4O + H_2O$. The nitrous acid, as soon as formed, reacts with a second mol. of alcohol, so as to form one mol. of nitrous ether or ethyl nitrite, with separation of one mol. of water, according to the reaction: $C_2H_5.OH + HNO_2 = C_2H_5NO_2 + H_2O$. It has, however, been shown by Dr. Golding Bird that, when an excess of alcohol is used, *saccharic acid* is first formed, and that, when the formation of the nitrous ether has nearly ceased, aldehyd appears in the distilled product, and simultaneously oxalic acid in the contents of the retort, before which time the latter cannot be discovered. All these products result from the oxidizing action of the nitric acid upon the alcohol, increasing the proportion of oxygen in the substances formed, either by removing the hydrogen, or by abstracting this element and adding oxygen at the same time.

In the process of the British Pharmacopœia the nitric acid is converted into nitrous acid by the reducing action of metallic copper and sulphuric acid, the reaction being: $HNO_3 + Cu + H_2SO_4 = HNO_2 + CuSO_4 + H_2O$. The nitrous acid now reacts with the alcohol as in the previous reaction, so as to produce the nitrous ether. The object of using the sulphuric acid is to economize the nitric acid.

Properties of Ethyl Nitrite. *Pure* ethyl nitrite is pale yellow, has the smell of apples and Hungary wine, boils at 18° C. (64·4° F.), and has the sp. gr. 0·900 at 15·5° C. The density of its vapor is 2·627. Litmus is not affected by it. When it is mixed with an alcoholic solution of potassa, hyponitrite of potassium and alcohol are formed, without producing a brown color, showing the absence of aldehyd. It is soluble in 48 parts of water, and in all proportions in alcohol or rectified spirit. It is highly inflammable, and burns with a white flame without residue. The *impure* ether, as formerly obtained by the Edinburgh and Dublin processes for subsequent dilution to form sweet spirit of nitre, boiled at 21·1° C. (70° F.), and had the density of 0·886 at 4·4° C. (40° F.). The specific gravity assigned to it by the Edinburgh College was 0·899. Mixed with an alcoholic solution of potassa, it became dark brown, with production of *aldehyd resin.* This discoloration showed the presence of aldehyd. When kept, it became acid in a short time, as shown by litmus; and nitric oxide was given off, which often caused the bursting of the bottle. Its tendency to become acid was rendered greater by the action of the air, and depended on the absorption of oxygen by the aldehyd, which thereby became acetic acid. Mr. Harvey, of Leeds, has suggested the use of pure crystals of bicarbonate of potassium in a bottle in order to prevent the development of an acid reaction. Dr. J. C. Rademacher has found that the crystals after a time are partially converted into a nitrate. (*A. J. P.*, xlii. 106.) These facts evince the propriety of preserving this ether in small, strong bottles, kept full and in a cool place. Nitrous ether is formed by the combination of one mol. of nitrous acid and one of ethyl, and its formula is $C_2H_5.NO_2$. It was, therefore, improperly called *nitric ether.* Considered as a salt, its proper name is *nitrite of ethyl.* In its pure and concentrated state it is never used in medicine.*

Properties of Spirit of Nitrous Ether. This is "a clear, mobile, volatile and inflammable liquid, of a pale straw-color, inclining slightly to green, a fragrant, ethereal odor, free from pungency, and a sharp, burning taste. Sp. gr. 0·823 to 0·825. It slightly reddens litmus paper, but should not effervesce when a crystal of bicarbonate of potassium is dropped into it." *U. S.* It keeps well in half-pint bottles, securely stopped with waxed glass stoppers, and covered with dark paper; as Dr. Squibb proved by examining some bottles thus put up, after the lapse of two years; when exposed it is apt to become acid with age. Sweet spirit of nitre mixes with water and alcohol in all proportions. It is very inflammable, and burns with a whitish flame. The Br. Pharmacopœia states, in regard to its own preparation, that, "when agitated with solution of sulphate of iron and a few drops of sulphuric acid, it becomes deep olive-brown or black;" and that "if it be agitated with twice its volume of saturated solution of chloride of calcium in a closed tube, two per cent. of its original volume will separate in the form of nitrous ether and rise to the surface of the mixture." *Br.* This indicates a strength about one-half that of the U. S. spirit. Nitrous ether has been proposed as a test for several alkaloids, but Prof. Maisch has shown that the reactions occur only with old specimens, and are due to the acetic acid which has been developed in it. (*A. J. P.*, xlv. 67.)

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* *Nitrite of Ethyl.* Mr. J. Williams recommends the preparation of this liquid by slowly passing nitrous acid gas, evolved by acting with nitric acid upon starch, into strong alcohol kept as cool as possible. When the gas ceases to be absorbed, the liquid is distilled at a very gentle temperature, and the vapors passed first through a small empty flask and then through one containing a little water, in which all the alcohol, free acid, and most of the aldehyd are retained; the vapors are now passed over a strong solution of potassa contained in a third flask, whereby the remaining aldehyd is absorbed, and the gaseous nitrous ether may then be condensed in a tube placed in a freezing mixture, which must afterwards be hermetically sealed, or, preferably, conducted into a known weight of absolute alcohol, the increase in weight indicating pure nitrous ether. This solution, if containing 50 per cent. of the ether, has the sp. gr. ·850; if 25 per cent., ·824, and if 10 per cent., ·810 sp. gr. If treated with twice the bulk of saturated solution of calcium chloride, they separate respectively 48, 23, and 5 per cent. of oily liquid by measure; a 5 per cent. solution separates only a very thin oily film. The mixing of the two liquids must be effected slowly and with care, to avoid loss of ether in consequence of the rise in temperature; a stream of cold water should be kept constantly running over the tube, and even then some loss of the very volatile ether is probably incurred. The 5 per cent. solution appears to represent the best samples of sweet spirit of nitre obtainable in London. (*A. J. P.*, Jan. 1878.)

Impurities and Tests. Sweet spirit of nitre is never quite free from aldehyd; and, if the distillation be too long continued, it is apt to contain a good deal of this substance, which afterwards becomes acetic acid by absorbing oxygen. The change goes on rapidly if the preparation be insecurely kept. Aldehyd, if in considerable proportion, may be detected by imparting a pungent odor and acrid flavor, and by the preparation assuming a brown tint on the addition of a weak solution of potassa, owing to the formation of aldehyd resin. The potassa test, with the best specimens, produces a straw-yellow tint within twelve hours. "When mixed with half its volume of solution of potassa, previously diluted with an equal volume of water, it assumes a yellow color, which slightly deepens without becoming brown, in twelve hours." *U. S.* Another test for aldehyd, less reliable, is the addition of an equal volume of sulphuric acid to the sweet spirit of nitre. If the sample be good, the change of color will be slight, and the mixture will be considerably viscid; but if it contain much aldehyd, it will become dark-colored. If water or spirit be present in undue proportion, the viscidity will be less. (*Phillips.*) Acetic acid, as well as other acids (usually nitrogen acids) that may happen to be present, may be discovered by the taste, by their acting on litmus strongly, and by their decomposing the alkaline carbonates or bicarbonates with effervescence. Nitrogen acids are known by coloring blue a piece of paper previously dipped into tincture of guaiac. These acids operate injuriously by their chemical reactions with other substances, when spirit of nitre is prescribed in mixtures. Thus, they liberate iodine from iodide of potassium, gradually decolorize compound infusion of rose, and in the compound mixture of iron, hasten the conversion of ferrous oxide into ferric oxide. To obviate these effects, Mr. Harvey, of Leeds, keeps sweet spirit of nitre standing on crystals of bicarbonate of potassium, and states that, if the preparation be of full strength, no appreciable portion of the alkali will be dissolved. (*P. J. Tr.*, Jan. 1842.) When acid sweet spirit of nitre is rectified from calcined magnesia, it becomes acid again in a short time; but, according to M. Klauer, when rectified from neutral tartrate of potassium, it continues unchanged for months. A deep olive color with ferrous sulphate shows the presence of a nitrogen oxide or acid.

According to Mr. Bastick, sweet spirit of nitre contains about one-fifth of one per cent. of anhydrous hydrocyanic acid, when made from nitrous ether, formed by impregnating alcohol with nitrous acid, evolved by the action of starch on nitric acid, according to the process of Liebig. In making sweet spirit of nitre on a large scale, Dr. Squibb found that hydrocyanic acid vapors were produced if the heat happened to rise too high, and the ether ceased to be formed. Recently Dr. Schoor and G. B. Schmidt found that, after a careful distillation, hydrocyanic acid could be detected in the residue left in the retort to the amount of 0·977 per cent., whilst the distillate contained but an insignificant trace. (*Pharm. Zeitung*, No. 37; *N. R.*, Sept. 1880.)

Alcohol and water are often fraudulently added to sweet spirit of nitre. These additions are difficult to detect. The officinal tests are as follows. "A portion of the Spirit, in a test-tube half filled with it, plunged into water heated to 63° C. (145·4° F.), and held there until it has acquired that temperature, should boil distinctly on the addition of a few small pieces of glass. If 10 Gm. of Spirit of Nitrous

Ether be macerated with 1·5 Gm. of potassa for twelve hours, with occasional agitation, the mixture then diluted in a beaker with an equal volume of water, and set aside until the odor of alcohol has disappeared, then slightly acidulated with diluted sulphuric acid, and a solution of 0·335 Gm. of permanganate of potassium gradually added, the color of the whole of this solution should be discharged (presence of at least 4 per cent. of real ethyl nitrite)." *U. S.* The officinal quantitative test is that of Kellström (*Farmaceutisk Tijdschrift; A. J. P.*, Dec. 1880). Nitrite of potassium is formed in the first place by the decomposition of the ethyl nitrite; this in turn is decomposed by the sulphuric acid, and the quantity of the nitrous radical present is shown by the amount of permanganate of potassium which it will deoxidize. When in undue proportion, alcohol and water may be detected in the British preparation, as stated before, by agitating it with twice its volume of a saturated solution of chloride of calcium. Specific gravity is no criterion of the quality of the preparation as obtained by any formula. The addition of water will raise its density; and the same effect will be produced by adding nitrous ether. A high density, in connection with deficient ethereal qualities, would of course indicate free acids, or an excess of water, or both. A specific gravity lower than the U. S. and Br. standard would show the presence of alcohol, either stronger than it should be, or in too large a proportion.

The fraudulent dilution of sweet spirit of nitre with alcohol and water is a great evil, considering its extensive use and valuable remedial properties. Water is injurious, not merely as a diluent, but as the most efficient promoter of chemical changes. In commerce this valuable medicine is usually found variously diluted with twice, thrice, and even four times its weight of alcohol and water. In this way its ether strength is often reduced to less than half what it should be. Dr. Squibb examined six samples of sweet spirit of nitre, five of which were obtained from respectable wholesale druggists; and of these one sample contained 3·16 per cent. of nitrous ether, four between one and two per cent., and one under one per cent.; while a standard preparation, made according to the U. S. Pharmacopœia, contained at least 4·3 per cent.

Medical Properties and Uses. Sweet spirit of nitre is diaphoretic, diuretic, and antispasmodic. It is deservedly much esteemed as a medicine, and is extensively employed in febrile affections, either alone or in conjunction with tartar emetic, for the purpose of promoting the secretions, especially those of sweat and urine. It often proves a grateful stimulus to the stomach, relieving nausea and removing flatulence, and not unfrequently quiets restlessness and promotes sleep. It is especially selected in cases in which the tendency is asthenic. On account of its tendency to the kidneys, it is often conjoined with other diuretics, such as squill, digitalis, acetate of potassium, nitre, etc., for the purpose of promoting their action in dropsical complaints. Dr. Duncan, of Edinburgh, praised a combination of it with a small proportion of aromatic spirit of ammonia, as eminently diaphoretic and diuretic, and well suited to certain states of febrile disease. The dose is from thirty minims to a fluidrachm (1·9–3·75 C.c.), every two or three hours, mixed with a portion of water. When used as a diuretic, it should be given in larger doses.

When the vapor of sweet spirit of nitre is inhaled, it produces, according to Mr. D. R. Brown, of Edinburgh, among other symptoms, a leaden-purple color of the lips, mouth, hands, etc., and extreme muscular debility, enduring for hours. In his own case, these symptoms were unaccompanied with the slightest effect on the brain; but in others the effects were different, headache being invariably produced. (*P. J. Tr.*, March, 1857, p. 456.) These symptoms indicate that the nitrite of ethyl has at least some of the physiological activities common to the nitrites.

Off. Prep. Mistura Glycyrrhizæ Composita, *U. S.*

SPIRITUS AMMONIÆ. *U. S.* *Spirit of Ammonia.*

(SPĬR'Ị-TŬS ẠM-MŌ'NỊ-Æ.)

"An alcoholic solution of Ammonia [**NH_3; 17.**—NH_3; 17], containing 10 per cent., by weight, of the gas." *U. S.*

Liquor Ammonii Caustici Spirituosus, *P.G.;* Spiritus Ammoniaci Caustici Dzondii; Alcoolé d'Ammoniaque, Liqueur d'Ammoniaque vineuse, *Fr.;* Weingeistige Ammoniakflüssigkeit, *G.*

"Stronger Water of Ammonia, *forty-five parts* [or eight fluidounces]; Alcohol, recently distilled, and which has been kept in glass vessels, *a sufficient quantity.* Pour the Stronger Water of Ammonia into a flask connected with a well-cooled receiver, into which *eighty parts* [or one pint] of Alcohol are introduced. Heat the flask carefully, and very gradually, to a temperature not exceeding 60° C. (140° F.), and maintain it at that temperature for about ten minutes. Then disconnect the receiver, and, having ascertained the ammoniacal strength of the contents by means of the volumetric solution of oxalic acid, add enough Alcohol to make the product contain *ten per cent.* of Ammonia. Keep the product in glass-stoppered bottles, in a cool place." *U. S.*

Spirit of ammonia is now officinal in the U. S. Pharmacopœia only; the British Pharmacopœia not having adopted it. It is a solution of caustic ammonia in alcohol. As prepared by the U. S. process of 1850, the ammoniacal gas was received in the alcohol and condensed by it; and the proportions of the ingredients were so adjusted as to give a preparation containing between 10 and 11 per cent. of ammonia, and capable of saturating about 30 per cent. of officinal sulphuric acid. Accordingly it agreed, as it was intended it should, in ammoniacal strength, with the U. S. *Liquor Ammoniæ.* Its sp. gr. was 0·831, or thereabouts. But, in the officinal process of 1870, the materials for the generation of ammonia were mixed with a large proportion of water, the vapor of which came over to some extent with the gas and was condensed along with it. The resulting spirit was, therefore, somewhat diluted with water, and to an indefinite extent, so that the preparation had no precise sp. gr.; and, though the whole amount obtained contained all the ammonia generated, no accurate criterion of its relative strength could be made. This fault has been remedied in the present officinal process by substituting stronger water of ammonia for the chloride of ammonium, water, and lime, and not permitting the temperature to rise above 60° C. (140° F.). In addition to this, the amount of ammonia present is determined by volumetric assay, and it contains the same quantity of ammonia that is present in water of ammonia,—*i.e.*, 10 per cent. Alcohol which has been kept in the cask for a long time will be discolored when the gaseous ammonia is passed into it.

Properties. The spirit of ammonia, formerly called *ammoniated alcohol*, is "a colorless liquid, having a strong odor of ammonia, and a sp. gr. of about 0·810. When diluted with water, it should respond to the tests and reactions mentioned under Water of Ammonia. (See *Aqua Ammoniæ.*) 8·5 Gm. Spirit of Ammonia, diluted with distilled water, should require, for complete neutralization, 50 C.c. of the volumetric solution of oxalic acid." *U. S.* When good, it does not effervesce with dilute hydrochloric acid; but if old, or carelessly kept, it is apt to be partially carbonated, as shown by this test. It, however, absorbs carbonic acid more slowly than Liquor Ammoniæ.

Medical Properties and Uses. Spirit of ammonia is stimulant and antispasmodic, and is given in hysteria, flatulent colic, and nervous debility. It is, however, little used internally; the aromatic spirit, which is pleasanter and has similar properties, being preferred. The dose is from ten to thirty drops (0·6–1·9 C.c.) in a wineglassful (7·5 C.c.) of water. Spirit of ammonia dissolves resins, gum-resins, camphor, and the volatile oils, and is a very convenient addition to spirituous liniments intended to produce a rubefacient effect. Not more than one part of the spirit should, as a general rule, be added to six or eight parts, by measure, of the liniment. It enters into no officinal preparation.

SPIRITUS AMMONIÆ AROMATICUS. *U.S., Br.* *Aromatic Spirit of Ammonia.*

(SPĬR'Ị-TŬS ẠM-MŌ'NỊ-Æ ĂR-Ọ-MĂT'Ị-CŬS.)

Alcoolat ammoniacal aromatique, *Fr.;* **Aromatischer Ammoniakgeist,** *G.*

"Carbonate of Ammonium, *forty parts* [or five hundred grains]; Water of Ammonia, *one hundred parts* [or twenty-two fluidrachms]; Oil of Lemon, *twelve parts* [or two and a half fluidrachms]; Oil of Lavender Flowers, *one part* [or twelve minims]; Oil of Pimenta, *one part* [or ten minims]; Alcohol, recently distilled and which has been kept in glass vessels, *seven hundred parts* [or twenty-two fluidounces]; Distilled Water, *a sufficient quantity*, To make *one thousand parts* [or two pints]. To the Water of Ammonia, contained in a flask [*or bottle*], add *one hundred and forty parts* [or four fluidounces] of Distilled Water and afterward, the Carbonate of Ammonium reduced to a moderately fine powder. Close the flask [*or bottle*] and agitate the contents until the Carbonate is dissolved. Weigh the Alcohol in a tared flask of suitable capacity [*or pour twenty-two fluidounces in a bottle*], add the oils, then gradually add the solution of Carbonate of Ammonium, and afterward enough Distilled Water to make the product weigh *one thousand parts* [or measure two pints]. Lastly, filter the liquid, through paper, in a well-covered funnel. Keep the product in glass-stoppered bottles, in a cool place." *U. S.*

"Take of Carbonate of Ammonia *eight ounces* [avoirdupois]; Strong Solution of Ammonia *four fluidounces;* Volatile Oil of Nutmeg *four fluidrachms;* Oil of Lemon *six fluidrachms;* Rectified Spirit *six pints* [Imperial measure]; Water *three pints* [Imp. meas.]. Mix and distil seven pints [Imp. meas.]. Sp. gr. 0·870." *Br.*

In both of these formulas carbonate of ammonium and uncombined ammonia are used; but they differ in the relative proportion of the materials and the mode of conducting the process. The U. S. spirit is a mere solution of the ingredients in alcohol diluted with a small proportion of water; while the British contains such and so much of the ingredients as may rise in distillation, and be condensed with the seven pints of spirit that result. The former is of definite strength, the latter more or less indefinite, as a portion of the materials must be left behind. The present preparation differs from that formerly officinal, in the substitution of oil of pimenta for oil of nutmeg, which is an improvement, and the use of alcohol recently distilled and which has been kept in glass vessels, to avoid discoloration. The translucent officinal carbonate of ammonium, which is a mixture of bicarbonate and carbamate, does not dissolve in alcohol; the bicarbonate precipitates, and the carbamate dissolves. The object of the addition of free ammonia in the officinal processes is to convert the insoluble bicarbonate into the carbamate. The effloresced carbonate of ammonium of the shops having parted with some of its ammonia is a bicarbonate; hence when it is used, unless more than the officinal proportion of the water of ammonia is added, some of the ammonia salt remains as the precipitate of the bicarbonate of ammonium, and the difficulty of precipitation which so many pharmacists complain of is thus explained. It is officinally described as "a nearly colorless liquid when freshly prepared, gradually acquiring a slightly darker tint, of an aromatic, pungent, ammoniacal odor, and having a sp. gr. of about 0·885." *U. S.* The sp. gr. of the Br. preparation is 0·870.

Medical Properties and Uses. Aromatic spirit of ammonia is fitted to fulfil the same indications as the simple spirit, but is much more used on account of its grateful taste and smell. It is advantageously employed as a stimulant antacid in sick headache. The dose of the U. S. spirit is from thirty drops to a fluidrachm (1·9–3·75 C.c.), sufficiently diluted with water. Aromatic spirit of ammonia may be usefully added to aperient draughts, to render them less offensive to the stomach; but care must be taken not to mix it with incompatible substances; most of the ammonia contained in it is probably in the state of the carbamate, which is converted into the carbonate upon the addition of water.

Off. Prep. Tinctura Guaiaci Ammoniata; Tinctura Valerianæ Ammoniata.

SPIRITUS AMMONIÆ FŒTIDUS. *Br.* *Fetid Spirit of Ammonia.*

(SPĬR'Ị-TŬS ẠM-MŌ'NỊ-Æ FŒT'Ị-DŬS—fĕt'ẹ-dŭs.)

Alcoolat ammoniacal fétide, Essence antihystérique, *Fr.;* Ammoniakalischer Stinkasantgeist, *G.*

"Take of Assafœtida *one ounce and a half* [avoirdupois]; Strong Solution of Ammonia *two fluidounces* [Imperial measure]; Rectified Spirit *a sufficiency.* Break the Assafœtida into small pieces and macerate it in a closed vessel, in fifteen fluidounces of the Spirit, for twenty-four hours, then distil off the Spirit, mix the product with the Solution of Ammonia, and add sufficient Rectified Spirit to make *one pint* [Imp. meas.]." *Br.*

This is an alcoholic solution of the volatile oil of asafetida mixed with strong water of ammonia, and is an energetic nervous stimulant and antacid, adapted to certain hysterical conditions associated with gastric weakness and acidity. It is one of the preparations formerly recognized by the British Colleges, and taken up again after having been dropped from the first Br. Pharmacopœia. The dose is from thirty minims to a fluidrachm (1·9–3·75 C.c.), to be largely diluted when administered.

SPIRITUS ANISI. *U. S.* *Spirit of Anise.*

(SPĬR′Ị-TŬS Ạ-NĪ′SĪ.)

Essentia Anisi, *Br.;* Essence of Anise; Alcoolat d'Anis, *Fr.;* Anisgeist, *G.*

"Oil of Anise, *ten parts* [or two fluidounces]; Alcohol, *ninety parts* [or twenty-two fluidounces], To make *one hundred parts* [or twenty-four fluidounces]. Mix them." *U. S.*

In the preparation of its Essence the British Pharmacopœia directs *one fluidounce* of the Oil to *four fluidounces* of Rectified Spirit. The strength of this spirit has been increased about 50 per cent. in the revision of the U. S. P. 1880.

The dose of the U. S. spirit, as a stomachic and carminative, is one or two fluidrachms (3·75–7·5 C.c.), that of the Br. essence one-fourth as much.

SPIRITUS ARMORACIÆ COMPOSITUS. *Br.* *Compound Spirit of Horseradish.*

(SPĬR′Ị-TŬS ĂR-MỌ-RĀ′CỊ-Æ CỌM-PŎṢ′Ị-TŬS.)

Esprit de Raifort composée, Alcoolat antiscorbutique, *Fr.;* Meerrettiggeist, *G.*

"Take of Horseradish Root, scraped, Bitter Orange Peel, cut small and bruised, of each, *twenty ounces* [avoirdupois]; Nutmeg, bruised, *half an ounce* [avoird.]; Proof Spirit *one gallon* [Imperial measure]; Water *two pints* [Imp. meas.]. Mix, and distil a gallon [Imp. meas.] with a moderate heat." *Br.*

This may be used advantageously as an addition to diuretic remedies, in dropsy attended with debility, especially in the case of drunkards. The dose is from one to four fluidrachms (3·75–15 C.c.).

SPIRITUS AURANTII. *U. S.* *Spirit of Orange.*

(SPĬR′Ị-TŬS ÂU-RĂN″TỊ-Ī—âw-răn′shẹ-ī.)

Alcoolat d'Huile d'Oranges, *Fr.;* Pomeranzengeist, *G.*

"Oil of Orange Peel, *six parts* [or one fluidounce]; Alcohol, *ninety-four parts* [or one pint], To make *one hundred parts* [or seventeen fluidounces]. Mix them." *U. S.*

This is a new officinal. There seemed very little necessity for its introduction, because of the adoption of the tincture of sweet orange peel, which is identical in properties, although not so strong as the spirit. It will serve a useful purpose, however, as a means of preserving the oil. (See *Oleum Aurantii.*) It is an excellent solution for flavoring purposes when the stimulant effect of the alcohol is desired.

SPIRITUS CAJUPUTI. *Br.* *Spirit of Cajuput.*

(SPĬR′Ị-TŬS CĂJ-U̇-PŪ′TĪ.)

Alcoolé de Cajeput, *Fr.;* Cajaputgeist, *G.*

"Take of Oil of Cajuput *one fluidounce;* Rectified Spirit *forty-nine fluidounces.* Dissolve." *Br.*

For an account of the medical properties and uses of oil of cajeput, of which this is simply an alcoholic solution, see *Oleum Cajuputi.* The dose of this spirit, which has only one-fifth of the strength of the Br. spirit of 1864, is from 30 minims to a fluidrachm (1·9–3·75 C.c.).

SPIRITUS CAMPHORÆ. *U. S., Br.* *Spirit of Camphor.*

(SPĬR′Ị-TŬS CĂM′PHỌ-RÆ.)

Tinctura Camphoræ, *U. S.* 1850; Tincture of Camphor; Alcohol Camphoratus; Spiritus Camphoratus, *P.G.;* Esprit de Camphré, Alcool camphré, *Fr.;* Kampferspiritus, *G.*

"Camphor, *ten parts* [or three ounces av.]; Alcohol, *seventy parts* [or twenty-five fluidounces]; Water, *twenty parts* [or six fluidounces], To make *one hundred parts* [or about two pints]. Dissolve the Camphor in the Alcohol, add the Water, and filter through paper." *U. S.*

"Take of Camphor *one ounce* [avoirdupois]; Rectified Spirit *nine fluidounces.* Dissolve." *Br.*

The present officinal spirit differs from that of 1870 in containing about 25 per cent. less camphor. The addition of water to the solution is by no means a practical improvement, in view of the extensive employment of the preparation in liniments containing chloroform, oils, etc., in which, of course, it will now be frequently immiscible without producing turbidity. This spirit is used chiefly as an anodyne embrocation in rheumatic and gouty pains, chilblains, and the inflammation resulting from sprains and bruises. M. Nélaton employed it, in the Clinical Hospital of Paris, in the dressing of open wounds, by compresses, lotion, or fomentation. (*Ann. de Thérap.*, 1865, p. 129.) It may also be employed internally, due regard being paid to the stimulant properties of the alcohol. The camphor is precipitated by the addition of water, but may be suspended by the intervention of sugar. The dose is from five drops to a fluidrachm (0·3–3·75 C.c.), first added to sugar, and then mixed with water.

SPIRITUS CHLOROFORMI. *U. S., Br.* *Spirit of Chloroform.*

(SPĬR'Ị-TŬS ȻHLŌ-RỌ-FŎR'MĪ.)

Alcoolé de Chloroforme, *Fr.;* Chloroformspiritus, *G.*

"Purified Chloroform, *ten parts* [or one fluidounce]; Alcohol *ninety parts* [or one pint], To make *one hundred parts* [or seventeen fluidounces]. Mix them." *U. S.*

"Take of Chloroform *one fluidounce;* Rectified Spirit *nineteen fluidounces.* Dissolve. Sp. gr. 0·871." *Br.*

The chloroform strength of this preparation was reduced at the last U. S. revision, so that now the spirit of chloroform is about half the strength of that officinal in 1870. The only advantage in the change is that the preparation is now more in accord with the British spirit. Solution of chloroform in alcohol in variable proportions was at one time erroneously called *chloric ether*, and was used as a respiratory anæsthetic agent in the place of chloroform, under the impression that it would be safer, the stimulant properties of the alcohol obviating the sedative action of the chloroform. It is at present, however, little used in this way; practitioners who employ chloroform, and yet wish to guard against its depressing effects, preferring *ether* to alcohol as the corrigent. The spirit of chloroform is a convenient form for internal exhibition, as it is more readily incorporated in mixtures than chloroform itself. The dose will now have to be doubled, and is from ten to sixty minims (0·6–3·75 C.c.); in which quantity the action of the alcohol would be noticeable.*

SPIRITUS CINNAMOMI. *U. S.* *Spirit of Cinnamon.*

(SPĬR'Ị-TŬS CĬN-NẠ-MŌ'MĪ.)

Alcoolé de Cannelle, *Fr.;* Zimmtspiritus, *G.*

"Oil of Cinnamon, *ten parts* [or one fluidounce]; Alcohol, *ninety parts* [or twelve fluidounces], To make *one hundred parts* [or thirteen fluidounces]. Mix them." *U. S.*

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* *Alcoholic Solution of Chloroform.* A preparation for inhalation, composed of one-third pure chloroform and two-thirds nearly absolute alcohol, was recommended by Dr. Warren, under the name of *strong chloric ether.* Dr. Snow has since employed a similar mixture, using equal parts of chloroform and alcohol. The mixture, made in the proportion adopted by Dr. Snow, is commended by M. Robert as the best anæsthetic agent yet proposed. As the name chloric ether was originally applied by the late Dr. T. Thomson, of Glasgow, to the Dutch liquid, it would be well to abandon the same appellation to designate chloroform, or its mixture with alcohol. A correct name for the latter would be *alcoholic solution of chloroform*, or *tincture of chloroform.* Dr. Warren used his preparation in fifty cases with success, and considered it safer than chloroform, and more agreeable than ether. Further observation is required to determine the value of "strong chloric ether" as an anæsthetic. The alcohol may prove useful by obviating, through its stimulant properties, the depressing influence of the chloroform; and ether has been occasionally mixed with chloroform, with the same view. The preparation, sold in London and elsewhere under the name of "chloric ether," is a weak tincture of chloroform of variable quality, containing at most but 16 or 18 per cent. of chloroform, and sometimes not more than 5 or 6 per cent.

The spirit of cinnamon is an agreeable aromatic cordial, and may be given in debility of the stomach in the dose of from ten to twenty drops (0·6–1·25 C.c.).

SPIRITUS FRUMENTI. *U. S.* *Whisky.*

(SPĬR'Ị-TŬS FRŪ-MĔN'TĪ.)

"An alcoholic liquid, obtained by the distillation of fermented grain (usually corn, wheat, or rye), and at least two years old." *U. S.*

Eau de Vie de Grains, *Fr.;* Kornbranntwein, *G.*

The term *whisky* is said to have been first applied to the spirit obtained from barley, in the Highlands of Scotland, and to signify water in the language of the people of that region. (*Rees's Cyclopædia.*) In the strict sense of the word, as at present understood, and as officinally defined, it belongs to the distilled spirit from different grains, including Indian corn, wheat, rye, and barley. The whisky of this country is generally made from corn or rye. The term, however, is sometimes extended to other forms of ardent spirit; and that resulting from the distillation of cider is frequently designated as *apple whisky.*

In the preparation of whisky, the infusion of rye or other grain is first made to undergo fermentation, by which the saccharine matter and indirectly the starch are converted into alcohol. In this state the liquid is called the *wash.* This is submitted to distillation, and the product is denominated *low wines.* By a second distillation it becomes purer and stronger, and now takes the name of raw corn spirit or whisky. Sometimes, we are informed, it is submitted to a third distillation, in order still further to purify it. By time certain chemical changes take place by which the natural impurities contained in the liquor are destroyed, and the whisky becomes mellowed, losing the disagreeable odor and taste which it is apt to have when first distilled.

There are volatile principles naturally existing in the grains, which accompany the liquor in all its changes, and give their characteristic flavor to the resulting spirit. These can scarcely be considered as impurities. But there are others, produced during the process of fermentation, which serve seriously to contaminate the product. Among these is *fusel oil* or *grain oil* (amylic alcohol), which is offensive both to the smell and taste, and from which it is very desirable that the spirit should be freed as far as possible. As this oil has a considerably higher boiling point than ethylic or common alcohol, or even water, it is mainly left behind if the distillation be not carried too far; yet portions still rise, and to a certain extent impregnate the spirit. Minute proportions of acetic and butyric acids are often present in whisky, and valerianic acid has been detected. (*A. J. P.*, 1859, p. 573.)* According to Dr. A. A. Hayes, of Boston, all new spirits, prepared with copper stills, are liable to be adulterated with that metal, which, however, is, he thinks, deposited in the process of ripening, which they undergo by time. (*Am. Journ. Sci. Arts*, July, 1861.)

Properties. Whisky, when recently prepared, is nearly colorless; but, when kept in casks, it gradually acquires a brownish color, which deepens with time; and hence it may be found of various shades, from a slight yellowish brown tint to the dark brown of brandy. Its taste and smell, when mellow by age, though peculiar, are not disagreeable. According to the Pharmacopœia, "whisky has an amber color, a distinctive taste and odor, and a sp. gr. not above 0·930, nor below 0·917, corresponding approximately with an alcoholic strength of 44 to 50 per cent. by weight, or 50 to 58 per cent. by volume. If 100 C.c. of Whisky be very slowly evaporated in a weighed capsule, on a water-bath, the last portions volatilized should not have a harsh or disagreeable odor (abs. of more than traces of fusel oil from grain or potato spirit). The residue, fully dried at 100° C. (212° F.), should weigh not more 0·250 Gm., equivalent to 0·25 per cent. (abs. of an undue amount of solids). This residue should have no sweet or distinctly spicy taste (abs. of added sugar, glycerin, or spices). It should nearly all dissolve in 10 C.c. of cold water, forming a solution which is colored light green by a dilute solution of ferric chloride (traces of oak tannin from casks). 100 C.c. of Whisky should be rendered distinctly alkaline to litmus by 2 C.c. of the volumetric solution of soda (abs. of an undue amount of free acid)." *U. S.*

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* Fusel oil may be detected by agitating ether with the suspected liquor, adding water and allowing to stand; the ether with the oil, if any be present, will rise to the top, and may be decanted, and allowed to evaporate spontaneously, when the oil will be left behind.

It was introduced into the Pharmacopœia as a cheap substitute for brandy, and may be employed for all the purposes which that spirit is capable of fulfilling. Indeed, it is preferable as a medicinal agent to brandy such as is now generally sold in our markets; since it can always be obtained of good quality. It is also used as an antiseptic dressing for wounds, ulcers, etc.

SPIRITUS GAULTHERIÆ. *U. S.* *Spirit of Gaultheria.*

(SPĬR′Ị-TŬS GÂUL-THĒ′RỊ-Æ.)

"Oil of Gaultheria, *three parts* [or one hundred and sixty minims]; Alcohol, *ninety seven parts* [or one pint], To make *one hundred parts* [or about one pint]. Mix them." *U. S.*

This is a new officinal spirit. A solution of the oil in alcohol in varying proportions has been used frequently in many parts of our country, and authoritative recognition was demanded. It will be most largely used for imparting flavor to prescriptions. The dose is from ten to twenty minims (0·6 to 1·25 C.c.).

SPIRITUS JUNIPERI. *U. S., Br.* *Spirit of Juniper.*

(SPĬR′Ị-TŬS JÛ-NĬP′Ẹ-RĪ.)

Alcoolat (Esprit) de Genièvre, *Fr.;* Wachholderspiritus, *G.*

"Oil of Juniper, *three parts* [or two hundred and twenty-four minims]; Alcohol, *ninety-seven parts* [or one pint], To make *one hundred parts* [or about one pint]. Mix them." *U. S.*

"Take of Oil of Juniper *one fluidounce;* Rectified Spirit *forty-nine fluidounces.* Dissolve." *Br.*

This spirit is used chiefly as an addition to diuretic infusions. It is about 33 per cent. stronger than the spirit formerly officinal. The dose is from thirty to sixty minims (1·9–3·75 C.c.).

Off. Prep. Mistura Creasoti, *Br.*

SPIRITUS JUNIPERI COMPOSITUS. *U. S.* *Compound Spirit of Juniper.*

(SPĬR′Ị-TŬS JŪ-NĬP′Ẹ-RĪ CỌM-PŎṢ′Ị-TŬS.)

"Oil of Juniper, *ten parts* [or twenty minims]; Oil of Caraway, *one part* [or two minims]; Oil of Fennel, *one part* [or two minims]; Alcohol, *three thousand parts* [or one pint]; Water, *a sufficient quantity*, To make *five thousand parts* [or one and a half pints]. Dissolve the Oils in the Alcohol, and gradually add enough Water to make the product weigh *five thousand parts* [or measure one and a half pints]." *U. S.*

This spirit is a useful addition to diuretic infusions and mixtures in debilitated cases of dropsy. It corresponds very closely with Holland gin. The dose is from two to four fluidrachms (7·5–15 C.c.).

SPIRITUS LAVANDULÆ. *U. S., Br.* *Spirit of Lavender.*

(SPĬR′Ị-TŬS LẠ-VĂN′DU̇-LÆ.)

Alcoolat (Esprit, Eau) de Lavande. *Fr.;* Lavandelspiritus, *G.*

"Oil of Lavender Flowers, *three parts* [or half a fluidounce]; Alcohol, *ninety-seven parts* [or one pint], To make *one hundred parts* [or about one pint]. Mix them." *U. S.*

"Take of Oil of Lavender *one fluidounce;* Rectified Spirit *forty-nine fluidounces.* Dissolve." *Br.*

Spirit of Lavender is used chiefly as a perfume, and as an ingredient in other preparations. The officinal spirit is about 33 per cent. stronger than the spirit of the U. S. P. 1870. The perfume usually sold under the name of *lavender water* is not a distilled spirit, but an alcoholic solution of the oil, with the addition of other odorous substances. The following is given by Mr. Brande as one of the most approved recipes for preparing it. "Take of rectified spirit five gallons, essential oil of lavender twenty ounces, essential oil of bergamot five ounces, *essence of ambergris* [made by digesting one drachm of ambergris and eight grains of musk in half a pint of alcohol] half an ounce. Mix." The *Br.* spirit is of one-fifth of the strength of the preparation of the Pharmacopœia of 1864. The dose may be from thirty minims to a fluidrachm (1·9–3·75 C.c.).

Off. Prep. Mistura Ferri Composita, *U. S.*

SPIRITUS LIMONIS. *U. S.* *Spirit of Lemon.* [*Essence of Lemon.*]

(SPĬR'I-TŬS LI-MŌ'NĬS.)

Alcoolat (Esprit) de Citrons, *Fr.;* Citronenessenz, *G.*

"Oil of Lemon, *six parts* [or one fluidounce]; Lemon Peel, freshly grated, *four parts* [or two hundred and forty grains]; Alcohol, *a sufficient quantity*, To make *one hundred parts* [or one pint]. Dissolve the Oil of Lemon in *ninety parts* [or fourteen fluidounces] of Alcohol, add the Lemon Peel, and macerate for twenty-four hours; then filter through paper, adding through the filter enough Alcohol to make the Spirit weigh *one hundred parts* [or measure one pint]." *U. S.*

This spirit is used chiefly for flavoring mixtures.

Off. Prep. Syrupus Acidi Citrici, *U. S.*

SPIRITUS MENTHÆ PIPERITÆ. *U. S., Br.* *Spirit of Peppermint.*

(SPĬR'I-TŬS MĔN'THÆ PĪ-PE-RĪ'TÆ.)

Essence of Peppermint: Spiritus Menthæ Piperitæ Anglicus, *P.G.;* Alcoolat (Essence) de Menthe poivrée, *Fr.;* Englische Pfefferminzessenz, *G.*

"Oil of Peppermint, *ten parts* [or eleven fluidrachms]; Peppermint, in coarse powder, *one part* [or forty grains]; Alcohol, *a sufficient quantity*, To make *one hundred parts* [or one pint]. Dissolve the Oil of Peppermint in *ninety parts* [or fourteen fluidounces] of Alcohol, add the Peppermint, and macerate for twenty-four hours; then filter through paper, adding through the filter enough Alcohol to make the Spirit weigh *one hundred parts* [or measure one pint]." *U. S.*

"Take of Oil of Peppermint *one fluidounce;* Rectified Spirit *forty-nine fluidounces.* Dissolve." *Br.* This spirit is only one-fifth of the strength of the Br. spirit of 1864, and contains about nine times as much Oil of Peppermint as Spiritus Menthæ Piperitæ of the London Pharmacopœia.

Under the name of ESSENTIA MENTHÆ PIPERITÆ, or *Essence of Peppermint*, the present Br. Pharmacopœia contains a preparation much stronger than either of the above spirits, consisting of *one fluidounce* of Oil of Peppermint to *four fluidounces* of Rectified Spirit.

The distilled spirit has no advantage over a simple solution of the oil in alcohol, and this mode of preparing it has been adopted both in the U. S. and British Pharmacopœias. The officinal spirit represents the Tincture of Oil of Peppermint of the U. S. Pharmacopœia of 1850, and is about 50 per cent. stronger than the preparation of U. S. P. 1870. It has long been popularly used under the name of *essence of peppermint.* The spirit of peppermint affords a convenient method of administering a dose of the volatile oil, being of such a strength that, when dropped on loaf-sugar, it may be taken without inconvenience. The dose is from ten to twenty minims (0·6–1·25 C.c.), given as just mentioned, or mixed with sweetened water. The dose of the British Spirit is from thirty minims to a fluidrachm (1·9–3·75 C.c.), that of the British Essence from ten to twenty minims (0·6–1·25 C.c.).

The only compensation for changing the strength of this very largely used preparation is the doubtful one that it is easy to recollect that it is now made of the strength of 10 per cent. *by weight.*

Off. Prep. Mistura Rhei et Sodæ, *U. S.*

SPIRITUS MENTHÆ VIRIDIS. *U. S.* *Spirit of Spearmint.*

(SPĬR′Ị-TŬS MĔN′THÆ VĬR′Ị-DĬS.)

Tinctura Olei Menthæ Viridis, *U. S.* 1850; Essence of Spearmint; Grüne Minzessenz, *G.*

"Oil of Spearmint, *ten parts* [or eleven fluidrachms]; Spearmint, in coarse powder, *one part* [or forty grains]; Alcohol, *a sufficient quantity,* To make *one hundred parts* [or one pint]. Dissolve the Oil of Spearmint in *ninety parts* [or fourteen fluidounces] of Alcohol, add the Spearmint, and macerate for twenty-four hours; then filter through paper, adding through the filter enough Alcohol to make the Spirit weigh *one hundred parts* [or measure one pint]." *U. S.*

"Take of Oil of Spearmint *a fluidounce;* Spearmint, in coarse powder, *one hundred and twenty grains;* Stronger Alcohol *fifteen fluidounces.* Dissolve the Oil in the Stronger Alcohol, add the Spearmint, macerate for twenty-four hours, and filter through paper." *U. S.*

The remarks made on the Spirit of Peppermint are equally applicable to this. Both are usually employed as carminatives. The Spirit of Spearmint may be given in the dose of thirty or forty drops (1·9–2·5 C.c.).

SPIRITUS MYRCIÆ. *U. S.* *Spirit of Myrcia.* [*Bay-rum.*]

(SPĬR′Ị-TŬS MY̆R′CỊ-Æ—mĭr′shẹ-ē.)

"Oil of Myrcia, *sixteen parts* [or one fluidounce]; Oil of Orange Peel, *one part* [or forty minims]; Oil of Pimenta, *one part* [or twenty-five minims]; Alcohol, *one thousand parts* [or four and a half pints]; Water, *seven hundred and eighty-two parts* [or three and a half pints], To make *eighteen hundred parts* [or eight pints]. Mix the Oils with the Alcohol, and gradually add the Water to the solution. Set the mixture aside, in a well-stopped bottle, for eight days, then filter through paper, in a well-covered funnel." *U. S.*

The distilled spirit has been abandoned and a formula for its preparation substituted in the last revision. It will in many cases be found that, even when complying strictly with the directions of the formula, simple filtration will not produce a transparent spirit. The addition to the filter of a small quantity of carbonate of magnesia, rubbed up with a little of the spirit to a smooth paste, will accomplish the object of clarification.

This was a new officinal of the U. S. Pharmacopœia of 1860, and was defined as obtained by distilling rum with the leaves of *Myrcia acris.* It has been long in use as a most agreeable and refreshing perfume; and many persons, on account of the name, believed it to be prepared by distilling spirit from the leaves of the bay-tree (*Laurus nobilis*). It appears, however, that this was an error. (*A. J. P.*, July, 1861.) A leaf was presented to Prof. Maisch, brought from the West Indies, with the information that it was from the tree of which the leaves were used in preparing this spirit. He observed that it had precisely the characteristic odor and taste of bay-rum, and on comparing it with the leaves of a twig in the collection of the Academy of Natural Sciences of this city, brought by the late Dr. Griffiths from St. Croix, and labelled as the plant from which bay-rum was prepared, found that the two closely corresponded. From the characters of the leaf, Prof. Bridges suggested that it might belong to a plant of the family Myrtaceæ, and was most probably the *Myrcia acris* of De Candolle, an opinion which is probably correct; and there is little room to doubt that it is the source of this very agreeable perfume.

Gen. Ch. Calyx five-parted, tube subglobose. *Petals* five. *Stamens* numerous, free. *Ovary* two or three-celled. *Berry* one or two-celled, one to three-seeded. *Seed* subglobose, smooth; cotyledons foliaceous.

Myrcia acris. Schwartz; De Cand. *Prodrom.* v. 243; Curtis's *Bot. Mag.*, 2d ser., vol. vi. pl. 3153.—*Myrtus acris.* Willd. *Sp. Plant.* p. 973. The *bayberry,* as it is sometimes called, is a tree of considerable size, with a straight stem, and a thick pyramidal summit. The young branches are green and sharply four-angled. The leaves are opposite, from 3 to 5 inches long, very coriaceous, lanceolate, obtuse, wavy, somewhat revolute at the edges, with numerous parallel nerves, reticulated on the upper surface, and sprinkled with pellucid dots. They have a very fragrant odor, and are somewhat astringent. The flowers, which are arranged in pedunculate, axillary panicles, longer than the leaves, are small, and white with a reddish tinge. The aromatic berries are round, about as large as a pea, with 7 or 8 seeds.

The tree is a native of Jamaica and other West India islands. The spirit is probably prepared by distilling rum from the leaves; but we are in want of precise information on the subject, and it is not impossible that the leaves of other species may also be used. Indeed, an odor of pimenta which it appears to us may be sometimes detected, suggests the idea that the leaves of this tree may be at least occasionally added to those of the bayberry. A *volatile oil* is also obtained from the leaves by distillation, and is now officinal. (See *Oleum Myrcia.*)

Bay-rum is used chiefly as a refreshing perfume in cases of nervous headache, faintness, and other nervous disorders, either held to the nostrils, or applied on soft linen to the head and forehead. It is also grateful to the feeble and convalescent patient, by being sprinkled on the bed covering, or otherwise made to impregnate the air of the chamber.

SPIRITUS MYRISTICÆ. *U. S., Br.* *Spirit of Nutmeg.* [*Essence of Nutmeg.*]

(SPĬR'Ị-TŬS MȲ-RĬS'TỊ-ÇÆ.)

Alcoole (Esprit) de Muscade, *Fr.;* Muskatspiritus, *G.*

"Oil of Nutmeg, *three parts* [or half a fluidounce]; Alcohol, *ninety-seven parts* [or one pint], To make *one hundred parts* [or about one pint]. Mix them." *U. S.*

"Take of Volatile Oil of Nutmeg *one fluidounce;* Rectified Spirit *forty-nine fluidounces.*" *Br.*

This preparation is about 33 per cent. stronger than that of the U. S. P. 1870. It is used chiefly for its flavor, as an addition to other medicines. The dose is one fluidrachm (3·75 C.c.).

Off. Prep. Mistura Ferri Composita, *Br.*

SPIRITUS ODORATUS. *U. S.* *Perfumed Spirit.* [*Cologne Water.*]

(SPĬR'Ị-TŬS Ō-DỌ-RĀ'TŬS.)

Eau de Cologne, *Fr.;* Kölnerwasser, *G.*

"Oil of Bergamot, *sixteen parts* [or two fluidounces]; Oil of Lemon, *eight parts* [or one fluidounce]; Oil of Rosemary, *eight parts* [or one fluidounce]; Oil of Lavender Flowers, *four parts* [or half a fluidounce]; Oil of Orange Flowers, *four parts* [or half a fluidounce]; Acetic Ether, *two parts* [or two fluidrachms]; Water, *one hundred and fifty-eight parts* [or eighteen fluidounces]; Alcohol, *eight hundred parts* [or six and a half pints], To make *one thousand parts* [or about eight pints]. Dissolve the Oils and the Acetic Ether in the Alcohol, and add the Water. Set the mixture aside, in a well-closed bottle, for eight days, then filter through paper, in a well-covered funnel." *U. S.*

Cologne Water is introduced for the first time in the Pharmacopœia of 1880; of the many formulas extant, the above has been selected. In our opinion a more fragrant spirit, and one more closely resembling the original, would be made if the quantity of oil of orange flowers or *neroli* were doubled. Cologne water is often useful in the sick room as a refreshing perfume.

SPIRITUS ROSMARINI. *Br.* *Spirit of Rosemary.*

(SPĬR'Ị-TŬS RŎŞ-MẠ-RĪ'NĪ.)

Spiritus Anthos; Alcoolat (Esprit) de Romarin, *Fr.;* Rosmarin Spiritus, *G.*

"Take of Oil of Rosemary *one fluidounce;* Rectified Spirit *forty-nine fluidounces.* Dissolve." *Br.*

This spirit has only one-fifth of the strength of the Br. spirit of 1864, and contains about ten times as much Oil of Rosemary as Spiritus Rosmarini of the London Pharmacopœia. It is a grateful perfume, and is used chiefly as an ingredient in lotions and liniments.

SPIRITUS VINI GALLICI. *U.S.*, *Br.* *Brandy.*

(SPĬR'I-TŬS VĪ'NĪ GĂL'LI-CĪ.)

"An alcoholic liquid obtained by the distillation of fermented grapes, and at least four years old." *U. S.*

"*Spirit of French Wine.* Spirit distilled from French wine. It has a peculiar flavor, and a light sherry color derived from the cask in which it has been kept." *Br.*

Eau de Vie, Cognac, *Fr.;* Branntwein, Franz Branntwein, *G.;* Acquavite, *It.;* Agua ardiente, *Sp.*

All liquids which have undergone the alcoholic fermentation yield an ardent spirit by distillation. (See *Alcohol*, page 140.) When the alcoholic liquid is wine, the product of the distillation is brandy. This ardent spirit is subject to variation, according to the character of the wine from which it is distilled. The best brandy is obtained from French wines, and the kinds called Cognac and Armagnac are most esteemed. Cognac is probably the most profitable wine-producing region in the world, and has given its name to the most widely known brandy. Very large quantities of brandy are now made in California, but the taste is peculiar and easily distinguished from that of Cognac. Our Pharmacopœia formerly recognized French brandy exclusively; but in the present edition all spirits are admitted under that name, when obtained from the juice of grapes, and sufficiently strong and pure to meet the requisitions above given.

Properties. "Brandy has a pale amber color, a distinctive taste and odor. and a sp. gr. not above 0·941, nor below 0·925, corresponding approximately with an alcoholic strength of 39 to 47 per cent. by weight, or 46 to 55 per cent. by volume. If 100 C.c. of Brandy be very slowly evaporated in a weighed capsule, on a water-bath, the last portions volatilized should have an agreeable odor, free from harshness (abs. of fusel oil from grain or potato spirit). The residue, dried at 100° C. (212° F.), should weigh not more than 0·250 Gm., equivalent to 0·25 per cent. (abs. of an undue amount of solids). This residue should have no sweet or distinctly spicy taste (abs. of added sugar, glycerin, or spices). It should nearly all dissolve in 10 C.c. of cold water, forming a solution which is colored light green by a dilute solution of ferric chloride (traces of oak tannin from casks). 100 C.c. of Brandy should be rendered distinctly alkaline to litmus by 3 C.c. of the volumetric solution of soda (abs. of an undue amount of free acid)." *U. S.* Besides alcohol, water, and volatile oil, it contains coloring matter, tannin, œnanthic ether described under *wine*, a little acetic ether, and a little aldehyd. Brandy is classed according to its color, as pale and high-colored. *Pale brandy* has a yellow color, derived from the cask in which it is kept. *High-colored* brandy has a deep red color given to it, before importation, by burnt sugar (caramel), which is said to impart a more agreeable flavor. *Factitious brandy* is sometimes made from alcohol, deprived of fusel oil, and reduced to the proper proof by water, by adding to it acetic ether in the proportion of from half an ounce to an ounce to the gallon. The proper color is then given by burnt sugar. The spurious liquid may be known by its leaving on evaporation a residue, containing sugar and no tannin; the absence of the latter being shown by its not striking a black color with ferric salts. It may also be detected by the absence of aldehyd. (*Magnes Lahens.*) For modes of detecting impurities in brandy and other ardent spirits, see *A. J. P.*, 1862, p. 118; also, *Journ. de Pharm.*, Août, 1875, p. 127.

Medical Properties. Brandy is esteemed cordial and stomachic, and is frequently given, in the form of toddy or milk-punch, in the sinking stages of low fevers. In the late Lond. Pharmacopœia there was an officinal preparation of it, called *Mistura Spiritus Vini Gallici*, consisting of brandy, cinnamon water, the yolks of eggs, sugar, and oil of cinnamon. This, though a convenient form for the administration of brandy, was omitted in the Br. Pharmacopœia. It has, however, been admitted into the new edition, and is now again officinal; but the oil has been omitted. If prepared with the U. S. cinnamon water, it would certainly be sufficiently flavored without the addition of the oil. Brandy is in general most conveniently exhibited, in low fevers, mixed with milk and flavored with sugar, the proportions being varied to meet the demands of the case.

Off. Prep. Mistura Spiritus Vini Gallici, *Br.*

STAPHISAGRIA. *U. S.* *Staphisagria.* [*Stavesacre.*]

(STĂPH-Ị-SĀ′GRỊ-Ạ.)

"The seed of Delphinium Staphisagria. Linné. (*Nat. Ord.* Ranunculaceæ.)" *U. S.*

Delphinium Staphisagria, L., or stavesacre, is a handsome annual or biennial plant, one or two feet high, with a simple, erect, downy stem, and palmate, five or seven-lobed leaves, supported on hairy footstalks. The flowers are bluish or purple, in terminal racemes, with pedicels twice as long as the flower, and bracteoles inserted at the base of the pedicel. The nectary is four-leaved and shorter than the petals, which are five in number, the uppermost projected backward so as to form a spur, which encloses two spurs of the upper leaflets of the nectary. The seeds are in straight oblong capsules. The plant is a native of the south of Europe.

Properties. The seeds of stavesacre are officinally described as "from one-eighth to one-sixth of an inch (3 to 4 mm.) broad, flattish-tetrahedral, one side convex, brown or brownish gray, with reticulate ridges, containing a whitish, oily albumen and a straight embryo; nearly inodorous; taste bitter and acrid." *U. S.* Their virtues are extracted by water and alcohol. Analyzed by MM. Lassaigne and Feneulle, they yielded a brown and a yellow bitter principle, a volatile oil, a fixed oil, albumen, a nitrogenous substance, a mucilaginous saccharine matter, mineral salts, and a peculiar alkaloid called *delphinine** or *delphinia*, which exists in the seeds combined with an excess of malic acid. It is white, pulverulent, inodorous, of a bitter acrid taste, fusible at 65·5° C. (150° F.) and becoming hard and brittle upon cooling, volatilizable at 148·8° C. (300° F.) (*Guy*), slightly soluble in cold water, very soluble in alcohol and ether, and capable of forming salts with the acids. It is obtained by boiling a decoction of the seeds with magnesia, collecting the precipitate, and treating it with alcohol, which dissolves the *delphinine*, and yields it upon evaporation. According to M. Couerbe, it is impure as thus obtained, consisting of three distinct principles; one of a resinous nature, separated from its solution in diluted sulphuric acid by the addition of nitric acid; another distinguished by its insolubility in ether, and named by M. Couerbe *staphisaine;* and the third soluble both in alcohol and in ether, and considered as pure delphinine. (*Journ. de Pharm.*, xix. 519.) Marquis, in Dragendorff's laboratory in 1877, isolated the following four alkaloids: *delphinine*, $C_{22}H_{35}NO_6$, in large crystals of the rhombic system; *staphisagrine*, $C_{22}H_{33}NO_5$, amorphous, very soluble in ether and in 200 parts of water; *delphinoidine*, formula not settled, amorphous, more abundant than the other two; and *delphisine* (formula doubtful), in crystalline tufts in small amount, sparingly soluble in alcohol, chloroform, or ether. The total amount of alkaloids is about 1 per cent. (*Pharmacographia*, 2d ed., p. 7.)

Medical Properties and Uses. The seeds were formerly used as an emetic and cathartic, but have been abandoned in consequence of their violence. A strong tincture has been employed as an embrocation in rheumatism. An ointment of them has been much used as a parasiticide against lice and the itch insect. It may be made by incorporating 3 parts of the coarsely-ground seeds with 5 of lard, keeping for 24 hours at a temperature of 212° F., and straining. B. Squire, however, says that the fixed oil obtained by expression represents all the virtues of the seeds, is non-irritant, and affords an elegant ointment very useful in scabies, prurigo senilis, etc. (*P. J. Tr.*, vii. 1042.) M. Bazin uses the extract internally in eczema in doses of a grain and a half (0·095 Gm.). (*Ann. de Thérap.*, 1851.) In some countries the seeds are used to intoxicate fish in the same manner as Cocculus Indicus.

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* *Delphinine* is highly poisonous, exerting its effects chiefly on the nervous system. Experiments made by Drs. Falck and Rörig on the lower animals show that, introduced into the rectum, the cellular tissue, or the veins, it produces death by asphyxia, preceded by symptoms of local irritation, convulsive movements, and extreme anæsthesia, without apparent disturbance of the cerebral functions until the moment before death. Introduced into the stomach, it caused salivation, vomiting, and diarrhœa, without other signs of absorption. (*Arch. Gén.*, 4e sér., xxx. 482.) Similar results were subsequently obtained by Dr. Van Praag, who found also that the nerves of motion were paralyzed as well as those of sensation. After death, congestion of the cerebral membranes, heart, great veins, and liver was observed. Dr. Turnbull, in his work *"On the Medical Properties of the Ranunculaceæ,"* states that pure delphinine may be given to the extent of three or four grains a day, in doses of half a grain each, without exciting vomiting, and without producing much intestinal irritation, though it sometimes purges. In most instances it proves diuretic, and gives rise to sensations of heat and tingling in various parts of the body. Externally, it acts like veratrine, but, according to Dr. Turnbull, produces more redness and burning, and less tingling than that substance. He has employed it in neuralgia, rheumatism, and paralysis. It may be applied by friction, in the form of ointment or alcoholic solution, in proportions varying from ten to thirty grains of the alkaloid to an ounce of the vehicle; and the friction should be continued till a pungent sensation is produced.

STILLINGIA. *U. S.* *Stillingia.* [*Queen's Root.*]

(STỊL-LĬN'ĢỊ-Ạ.)

"The root of Stillingia sylvatica. Linné. (*Nat. Ord.* Euphorbiaceæ.)" *U. S.*

Queen's Root, Silver Leaf, Queen's Delight; Stillingie, *Fr.*, *G.*

Gen. Ch. MALE. *Involucre* hemispherical, many-flowered, or wanting. *Calyx* tubular, eroded. *Stamens* two and three, exserted. FEMALE. *Calyx* one-flowered, inferior. *Style* trifid. *Capsule* three-grained. *Nuttall.*

From the fruit of *Stillingia sebifera*, the Chinese procure a *vegetable tallow* in large quantities, which is said to be almost pure stearin, and is much used in making candles. It exists between the shell of the seeds and the outer husk; the kernel, contained within the shell, yielding a liquid fixed oil. (*P. J. Tr.*, xii. 73.)

Stillingia sylvatica. Willd. *Sp. Plant.* iv. 588; *B. & T.* 241. This is an indigenous perennial plant, commonly called *Queen's delight*, with herbaceous stems, two or three feet high, and alternate, sessile, oblong or lanceolate-oblong, obtuse, serrulate leaves, tapering at the base, and accompanied with stipules. The male and female flowers are distinct upon the same plant. They are yellow, and arranged in the form of a spike, of which the upper part is occupied by the male, the lower by the female flowers. The male florets are scarcely longer than the bracteal scales. The plant grows in pine-barrens from Virginia to Florida, flowering in May and June. When wounded it emits a milky juice.

The root, which is the part used, is large, thick, and woody. It is officinally described as "about twelve inches (30 cm.) long, and nearly two inches (5 cm.) thick, sub-cylindrical, slightly branched, compact, wrinkled, tough, grayish brown, breaking with a fibrous fracture, showing a thick bark and porous wood, the inner bark and medullary rays with numerous yellowish brown resin-cells; odor peculiar, unpleasant; taste bitter, acrid, pungent." *U. S.* The odor is slight, peculiar, and somewhat oleaginous, but in the recent root is said to be strong and acrimonious. The taste is bitterish and pungent, leaving an impression of disagreeable acrimony in the mouth and fauces. It imparts its virtues to water and alcohol. Dr. H. R. Frost thinks that the active principle is somewhat volatile, and states that the root loses much of its activity when long kept. Mr. M. Saunders has obtained from the root a volatile oil, which he found to possess the odor, taste, and peculiar acrimony of the root in a high degree. He procured six and a quarter ounces from five pounds of the dried root. It had a thick consistence, and required the addition of alcohol to render it fit for manipulation. The substance sold in the shops of Cincinnati by this name, he believes to be factitious. (*A. J. P.*, 1869, p. 149.)

Medical Properties and Uses. In large doses, stillingia is emetic and cathartic, in smaller doses alterative, with some influence over the secretions. It has been long popularly used in South Carolina, but was first introduced to the notice of the profession by Dr. Thomas Young Simons (*Amer. Med. Recorder*, 1828, vol. xiii. p. 312), as a valuable alterative remedy in syphilitic affections, and others ordinarily requiring the use of mercury. From the reports in its favor there seems no reason to doubt the efficacy of this medicine in secondary syphilis, scrofula, cutaneous diseases, chronic hepatic affections, and other complaints ordinarily benefited by alterative medicines. It may be given in substance, decoction, or tincture; but the two latter forms are preferable. The dose of the powder is stated at from fifteen to thirty grains (1–1·95 Gm.). The decoction, made by slowly boiling an ounce of the bruised root in three pints of water to a pint, may be given in the quantity of one or two fluidounces (30–60 C.c.) three or four times a day, increased as the stomach will bear it. The dose of a tincture, made with two ounces of the root and a pint of diluted alcohol, is about a fluidrachm (3·75 C.c.). Stillingia is sometimes advantageously combined with sarsaparilla and other alteratives.[*]

Off. Prep. Extractum Stillingiæ Fluidum, *U. S.*

STRAMONII FOLIA. *U. S., Br.* *Stramonium Leaves.*

(STRẠ-MŌ'NỊ-Ī FŌ'LỊ-Ạ.)

"The leaves of Datura Stramonium. Linné. (*Nat. Ord.* Solanaceæ.)" *U. S.*
"The dried leaves of Datura Stramonium. Collected from plants in flower." *Br.*

Herba Stramonii; Thornapple Leaves; Feuilles de Stramoine, *Fr.;* Stechapfelblätter, *G.*

STRAMONII SEMEN. *U. S.* *Stramonium Seed.*

(STRẠ-MŌ'NỊ-Ī SĒ'MẸN.)

"The seed of Datura Stramonium. Linné. (*Nat. Ord.* Solanaceæ.)" *U. S.*
"The ripe seeds of Datura Stramonium." *Br.*

Stramonii Semina, *Br.;* **Semen Stramonii,** *P.G.;* **Thornapple; Stramoine, Pomme épineuse, Semences (Graines) de Stramoine,** *Fr.;* **Stechapfel, Stechapfelsamen,** *G.;* **Stramonio,** *It.;* **Estramonio,** *Sp.*

Gen. Ch. Corolla funnel-shaped, plaited. *Calyx* tubular, angular, deciduous. *Capsule* four-valved. *Willd.*

Datura Stramonium. Willd. *Sp. Plant.* i. 1008; Bigelow, *Am. Med. Bot.* i. 17; *B. & T.* 192. The *thornapple* is an annual plant, of rank and vigorous growth, usually about three feet high, but in a rich soil sometimes six feet or more. The root is large, whitish, and furnished with numerous fibres. The stem is erect, round, smooth, somewhat shining, simple below, dichotomous above, with numerous spreading branches. The leaves, which stand on short round footstalks in the forks of the stem, are five or six inches long, of an ovate-triangular form, irregularly sinuated and toothed at the edges, unequal at the base, dark green on the upper surface, and pale beneath. The flowers are large, axillary, solitary, and peduncled; having a tubular, pentangular, five-toothed calyx, and a funnel-shaped corolla with a long tube, and a waved plaited border, terminating in five acuminate teeth. The upper portion of the calyx falls with the deciduous parts of the flower, leaving its base, which becomes reflexed, and remains attached to the fruit. This is a large, fleshy, roundish-ovate, four-valved, four-celled capsule, thickly covered with sharp spines, and containing numerous seeds, attached to a longitudinal receptacle in the centre of each cell. It opens at the summit. There are two varieties of this species of Datura, one with a green stem and white flowers; the other with a dark reddish stem minutely dotted with green, and purplish flowers striped with deep purple on the inside. The latter, however, is considered by some botanists as a distinct species, being the *D. Tatula* of Linnæus. The properties of both are the same.[†]

It is doubtful to what country this plant originally belonged. Many European botanists refer it to North America, while we in return trace it to the old continent.

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[*] *Syrupus Stillingiæ Compositus. Compound Syrup of Stillingia.* This syrup, notwithstanding its reputation as a model of polypharmaceutical skill, is largely used in the West and South. Dr. John King makes it as follows. Take of Queen's Root (Stillingia) 2 ℔s. [avoirdupois]; Turkey-corn Root (Corydalis) 2 ℔s. [avoird.]; Blue-flag Root (Iris versicolor) 1 ℔. [avoird.]; Elder Flowers 1 ℔. [avoird.]; Pipsissewa Leaves (Chimaphila) 1 ℔. [avoird.]; Coriander ½ ℔. [avoird.]; Prickly Ash Berries (Xanthoxylum) ½ ℔. [avoird.]; Sugar, Refined, 24 ℔s. [avoird.]; Water q. s.; Alcohol, 76 per cent., q. s. Grind, and mix the vegetable drugs together, place them in a convenient vessel, cover them with alcohol of 76 per cent., and macerate for three days. Then transfer the whole to a percolator and gradually pour alcohol on top until 4 pints of tincture have been obtained, which retain and set aside. Then continue the percolation with water, and of this second percolate reserve so much as contains a sensible amount of alcohol, and distil or evaporate the latter from it. Continue the percolation by water, until the solution obtained is almost tasteless, and boil down this weaker infusion until, when added to the second solution, after the evaporation of its alcohol, it will make 24 pints. To these two solutions combined add the sugar, and dissolve it by heat, carefully removing any scum which arises as it begins to boil; and, if it exceeds 28 pints, evaporate to that quantity with constant stirring. Then remove from the fire, and, when nearly cold, add the 4 pints of reserved alcoholic tincture and make 4 gallons of syrup, each pint of which will be equal to 4 fluidounces of the ingredients. The 24 pounds of sugar, when added to the 24 pints of solution, will always make more than 28 pints. (*N. R.*, May, 1880.)

[†] M. Naudin maintains that they are distinct species, always retaining their distinctive characters, the one of green stems and pure white flowers, the other dark purple stems and violet-tinted flowers. The two species were crossed by M. Naudin, who obtained hybrids twice the size of their parents, but in other respects intermediate; and, when these hybrids were cultivated, they showed a constant tendency to revert to the original forms. (*A. J. P.*, 1865, p. 341.)

Nuttall considers it as having originated in South America or Asia; and it is probable that its native country is to be found in some portion of the East. It is said to grow wild abundantly in Southern Russia, from the borders of the Black Sea eastward to Siberia. Its seeds, being retentive of life, are taken in the earth put on shipboard for ballast from one country to another, not unfrequently springing up upon the passage, and thus propagating the plant in all regions which have any commercial connection. In the United States it is found everywhere in the vicinity of cultivation, frequenting dung-heaps, the road-sides and commons, and other places where a rank soil is created by the deposited refuse of towns and villages. Its flowers appear from May to July or August, according to the latitude. Where the plant grows abundantly, its vicinity may be detected by the rank odor which it diffuses to some distance around. All parts of it are medicinal. The leaves and seeds only are now officinal; the root having been omitted in the recent revision of the U. S. Pharmacopœia. The leaves may be gathered at any time from the appearance of the flowers till the autumnal frost. In this country the plant is generally known by the name of *Jamestown* (*vulgo* Jimson) *weed*, derived probably from its having been first observed in the neighborhood of that old settlement in Virginia. In Great Britain it is called *thornapple*. In India *Datura alba*, *D. ferox*, and *D. fastuosa* are used as intoxicants, and it is probable that all the species of the genus are possessed of similar poisonous properties.

1. The *fresh leaves* when bruised emit a fetid narcotic odor, which they lose upon drying. Their taste is bitter and nauseous. These properties, together with their medical virtues, are imparted to water and alcohol. Water distilled from them, though possessed of their odor in a slight degree, is destitute of their active properties. They contain, according to Promnitz, 0·58 per cent. of gum, 0·6 of extractive, 0·64 of green starch, 0·15 of albumen, 0·12 of resin, 0·23 of saline matters, 5·15 of lignin, and 91·25 of water. The leaves, if carefully dried, retain their bitter taste. They are officinally described as "about six inches (15 cm.) long, petiolate, smooth, ovate, pointed, unequal at the base, coarsely and sinuately toothed; after drying, thin, brittle and nearly inodorous; taste unpleasant, bitter and nauseous." *U. S.*

2. The *seeds* are small, kidney-shaped, pitted and wrinkled, flattened on the sides, of a dark brown almost black color, inodorous unless bruised, and of the bitter, nauseous taste of the leaves, with some degree of acrimony. The testa is dull brownish black, hard, and encloses a cylindrical, curved embryo, which is embedded in a whitish oily albumen. They are much more energetic in their action on the system than the leaves. MM. Hirtz and Hopp inferred, from their experiments, that one part of an extract prepared from them was equal in strength to five parts of an extract prepared in precisely the same manner from the leaves. (*Ann. de Thérap.*, 1862, p. 22.) They were analyzed by Brandes, who found, besides a peculiar alkaloid which he called *daturine*, a glutinous matter, albumen, gum, a butyraceous substance, green wax, resin insoluble in ether, fixed oil, bassorin, sugar, gummy extractive, orange-colored extractive, and various saline and earthy substances. Other chemists, however, failed to obtain the daturine of Brandes by his own process; and Berzelius states that it has been admitted, even by that chemist himself, to be nothing more than phosphate of magnesium. (*Traité de Chimie*, vi. 319.) But Geiger and Hesse succeeded in isolating an alkaloid, to which the same name was given, and which Trommsdorff has repeatedly procured by their process. Von Planta (*A. J. P.*, 23, p. 38) found that daturine was identical with atropine, and this result has since been confirmed; but Ladenburg (*Berichte Chem. Ges.*, 13, p. 909) finds that *Datura Stramonium* contains two alkaloids, which may be designated as *heavy* and *light daturine*. The more difficultly soluble heavy daturine fuses at 113·5° C. to 114° C. (237° F. to 237·2° F.), and must be considered as a mixture of *atropine* and *hyoscyamine*. It yields a gold salt fusing between 135° C. and 150° C. (275° F. and 302° F.), out of which, by crystallization repeated six times and by rejection each time of the mother-liquor, is obtained hyoscyamine gold-chloride fusing at 158° C. to 160° C. (316·4° F. to 320° F.). From the mother-liquors by evaporation is obtained nearly pure atropine gold-chloride fusing at

135° C. to 140° C. (275° F. to 284° F.). If the heavy daturine be repeatedly crystallized out of dilute alcohol, pure atropine can be isolated from it, fusing at 113·5° C. to 114·5° C. (237° F to 238° F.), and yielding a lustreless gold salt fusing at 135° C. to 139° C. (275° F. to 282·2° F.). The light daturine is the alkaloid which Ladenburg and Meyer in a previous study had shown to be identical with hyoscyamine. Mr. Morries obtained a poisonous empyreumatic oil by the destructive distillation of stramonium.

Stramonium, when taken either in small or in large doses, produces symptoms which are precisely similar to those caused by belladonna. Poisoning by it is indistinguishable from that produced by the deadly nightshade, and the closest studies have shown that the minute physiological actions of the two drugs are identical. The reader is therefore referred to the article upon belladonna.

Though long known as a poisonous and intoxicating herb, stramonium was first introduced into regular practice by Baron Störck, of Vienna, who found some advantage from its use in mania and epilepsy. Subsequent observation has not confirmed his estimate of the remedy; but the drug is still occasionally employed in mania. Other diseases in which it has been found beneficial are neuralgic and rheumatic affections, dysmenorrhœa, syphilitic pains, cancerous sores, and spasmodic asthma. In the last complaint it has acquired considerable reputation. It is employed only during the paroxysm, which it very often greatly alleviates or altogether subverts. The practice was introduced into Great Britain from the East Indies, where the natives are in the habit of smoking the dried root and lower part of the stem of *Datura ferox*, in the paroxysms of this distressing complaint. The same parts of *D. Stramonium* were substituted, and found equally effectual. To prepare the roots for use, they are quickly dried, cut into pieces, and beaten so as to loosen the texture. The dried leaves answer the same purpose. They are smoked by means of a common tobacco-pipe. These and other narcotic leaves have also been used in the shape of cigars. The smoke produces a sense of heat in the lungs, followed by copious expectoration, and attended frequently with temporary vertigo or drowsiness, and sometimes with nausea. The remedy should never be used in plethoric cases, unless preceded by ample depletion, and in no case where there is determination to the head. Dangerous and even fatal consequences have resulted from its incautious or improper use; and General Gent, who was instrumental in introducing the practice into England, is said at last to have fallen a victim to it.

Externally the medicine is used advantageously as an ointment or cataplasm in irritable ulcers, inflamed tumors, swelling of the mammæ, and painful hemorrhoidal affections. Dr. J. Y. Dortch has found it useful in tinea capitis. (*Thesis*, 1846.)

Of the parts of the plant employed, the seeds are the most powerful. They may be given in the dose of a grain (0·065 Gm.) twice a day; and an extract made by evaporating the decoction, in one-quarter or half the quantity. The dose of the powdered leaves is two or three grains (0·13–0·20 Gm.). The inspissated juice of the fresh leaves was formerly very commonly prescribed; but the alcoholic extract is now almost exclusively used, the dose being half a grain (0·03 Gm.). (See *Extractum Stramonii.*) A tincture and fluid extract are also officinal, to which the reader is referred. The dose should be gradually increased till the narcotic operation becomes evident, or relief from the symptoms of the disease is obtained. Fifteen or twenty grains of the powdered leaves (1–1·3 Gm.), and a proportionate amount of the other preparations, have often been given daily without unpleasant effects.

Prep. of the Leaves. Extractum Stramonii, *Br.*

Off. Prep. of the Seeds. Extractum Stramonii, *Br.;* Extractum Stramonii, *U. S.;* Extractum Stramonii Fluidum, *U. S.;* Tinctura Stramonii.

STRYCHNINA. *U. S.* *Strychnine.*

$C_{21}H_{22}N_2O_2$; 334. (STRY̆CH-NĪ'NA̤.) $C_{42}H_{22}N_2O_4$; 334.

"An alkaloid prepared from Nux Vomica or Ignatia, and also occurring in other plants of the *Nat. Ord.* Loganiaceæ." *U. S.*

Strychnia, *U. S.* 1870; Strychninum, *P.G.;* Strychnine, *Fr.;* Strychnin, *G.*

"Take of Nux Vomica *one pound* [avoirdupois]; Acetate of Lead *one hundred* *and eighty grains;* Solution of Ammonia, Rectified Spirit, Distilled Water, each, *a sufficiency.* Subject the Nux Vomica for two hours to steam in any convenient vessel; chop or slice it; dry it in a water-bath or hot air chamber, and immediately grind it in a coffee mill. Digest the powder at a gentle heat for twelve hours with two pints [Imperial measure] of the Spirit and one of the Water, strain through linen, express strongly, and repeat the process twice. Distil off the Spirit from the mixed fluid, evaporate the watery residue to about sixteen [fluid]ounces, and filter when cold. Add now the Acetate of Lead, previously dissolved in Distilled Water, so long as it occasions any precipitate; filter; wash the precipitate with ten ounces of cold Water, adding the washings to the filtrate; evaporate the clear fluid to eight [fluid]ounces, and when it has cooled add the Ammonia in slight excess, stirring thoroughly. Let the mixture stand at the ordinary temperature for twelve hours; collect the precipitate on a filter, wash it once with a few ounces of cold Distilled Water, dry it in a water-bath or hot air chamber, and boil it with successive portions of Rectified Spirit, till the fluid scarcely tastes bitter. Distil off most of the Spirit, evaporate the residue to the bulk of about half an ounce, and set it aside to cool. Cautiously pour off the yellowish mother-liquor (which contains the brucia of the seeds) from the white crust of strychnia which adheres to the vessel. Throw the crust on a paper filter, wash it with a mixture of two parts of Rectified Spirit and one of Water, till the washings cease to become red on the addition of nitric acid; finally dissolve it by boiling it with an ounce of Rectified Spirit, and set it aside to crystallize. More crystals may be obtained by evaporating the mother-liquor." *Br.*

The U. S. Pharmacopœia very properly omits a process for preparing this alkaloid, as it can only be made profitably by the manufacturing chemist on a large scale.[*]

In preparing strychnine, the first step is properly to comminute the nux vomica. This may be done by rasping the seeds, or, as directed in the British Pharmacopœia, by first softening them by steam, then slicing, drying, and grinding them. The next object is to extract the strychnine. For this purpose, in the U. S. process of 1870 water is employed acidulated with hydrochloric acid; in the British, rectified spirit diluted with half its bulk of water. In the latter, the native igasurate of strychnine is taken up; in the former, the hydrochlorate, which is a very soluble salt. In the U. S. process, after a concentration of the infusion, the salt of strychnine is decomposed by lime, which precipitates the strychnine along with the excess of lime employed and impurities. The strychnine is extracted from the precipitate by boiling alcohol, and may be obtained in crystals by the concentration of the solution. But in this state it is much colored and impure. To obviate these impurities in some degree, the British Pharmacopœia directs that the concentrated liquid should be treated with acetate of lead, which precipitates much of the contaminating matter, and then that the liquor, previously filtered, should be treated with ammonia, by which the strychnine is thrown down less impure than in the U. S. process of 1870. At this stage of the proceedings, the U. S. Pharmacopœia directed that the precipitate, which, besides strychnine, contains also brucine and various impurities, should be freed from the latter alkaloid by washing with cold diluted alcohol, in which brucine is much more soluble than strychnine. In the U. S. process of 1870 the impure strychnine was converted into a sulphate by the addition of sulphuric acid, and precipitated again by ammonia; being, while in the state of the sulphate, decolorized by means of animal charcoal. The Br. Pharmacopœia completes the process by washing the precipitate produced by ammonia with cold water, drying it, then exhausting it with alcohol, and concentrating the alcoholic solution. The strychnine now crystallizes, leaving most of the brucine in the mother-liquor. But, as some of the latter alkaloid still contaminates the product, the Pharmacopœia directs this to be washed with cold alcohol somewhat diluted, until the washings cease to give evidence of the presence of brucine by being reddened by nitric acid; thus accomplishing at the end of the process what was done in the U. S. formula at an earlier stage. To free the strychnine entirely from brucine requires repeated crystallizations, and a little of the latter principle is consequently almost always retained; but it is not injurious, as the physiological effects of the alkaloids are very similar. The bean of St. Ignatius yields strychnine more easily and more largely than nux vomica.*

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[*] *Strychnia*, U. S. 1870. "Take of Nux Vomica, rasped, *forty-eight troyounces;* Lime, in fine powder, *six troyounces;* Muriatic Acid, *three troyounces and a half;* Alcohol, Diluted Alcohol, Diluted Sulphuric Acid, Water of Ammonia, Purified Animal Charcoal, Water, each, *a sufficient quantity.* Macerate the Nux Vomica for twenty-four hours in sixteen pints of water, acidulated with one-third of the Muriatic Acid; then boil for two hours, and strain with expression through a strong muslin bag. Boil the residue twice successively in the same quantity of acidulated Water, each time straining as before. Mix the decoctions and evaporate to the consistence of thin syrup; then add the Lime previously mixed with a pint of Water, and boil for ten minutes, frequently stirring. Pour the whole into a double muslin bag, and, having thoroughly washed the precipitate, press, dry, and powder it. Treat the powder repeatedly with Diluted Alcohol, in order to remove the brucia, until the washings are but faintly reddened by nitric acid. Then boil it repeatedly with alcohol until deprived of its bitterness, mix the several tinctures, and distil off the Alcohol by means of a water-bath. Having washed the residue, mix it with a pint of Water, and, applying a gentle heat, drop in enough Diluted Sulphuric Acid to neutralize and dissolve the alkaloid. Then add Purified Animal Charcoal, and, having boiled the mixture for a few minutes, filter, evaporate, and set aside to crystallize. Dissolve the crystals in Water, and add sufficient Water of Ammonia to precipitate the Strychnia. Lastly, dry this on bibulous paper, and keep it in a well-stopped bottle." *U. S.* 1870.

If thought desirable, brucine may be in great measure separated from the strychnine of commerce, by dissolving the latter in very dilute nitric acid, filtering, and concentrating. Nitrate of brucine crystallizes in short, thick, dense prisms grouped together; nitrate of strychnine in radiated tufts of long, light, capillary needles. By gentle agitation with the liquid, the latter salt is suspended and may be poured off, leaving the former. The alkaloids may be obtained by dissolving the salts in water, and precipitating with ammonia.

Properties. As usually found in commerce, strychnine is a white or grayish white powder. When rapidly crystallized from its alcoholic solution, it has the form of a white, granular powder; when slowly crystallized, that of elongated octahedra, or rhombic prisms with pyramidal capping. It is officinally described as in "colorless, octahedral or prismatic crystals, or a white, crystalline powder, permanent in the air, odorless, but having an intensely bitter taste, which is still perceptible in highly dilute (1 in 700000) solution, and of an alkaline reaction. Soluble in 6700 parts of water, and in 110 parts of alcohol at 15° C. (59° F.); in 2500 parts of boiling water, and in 12 parts of boiling alcohol; also soluble in 6 parts of chloroform, but almost insoluble in ether or in absolute alcohol. When heated to about 312° C. (594° F.), Strychnine melts, but is previously decomposed; at a red heat it is wholly dissipated. On adding to a few drops of cold, concentrated sulphuric acid, one drop of a solution of Strychnine, or of any of its salts, and then a small crystal of bichromate of potassium, a deep blue color makes its appearance, which rapidly passes into violet, then cherry-red, and fades after some time. Strychnine should not be reddened at all, or at most but very faintly, by nitric acid (abs. of more than traces of brucine)." *U. S.* It melts like a resin, is decomposed at a comparatively low temperature, and entirely dissipated at a red heat. Dr. Guy obtained a crystalline sublimate, at a heat but a few degrees below that at which it begins to change color and undergo decomposition. Its melting point is variously given as 284° C. (543° F.) and 312° C. (594° F.). According to Dr. Waddington, when heated to decomposition, it emits a most suffocating odor, resembling the smell of asphaltum. (*P. J. Tr.*, March, 1868, p. 413.) According to the experiments of Messrs. Plummer and Kelly, strychnine is soluble, at the ordinary temperature, in 387 parts of alcohol (sp. gr. 0·835), 179 parts of absolute alcohol, and 682 parts of ether. (*A. J. P.*, Jan. 1859, p. 25.) The volatile oils dissolve it freely. Benzin dissolves 0·607 per cent. of it, and amylic alcohol 0·55 per cent. (Dragendorff, *Journ. de Pharm.*, 4e sér., iv. 473.) It has an alkaline reaction on test paper, and forms salts with the acids. Nitric acid does not redden it if perfectly pure, but almost always reddens it as found in commerce, in consequence of the presence of brucine. M. Eugene Marchand proposes the following test, by which a very minute proportion of strychnine may be detected. If a little of the alkaloid be rubbed with a few drops of concentrated sulphuric acid containing one-hundredth of nitric acid, it will be dissolved without change of color; but if the least quantity of peroxide of lead be added to the mixture, a magnificent blue color will be instantly developed, which will pass rapidly into violet, then gradually to red, and ultimately become yellow. (*Journ. de Pharm.*, 3e sér., iv. 200.) Professor Otto recommended as a test a minute quantity of solution of bichromate of potassium, which, added to the solution of strychnine in concentrated sulphuric acid, produces a splendid violet color. (*A. J. P.*, xix. 77.) A similar change of color is produced, according to Dr. E. W. Davy, by substituting a strong solution of ferricyanide of potassium (red prussiate of potassium) for that of bichromate of potassium. (*Ibid.*, xxv. 414.) It appears that any substance capable of yielding nascent oxygen readily will serve to develop the characteristic violet color, when applied after the addition of sulphuric acid. Landerer has found that solid iodic acid or iodate of potassium, heated gently with strychnine, gives rise to a beautiful violet color, gradually passing to red, which remains unchanged for many days. (*Ibid.*, March, 1861, p. 110.) According to Mr. Wm. Copney, the least efficacious agent is chlorate of potassium, a much better is lead dioxide, a still better is manganese dioxide, and the best of all is bichromate of potassium; and the general result of numerous experiments, recently made, is that the last-mentioned reagent is the most effective. The sulphuric acid must be of not less sp. gr. than 1·84. The play of colors, according to Mr. Copney, is first blue, then purple, then crimson, which is followed by red and green, the latter sometimes giving place to yellow. It is stated that the 1-500,000th part of a grain may be detected. (See *A. J. P.*, xxviii. 459.) On the other hand, some chemists have found difficulties with the bichromate of potassium test. Thus, Brieger (*Jahresb.*, 1850, p. 617) found that unless the substance was first moistened with sulphuric acid and the bichromate added to it subsequently, the reaction of strychnine was interfered with by quinine, morphine, and especially by sugar. Sonnenschein (*Fresenius' Zeitschrift*, 9, p. 495) found that ceroso-ceric oxide was much more sensitive as a reagent to use with sulphuric acid for strychnine than bichromate of potash. This fact we can confirm from experience. It gives a blue color lasting longer, which then becomes violet, and then a permanent cherry-red.*

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* M. J. F. Molyn proposes, previously to the extraction of strychnine, to subject nux vomica to fermentation, by which the saccharine and gummy matters of the seeds are decomposed, and lactic acid is formed, which decomposes the igasurates of strychnine and brucine, producing with these bases very soluble lactates. For the particulars of his process, see *A. J. P.* (xix. 99), and for other processes, see U. S. D., 14th ed., p. 1456.

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* To succeed in detecting the alkaloid when mixed, in small proportion, with organic matters, it is necessary first to disintegrate the organic matter, that the action of a solvent of the strychnine should not be impeded, and that the alkaloid should be completely separated from the foreign matter. The process of Messrs. Rogers & Girdwood, by which these objects are effected, is the following. Digest the substance, supposed to contain the strychnine, with a mixture of 1 part of hydrochloric acid and 10 of water, until it becomes apparently fluid. Filter, and evaporate the liquid to dryness by a water-bath. Treat the residue with alcohol as long as anything is dissolved, filter, and evaporate. Dissolve the residue in water, and filter. Add solution of ammonia in excess to the aqueous solution, and agitate in a bottle or long tube with half an ounce of chloroform. Upon repose the chloroform subsides, holding the alkaloid in solution. Draw it off by a pipette, and evaporate the chloroform over a water-bath. Moisten the dry residue with concentrated sulphuric acid, and expose the mixture for some hours to the temperature of a water-bath, by which means all the organic matter except the strychnine is decomposed. Treat the charred mass with water, filter, add excess of ammonia, and shake the mixture with a drachm of chloroform. Separate the chloroform as before; and, if the matter left after the evaporation of a small portion of it is charred by concentrated sulphuric acid, the whole of it must be treated in the same manner as the previous chloroform solution. The last chloroform solution obtained is then to be tested for strychnine. Take up a little of it in a capillary tube, and drop it on the smallest space of a warm porcelain capsule, so that each successive drop may be evaporated. When the capsule is quite cold, moisten the spot with concentrated sulphuric acid, and add a minute fragment of bichromate of potassium. Should the characteristic color not be developed, it is said that, if there be the minutest quantity of strychnine present, the color will become visible by adding sulphuric acid rendered slightly yellow by chromic acid. In conducting the process, care must be taken not to stir the spot moistened by sulphuric acid with a rod before the addition of the bichromate, and not to expose the spot to a very strong light, which interferes with the chemical reactions. (*Lond. Med. Times and Gaz.*, June, 1857, p. 620.) The process of dialysis may be advantageously applied to the separation of strychnine from the organic matters containing it, when brought to the liquid state. (See *Dialysis*, Part II.) Diluted acetic acid may be used for extracting the alkaloid with other soluble substances from the contents of the stomach.

It is stated by Mr. C. W. Bingley that, if much tartar emetic be contained in a solution with a little strychnine, a pale greenish color is produced instead of the violet; and, in like manner, if chloride of antimony be present, the sulphuric acid and bichromate of potassium test fails altogether. (*Chem. Gaz.*, June 16, 1856, p. 229.) Mr. Richard Hagen, having been induced, by the assertion of Von Sicherer that this test fails when the strychnine is mixed with tartar emetic or other tartrates, or even tartaric acid, to investigate the subject, ascertained that this statement, as

Mr. Wm. T. Wenzell states that, when very minute quantities of the alkaloid are being dealt with, much the best plan is to prepare a reagent by dissolving in 2000 grains of sulphuric acid one grain of the permanganate of potassium. The alkaloid, during the evaporation of the fluid on the porcelain, as just described, collects in the margins of the film, and the smallest possible dot of the reagent is to be placed so that its margin comes in contact with that of the film. In this way, Mr. Wenzell affirms, he was able to detect 1-900,000th part of strychnine. (*A. J. P.*, xlii. 385.) Some doubt was thrown upon the value of this test by experiments, which seemed to prove that the presence of morphine in excess, especially in connection with organic matter, so far modified or disguised the action of the test upon strychnine as to prevent the appearance of the characteristic color; but subsequent and carefully conducted experiments, by the late Dr. Robert P. Thomas, satisfactorily determined that the conclusions in relation to the effects of morphine were erroneous, and that whether alone or associated with organic matters, in small or in large quantity, it does not prevent the operation of this color-test if carefully applied. (*Am. Journ. of Med. Sci.*, Oct. 1861, and April, 1862, p. 340.) Strychnine consists of carbon, hydrogen, nitrogen, and oxygen, and has the formula $C_{21}H_{22}N_2O_2$ (or, as given by others, $C_{22}H_{22}N_2O_2$). The salts of strychnine are for the most part soluble and crystallizable. Their solution is decomposed by the alkalies and their carbonates, and by tannic, but not by gallic acid, and is not affected by ferric salts. They are precipitated by the solution of iodine in iodide of potassium, and the precipitate, though soluble in alcohol, is insoluble in the diluted acetic and hydrochloric acids of the U. S. Pharmacopœia. (Fairthorne, *A. J. P.*, xxvii. 212.)*

Strychnine is apt to contain impurities, of which the chief, besides brucine, are coloring matter, and lime or magnesia. The two latter impurities are left behind when the adulterated alkaloid is incinerated in the open air. Pure strychnine leaves

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a general rule, is erroneous; for the reaction takes place with strychnine or its hydrochlorate, though mixed with 20 or 30 parts of tartrate of antimony; yet when *nitrate of strychnine* is used with 20 parts of the antimonial tartrate, the mass almost instantly acquires a green color with the reagents mentioned. But even with nitrate of strychnine, the test succeeds if peroxide of lead is used instead of chromic acid as the oxidizing agent. (*Ibid.*, Oct. 15, 1857, p. 398.)

For a particular account of the results produced by the reaction of a large number of substances with strychnine, the reader is referred to a paper by Dr. T. G. Wormley, in the *Chemical News* for April 14th and 28th, 1860 (pp. 218 and 242). Among other trials made by him was that of the action of this alkaloid on frogs, proposed as a test by the late Dr. Marshall Hall. The poison was injected into the stomach of the animals through a pipette. A solution containing 1 per cent. of strychnine immediately produced rigidity and violent tetanic spasms, and death in 8 minutes. With 1 part of strychnine to 1000 of the menstruum, the spasmodic symptoms were induced in 3 or 4 minutes; with 1 in 10,000, in from 10 to 24 minutes; with 1 in 20,000, and 1 in 30,000, the symptoms were less unequivocal, though tetanic spasms were noticed in some of the animals.

Experiments by Mr. W. A. Guy on the effects of sulphuric and nitric acids on strychnine and many other alkaloids, published with tabulated results, show that in no one out of 66 proximate principles, chiefly alkaloids, was the same change of color produced as in strychnine by concentrated sulphuric acid, followed by a crystal of bichromate of potassium. (See *A. J. P.*, Nov. 1861, p. 517.) In the same number of the same journal (p. 527) is a paper by Mr. T. E. Jenkins, giving the result of experiments with sulphuric acid and bichromate of potassium on numerous alkaloids, all tending to prove the delicacy and certainty of this color-test of strychnine. Mr. A. Wynter Blyth distils the suspected alkaloid with a solution of permanganate of potassium to dryness, condensing the vapor in a cold flask, and applying Nessler's test for ammonia to the liquid thus obtained. He finds that all the poisonous alkaloids differ, but are individually constant in the amount of ammonia yielded, and that the test is always competent to decide to which class the alkaloid belongs, and often what alkaloid it is. Strychnine yields half its nitrogen, or 5·09 per cent. of ammonia. For further particulars consult *Med. Times and Gaz.*, 1875, i. 387.

* When an aqueous solution of sulphate of strychnine and nitrite of potassium is boiled, an effervescence takes place, owing to the escape of nitrogen, and the solution becomes yellow. If ammonia is now added, a precipitate takes place, which has been found to consist of two alkaloids, resulting from the oxidation of the strychnine in different degrees. One of these the discoverer, P. Schutzenberger, proposes to name *oxystrychnine*, and the other *dioxystrychnine.* (See *A. J. P.*, March, 1859, p. 133.)

Methyl-strychnine. Methyl-brucine. These alkaloids are formed by replacing one of the atoms of hydrogen in strychnine by methyl (CH_3), which is effected by acting on the alkaloids by iodide of methyl. A singular and, if verified, very important statement in relation to these modifications of strychnine and brucine, made by Stahlschmidt (*Ann. der Phys. und Chem.*), is that they are not poisonous. He gave to a rabbit five grains of methyl-strychnine, without any bad symptoms, though the same animal was afterwards killed in five minutes by one-twentieth of a grain of strychnine placed upon its tongue. The important practical inference is that iodide of methyl ought to be an antidote to strychnine. (See *A. J. P.*, May, 1860, p. 220.)

no ashes under these circumstances. Brucine is detected by the red color which it yields with nitric acid. Neither this nor sulphuric acid colors strychnine; a test which serves to distinguish it from several other alkaloids.

Medical Properties and Uses. The effects of strychnine upon the system are identical in character with those of nux vomica, and it is employed for the same purposes as a medicine. In whatever way strychnine is introduced into the system, it acts, if in sufficient quantity, as a violent poison. The evidences of its slightest action are muscular twitchings and stiffness. After poisonous doses the symptoms usually come on not only speedily but very suddenly. They are convulsions, both tonic and clonic, affecting all the voluntary muscles, plainly reflex in character, and interrupted by periods of usually complete relaxation. Consciousness is undisturbed. The body is during the convulsion rigid, with the face drawn into the *risus sardonicus*, the limbs stiffly extended, and the whole person bowed backward in marked opisthotonus. The convulsions are accompanied with pain, and may be so severe as to cause death by locking the chest in a general respiratory spasm. This death during a convulsion may occur very early, and is accompanied by evident signs of asphyxia; if in any convulsion consciousness be affected, it is by approaching asphyxia, and is an evidence of imminent peril. In many instances the patient survives some hours, and finally dies of exhaustion. The chief physiological action of strychnine is stimulation of the motor and vaso-motor centres of the cord; the peripheral nerves are only affected by very large toxic doses, which exert both a direct and an indirect sedative influence upon them. The diagnosis of strychnine poisoning from tetanus, hysteria, and other convulsive diseases is to be determined by the jaw being affected after the limbs and trunk, the relaxation between the convulsions, the universality of the latter, the retention of consciousness, the rapidity of the attack, and the history of the case.

There is no reliable chemical antidote to strychnine, but tannic acid or soluble iodine, or a soluble iodide, may be given as forming with the alkaloid compounds of difficult solubility; it must not, however, be forgotten that both the tannate and the iodide of strychnine are capable of causing death; hence it is essential always to produce vomiting in strychnine poisoning when the patient is seen early. The further treatment consists in the maintenance of absolute quiet, and the use of such spinal sedatives as chloroform, nitrite of amyl, opium, chloral, bromide of potassium: tobacco, aconite, and various similar sedative substances have been used, but no drug which acts powerfully as a cardiac depressant should be employed. Calabar bean is also less efficacious than the remedies first mentioned, as its influence is not upon the spinal centres, but upon the peripheral nerves. Chloroform and nitrite of amyl act very promptly, but their impression is a fugacious one, and their use should be restricted to the arresting of convulsions so severe as to threaten life. Opium may be given in moderate doses, and very large doses of cannabis Indica have been employed in some cases with excellent result, but, as it exists in our markets, this drug is too uncertain for any reliance to be placed upon it. Bromide of potassium and chloral are exceedingly valuable remedies. In any case of severe strychnine poisoning it would be advisable to begin the general medicinal treatment with the administration of half an ounce (℥ss) of bromide of potassium. After this chloral may be given in 20 to 30 gr. doses, at intervals of greater or less length, according to the severity of the symptoms; inhalations of chloroform, ether, and nitrite of amyl being practised *pro re nata*, and the bromide also being repeated in much smaller dose if it seems advisable.

Ether acts too slowly to be comparable in its effects to chloroform in this toxæmia, but it must not be forgotten that chloroform is alleged to have produced sudden cardiac death in strychnine poisoning, and in the latter stages, when exhaustion has set in, ether certainly is the safer remedy. Under the latter circumstances alcohol should be freely administered, as tending not only to quiet spasm, but also to sustain the heart's action.

On account of its stimulant effect upon the gastric mucous membrane, and of its tendency to excite the vaso-motor and motor centres of the spinal cord, and thereby increase the activity of the circulation and the general systemic tone, strychnine is a very valuable tonic, which may be given along with iron and simple bitters in cases of anæmia, especially in cases of general relaxation. Its striking convulsive influence early led to its use in palsies, and it is habitually employed to-day in hemiplegia and various paralytic affections. As, however, the loss of muscular power in these cases is very rarely due in chief part, if at all, to depression of the spinal centres, it is not common to see any very marked result from the use of the drug. In infantile palsies and other affections in which the nutrition of the muscles is largely at fault, the injection of strychnine into the affected muscles is sometimes conducive of great good.

Strychnine, owing to its tendency to increase the activity of non-striated as well as of striated muscular fibres, is a valuable addition to laxative medicines, where there is reason to suspect relaxation of the muscular coat of the bowel. By the oculists, strychnine is much used in atrophy of the optic nerve, and the late Dr. Isaac Hays (*Am. Journ. Med. Sci.*, July, 1863, p. 266) ascribed to it a myotic power similar to that of Calabar bean.

The ordinary dose of strychnine is $\frac{1}{20}$ of a grain (0·003 Gm.) by the mouth, or $\frac{1}{30}$ of a grain (0·0021 Gm.) used hypodermically.* There are a few persons who will not well bear these amounts, and by accustoming the patient gradually to the drug, very much larger doses may be used with safety.

Off. Prep. Liquor Strychniæ, *Br.;* Ferri et Strychninæ Citras; Syrupus Ferri, Quininæ et Strychninæ Phosphatum, *U. S.*

STRYCHNINÆ SULPHAS. *U. S.* *Sulphate of Strychnine.*

(STRY̆ЄH-NĪ'NÆ SŪL'PHĂS.)

$(C_{21}H_{22}N_2O_2)_2H_2SO_4.7H_2O$; 892. $C_{42}H_{23}N_2O_4, HO, SO_3.7HO$; 446.

"Sulphate of Strychnine should be kept in well-stopped vials." *U. S.*

Strychniæ Sulphas, *Pharm.* 1870; Strychninum Sulfuricum; Sulfate de Strychnine, *Fr.;* Schwefelsaures Strychnin, *G.*

A process for this salt is no longer officinal. That of the U. S. P. 1870 will be found in the foot-note.† Two forms of sulphate of strychnine are known, the acid sulphate, or commercial sulphate, and the officinal or neutral sulphate. Commercial strychnine sulphate, $C_{21}H_{22}N_2O_2.H_2SO_4 + 2H_2O$, crystallizes in needles. The water is expelled at 150° C. (302° F.). To prepare the neutral sulphate $(C_{21}H_{22}N_2O_2)_2.H_2SO_4$, a solution of the acid sulphate is divided into two equal portions, one-half is precipitated by ammonia, and the precipitate is added to the other part of the solution and the mixture boiled. On cooling, the liquid deposits the neutral salt in transparent prisms, containing 5 mols. H_2O. The crystals become anhydrous at 200° C. (392° F.). By the spontaneous evaporation of an aqueous solution of the salt, transparent pyramids belonging to the quadratic system are obtained. According to Rammelsberg, these crystals contain 6 mols. H_2O. (*Ber. d. Deutsch. Chem. Ges.*, 1881, p. 1231; *N. R.*, Jan. 1882.)

This salt is in "colorless or white, shining, prismatic crystals, efflorescent in dry air, odorless, but having an intensely bitter taste, which is still perceptible in highly dilute (1 in 700,000) solution, and of a neutral reaction. Soluble in 10 parts of water, and in 60 parts of alcohol at 15° C. (59° F.); in 2 parts of boiling water, and in 2 parts of boiling alcohol; also soluble in 26 parts of glycerin, but insoluble in ether. When heated to about 135° C. (275° F.), the salt melts, and loses 14·1 per cent. of its weight (water of crystallization); at a red heat it is completely dissipated. On adding solution of potassa to the aqueous solution, a white precipitate is thrown down, which is insoluble in an excess of potassa, and which answers to the reaction of strychnine. (See *Strychnina.*) The aqueous solution of the salt yields, with test-solution of chloride of barium, a white precipitate insoluble in hydrochloric acid." *U. S.* The chief advantage of this preparation over strychnine is its much greater solubility in water, by which it is better adapted to external use, as for application to blistered surfaces, or for hypodermic injection, or as an ingredient in collyria. These advantages may be easily gained, however, by adding a few drops of an acid, the acetic for example, to strychnine, so that the value of this as a distinct officinal preparation is diminished. Owing to the presence of sulphuric acid and water of crystallization in this salt, it contains but about 75 per cent. of strychnine, and the dose would be therefore one-fourth greater than that of the alkaloid. The maximum commencing dose of the sulphate is one-sixteenth of a grain (0·004 Gm.).*

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* Strychnine should never be prescribed in liquid form in combination with bromides, iodides, or chlorides, for fear of forming the insoluble hydrobromate, hydriodate, or hydrochlorate of strychnine. Several cases of poisoning have occurred through neglect of this precaution. Dr. A. B. Lyons (*A. J. P.*, Oct. 1877) records a case of poisoning through the patient receiving in the last dose the greater portion of the hydrobromate of strychnine, which had crystallized out.

† *Strychniæ Sulphas.* "Take of Strychnia *a troyounce;* Diluted Sulphuric Acid *nine fluid-drachms*, or *a sufficient quantity;* Distilled Water *a pint.* Mix the Strychnia with the Distilled Water, heat the mixture gently, and gradually add Diluted Sulphuric Acid until the alkaloid is neutralized and dissolved. Filter the solution, and evaporate with a moderate heat, so that crystals may form on cooling. Lastly, having drained the crystals, dry them rapidly on bibulous paper, and keep them in a well-stopped bottle." *U. S.* 1870.

STYRAX. *U. S.* *Storax.*

(STȲ′RĂX.)

"A balsam prepared from the inner bark of Liquidambar orientalis. Miller. (*Nat. Ord.* Hamamelaceæ, Balsamifluæ.)" *U. S.* "A balsam, obtained from the bark of Liquidambar orientale. Purified by means of rectified spirit and straining." *Br.*

Styrax Præparatus, *Br.;* Prepared Storax; Styrax Liquidus, *P.G.;* Balsamum Storacis; Liquid Storax; Storax, Styrax liquide, *Fr.;* Flüssiger Storax, *G.;* Storace, *It.;* Estoraque, *Sp.*

Gen. Ch. MALE. *Amentum* conical, surrounded by a four-leaved involucre; *corolla* none; *filaments* numerous. FEMALE. *Amentum* globose, with a four-leaved involucre; *calyx* one-leafed, urceolate, two-flowered; *styles* two; *capsules* two, surrounded at the base by the calyx, one-celled, many-seeded.

Liquidambar orientale. Miller, *Dict.* No. 2; *B. & T.* 107. The *oriental sweet-gum* is a tree from twenty to forty feet high. The palmate leaves have each of their divisions obscurely three-lobed, and are serrate, perfectly smooth, bright green and shining on the upper, and pale on the under surface. The tree is a native of Asia Minor, in the southwestern parts of which it forms large forests. It yields the variety of the drug called *liquid storax.*

Accounts somewhat differ as to the mode of collecting the balsam. They agree, however, in the point that, the outer bark having been removed, the inner bark is scraped off and submitted to pressure. According to Mr. Maltass, the bark is first pressed cold in horse-hair bags, after which hot water is thrown over them, and they are again pressed. Lieutenant Campbell states that the inner bark is first boiled with water, and, a portion of the balsam which rises having been skimmed off, is then pressed so as to extract the remainder. The residuary bark, after expression, is dried in the sun, and employed in various parts of Turkey for fumigation. It is the drug known in commerce as *Storax bark* or *Cortex Thymiamatis.* (Hanbury, *P. J. Tr.*, xvi. 463.) The balsam is sent in casks to Constantinople, Smyrna, and other ports of the Levant.

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* *Arsenite of Strychnine* having been proposed as a remedy by Prof. Grimelli, of Modena, M. Chiappero, of Turin, undertook to prepare the salt. For this purpose he dissolved arsenious acid in water acidulated with hydrochloric acid, and neutralized the arsenious acid with strychnine. But, according to M. T. Ceresoli, of Paris, the result was a mixture of arsenite and hydrochlorate of strychnine. The latter chemist prepares a pure arsenite of strychnine in the following manner. He takes 3·12 grammes of caustic potassa, 3·30 of arsenious acid, and 40·00 of distilled water. Having dissolved the potassa in the water, boiling hot, he adds the arsenious acid, which is completely dissolved. He then dilutes 2·65 grammes of monohydrated sulphuric acid with 20 grammes of distilled water, and, having heated the mixture to ebullition, adds 12 grammes of pure crystallized strychnine, which is entirely dissolved. The two solutions being kept at about the temperature of 100° F., he pours the arsenical solution into that of strychnine. A grumous mass is produced, much of which, however, is dissolved by heat. The liquid being filtered boiling-hot from the undissolved mass, which consists almost exclusively of sulphate of potassium, the filtered liquid is evaporated nearly to dryness, and the residue dissolved in absolute alcohol, by which the sulphate of potassium is all left behind. The undissolved mass, after the first filtration, is repeatedly washed with alcohol; and the alcoholic solutions are mixed, concentrated, and set aside to crystallize. At the end of two days the arsenite separates in the form of cubic crystals.

Arsenite of strychnine is in white cubic crystals, containing water, which they lose in contact with the air, becoming almost efflorescent. They are completely decomposed by heat with an empyreumatic smell, and leave nothing but a black and porous charcoal. Toward the end of the vaporization, dense white vapors rise with the alliaceous smell of arsenic. The taste is bitter and metallic. Arsenite of strychnine is soluble in 35 parts of cold, and 10 of boiling water; is soluble also in alcohol, and less so in ether. Its formula is $(C_{21}H_{22}N_2O_2)_2As_2O_3$. Though scarcely yet employed, at least to any considerable extent, as a medicine, it would seem, from its constituents, to be likely to fulfil important indications, and has the advantage of a uniform composition. Consisting of two ingredients, each of which is perhaps scarcely inferior, as a remedy in intermittent fever, to any other except cinchona and its derivatives, it probably possesses strong antiperiodic powers, and might very properly be the subject of trial in any intermittent disease which proves rebellious to quinine; the prescriber, however, being always on his guard against its poisonous action. Its commencing dose should not be larger that the smallest dose of strychnine. (*Journ. de Pharm.*, 4e sér., i. 343.)

Several kind of storax have been described. The purest was the *storax in grains*, which was in whitish, yellowish white, or reddish yellow tears, about the size of a pea, opaque, soft, adhesive, and capable of uniting so as to form a mass. Another variety, formerly called *styrax calamita*, from the circumstance, it is supposed, that it was brought wrapped in the leaves of a kind of reed, consisted of dry and brittle masses, formed of yellowish agglutinated tears, in the interstices of which was a brown or reddish matter. The French call it *storax amygdaloïde.* This and the preceding variety had a pleasant odor like that of vanilla. Neither of them, however, is now found in the markets. It is probable that one or both of these varieties may have been the product of *Styrax officinale.*

A third variety, which is sometimes sold as the *styrax calamita*, is in brown or reddish brown masses of various shapes, light, friable, yet possessing a certain degree of tenacity, and softening under the teeth. Upon exposure, it becomes covered upon the surface with a white efflorescence of styracin. It evidently consists of saw-dust, united with a portion of the balsam. As found in our shops, it is usually in the state of a coarse, soft, dark-colored powder, mingled with occasional light friable lumps of various magnitude, and containing very little of the balsam. When good, it should yield, upon pressure between hot plates, a brown resinous fluid having the odor of storax. Mr. Hanbury states that some of this variety is prepared at Trieste, Venice, and Marseilles, by mixing the residue of the liquidambar bark remaining after expression, and reduced to coarse powder, with genuine liquid storax. (*P. J. Tr.*, April, 1863, p. 438.)*

A fourth variety, which, under the name of *liquid storax*, is the one commonly used, is a semi-fluid, adhesive substance, brown or almost black upon the surface exposed to the air, but of a slightly greenish gray color within, and of an odor somewhat like that of Peruvian balsam, though less agreeable. It is kept in jars.

The storax used by pharmacists should correspond to the following officinal directions and tests. "Semi-liquid, gray, sticky, opaque; depositing, on standing, a heavier, dark brown stratum, transparent in thin layers, of an agreeable odor and balsamic taste. It is completely soluble, with the exception of accidental impurities, in an equal weight of warm alcohol. This solution (which has an acid reaction), almost completely soluble in ether and in disulphide of carbon, but insoluble in after being cooled and filtered, should leave, on evaporation, not less than 70 per cent. of the original weight of the balsam, in form of a brown, semi-liquid residue, benzin. When heated on a water-bath, Storax becomes more liquid, and if then agitated with warm benzin, the supernatant liquid, on being decanted and allowed to cool, will be colorless and will deposit white crystals (cinnamic acid, and cinnamic ethers)." *U. S.*

As found in the shops, storax is usually so much adulterated as to require purification before it can be used; and in both Pharmacopœias processes were formerly given. Whenever not originally pure enough for use, it should be dissolved in alcohol, the solution strained, and the alcohol distilled off to a certain extent, and then completely evaporated at a gentle heat.

Among the substances used in the adulteration of storax is turpentine. To detect it Mr. Hager employed the following method. He liquefied the resin, in a tube, by means of the water-bath, added half its volume of absolute alcohol, and favored the solution by agitation; then treated with several volumes of benzin. This operation was twice repeated. The liquors obtained were then evaporated, in a tared vessel; and there was obtained, for pure storax, a residue (45 to 55 per cent.) colorless, with a light blue opalescence; for that mixed with turpentine, a residue more considerable, yellowish, and having the terebinthinate odor. (*Journ. de Pharm.*, Fév. 1876, p. 161.)

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* The *Liquidambar Styraciflua*, or Sweet Gum, of our Southern States was at one time thought to be the source of storax. Its geographical range reaches into Mexico, and it yields a styrax-like product in an abundance proportionate to the heat of the climate. A specimen from Guatemala is described by Flückiger and Hanbury as a yellow, opaque resin, of honey-like consistence, becoming transparent, amber-colored, and brittle by exposure to the air, and having a rather terebinthinous balsamic odor and but little taste. Sometimes it occurs as a thick golden-brown fluid. It contains cinnamic acid and styracin. (*A. J. P.*, 1874, p. 161.) It is soluble in alcohol, and has been gathered to a considerable extent in the United States for the preparation of chewing gum. The resins of Liquid formosana and altingiana are known in Eastern commerce.

General Properties. Storax has a fragrant odor and aromatic taste. It melts with a moderate heat, and, when the temperature is raised, takes fire and burns with a white flame, leaving a light spongy carbonaceous residue. It imparts its odor to water, which it renders yellow and milky. Its active constituents are dissolved by alcohol and ether. Neumann obtained from 480 grains of storax 120 of watery extract; and from an equal quantity, 360 grains of alcoholic extract. Containing volatile oil and resin, and yielding benzoic or cinnamic acid by distillation, it is entitled to be ranked as a balsam.

The most abundant constituent of storax is probably the *storesin*, $C_{36}H_{55}(OH)_3$, discovered in 1877 by W. von Miller. This is present in the form of a cinnamic ether. Storesin is an amorphous substance, melting at 168° C. (334·4° F.), readily soluble in benzin. *Cinnamic ethers of phenyl-propyl*, *cinnamic ether of ethyl*, *cinnamic ether of benzyl*, and especially *cinnamate of cinnamyl*, $C_9H_7O_2.C_9H_9$, the so-called *styracin* of Bonastre, have also been observed. This last compound can be removed by ether, benzol, or alcohol after the separation from the resin of the cinnamic acid; it is insoluble in water, and volatile only in superheated steam. It crystallizes in tufts of long rectangular prisms, which melt at 38° C. (100·4 F.), but frequently does not solidify readily. By concentrated solution of potash, it is resolved into a cinnamate and cinnamic alcohol (*styrone*), $C_9H_{10}O$, which latter is not present in liquid storax. The yield of *cinnamic acid* varies from 6 to 12 per cent., or even, according to Löwe, as much as 23 per cent. of crystallized cinnamic acid can be obtained. The acid dissolves abundantly in ether, alcohol, or hot water, slightly in cold water; it is inodorous, but has an acrid taste. It fuses at 133° C. (276·4° F.), and boils at 290° C. (554° F.).

Another constituent of storax is a fragrant substance, perhaps *ethylvanillin*, occurring in but small quantity. Miller also shows that water removed from the drug a little free benzoic acid.

There is further found in liquid storax a hydrocarbon, C_8H_8, first prepared by Simon in 1839, which exists in the resin as a liquid, and also in a polymeric form as a solid. The former, called *styrol*, or *cinnamene*, has a sp. gr. of 0·924, and a boiling point of 146° C. (294·8° F.). It is a colorless, mobile liquid, possessing the odor and burning taste of liquid storax. When heated for a considerable time to 100° C. (212° F.), or for a shorter period to 200° C. (392° F.), it is converted without change of composition into the colorless, transparent solid *metastyrol*, which, unlike styrol, is not soluble in alcohol or ether.

Lastly, there has been found in liquid storax, by J. H. van t'Hoff (1876), about 0·4 per cent. of an essential oil, probably $C_{10}H_{16}O$. (*Pharmacographia*, 2d ed., pp. 274 and 275.)

Medical Properties and Uses. This balsam is a stimulating expectorant, and was formerly recommended in phthisis, chronic catarrh, asthma, and amenorrhœa; but it is very seldom used at present, except as a constituent of the compound tincture of benzoin. It has been highly praised as a remedy in diphtheria and pseudo-membranous croup. Liquid storax has been recommended in gonorrhœa and leucorrhœa as equally effectual with copaiba, and less disagreeable. From ten to twenty grains (0·65–1·3 Gm.) may be given twice a day, and the dose gradually increased. The same variety of storax, mixed with olive oil, has been found by Dr. H. Schultze, of Magdeburg, effectual in the cure of itch; the death of the insect resulting from a single thorough rubbing of the surface in twenty-four hours, and the eruption then subsiding spontaneously. (*Am. Journ. of Med. Sci.*, July, 1867, p. 258.)

Off. Prep. Tinctura Benzoini Composita.

SUCCI. *Br.* *Juices.*

(SŬC′CĪ—sŭk′sī.)

Though introduced to professional notice by Mr. Squire so long since as in the year 1835, and subsequently used by many practitioners, the Juices were recognized but once by the U. S. Pharmacopœia (1870). They consist of the expressed juices of fresh plants, preserved by the addition of one-third of their bulk of alcohol. Considering the great inequality in strength, and of course the uncertainty in operation, of the fresh juices themselves, varying according to the soil, climate, mode of cultivation, season, and the age of the plant, it may be questioned whether they merit the prominence which has been given them in the British Pharmacopœia.

SUCCUS CONII. *Br.* *Juice of Hemlock.*

(SŬC′CỤS CỌ-NĪ′Ī.)

Suc de grande Ciguë, *Fr.;* Schierlingsaft, *G.*

"Take of Fresh Leaves of Hemlock *seven pounds;* Rectified Spirit *a sufficiency.* Bruise the Hemlock in a stone mortar; press out the juice; and to every three measures of juice add one of the Spirit. Set aside for seven days and filter. Keep it in a cool place." *Br.*

The albumen is probably coagulated under the influence of the alcohol; and hence the propriety of directing filtration. The dose of this preparation is from thirty to sixty minims (1·9 to 3·75 C c.).

The experiments of Dr. John Harley (*A. J. P.*, 1867, p. 363) seemed to indicate that the juice is the best preparation of conium. He found that one fluidounce of it contained 0·42 grains of the alkaloid, and five and a half fluidrachms of it produced very severe and characteristic symptoms. Subsequent experience has shown, however, that the Succus Conii, at least as it reaches Philadelphia, is even in the best brands a very uncertain preparation, distinctly inferior in every way to the U. S. fluid extract made from the green fruit. Half a fluidrachm (1·9 C.c.), may be given at a dose, and rapidly increased until some effects are produced.

SUCCUS HYOSCYAMI. *Br.* *Juice of Hyoscyamus.*

(SŬC′CỤS HȲ-ỌS-CȲ′Ạ-MĪ.)

"Take of Fresh Leaves and Young Branches of Hyoscyamus *seven pounds;* Rectified Spirit *a sufficiency.* Bruise the Hyoscyamus in a stone mortar; press out the juice; and to every three measures of juice add one of Spirit. Set aside for seven days, and filter. Keep it in a cool place." *Br.*

The dose of this new officinal of the British Pharmacopœia is a half to one fluidrachm (1·9 to 3·75 C.c.).

SUCCUS SCOPARII. *Br.* *Juice of Broom.*

(SŬC′CỤS SCỌ-PĀ′RỊ-Ī.)

Suc de Génêt à Balais, *Fr.;* Besenginstersaft, *G.*

"Take of Fresh Broom Tops *seven pounds;* Rectified Spirit *a sufficiency.* Bruise the Broom Tops in a stone mortar; press out the juice; and to every three measures of juice add one of the Spirit. Set aside for seven days, and filter. Keep it in a cool place." *Br.*

The dose of this preparation as a diuretic is from one to two fluidrachms (3·75–7·5 C.c.). In large doses it would be apt to disturb the stomach and bowels. It is more appropriately used as an adjuvant to other diuretics than alone.

SUCCUS TARAXACI. *Br.* *Juice of Dandelion.*

(SŬC′CỤS TẠ-RĂX′Ạ-CĪ—tạ-răk′sạ-sī.)

Suc de Pissenlit, *Fr.;* Löwenzahnwurzelsaft, *G.*

"Take of Fresh Dandelion Root *seven pounds;* Rectified Spirit *a sufficiency.* Bruise the Dandelion Root in a stone mortar; press out the juice; and to every three measures of juice add one of the Spirit. Set aside for seven days and filter. Keep it in a cool place." *Br.*

The dose of this juice is from two fluidrachms to half a fluidounce (7·5–15 C.c.).*

SULPHURIS IODIDUM. *U. S., Br.* *Iodide of Sulphur.*

(SŬL′PHU̇-RĬS Ī-ŎD′Ị-D̈ŬM.)

Sulfur Iodatum, *P.G.;* Ioduretum Sulfuris, *F.P.;* Iodure de Soufre, *Fr.;* Jodschwefel, *G.*

"Washed Sulphur, *one part* [or sixty grains]; Iodine, *four parts* [or two hundred and forty grains]. Rub them together until they are thoroughly mixed. Introduce the mixture into a flask, close the orifice loosely, and apply a gentle heat so as to darken the mass without melting it. When the color has become uniformly dark throughout, increase the heat so as to produce liquefaction, and incline the flask in different directions, in order to return into the liquid any portion of Iodine which may have been condensed on the inner surface of the flask. Then withdraw the heat, and, after the liquid has become solid, break the flask, reduce the fused mass to pieces, and keep them in a glass-stoppered bottle." *U. S.*

The British process is precisely the same as the above, which was derived from the French Codex. Though formerly officinal with the London and Dublin Colleges, it was omitted in the first British Pharmacopœia, to be resumed in the present. It simply effects a combination of the two elements by melting them together.

Properties. Iodide of sulphur is "a grayish black solid, generally in pieces having a radiated, crystalline appearance, the characteristic odor of iodine, a somewhat acrid taste, and a faintly acid reaction. It is insoluble in water, but very soluble in disulphide of carbon; also soluble in about 60 parts of glycerin. Alcohol and ether dissolve out all the iodine, leaving the sulphur. When exposed to the air, it gradually loses iodine. On being heated, it sublimes, the first part of the sublimate consisting of iodine, and the subsequent portion containing both iodine and sulphur. On continued heating it is volatilized, without leaving more than a trace of residue. If 100 parts of Iodide of Sulphur be thoroughly boiled with water, all the iodine will escape, and about 20 parts of sulphur will remain." *U. S.* This compound is chemically regarded as *iodine disulphide*, I_2S_2, or, as sometimes stated, *subiodide of sulphur.* Its solution in glycerin would probably prove useful, in some cases, as a substitute for the ointment of this iodide. It is rapidly decomposed, when in a state of powder, upon the addition of several of the volatile oils, violet vapors of iodine being evolved, and the smell of sulphur perceived. (*Dr. G. W. Patterson.*) This result renders it doubtful whether the so-called iodide of sulphur is really a distinct chemical compound formed according to the laws of chemical combination, or a mere physical mixture. Iodide of sulphur has been very usefully employed as an external remedy in various skin diseases, such as tinea capitis, lupus, lepra, etc., applied in the form of ointment. (See *Unguentum Sulphuris Iodidi.*) It has been used internally, associated with iodide of potassium and senna, in the form of a syrup, in scrofulous and cutaneous diseases. (*E. Levrat.*) This syrup contains iodized iodide of potassium, and free sulphur in consequence of the solvent action of iodide of potassium for iodine. In a case of glanders in the human subject, which terminated in recovery under the care of M. Bourdon, of Paris, the iodide of sulphur was used internally, and was thought to have exercised a favorable influence. (*Ann. de Thérap.*, 1858, p. 239.)

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* *Procter's Preserved Juice of Taraxacum.* Of the fresh roots collected in September or October, twenty pounds avoirdupois are to be sliced transversely, reduced to a pulpy mass by grinding or contusion, then thoroughly incorporated with four pints of alcohol of 0·835, and set aside in stoneware jars. After a week, or a longer time, the pulpy mass is to be subjected to strong pressure, and the liquor filtered and bottled for use. Even after six months the pulp thus treated preserves the sensible properties of the dandelion in a marked degree. Should the alcohol in the expressed liquor be objected to, it may be partially removed by a gentle evaporation by means of a water-bath until the bulk of the juice has been diminished one-sixth, and then adding eight ounces of sugar for every pint. (*A. J. P.*, xxv. 408.)

SULPHUR LOTUM. *U. S.* *Washed Sulphur.*

S; 32. (SŬL'PHŬR LŌ'TŬM.) **S; 16.**

Sulphur Depuratum, s. Flores Sulphuris Loti, *P.G.;* **Soufre lavé,** *Fr.;* **Gereinigte Schwefelblumen,** *G.*

"Sublimed Sulphur, *twelve parts* [or sixteen ounces av.]; Water of Ammonia, *one part* [or ten fluidrachms]; Water, *a sufficient quantity.* Add the Sulphur to *twelve parts* [or one pint] of Water previously mixed with the Water of Ammonia, and digest for three days, agitating occasionally. Then add *twelve parts* [or one pint] of Water, transfer the mixture to a muslin strainer, and wash the Sulphur with Water, until the liquid running from the strainer ceases to produce a precipitate in test-solution of chloride of barium. Then allow it to drain, press the residue strongly, dry it at a very gentle heat, and pass it through a No. 30 sieve." *U. S.*

Sublimed Sulphur is frequently contaminated with small quantities of sulphuric acid and other impurities, and the object of the ammonia in the above process is to neutralize the acid, the salt being subsequently washed out. (See *Sulphur Sublimatum.*)

Properties. "A fine, citron-yellow powder, odorless and almost tasteless, insoluble in water or alcohol, but completely soluble in a boiling solution of soda, or in disulphide of carbon. When heated to 115° C. (239° F.), Washed Sulphur melts, and at a higher temperature it is volatilized, without leaving more than a trace of residue. Water agitated with it should not redden blue litmus paper (abs. of free acid). If Washed Sulphur be digested with 2 parts of water of ammonia and the mixture filtered, the filtrate, on being supersaturated with hydrochloric acid, should remain unaltered (abs. of arsenious sulphide), nor should a precipitate make its appearance on passing hydrosulphuric acid through the filtrate (abs. of arsenious acid)." *U. S.* The dose is from half a drachm to half an ounce.

Off. Prep. Pulvis Glycyrrhizæ Compositus, *U. S.;* Sulphuris Iodidum, *U. S.;* Unguentum Sulphuris Alkalinum, *U. S.*

SULPHUR PRÆCIPITATUM. *U. S., Br.* *Precipitated Sulphur.*

S; 32. (SŬL'PHŬR PRÆ-CĬP-I-TĀ'TŬM.) **S; 16.**

Lac Sulphuris, *Br.;* **Milk of Sulphur; Lac (s. Magisterium) Sulphuris; Soufre précipité, Lait de Soufre,** *Fr.;* **Schwefelmilch,** *G.*

"Sublimed Sulphur, *one hundred parts* [or sixteen ounces av.]; Lime, *fifty parts* [or eight ounces av.]; Hydrochloric Acid, Water, each, *a sufficient quantity.* Slake the Lime, and make it into a uniform mixture with *five hundred parts* [or five pints] of Water. Add the Sulphur, previously well dried and sifted, mix well, add *one thousand parts* [or ten pints] of Water, and heat the mixture to boiling, over a fire, for one hour, stirring constantly, and replacing the Water lost by evaporation. Then cover the vessel, allow the contents to cool, pour off the clear solution, filter the remainder, and to the united liquids add, gradually, Hydrochloric Acid, previously diluted with an equal volume of Water, until the liquid is nearly neutralized, still retaining, however, an alkaline reaction. Collect the precipitate on a strainer, and wash it with Water until the washings are tasteless. Then dry it with a gentle heat." *U. S.*

"Take of Sublimed Sulphur *five ounces* [avoirdupois]; Slaked Lime *three ounces* [avoird.]; Hydrochloric Acid *eight fluidounces,* or *a sufficiency;* Distilled Water *a sufficiency.* Heat the Sulphur and Lime, previously well mixed, in a pint [Imperial measure] of the Water, stirring diligently with a wooden spatula; boil for fifteen minutes, and filter. Boil the residue again in half a pint [Imp. meas.] of the Water, and filter. Let the united filtrates cool, dilute with two pints [Imp. meas.] of the Water, and, in an open place or under a chimney, add in successive quantities the Hydrochloric Acid previously diluted with a pint [Imp. meas.] of the Water, until effervescence ceases and the mixture acquires an acid reaction. Allow the precipitate to settle, decant off the supernatant liquid, pour on fresh Distilled Water, and continue the purification by affusion of Distilled Water and subsidence, until the fluid ceases to have an acid reaction and to precipitate with oxalate of ammonium.

Collect the precipitated sulphur on a calico filter, wash it once with Distilled Water, and dry it at a temperature not exceeding 120°." *Br.*

The process for precipitated sulphur has not been much changed in the last revision, except in that the quantity of lime has been diminished to one-third of the amount used in the process of U. S. P. 1870; this is an improvement, as the excess of lime caused loss in filtration unless great care was taken to wash the precipitate well.

In the U. S. process three molecules of calcium oxide react with six atoms of sulphur to form two mols. of calcium disulphide and one of calcium thiosulphate (hyposulphite): $3CaO + (S_2)_3 = 2CaS_2 + CaS_2O_3$. On the addition of the hydrochloric acid, six atoms of sulphur are precipitated (four from the two mols. of calcium disulphide and two from the one mol. of hyposulphite of calcium), and the calcium and oxygen unite with the hydrochloric acid, so as to form chloride of calcium and water, according to the reaction: $2CaS_2 + CaS_2O_3 + 6HCl = 3CaCl_2 + 3H_2O + (S_2)_3$. This rationale is not exactly applicable to the British process, in which the proportion of the sulphur to the lime employed is greater than in that of the U. S. Pharmacopœia, and on account of this greater excess of sulphur the reaction takes place as follows: $3CaO + (S_2)_6 = 2CaS_5 + CaS_2O_3$, a pentasulphide of calcium being formed. Hydrochloric acid is the most eligible precipitant for the sulphur, as it gives rise to chloride of calcium, which is a very soluble salt and is easily washed away. Sulphuric acid is wholly inadmissible, as it generates sulphate of calcium, which, from its sparing solubility, becomes necessarily intermingled with the precipitated sulphur. According to Schweitzer, the best material from which to precipitate the sulphur is the sulphide of potassium, formed by boiling sulphur with caustic potassa. Dr. Otto, of Brunswick, finds that sulphide of potassium is apt to contain sulphide of copper, and therefore prefers sulphide of calcium.

Properties. Precipitated sulphur is in friable lumps, of a white color, with a pale yellowish green tint, and consisting of finely divided particles slightly cohering, or, as officinally described, it is "a very fine, yellowish white, amorphous powder, odorless and almost tasteless, insoluble in water or in alcohol, but completely soluble in a boiling solution of soda or in disulphide of carbon. By heat it is completely volatilized. Water agitated with it should not redden blue litmus paper (abs. of free acid). If Precipitated Sulphur be boiled with diluted hydrochloric acid, the liquid filtered, and the filtrate divided into two portions, one portion should not be precipitated by test-solution of chloride of barium, and the other portion should not be rendered more than slightly turbid by test-solution of carbonate of ammonium with excess of water of ammonia (abs. of sulphate of calcium). When digested successively with water, hydrochloric acid, and water of ammonia, these liquids, after filtration, should leave no residue on evaporation (abs. of alkalies, alkaline earths, or sulphide). If Precipitated Sulphur be digested with twice its weight of water of ammonia and the mixture filtered, the filtrate, after being supersaturated with hydrochloric acid, should remain unaltered (abs. of arsenious sulphide), nor should a precipitate make its appearance on passing hydrosulphuric acid through the filtrate (abs. of arsenious acid)." *U. S.* It is entirely dissipated by heat. Water boiled with it should not redden litmus. When recently prepared, it is devoid of taste, but possesses a peculiar smell. When long exposed, in a moist state, to the air, it becomes strongly contaminated with sulphuric acid. From its color it was formerly called *lac sulphuris*, or *milk of sulphur.* It is insoluble in water, but dissolves in a boiling solution of caustic potassa, and in oil of turpentine by the aid of heat. When of a brilliant white color, the presence of sulphate of calcium may be suspected; in which case the preparation will not be wholly volatilized by heat. If pure, it communicates a harsh feel when rubbed between the fingers, owing to the friction of the particles. (*Dr. Bridges.*) We have seen a sample of so-called precipitate of sulphur which consisted almost entirely of sulphate of calcium. Precipitated sulphur differs from sublimed sulphur in being in a state of more minute division, and in presenting, after fusion, a softer and less brittle mass. Its peculiarities are supposed to depend upon the presence of water, which, however, is found in too small a quantity to constitute a regular *hydrate.* According to Rose, its white color is occasioned by the presence of a small proportion of a sulphide of hydrogen. Soubeiran states that it always contains some sulphuretted hydrogen, which causes it to differ as a therapeutic agent from sublimed sulphur.

Medical Properties and Uses. Precipitated sulphur possesses similar medical properties to those of sublimed sulphur. Its state of extreme division renders it more readily suspended in liquids; but its liability to become acid by keeping is an objection to it. It is sometimes selected for forming ointments, which have the advantage of being of a lighter color and smoother than when made with sublimed sulphur. The dose is from one to three drachms (3·9–11·65 Gm.).

SULPHUR SUBLIMATUM. *U.S., Br.* *Sublimed Sulphur.*

S; 32. (SŬL'PHŬR SŬB-LI-MĀ'TŬM.) S; 16.

"Sulphur, prepared from crude or rough sulphur by sublimation." *Br.*

Flores Sulphuris; Flowers of Sulphur; Brimstone; Soufre, Fleurs (Crême) de Soufre, *Fr.;* Schwefel, Schwefelblumen, Schwefelblüthe, *G.;* Zolfo, *It.;* Azufre, *Sp.*

Natural States. Sulphur is very generally disseminated throughout the mineral kingdom, and is almost always present, in minute quantity, in animal and vegetable matter. Among vegetables, it is particularly abundant in mustard and other cruciform plants. It occurs in the earth, either native or in combination. When native it is found in masses, translucent or opaque, or in the powdery form mixed with various earthy impurities. In combination it is usually united with certain metals, as iron, lead, mercury, antimony, copper, and zinc, forming compounds called sulphides. *Native sulphur* is most abundant in volcanic countries, and is hence called *volcanic sulphur.* The most productive mines of sulphur are found in Sicily (250 distinct sulphur workings existing there) and in the Roman States. A large mine of native sulphur has been opened in California, about twenty miles from Santa Barbara, and seven from the sea-coast. Near the borax lake in California (see *Sodii Boras,* p. 1316) is an elevation, where the deposition of sulphur is constantly going on from vapors arising from innumerable crevices in a decomposed volcanic rock, the surface of which is so far covered with the deposited matter as to give the mass the appearance of a bank of sulphur. It is called "Sulphur Banks," according to Whitney. In the year 1869 or 1870, sulphur in large masses was discovered in the island of Saba, one of the Dutch West Indies, about 110 miles south of St. Thomas. The island is of volcanic origin, about 11 miles in circumference. (*A. J. P.,* 1870, p. 431.) In 1872 a great hill of almost pure sulphur was found in the United States, about 900 miles west of Omaha and 30 south of the Union Pacific Railroad. In the year 1880 there were mined in the United States, according to the census reports, 1,200,000 lbs. of native sulphur, valued at $21,000. In the year 1881 there were imported into the United States 105,438 tons of crude sulphur, valued at $2,713,494.

Extraction, etc. Sulphur is obtained either from sulphur earths, or from the native sulphides of iron and copper, called iron and copper pyrites. The sulphur earths are placed in earthen pots, set in oblong furnaces of brickwork. From the upper and lateral part of each pot, a tube proceeds obliquely downwards, which communicates with the upper part of a similar pot, situated outside the furnace, and perforated near its bottom, to allow the melted sulphur to flow into a vessel containing water, conveniently placed to receive it. Fire being applied, the sulphur rises in vapor, leaving the impurities behind, and, being condensed again, flows from the perforated pot into the vessel containing the water. Sulphur, as thus obtained, is called *crude sulphur,* and contains about one-twelfth of its weight of earthy matter. For purification it is generally melted in a cast-iron vessel. When the fusion is complete, the impurities subside, and the purer sulphur is dipped out and poured into cylindrical wooden moulds, which give it the form of solid cylinders, about an inch in diameter, called in commerce *roll sulphur* or *cane brimstone.* The dregs of this process, ground to powder, constitute a very impure kind of sulphur, of a gray color, called in the shops *sulphur vivum* or *horse brimstone.* The above process purifies the sulphur but imperfectly. At the same time it causes a considerable loss; as the dregs just mentioned contain a large proportion of sulphur. A more eligible mode of purification consists in distilling the crude sulphur from a large cast-iron still, set in brickwork over a furnace, and furnished with an iron head. The head has two lateral communications, one with a chamber of brickwork, the other with an iron receiver immersed in water, which is constantly renewed to cool it sufficiently to cause the sulphur to condense in the liquid form. When the tube between the still and receiver is shut, and that communicating with the chamber is open, the sulphur condenses on its walls in the form of an impalpable powder, and constitutes *sublimed sulphur*, or *flowers of sulphur.* If, on the other hand, the communication with the chamber is closed, and that with the receiver opened, the sulphur condenses in the latter in the fused state, and, when cast in cylindrical moulds, forms the *roll sulphur* of commerce.

The extraction of sulphur from the bisulphide of iron (iron pyrites) is performed by distilling it in stone-ware cylinders. Half the sulphur contained in the bisulphide is volatilized by the heat, and conducted, by means of an adapter, into vessels containing water, where it condenses. The residue of the mineral is employed for making sulphate of iron, or green vitriol. In the island of Anglesea, large quantities of sulphur are obtained from copper pyrites in the process for extracting that metal. The furnaces in which the ore is roasted are connected by horizontal flues with chambers, in which the volatilized sulphur is condensed. Each chamber is furnished with a door, through which the sulphur is withdrawn once in six weeks.

A process for separating pure sulphur from the residue of the manufacture of soda, proposed by Max Schaffner, has been put in operation in most of the soda-factories of the German Zollverein, and has been introduced, to a greater or less extent, in England, France, and Belgium. (See details, *A. J. P.*, 1869, p. 545.) We shall confine ourselves to an outline. The process is divided into three parts; *first*, the preparation of the *soda solution* by heaping up the soda residue in the air, whereby oxidation takes place, and polysulphides and hyposulphites are formed, which are extracted by lixiviation; *secondly*, the solution thus obtained is decomposed in close stone or iron vessels, by hydrochloric acid, which decomposes the polysulphides and hyposulphites, with precipitation of sulphur; and, *thirdly*, the sulphur is obtained pure by fusing it under water, with steam and a pressure of 1¾ atmospheres. Chloride of calcium remains in solution, gypsum is suspended, and the addition of a little milk of lime neutralizes any free acid present, and with the sulphur forms sulphide of calcium, which dissolves whatever sulphide of arsenic may be present, leaving the sulphur free from impurities. This collects in the bottom of the kettle, and is drawn off into moulds. From 60 to 65 per cent. of pure sulphur is thus obtained from the soda residue.

Crude sulphur comes to this country principally from Messina, in Sicily, and the ports of Italy. Roll sulphur and the flowers are usually brought from Marseilles. Good Sicilian sulphur does not contain more than 3 per cent. of impurity, consisting chiefly of earths. Crude sulphur is employed by the manufacturers of sulphuric acid; and, as it is very variable in quality, it becomes important to ascertain its value. This may be done by drying a given weight of it and submitting it to combustion. The weight of the incombustible residue, added to that lost in drying, gives the amount of impurity.

Properties. Sulphur is a non-metallic element, susceptible of several allotropic states. In its ordinary state it is a brittle solid, of a pale yellow color, permanent in the air, and exhibiting a crystalline texture and shining fracture. It has a slight taste, and a perceptible smell when rubbed. When pure its sp. gr. is about 2; but it varies a little in density in its different allotropic states. Occasionally, from impurity, its sp. gr. is as high as 2·35. Its atomic weight is 32, and its symbol S. It is a bad conductor of heat, and becomes negatively electric by friction. The melting point of sulphur varies with its allotropic state, which is readily altered by heat. Pure sulphur melts and sublimes at 114·5° C. (238° F.). If heated above its melting point, it undergoes, in proportion to the heat applied, a progressive change, which will cause it, upon slow cooling, to solidify at a temperature lower than that at which it was melted; and, if it be remelted, it will be found to have a higher melting point than before. Melted sulphur is perfectly limpid, and of a bright yellow color. When sulphur is melted, and, after partial cooling, the crust formed on its surface is pierced, and the fluid portion poured out, it may be obtained in slender monoclinic crystals, constituting an allotropic condition of the element. This variety, however, gradually passes back into the more permanent variety found in nature. When sulphur is heated above its melting point, it becomes deeper colored and less fluid. At 200° C. (392° F.), it has a deep brown color, and is so viscid that it cannot be poured from the containing vessel. If the temperature be still further increased, the sulphur resumes its fluidity, but retains its brown color. Finally, when the temperature reaches 448·4° C. (839° F.), it boils, forming a yellow vapor, and may be distilled. If melted sulphur, heated above 200° C. (392° F.), is suddenly cooled by being poured out into water, it becomes a reddish brown plastic mass, with alteration of properties, called *soft sulphur* (*viscid sulphur*), which constitutes another allotropic variety, and is employed in taking impressions of medals, etc. This form of sulphur resumes the hard state, but not its original color, after the lapse of a few days, or suddenly if heated to 100° C. (212° F.). Sulphur is insoluble in water, but soluble in alkaline solutions, petroleum, rectified coal naphtha, the fixed oils, oil of turpentine and other volatile oils, alcohol and ether, chloroform, and bisulphide of carbon. One of its best solvents is bisulphide of carbon, from solution in which it crystallizes generally in rhombic octohedra, forms belonging to a different system from the monoclinic prisms obtained by crystallizing melted sulphur by cooling. Hence sulphur is said to be dimorphous. M. Eugene Pelouze has observed that the oils obtained by distilling the tar from gas-works dissolve most sulphur at a temperature near their boiling point, and, if a saturated solution at this heat were to be allowed to cool, it would deposit sulphur in a crystalline form; and M. C. Wiedmann has suggested the application of this property to extraction of sulphur from native sulphur earths and ores, and from the residue of coal gas-works. (*A. J. P.*, June, 1871, p. 267.)

The allotropic states of sulphur have been studied chiefly by Brodie, Magnus and Weber, and Berthelot. These states are induced, for the most part, by heat, and are distinguished by the crystalline form of the sulphur, and by its solubility or non-solubility in bisulphide of carbon. *Insoluble sulphur* is the name given to that part of the soft sulphur which is left undissolved by the bisulphide, amounting to between one-third and nearly one-half of the former. Mr. Brodie was unable to determine the melting point of this sulphur, but found it considerably above 120° C. (248° F.), or the melting point of prismatic sulphur. Flowers of sulphur contain about one-third of their weight of insoluble sulphur.

The physical properties of sulphur are remarkably modified by heating it in contact with a minute proportion of certain other substances. MM. Moutier have ascertained that, heated with $\frac{1}{400}$ of iodine, it becomes, on cooling, soft, plastic, and in great measure insoluble in bisulphide of carbon. The same authors found that many other substances have a similar effect on sulphur; as naphthalene, paraffin, creasote, camphor, and oil of turpentine; the quantity of the substance required varying from $\frac{1}{400}$ to $\frac{1}{600}$; and the necessary temperature being different with the substances used; camphor requiring 230° C. (446° F.), and naphthalene and oil of turpentine much more. After cooling, a paste is obtained, black, soft, plastic, ductile, which passes very slowly into the hard and brittle state of ordinary sulphur. (*Journ. de Pharm. et de Chim.*, 4e sér., i. 288, 1865.)

According to M. Marès, sulphur mixed with carbonate of calcium, in the presence of the organic matters of the soil, is converted at first into hydrogen sulphide, then, under the influence of air and porous bodies, into sulphuric acid, finally into sulphate of calcium; but Prof. Egidio Pollacer, on the contrary, thinks that sulphur, in contact with carbonate of calcium, passes very readily into sulphuric acid, and then to sulphate of calcium, independently of organic matters, and without being preliminarily changed into hydrogen sulphide; and this opinion he supports by several experiments. (*Journ. de Pharm.*, Oct. 1874, p. 330.)

Sulphur takes fire at about the temperature of 148·8° C. (300° F.), and burns with a blue flame, combining with the oxygen of the air, and giving rise to sulphurous oxide, SO_2. The combinations of sulphur are numerous, and are among the most powerful chemical agents. It forms with oxygen two oxides, *sulphurous* oxide, SO_2, and *sulphuric* oxide, SO_3. These oxides, by their union with water, form *sulphurous acid.* H_2SO_3 and *sulphuric acid*, H_2SO_4. There is also known *hyposulphurous acid*, H_2SO_2, the corresponding oxide of which is not known, and *thiosulphuric acid* (frequently known as hyposulphurous acid), $H_2S_2O_3$, and a series of acids, $H_2S_2O_6$, $H_2S_3O_6$, $H_2S_4O_6$, and $H_2S_5O_6$, known as the *thionic series.* It forms with hydrogen, hydrogen sulphide (*hydrosulphuric acid* or *sulphuretted hydrogen*); and with the metals, various *sulphides.** Some of the sulphides are analogous to acids, others to bases; and these different sulphides, by combining with each other, form compounds, which, from their analogy to salts, are called by Berzelius *sulphosalts.*

An extremely sensitive test of this element is a solution of molybdate of ammonia in hydrochloric acid, diluted with water, which is rendered blue by contact with even a trace of sulphur. (*Journ. de Pharm.*, Mai, 1862, p. 367.)

Sulphur, when obtained by roasting the native sulphide, sometimes contains arsenic, and is thereby rendered poisonous. Sicilian sulphur, being volcanic, is not subject to this impurity. The common English roll sulphur is sometimes made from iron pyrites, and is then apt to contain orpiment (*tersulphide of arsenic*). This impurity may be detected by heating the suspected sulphur with nitric acid. The arsenic, if present, will be converted into arsenic acid; and the nitric solution, diluted with water, neutralized with carbonate of sodium, and acidulated with hydrochloric acid, will give a yellow precipitate of pentasulphide of arsenic with a stream of sulphuretted hydrogen. A precipitate may be more readily obtained from the nitric solution, if, after neutralization, sulphurous acid be added. which will convert the arsenic acid into the arsenious. This is more easily decomposed by the sulphuretted hydrogen; but the precipitate obtained will now be the tersulphide. Sulphur, when perfectly pure, is wholly volatilized by heat, and soluble without residue in oil of turpentine. According to Dr. Playfair, a solution of nitro-prusside of sodium is a delicate test for the alkaline sulphides, producing with them a violet tint. The late Prof. Bailey, of West Point, employed the same test for detecting sulphur in any compound. The substance suspected to contain it is fused with carbonate of sodium, with the addition of carbonaceous matter if necessary. If sulphur be present it will be converted into sulphide of sodium; and, upon the addition of a small portion of the fused mass to a drop of the nitro-prusside, the characteristic violet tint will be produced.

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* *Ferri Sulphidum*, FeS; 88. *Ferrous Sulphide.* "Protosulphide of Iron, prepared by melting together Iron, in small pieces, and Sublimed Sulphur." *U. S.* 1870.

This was introduced into the U. S. Pharmacopœia of 1870 as the material from which sulphuretted hydrogen may be obtained, which, though not officinal, is in constant use as a reagent, and is often employed with great advantage in processes for isolating the active principles of medicinal substances. Sulphide of iron is best prepared by bringing iron and sulphur into contact at a red or white heat. The following are the processes of the late Dublin and Edinburgh Pharmacopœias.

"Take of rods of Iron, of the size employed in the manufacture of nails, *any convenient number.* Having raised them to a strong red or white heat, apply them in succession by their heated extremities to sticks of Sulphur, operating so that the melted Sulphide, as it is formed, may drop into a stone cistern filled with water, and be thus protected from oxidation. The water being poured off, let the product be separated from the Sulphur with which it is mixed, and, when dried, let it be enclosed in a well-stopped bottle." *Dub.*

"An inferior sort, good enough, however, for many purposes, is obtained by heating one part of Sublimed Sulphur and three of Iron Filings, in a crucible, in a common fire till the mixture begins to glow, and then removing the crucible, and covering it until the action, which at first increases considerably, shall come to an end." *Ed.*

Iron and sulphur form a number of sulphides, such as ferrous sulphide, FeS, ferric disulphide, FeS_2 (this occurs in nature as *common* or *cubic pyrites*), and ferric sesquisulphide, Fe_2S_3, which, while not found free in nature, occurs in magnetic pyrites, the formula of which is Fe_7S_8 or $5FeS + Fe_2S_3$. When the sulphide is obtained by the application of solid sulphur to white-hot iron, the product corresponds with magnetic pyrites; but, when procured by heating flowers of sulphur with an excess of iron filings, as directed in the above Edinburgh process, a protosulphide is formed mixed with metallic iron. When sulphur is applied to white-hot iron over water, the metal appears to become hotter, burns with scintillations in the vapor of the sulphur, and forms instantly the sulphide, which, being comparatively fusible, melts into globules, and drops into the water, which serves to extinguish them.

Properties. The officinal sulphide of iron has a yellowish color and the metallic lustre. When obtained over water it is in the form of brownish yellow globules, having a somewhat crystalline texture. When pure it furnishes a yellow powder, and dissolves in dilute sulphuric or hydrochloric acid without leaving a residue of sulphur, and with the production of sulphuretted hydrogen, free from admixture of hydrogen. As prepared, however, by the usual processes, it is not entirely soluble in dilute sulphuric acid, a portion of uncombined sulphur being left. The fused globules have the composition $5FeS + FeS_2$, or, according to some, $5FeS + Fe_2S_3$. This sulphide is employed solely as a pharmaceutical agent for the production of hydrosulphuric acid. It yields this gas by reaction with diluted sulphuric acid, $FeS + H_2SO_4 = H_2S + Fe.SO_4$. Sulphuretted hydrogen is a colorless gas, having a smell like that of putrid eggs. Its sp. gr. is 1·1782. It saturates bases, with which it forms salts called sulphides.

Sublimed sulphur, usually called *flowers of sulphur* (*flores sulphuris*), is "a fine, citron-yellow powder, of a slight, characteristic odor, and generally of a faintly acid taste, and an acid reaction. It is insoluble in water or alcohol. When ignited, it burns with a blue flame, forming sulphurous acid gas, and leaving no residue or only a trace." *U. S.* It is always contaminated with a little sulphuric acid, which is formed at the expense of the oxygen of the air contained in the subliming chambers. Accordingly, it always reddens litmus, and, if the acid is present in considerable quantity, sometimes cakes. It may be freed from acidity by careful ablution with diluted water of ammonia, when it becomes the officinal washed sulphur. (See *Sulphur Lotum.*)

Medical Properties and Uses. Sulphur is laxative, diaphoretic, and resolvent. It is supposed to be rendered soluble by the soda of the bile. M. Miahle teaches that it is carried into the circulation by the fatty matters in the alimentary canal which dissolve it. (*Med. T. and Gaz.*, June, 1868, p. 642.) It evidently passes off by the pores of the skin; as is shown by the fact that silver, worn in the pockets of patients under a course of it, becomes blackened with a coating of sulphide. The stools which it occasions are usually solid, and it is gentle in its operation, unless it contain a good deal of acid, when it may cause griping; and the liability of the sublimed sulphur to contain acid renders it less eligible for exhibition than the washed sulphur, from which all acidity is removed. The diseases in which sulphur is principally used are hemorrhoidal affections, atonic gout, chronic rheumatism, chronic catarrh, and asthma. It has also been given as an antiperiodic, being considered as particularly applicable to cases in which the apyrexia is incomplete. It is also much employed, both internally and externally, in cutaneous affections, especially scabies, for the cure of which it is considered a specific. In these affections, as well as in chronic rheumatism, it is sometimes applied as an air-bath, in the form of sulphurous acid gas, the head being protected from its effects. It has been employed with great success, by M. Lagauldrie, in diphtheritic croup, given freely every hour, simply suspended in water. M. Thévenot finds it promptly effectual in the removal of diphtheritic exudation, simply applied locally to the patches. (*Ann. de Thérap.*, 1867, p. 78.) Dr. Keiser recommends it highly in diphtheria, blowing the flowers, by means of a little cone of paper like a lamplighter, into the fauces three times a day. Usually from three to six insufflations are sufficient, in cases seen early, to remove the deposits; in neglected cases, from nine to ten are necessary. It is said also to be very useful in lead colic. (*Ibid.*, 1868, p. 108.) The external use of sulphur is strongly recommended by Dr. O'Connor, of London, in sciatica and chronic articular rheumatism. The limb affected is covered with sulphur, and bandaged with new flannel, over which sheets of wadding are wrapped. The dressing should not be taken off for several days, as its earlier removal would interfere with the absorption of the sulphur, on which its curative effect depends. (*Lancet*, Am. ed., June, 1857, p. 507) The dose of sulphur is from one to three drachms (3·9–11·65 Gm.), mixed with syrup or molasses, or taken in milk. It is often combined with bitartrate of potassium, or with magnesia.

According to M. Hannon, of Brussels, *soft sulphur*, recently prepared, possesses valuable therapeutic properties, not as a laxative, but as a stimulant to the circulation, lungs, and skin, far more active than ordinary sulphur. The dose of soft sulphur is from twenty to fifty grains (1·3–3·25 Gm.), given in the form of pill. It has also been successfully employed for filling the hollows of carious teeth. (*P. J. Tr.*, xvii. 330.)

Much sulphur is consumed in the arts, principally in the manufacture of gunpowder and sulphuric acid.

Off. Prep. of Sulphur Sublimatum. Confectio Sulphuris, *Br.;* Emplastrum Ammoniaci cum Hydrargyro; Emplastrum Hydrargyri, *Br.;* Potassa Sulphurata, *U. S.*, *Br.;* Sulphur Lotum, *U. S.;* Sulphur Præcipitatum; Unguentum Sulphuris.

SUMBUL. *U. S.* *Sumbul.*

(SŬM'BŬL.)

"The root of Ferula Sumbul. Hooker filius. (*Nat. Ord.* Umbelliferæ, Orthospermæ." *U. S.* "The dried transverse sections of the root of a plant the botanical history of which is unknown. Imported from Russia and also from India." *Br.*

Sumbul Radix, *Br.;* Racine de Sumbul, *Fr.;* Sumbulwurzel, Moschuswurzel, *G.*

Under the name of *sumbul* or *jatamansi*, a root has long been used in India, Persia, and other parts of the East, as a perfume, an incense in religious ceremonies, and medicinally. It is the product of an unknown plant, supposed to be umbelliferous, and, from the character of the root, to grow in low wet places. The plant is said to inhabit no part of British India, but the regions to the north and east of it, as Nepaul, Bootan, Bucharia, etc. The root is taken northward to Russia, and reaches the rest of Europe through St. Petersburg. The physicians of Moscow and St. Petersburg were the first to employ it on the continent of Europe. Dr. Granville first introduced it to the notice of the profession in Great Britain and this country. It has also been imported into England from India, whither it was brought from a great distance.

Gen. Ch. See *Asafœtida.*

Ferula Sumbul. Hooker. *B. & T.* 131.—*Euryangium Sumbul.* Kauffmann. *Nouv. Mém. Soc. Imp. Nat. de Moscou*, xiii. t. 24, 25. The plant which yields sumbul was first discovered by the Russian Fedschenks in 1869, growing at an elevation of 3000 feet in the mountains which separate Russian Turkestan from Bucharia. In 1870 it was described by Kauffmann, who erected a new genus on characters dependent upon the enormous size of the vittæ in the immature fruit. The plant has been cultivated in the Moscow botanical gardens, and less successfully at Kew; and it has been found that the vittæ almost disappear in ripening, and do not afford a good generic character. The plant is described as an enormous umbellifer, reaching a height of 8 feet, and having a solid, cylindrical, slender stem, which in the upper part gives origin to about 12 slender divaricate branches. The root leaves are two and a half feet long, with short, channelled, broadly dilated, completely clasping petioles. They are triangular in outline, tripinnate, with the alternate divisions fine. The stem leaves rapidly decrease in size until they become above mere sheathing bracts. The flowers are polygamous. The fruit $\frac{3}{8}$–$\frac{1}{2}$ inch long by $\frac{1}{4}$ inch wide; the mericarps oblong-oval, dorsally much compressed, thin, with 3 faint, thread-like, dorsal ridges; no dorsal vittæ, and commissural ones collapsed.

Properties. Sumbul is officinally described as "in transverse segments, varying considerably in diameter and thickness, light, spongy, annulate or longitudinally wrinkled; bark thin, brown, more or less bristly fibrous; the interior whitish, with numerous brownish yellow resin-dots and irregular, easily separated fibres; odor strong, musk-like; taste bitter and balsamic." *U. S.* The fresh-cut surface of a transverse section presents, within the epidermis, an exterior white and spotted layer, and an inner yellow substance which forms the greater part of the root. Examined by means of a microscope, it exhibits translucent points which probably represent starch granules. Sumbul has a strong odor, much resembling that of musk, which it retains when long kept; and hence the name of *musk-root* sometimes attached to it. The taste, at first feebly sweetish, becomes after a time bitterish and balsamic, but not disagreeable; and a strong aroma is developed under mastication, diffusing itself with a sensation of warmth through the mouth and throat, and rendering the breath fragrant. This effect, however, is much diminished by time. That which was formerly brought from India differs somewhat from the Russian, being of closer texture, more dense and firm, and of a reddish tint. (*A. J. P.*, xxiv. 174.) The root has been analyzed by Reinsch and other German chemists, and found to contain volatile oil, two balsamic resins, one soluble in alcohol, the other in ether, wax, gum, starch, a bitter substance soluble in water and alcohol, and an acid which was named *sumbulic acid*, but which Ricker and Reinsch showed to be angelic acid, $C_5H_8O_2$, accompanied by a little valerianic acid, $C_5H_{10}O_2$. Solution of potash is said to convert the resin into the potassium salt of an acid called *sumbulamic*, but which has not been sufficiently investigated. The musk-like odor seems to be connected with the balsamic resins, and probably depends on some principle associated with them not yet isolated. The volatile oil, of which ⅓ of 1 per cent. is yielded by distillation, has a taste like that of peppermint.

Medical Properties. The virtues of the drug appear to be those of a nervous stimulant. It is used by the Russian physicians in delirium tremens, low fevers, in asthenic cases of dysentery and diarrhœa, and even with asserted success in malignant cholera. Dr. Granville (pamphlet, London, 1850) recommends it in gastric spasm, hysteria, chlorosis, amenorrhœa, dysmenorrhœa, palsy of the limbs, epilepsy, and other nervous disorders. It is given in substance, infusion, decoction, and alcoholic and ethereal tincture. There seems to be no great precision in relation to the dose; but it is inferable, from the accounts of the drug, that it may be used very much as we use valerian, one or two drachms at a time.

Dr. Murawieff, of Russia, prepares the resin, which he considers as the active principle, by macerating the root first in water, and then in a solution of carbonate of sodium, washing it well with cold water, drying it, treating it with alcohol, filtering the tincture, adding a little lime and again filtering, separating the lime by sulphuric acid, agitating with animal charcoal, again filtering, distilling off nearly all the alcohol, mixing the residuum with water, driving off the remaining alcohol, and, finally, washing the precipitate with cold water, and drying it. The resin thus obtained is whitish, translucent, softening between the fingers, combustible without residue, of an acid taste, and an aromatic smell, like that of the root. Dr. Murawieff gives it in the dose of a grain or two (0·065–0·13 Gm.), in the form of pill, three or four times a day, with or without opium, and has found it useful in chronic bronchitis and pneumonia slow of resolution, in the moist asthma of old, anæmic, and scorbutic patients, in atonic dysentery, leucorrhœa, hypochondriasis, and hysteria. (*Dub. Quart. Journ.*, Feb. 1855, p. 252.) Prof. Procter has published a formula for a fluid extract, of which the dose is from 15 minims to a fluidrachm (0·9–3·75 C.c.). (*A. J. P.*, xxvii. 233.) Half an ounce of a tincture produced narcotic symptoms, such as confusion of the head, a tendency to snore, even when awake, feelings of tingling, etc., with a strong odor of the medicine from the breath and skin, which continued for a day or two and gradually passed off. (*N. R.*, Oct. 1874, p. 309.)

Off. Prep. Tinctura Sumbul, *U. S.*, *Br.*

SUPPOSITORIA. *U. S.*, *Br.* *Suppositories.*

(SU̦P-PŎȘ-I̦-TŌ′RI̦-A̦.)

Suppositoires, *Fr.;* Stuhlzäpfchen, *G.*

Suppositories are solid bodies intended to be introduced into the rectum, with a view either of evacuating the bowels by irritating the mucous membrane of the rectum, or of producing a specific effect on the neighboring parts, or on the system at large. They fulfil the same indications as enemata, and are sometimes preferable from the facility of their application, and, when the object is to produce the peculiar effect of a medicine, from the smallness of their bulk, which facilitates retention. Their form may be cylindrical, conical, or spherical; the last being preferable when the bulk is small. They should be of such a consistence as to retain their shape, but so soft as to incur no risk of wounding the rectum. For laxative purposes the suppository may be from one to three inches long, and about as thick as a common candle; with a view to the specific effects of medicines, it should be considerably smaller, as in this case it is important that the medicines should be retained, and the irritative influence of distention avoided. Soap is not unfrequently employed in this way as a laxative. A piece of solidified molasses (molasses candy) is sometimes preferred. To increase the purgative effect, and at the same time act on the uterine function, aloes may be added to the soap. Mr. A. B. Taylor, of Philadelphia, in

1852 called attention to cacao butter as the best base for suppositories, having more exactly the requisite degree of consistence and fusibility than any combination of suet, spermaceti, wax, etc., that could be employed. (*A. J. P.*, 1852, p. 211.) Experience has proved the correctness of his views. It has been thought necessary to use wax, spermaceti, or some other substance having a comparatively high fusion point, in order to render the suppository sufficiently firm. Continued experience has, however, demonstrated that, except in the warmest weather, or in the case of camphor, carbolic acid, the essential oils, and similar medicinal substances, even the commercial cacao butter will suffice. It is stated that cacao butter is usually adulterated with some other fat which melts at a low temperature, and that if a pure article can be obtained any substance to increase its hardness is never required. When such a material is employed, wax is usually selected, although cetaceum is preferable. If not more than 10 per cent. of the spermaceti is added, the value of the suppository is not very materially affected, although it melts more slowly, and consequently requires a longer time to act, than when the butter of cacao is used alone. Suppositories containing a considerable percentage of wax melt so slowly in the rectum as to be comparatively useless, or they may fail altogether to soften down and be finally passed from the anus unchanged. A very good method of mixing the oil of theobroma with the hardening material is by grating with an ordinary tin grater, such as used in kitchens, and mixing the coarse powders before melting; and Mr. W. G. Ewing has proposed rubbing the powders and the medicinal substance in a mortar together, dividing the plastic mass, and shaping it with the fingers. It is better to shape them with a spatula, and roll them upon a pill tile with a little lycopodium. This plan, although having its advantages, is, however, not equal to the officinal one of melting the ingredients and running them into moulds. Extempore moulds, made by rolling the paper into a cone about an inch long, may be used, but are much less convenient than permanent metallic moulds. The tendency of the hardened suppositories to cohere to the moulds may be remedied more or less perfectly by dusting the moulds with lycopodium powder, or greasing them well with olive oil; but it is far better to rely upon the natural contraction of the mass, caused by thoroughly cooling the moulds. Mr. Wm. B. Addington (*A. J. P.*, 1873, p. 257) advises lining the moulds with tin foil. The difficulty may also be met by the use of moulds which open lengthwise, which are now used almost exclusively in preference to individual moulds, and Mr. Chas. E. Dwight commends most highly the substitution of plaster of Paris moulds* for the metallic ones commonly employed. The mould must be very cold, so as to chill the melted liquid at once, and prevent any separation of its ingredients by gravity. It has been proposed to condense the powdered ingredients of suppositories in a cold mould. (*A. J. P.*, 1875, p. 79.) It has also been recommended to form the excipient into the required shape, and then, while it is still soft, make an excavation from the base upward, into which the medicine may be introduced, and afterwards enclosed by a little of the cacao butter. But as one of the objects of the excipient is an equable diffusion of the medicine to prevent irritation, this method would be altogether inapplicable to substances in any degree locally irritant. The weight—*i.e.*, the size—of suppositories should vary according to the purposes for which they are employed. When they are to be used for infants and children they should weigh from five to ten grains. The Br. Pharm., in conformity with the recommendation of Mr. H. B. Brady

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* Mr. Dwight makes these moulds in the following manner. Into a pasteboard box, about six inches long and two wide, pour liquid plaster about the consistency of thick cream until half full. Having prepared six well-moulded suppositories of wax, immerse them in the soft plaster half their diameters, with their large end close to the edge of the box, in a row, and at a uniform distance. When the plaster has set, gently remove the wax, and with a knife smooth off the surface and trim the edges of each mould sharp, and between each depression made by the wax suppository dig a small cavity about the size and shape of a small pen cut through the centre. When the face has become hard, grease it with linseed oil or lard, replace the wax suppositories, and raise the edges of the box by wrapping heavy paper around, which will extend about another inch above the surface of the face; pour a portion of the plaster, equal to the first, gently over the greased surface until it is about one inch deep. When hard, separate the parts carefully, trim the edges. and boil for an hour in linseed oil, which will prevent the adhesion of the substance to be moulded. To be substantial, the plaster must be mixed thin and well stirred.

(*P. J. Tr.*, 1866, p. 544, and 1868, p. 321, and 1871, pp. 193, 488, 563),[*] adopts the weight of fifteen grains. Experience has shown this to be the most useful size, and the U. S. P. of 1880 has also adopted it. The officinal directions of the U. S. Pharmacopœia are as follows. "Mix the medicinal portion (previously brought to a proper consistence, if necessary) with a small quantity of Oil of Theobroma, by rubbing them together, and add the mixture to the remainder of the Oil of Theobroma, previously melted and cooled to the temperature of 35° C. (95° F.). Then mix thoroughly, without applying more heat, and immediately pour the mixture into suitable moulds. The moulds must be kept cold by being placed on ice, or by immersion on ice-cold water; and the inner surface of the moulds should be carefully freed from adhering moisture, before the melted mass is poured in. In the absence of suitable moulds, Suppositories may be formed by allowing the mixture, prepared as above, to cool, care being taken to keep the ingredients well mixed, and dividing into parts of a definite weight each, which may be made into a conical or other convenient form for a suppository. Unless otherwise specified, Suppositories shall be made to weigh about fifteen grains, or one gramme." *U. S.* The Pharmacopœia of 1880 gives no detailed formulæ for suppositories. Opium, or some one of its preparations, is very advantageously administered in the form of a suppository, in cases of irritation of the rectum, urinary passages, or genital apparatus. The other narcotics may be used in the same way; and indeed almost any other medicine, in reference to its effects on the system, provided the quantity be not too large, and the local effects not too pronounced. Tannic acid or other astringent substances may also be very appropriately employed in this way in cases of prolapsus, or other affection depending on relaxation of the rectum or anus. The dose may in general be one and a half times that of the medicine given by the mouth.[†]

The inventive genius of pharmacists has been industriously applied to the construction of suppository moulds, and there are now many varieties; the principle is much the same in all, however, but for convenience they may be classed as follows. 1. Individual moulds; these were among the first to be used. Half a dozen conical, hard metal moulds are retained in an upright position in a tray containing ice water, or made of paper, tin foil, etc. (See *A. J. P.*, 1861, p. 5; 1863, p. 228; 1867, p. 121; 1868, p. 52; 1870, pp. 296, 392.) 2. Moulds which consist of two solid pieces of metal, hinged or temporarily joined, so that when the suppository is thoroughly cooled the parts may be separated and the suppository dropped out. (See *A. J. P.*, 1871, pp. 488, 563; 1874, pp. 192, 246; 1875, pp. 98, 202; 1877, p. 569; 1879, pp. 184, 277.) 3. Moulds designed to be used through compression, more or less powerful. (*N. R.*, June, 1879, Jan. and March, 1880.)

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[*] The papers of Mr. Brady upon the subject of suppositories may be consulted with advantage; also a series of articles by several other authors in *A. J. P.*, 1871.

[†] *Medicated Pessaries*, which have been brought into notice of late years, chiefly through the recommendation of Sir J. Y. Simpson, of Edinburgh, so closely resemble suppositories, so far as pharmacy is concerned, as to justify an allusion to them in this place. All that has been said of the materials out of which suppositories are made, and the mode of preparing them, is equally applicable to medicated pessaries. The latter, however, are considerably larger, generally weighing one or two drachms. They differ also from suppositories in the purposes to which they are applied; being used for local effect, in allaying pain, checking discharge, acting as alterative to contiguous parts, etc. For important pharmaceutical details, see an article in *A. J. P.*, 1868, p. 223.

Urethral and Vaginal Suppositories. Medicated Bougies. These articles, which are exceedingly useful for the purpose of exerting a local action upon the urethra or neck of the bladder in cases of inflammation, pain, or spasm, may be made in the same manner as ordinary suppositories, except in regard to size. The vaginal suppository should be about two to two and a half inches long, and three-quarters of an inch in diameter at the base. The urethral suppository should be cylindrical, with a conical point, and about one-fourth of an inch in diameter; their length should vary according to circumstances. They should never contain wax or other substance which does not melt readily and certainly at the temperature of the body, and which might, by a possible mishap, become the nucleus of a calculus. When it is desired to reach any considerable length of the urethra the requisite toughness may be obtained, as suggested by Mr. Jos. L. Lemberger (*A. J. P.*, 1872, p. 166), by using a mould like an old-fashioned candle-mould, with a candle-wick running through and projecting some distance from it. When a suppository so made is used, of course the free end of the wick should be secured with sticking-plaster or a drop of collodion externally, and after the requisite period of contact the whole be pulled out. These are now largely made from gelatin, water, and a little glycerin. (See C. L. Mitchell's paper, *A. J. P.*, 1878, p. 108.)

SUPPOSITORIA ACIDI TANNICI. *Br.* *Tannic Acid Suppositories.*

(SỤP-PŎṢ-Ị-TŌ′RỊ-Ạ ĂÇ′Ị-DĪ TĂN′NỊ-CĪ.)

Suppositoires de Tannin, *Fr.;* Tannin-Stuhlzäpfchen, *G.*

"Take of Tannic Acid *thirty-six grains;* Benzoated Lard *forty-four grains;* White Wax *ten grains;* Oil of Theobroma *ninety grains.* Melt the Wax and Oil of Theobroma with a gentle heat, then add the Tannic Acid and Benzoated Lard previously rubbed together in a mortar, and mix all the ingredients thoroughly. Pour the mixture while it is fluid into suitable moulds of the capacity of fifteen grains; or the fluid mixture may be allowed to cool, and then be divided into twelve equal parts, each of which shall be made into a conical or other convenient form for a *suppository.*" *Br.*

As it is hardly conceivable that a rectal dose of less than five grains should be wanted for the adult, the U. S. preparation of 1870 was of the better strength (*i.e.*, 5 grains). The benzoated lard has been added by the British authorities with a view of preventing rancidity, but seems to be unnecessary. The remedy is especially applicable to cases of piles and prolapsus of the rectum from relaxation.

SUPPOSITORIA HYDRARGYRI. *Br.* *Mercurial Suppositories.*

(SỤP-PŎṢ-Ị-TŌ′RỊ-Ạ HȲ-DRÄR′ÇỴ-RĪ.)

Suppositoires mercuriels, *Fr.;* Mercurial-Stuhlzäpfchen, *G.*

The British Pharmacopœia takes of Ointment of Mercury *sixty grains;* Benzoated Lard and White Wax, of each, *twenty grains;* and Oil of Theobroma *eighty grains;* and, having directed the Benzoated Lard, Wax, and Oil of Theobroma, previously melted with a gentle heat, to be thoroughly mixed with the Ointment of Mercury, without the further application of heat, completes the process precisely in the manner directed for the Tannic Acid Suppositories.

The quantity of the mercurial contained in each suppository is five grains (0·33 Gm.). This is not a common method of employing mercury for affecting the system, but might be advantageously resorted to in cases of great irritability of stomach, and where objection exists to the use of the ointment by friction to the skin. When this object is aimed at, the suppository might be repeated twice or three times in 24 hours.

SUPPOSITORIA MORPHIÆ. *Br.* *Morphia Suppositories.*

(SỤP-PŎṢ-Ị-TŌ′RỊ-Ạ MÖR′PHỊ-Æ.)

Suppositoires morphinés, *Fr.;* Morphin-Stuhlzäpfchen, *G.*

The British Pharmacopœia takes of Hydrochlorate of Morphia *six grains;* Benzoated Lard *sixty-four grains;* White Wax *twenty grains;* and Oil of Theobroma *ninety grains;* and, having melted the Wax and Oil with a gentle heat, added the Hydrochlorate of Morphia and Benzoated Lard previously rubbed together in a mortar, and mixed all the ingredients thoroughly, completes the process in the same manner as that for the Tannic Acid Suppositories.

This is an excellent remedy in strangury, tenesmus, and other cases of irritation in the lower bowels and urinary passages. It may also be used to control vomiting, and to produce the general effects of opium on the system. Each suppository contains half a grain of a salt of morphine (0·03 Gm.), which is about the quantity required to produce the full effects of morphine on the system in the adult.

SUPPOSITORIA PLUMBI COMPOSITA. *Br.* *Compound Lead Suppositories.*

(SỤP-PŎṢ-Ị-TŌ′RỊ-Ạ PLŬM′BĪ CỌM-PŎṢ′Ị-TẠ.)

Suppositoires de Plomb opiacés, *Fr.;* Stuhlzäpfchen von Opium und Bleizucker, *G.*

The British Pharmacopœia takes of Acetate of Lead *thirty-six grains;* Opium, in powder, *twelve grains;* Benzoated Lard *forty-two grains;* White Wax *ten grains;* and Oil of Theobroma *eighty grains;* and, having melted the Wax and Oil with a gentle heat, added the other ingredients previously rubbed together in a mortar, and mixed the whole thoroughly, completes the process in the same manner as that for the Tannic Acid Suppositories.

Each suppository contains three grains (0·20 Gm.) of the acetate of lead and one grain (0·065 Gm.) of opium. An excellent remedy in some cases of diarrhœa, dysenteric irritation of the rectum, piles, and hemorrhage.

SYRUPI. *Syrups.*

(SY-RŪ'PĪ.)

Sirops, *Fr.;* Syrupe, *G.*

Syrups are concentrated solutions of sugar in watery fluids, either with or without medicinal impregnation. When the solution is made with pure water, it is named *syrup* or *simple syrup;* when made with water charged with one or more medicinal agents, it is called in general terms a *medicated syrup*, and receives its particular designation from the substance or substances added.

Medicated syrups are usually prepared by incorporating sugar with vegetable infusions, vinegars, decoctions, expressed juices, fermented liquors, or simple aqueous solutions. When the active matter of the vegetable is not readily soluble in water, is associated with soluble matter which it is desirable to avoid, or is volatilized or decomposed by a heat of 100° C. (212° F.), it is sometimes extracted by diluted alcohol, the spirituous ingredient of which is subsequently driven off. Medicated syrups are also occasionally prepared by adding a tincture to simple syrup, and evaporating the alcohol. Another and better mode of effecting the same object, when aromatic or other volatile substances are concerned, is to mix the tincture with sugar in coarse powder, expose the mixture to a very gentle heat or in the sun till the alcohol has evaporated, and then prepare the syrup from the impregnated sugar by dissolving it in the requisite proportion of water. Since the introduction into use of the process of percolation, or filtration by displacement, it has been applied very advantageously to the preparation of various syrups, especially those made from vegetables of which the active principle is injured or dissipated by decoction. But, unless the operator be at once skilful and careful, there will be danger of imperfectly extracting the active matters, and thus making a feeble preparation. One important practical rule is, when the liquid obtained by percolation requires concentration, to set aside the first portions of filtered liquor, which are usually strongly impregnated, and to subject only the subsequent weaker portions to evaporation. For the mode of properly conducting this process the reader is referred to page 574.

The quality and quantity of the sugar employed are points of importance. Refined sugar should always be used, as it saves the necessity of clarification, and makes a clearer and better flavored syrup than the impure kinds. The U. S. Pharmacopœia simply directs sugar, but explains that it is the purified or refined sugar which is indicated by that term. In relation to the quantity of sugar, if in too small proportion, fermentation is apt to occur; if too abundant, crystallization. The proper proportion is about two parts to one of the liquid. A somewhat smaller quantity will answer, where an acid, such as lemon-juice or vinegar, is used.

As it is desirable, in many instances, that the active matters should be in as concentrated a state as possible in the syrup, it is often necessary to evaporate a large proportion of the watery fluid in which they are dissolved. This may be done either before the addition of the sugar or afterwards. In either case care is requisite not to apply a heat too great or too long continued, lest the active principles should be injured. When these are very volatile or easily decomposed by heat, it is expedient to dispense with concentration altogether. Some substances which are volatilized or decomposed at the temperature of boiling water remain fixed and unaltered at that which is necessary for the evaporation of alcohol. These, as before observed, may be dissolved in diluted alcohol, and the concentration effected by evaporating the spirituous part of the solvent. Independently of the injury which the medicinal ingredient of the syrup may sustain, the syrup itself is apt to become brown by a long-continued application of heat, even when the degree is not excessive. It is recommended, therefore, that syrups which admit of concentration should be boiled briskly over a lively fire, so as to accomplish the object as quickly as possible. It is important to be able to ascertain positively when syrups have attained the due consistence. An operator skilled in their preparation can judge with sufficient accuracy by various familiar signs; such as the slowness with which the parts of a drop of syrup coalesce, when previously separated by the edge of a blunt instrument; and the receding of the last portion of each drop, when the syrup, after being cooled, is poured out drop by drop. A pellicle forming upon the surface of the syrup when it cools, indicates that it has been boiled too much. But these signs are not to be relied on, except by those who have acquired much experience. The proper point of concentration is best ascertained by the use of that variety of Baumé's hydrometer called a *saccharometer;* an instrument useful to those making syrups upon the large scale. This should stand at 30° in boiling syrup (30½° in hot weather), and at 35° in the syrup when it is cool. Another very accurate, though less ready, method, is to ascertain the sp. gr. by weighing a portion of the liquid. Syrup when boiling should have a sp. gr. of about 1·261; when cold, of about 1·310. Thomson and Duncan are mistaken in giving the proper sp. gr. of cold syrup as 1·385. We found that of a specimen of simple syrup, made with two pounds and a half of sugar to a pint of water, as directed in former editions of the U. S. Pharmacopœia, to be 1·326 at 68° F.; this strength is rather too great for practical convenience in cold weather. In the syrup now officinal it is only 1·310 at 15° C. (59° F.), which is an improvement. A third method of ascertaining the proper point of concentration is by the thermometer, which, in boiling syrup of the proper consistence, stands at 105° C. (221° F.). This indication is founded on the fact that the boiling point of syrup rises with the increase of its density.

When carefully prepared with the best double refined sugar, syrups usually require no other clarification than to remove any scum which may rise to their surface upon standing, and to pour them off from any dregs which may subside. But, as the sugar employed is seldom free from impurities, it may be best, as a general rule, to remove the scum as it rises during the heating process, and to strain the syrup while hot through muslin or flannel. Should syrups at any time want the due degree of transparency, they may be filtered through paper if a hot-water funnel is used, or, when likely to be injured by the treatment, may be clarified by means of the white of egg or animal charcoal, as mentioned under the head of *Syrupus.* But the active vegetable principles are so apt to be absorbed by the charcoal along with impurities, that this agent should be used with caution.

The medicated syrups are liable to undergo various alterations, according to their nature and mode of preparation. The acid syrups, when too much boiled, often let fall a copious white deposit, which is a saccharine matter analogous to the sugar of grapes, produced by the reaction of the acid upon the sugar. Even at ordinary temperatures, acids slowly convert common sugar into grape sugar, which, being less soluble than the former, is gradually deposited in the form of crystalline grains. Syrups containing too little sugar are subject to the vinous fermentation, in consequence of the presence of matters which act as a ferment. Those which contain too much, deposit a portion in the crystalline state; and the crystals, attracting the sugar remaining in solution, gradually weaken the syrup, and render it liable to the same change as when originally made with too little sugar. The want of due proportion of saccharine matter frequently also gives rise to mouldiness, when air has access to the syrup. It is said that syrups enclosed while they are still hot in bottles which are not full are apt to ferment, because the watery vapor, rising to the surface and there condensing, diminishes the proportion of sugar, so as to produce a commencement of chemical action, which gradually extends through the whole mass; but, if the bottles are filled, or are well shaken, this result is obviated; and the syrups will generally keep better when thus treated. When syrups undergo the vinous fermentation, they become covered at the surface with froth, produced by the disengagement of carbonic acid, and acquire a vinous odor from the presence of alcohol; while their consistence is diminished by the loss of a portion of the sugar, which has been converted into that liquid. When the quantity of alcohol has increased to a certain point, the fermentation ceases, or goes on more slowly, owing to the preservative influence of that principle; and, as the active ingredient of the syrup has frequently undergone no material change, the preparation may often be recovered by boiling so as to drive off the alcohol and carbonic acid, and concentrate the liquid sufficiently. A syrup thus revived is less liable afterwards to undergo change, because the principles which acted as ferments have been diminished or consumed. It is obvious that syrups which depend for their virtues upon a volatile ingredient, or one readily changeable by heat, cannot be restored to their original condition. A very convenient method of preparing syrups has come into use recently, called the "cold process." For some syrups it is to be preferred to the usual method of heating, and all syrups which contain a volatile principle, or one likely to be injured by heat, are preferably made by *percolation.* Mr. L. Orynski, *Druggists' Circular*, March, 1871, first drew attention to the subject, and R. Hunstock, in *A. J. P.*, Sept. 1875, and Sept. 1878, gave the results of his experience with the process. He takes a percolator and introduces lightly into the lower orifice a small piece of sponge, the sugar (granulated) is then poured in, and upon this the water, the apparatus being arranged as is usual in the process of percolation. The percolator may be covered loosely, and the operation will proceed without further attention, the syrup coming through drop by drop. If it should be necessary to use crushed sugar, the percolator must be corked at the lower orifice, the sugar and water introduced and allowed to macerate until the former has dissolved down to *half its bulk*, when the cork may be removed and the liquid be allowed to drop. If, after the liquid has all passed, there remains a quantity of undissolved sugar in the percolator, enough may be poured back to dissolve it, afterwards adding sufficient water to bring the whole up to the required measure.

To be successful in using the process, care in several particulars must be exercised. 1. The percolator used should be cylindrical or semi-cylindrical, and cone-shaped as it nears the lower orifice. 2. The sugar must be coarse, else it forms into a compact mass, which the liquid cannot permeate. 3. The sponge must be introduced with care. If pressed too tightly in, it will effectually stop the process; if too loosely, the liquid will pass too rapidly and will, in consequence, be weak and turbid (not properly filtered). See also a practical paper on this subject in *A. J. P.*, Jan. 1881, by G. H. Chas. Klie.

At best syrups are apt to change, and various measures have been proposed for their preservation; but the best plan is to make small quantities of syrups at a time, and to keep them, unless when wanted for immediate use, in bottles quite full and well stopped, which should be put in the cellar or other cool place.

The following Syrups have been admitted to the U. S. Pharmacopœia of 1880. *Syrupus Acidi Hydriodici, Syrupus Althææ, Syrupus Calcii Lactophosphatis, Syrupus Calcis, Syrupus Ferri Bromidi, Syrupus Ferri Quininæ et Strychninæ Phosphatum, Syrupus Hypophosphitum, Syrupus Hypophosphitum cum Ferro, Syrupus Picis Liquidæ, Syrupus Rubi Idæi, Syrupus Sennæ.*

SYRUPUS. *U.S., Br.* *Syrup.*

(SY̆-RŪ'PŬS.)

Syrupus Simplex, *Br.*, also *P.G.;* Simple Syrup; Syrupus Sacchari, s. Albus; Sirop de Sucre, Sirop simple, *Fr.;* Weisser Syrup, *G.*

"Sugar, in coarse powder, *sixty-five parts* [or eighty ounces av.]; Distilled Water, *a sufficient quantity*, To make *one hundred parts* [or ninety fluidounces]. Dissolve the Sugar, with the aid of heat, in *thirty-five parts* [or forty fluidounces] of Distilled Water, raise the temperature to the boiling point, and strain the solution while hot. Then incorporate with the solution enough Distilled Water, added through the strainer, to make the Syrup weigh *one hundred parts* [or measure five pints and ten fluidounces]. Syrup thus prepared has the sp. gr. 1·310." *U. S.*

"Take of Refined Sugar *five pounds* [avoirdupois]; Distilled Water *two pints* [Imperial measure]. Dissolve the Sugar in the Water with the aid of heat; and add, after cooling, as much Distilled Water as may be necessary to make the weight of the product seven pounds and a half [avoird.]. The sp. gr. should be 1·330." *Br.*

This syrup, when properly prepared, is inodorous, of a sweet taste without peculiar flavor, thick, viscid, nearly colorless, and perfectly transparent. If somewhat turbid, as it is apt to be when made with sugar not well refined, it may be clarified by beating the white of an egg to a froth with three or four ounces of water, mixing this with the syrup, boiling the mixture for a short time that the albumen may coagulate, and taking off the scum which rises to the surface, or separating it by filtration through paper or flannel. Two gallons of the syrup may be thus clarified. Any color and peculiar flavor which it may possess may be removed by treating it, at the same time, with a small proportion (about 5 per cent.) of animal charcoal.

The white of egg is beaten to a froth in order that, when it coagulates, it may be rendered by the air which it contains specifically lighter than the syrup, and thus rise to the surface. If not thus treated, it floats, when coagulated, in the syrup, or sinks to the bottom. Now it is obvious that, if the syrup and albumen be heated together, the latter must be deprived of a portion of the air which it contains before the point of coagulation is attained, and thus become less disposed to rise to the surface. Guibourt, therefore, recommends that it should not be added till the syrup is boiling hot, and should then be poured in from a height, in order to increase the quantity of air entangled in it. M. Magnes-Lahens has found paper pulp to be of the greatest service in the clarification of syrup. He uses a white unsized paper of good quality, reducing it to a paste by agitation in a bottle with a portion of the menstruum to be used, and heating it with the syrup during the whole process of solution, and finally filtering through a "swan's down paper" filter. (*P. J. Tr.*, April, 1872, p. 825.)

From the observations of M. Maumené, it appears that a solution of pure cane sugar, when long kept, undergoes a molecular change analogous to that produced by the reaction of weak acids; the saccharine liquid becoming brown when boiled with potassa. But, as this phenomenon is exhibited alike by uncrystallizable sugar and by glucose, the experiment does not determine which of those forms of saccharine matter has been produced. (*Comptes-Rendus*, xxxix. 914.) Prof. Procter observed a similar change in simple syrup which had been kept in his cabinet for six years. (*A. J. P.*, xxvii. 430.) M. Schacuffèle, having noticed, on one occasion, in the preparation of simple syrup, that the foam exhibited a singular blue color, while a part of the cane sugar was rapidly transformed into the uncrystallizable variety, made investigations as to the cause, and was led to the conclusion that it was the presence of indigo in the loaves of sugar, introduced with the view of giving brilliancy and whiteness; but this conclusion was probably erroneous, as it is well known that *ultramarine*, and not indigo, is used for this purpose. The presence of a blue coloring matter in sugar has frequently been noticed in this country, and syrup made from such sugar is not colorless, and in a short time deposits a dark-colored sediment.

Syrup is very useful in the formation of pills and mixtures, and in various other pharmaceutical operations in which sugar in solution is required.

The U. S. syrup is slightly weaker than that formerly officinal; it has the sp. gr. 1·310, which is as near as may be the true standard for our climate. That of the Br. syrup is 1·330, probably adapted to the climate of Great Britain, which is not so cold in winter as ours, at least in the Northern and Middle States.

Pharm. Uses. In preparing Pilulæ Aloes et Myrrhæ, *U. S.;* Pilula Cambogiæ Composita, *Br.;* Pilulæ Galbani Comp., *U. S.;* Pilulæ Scillæ Comp., *U. S.*

Off. Prep. Confectio Opii, *Br.;* Confectio Scammonii, *Br.;* Mistura Creasoti, *Br.;* Mistura Cretæ, *Br.;* Pilula Cambogiæ Composita, *Br.;* Massa Ferri Carbonatis, *U. S.;* Pilulæ Ferri Compositæ, *U. S.;* Syrupus Acaciæ, *U. S.;* Syrupus Acidi Citrici, *U. S.;* Syrupus Acidi Hydriodici, *U. S.;* Syrupus Aurantii, *Br.;* Syrupus Chloral, *Br.;* Syrupus Ipecacuanhæ, *U. S.;* Syrupus Krameriæ, *U. S.;* Syrupus Lactucarii, *U. S.;* Syrupus Rosæ, *U. S.;* Syrupus Rhei Aromaticus, *U. S.;* Syrupus Rubi, *U. S.;* Syrupus Zingiberis, *Br.*

SYRUPUS ACACIÆ. *U. S.* *Syrup of Gum Arabic.*

(SY̦-RŪ′PU̦S A̦-CĀ′CI̦-Æ.)

Syrupus Gummosus, *P. G.;* Sirop de Gomme, *Fr.;* Gummisyrup, *G.*

"Mucilage of Acacia, *twenty-five parts* [or four and a half fluidounces]; Syrup, *seventy-five parts* [or twelve fluidounces], To make *one hundred parts* [or about one pint]. Mix them. This Syrup should be freshly made, when required for use." *U. S.*

We do not think that the direction to make this syrup from mucilage and syrup is an improvement; the proportion of gum was not too great in the former process, and there is less in that of 1880. The greatest objection is, however, in the fact that mucilage of acacia will sometimes not keep a day in hot weather, and its introduction into syrup without heating will surely induce fermentation, which, when once started, increases with great rapidity in this syrup. We append in the foot-note the process of the U. S. P. 1870, as it is to be preferred.* This syrup is useful in the preparation of mixtures, pills, and troches, and is a good demulcent; but unfortunately the proportion of the gum to the sugar is too small to meet all the indications calling for the conjoint use of these two substances. To obviate fermentation, Mr. C. B. Mann commends the use of one fluidounce of glycerin and seven fluidounces of water as the solvent.

SYRUPUS ACIDI CITRICI. *U. S.* *Syrup of Citric Acid.*

(SỴ-RÛ-PỤS ĂÇ'Ị-DĪ CĬT'RỊ-CĪ.)

Sirop d'Acide citrique, *Fr.;* Citronensäuresyrup, *G.*

"Citric Acid, *eight parts* [or one hundred and fifty grains]; Water, *eight parts* [or three fluidrachms]; Spirit of Lemon, *four parts* [or one hundred minims]; Syrup, *nine hundred and eighty parts* [or two pints], To make *one thousand parts* [or about two pints]. Mix the Spirit of Lemon with the Syrup contained in a bottle; then add, gradually, the Citric Acid dissolved in the Water, shaking the bottle after each addition until the whole is thoroughly mixed." *U. S.*

This is more uniform in its character, keeps better, and is more readily prepared than lemon syrup, but does not equal it in flavor, if the latter is well made. If long kept it is apt to acquire a musty taste, and to deposit grape sugar copiously, in consequence of the action of the acid on the cane sugar. It is much employed as an agreeable and refrigerant addition to drinks, especially carbonic acid water. Tartaric acid, on account of its greater cheapness, has not unfrequently been substituted for the citric; but the syrup made with it does not keep so well, and, moreover, is more apt to irritate the stomach.

Off. Prep. Liquor Magnesii Citratis, *U. S.*

SYRUPUS ACIDI HYDRIODICI. *Syrup of Hydriodic Acid.*

(SỴ-RÛ'PỤS ĂÇ'Ị-DĪ HȲ-DRỊ-ŎD'Ị-CĪ.)

"A syrupy liquid containing 1 per cent. of absolute hydriodic acid [**HI ; 127·6**]." *U. S.*

"Iodine, *ten parts* [or ninety-five grains]; Alcohol, *eighty parts* [or two fluidounces]; Syrup, *one hundred and fifty parts* [or two and a half fluidounces]; Sugar, *five hundred parts* [or eleven ounces av.]; Spirit of Orange, *five parts* [or one fluidrachm]; Distilled Water, *a sufficient quantity*, To make *one thousand parts* [or one pint]. Dissolve the Iodine in the Alcohol, with a very gentle heat, in a loosely stoppered flask, avoiding loss of Iodine from vaporization. Add the solution to the Syrup previously mixed with *one hundred and fifty parts* [or three fluidounces] of Distilled Water, and pass through the mixture a current of hydrosulphuric acid gas, until it acquires a pure yellowish color, and ceases to turn brown on shaking. Filter the liquid through white filtering paper, returning the first portions until it runs clear; wash the filter with a little Distilled Water, and evaporate the filtrate and washings, in a tared porcelain capsule, on a water-bath, at a temperature not exceeding 55° C. (131° F.), constantly stirring, until all odor of hydrosulphuric acid has disappeared. Then set the capsule aside, well covered, and allow the contents to cool. When cold, add the Spirit of Orange, the Sugar, and enough Distilled Water to make the whole weigh *one thousand parts* [or measure one pint]. When the Sugar has been dissolved, by stirring, strain the Syrup through a pellet of cotton placed in the neck of the funnel, which is to be kept covered, and transfer the filtered Syrup to small vials, which should be completely filled, securely corked, and kept in a cool and dark place." *U. S.*

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* *Syrupus Acaciæ, U. S.* 1870. "Take of Gum Arabic, in pieces, *two troyounces;* Sugar [refined], in coarse powder, *fourteen troyounces;* Water *eight fluidounces.* Dissolve the Gum Arabic in the Water, without heat; then, having added the Sugar, dissolve it with a gentle heat, and strain." *U. S.* 1870. The gum should be carefully selected; and, if its solution contain impurities, it should be strained before the addition of the sugar. On the whole, taking into consideration the great liability to the use of materials not quite pure, it might be advisable, in all cases, to heat momentarily to the boiling point, skim off what may rise to the surface, and then strain.

This is a new officinal syrup; its introduction grows out of the fact that an aqueous solution of hydriodic acid is unstable, the iodine being in time always liberated, thus rendering it irritant and unfit for internal administration. (See *Hydriodic Acid*, in Part II.) It has been proved that syrup protects the acid efficiently, and the above process has been devised with the view of furnishing a preparation which will remain, if carefully preserved, for a long time unchanged. By dissolving the iodine in the alcohol, and adding the solution to the syrup, the greater part is precipitated as a fine powder, and diffused through the liquid, whilst the formation of large particles of iodine coated with sulphur, which are very apt to form in the ordinary processes for making hydriodic acid, is avoided. Care should be taken to drive off all of the sulphuretted hydrogen, at a temperature not exceeding that indicated in the process.

Properties. Syrup of hydriodic acid is officinally described as "a transparent, colorless or not more than pale straw-colored liquid, odorless, having a sweet and acidulous taste, and an acid reaction. It contains about 1 per cent. of absolute hydriodic acid, and has the sp. gr. 1·300. If disulphide of carbon be poured into a small portion of the Syrup, a little chlorine water then added, and the whole agitated, the disulphide will separate with a violet color. Gelatinized starch added to the Syrup should not impart to it more than a faint bluish tint (abs. of more than traces of free iodine). Test-solution of chloride of barium, added to a portion of the Syrup, should produce no precipitate (abs. of sulphuric acid). Test-solution of nitrate of silver produces a precipitate which is nearly insoluble in water of ammonia (abs. of hydrochloric acid). "31·9 Gm. of Syrup of Hydriodic Acid should require for complete precipitation 25 C.c. of the volumetric solution of nitrate of silver." *U. S.*

For the medical properties of this syrup, see *Hydriodic Acid*, Part II. The dose of the syrup is twenty to forty minims (1·25 to 2·5 C.c.), well diluted.

SYRUPUS ALLII. *U. S.* *Syrup of Garlic.*

(SY-RÛ′PUS ĂL′LI-Ī.)

Sirop d'Ail, *Fr.;* Knoblauchsyrup, *G.*

"Fresh Garlic, sliced and bruised, *fifteen parts* [or seven ounces av.]; Sugar, in coarse powder, *sixty parts* [or twenty-eight ounces av.]; Diluted Acetic Acid, *forty parts* [or eighteen fluidounces], To make *one hundred parts* [or about two pints]. Macerate the Garlic with *twenty-five parts* [or eleven fluidounces] of the Diluted Acetic Acid, in a glass vessel, for four days, and express the liquid. Then mix the residue with the remainder of the Acid, and again express, until enough additional liquid has been obtained to make the whole, when filtered, weigh *forty parts* [or measure eighteen fluidounces]. Lastly, pour the filtered liquid upon the Sugar contained in a suitable bottle, and agitate until it is dissolved. Keep the Syrup in well-stopped, filled bottles, in a cool place." *U. S.*

This preparation is made upon correct principles; as vinegar is a better solvent of the active matter of garlic than water. The syrup is given in chronic catarrhal affections of the lungs, and is particularly beneficial in infantile cases, by the stimulus which it affords to the nervous system. A teaspoonful (3·75 C.c.) may be given for a dose to a child a year old.

SYRUPUS ALTHÆÆ. *U. S.* *Syrup of Althæa.*

(SY-RÛ′PUS ĂL-THÆ′Æ—ăl-thē′ē.)

"Althæa, cut in small pieces, *four parts* [or one ounce av.]; Sugar, in coarse powder, *sixty parts* [or fifteen ounces av.]; Water, *a sufficient quantity*, To make *one hundred parts* [or about one pint]. Having washed the Althæa with cold Water, pour upon it *sixty parts* [or fourteen fluidounces] of cold Water, and macerate for one hour, stirring frequently; then drain through flannel, without expressing. To *forty parts* [or nine fluidounces] of the drained liquid add the Sugar, and dissolve it by agitation, without heat. This Syrup should be freshly made, when required for use." *U. S.*

This is a new officinal syrup, identical with that of the German Pharmacopœia. It is an agreeable demulcent, but not superior to syrup of acacia, which it equals in its tendency to ferment. Dose, a fluidrachm to half a fluidounce.

SYRUPUS AMYGDALÆ. *U. S.* *Syrup of Almond.* *Syrup of Orgeat.*

(SY̦-RŪ′PU̦S A̦-MY̆G′DA̦-LÆ).

Syrupus Emulsivus; Sirop d'Orgeat (d'Amandes, émulsif), *Fr.;* Mandelsyrup, *G.*

"Sweet Almond, *ten parts* [or five ounces av.]; Bitter Almond, *three parts* [or one and a half ounces av.]; Sugar, in coarse powder, *fifty parts* [or twenty-five ounces av.]; Orange Flower Water, *five parts* [or two and a half fluidounces]; Water, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Having blanched the Almonds, rub them in a mortar to a very fine paste, adding, during the trituration, *three parts* [or one and a half fluidounces] of Water and *ten parts* [or five ounces av.] of Sugar. Mix the paste thoroughly with the Orange Flower Water and *thirty parts* [or fifteen fluidounces] of Water, strain with strong expression, and add enough Water to the dregs, to obtain, after renewed expression, *sixty parts* [or twenty-five fluidounces] of strained liquid. To this add the remainder of the Sugar, dissolve it by agitation without heat, and strain through muslin. Keep the Syrup in well-stopped, filled bottles, in a cool place." *U. S.**

This process corresponds closely with that of the French Codex. Orange-flower water, which is an ingredient of the French preparation, was wanting in the U. S. P. 1870 syrup. This is an elegant syrup, much employed in Europe and in this country. It is demulcent, nutritive, and, in consequence of the hydrocyanic acid of the bitter almonds, very slightly sedative. It is said to impair greatly the odor of musk and asafetida, when mixed with them. It may be added to cough mixtures, or used as an agreeable vehicle for administering stronger remedies.

SYRUPUS AURANTII. *U. S., Br.* *Syrup of Orange.*

(SY̦-RŪ′PU̦S ÂU-RĂN′TI̦-Ī—âw-răn′she̦-ī.)

Sirop d'Écorces d'Oranges, *Fr.;* Orangenschalensyrup, *G.*

"Sweet Orange Peel, deprived of the inner, white layer, and cut into small pieces, *five parts* [or two and a half ounces av.]; Alcohol, *five parts* [or three fluidounces]; Precipitated Phosphate of Calcium, *one part* [or half an ounce av.]; Sugar, *sixty parts* [or twenty-eight ounces av.]; Water, *a sufficient quantity*, To make *one hundred parts* [or about two pints]. Macerate the Orange Peel with the Alcohol for seven days; then express the liquid. Rub this with the Precipitated Phosphate of Calcium and *thirty parts* [or thirteen fluidounces] of Water, gradually added; filter the mixture, and pass enough Water through the filter to make the filtrate weigh *forty parts* [or measure seventeen fluidounces]. Lastly, add the Sugar, dissolve it by agitation, without heat, and strain." *U. S.*

"Take of Tincture of Orange Peel *one fluidounce;* Syrup *seven fluidounces.* Mix." *Br.*

The present U. S. formula is an improvement over that of 1870, in which evaporation was resorted to, to deprive the tincture of orange peel of alcohol, for, although the temperature was limited to 120° F., even this was sufficient to affect the flavor of the concentrated tincture. By employing maceration and expression with a smaller quantity of alcohol, the use of heat is avoided. The proportion of alcohol directed to extract the oil from the orange peel is necessarily small; indeed, it is almost entirely absorbed by the orange peel, which should be grated. The substitution of precipitated phosphate of calcium for carbonate of magnesium is a change, but not an improvement, for the use of this substance under the impression that it is an unobjectionable substitute for the magnesium salt, on account of its insolubility, has been abandoned. The British preparation, which is a mere mixture of the tincture with syrup, is in all respects inferior. The use of carbonate of magnesium was first suggested by Mr. John D. Finley. The syrup has an agreeable flavor, for which it is alone employed.

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* *Orgeat Powder.* Dr. Enders, on account of the tendency of syrup of almond to spoil, prepares a powder by making an emulsion of twenty parts of sweet almonds with sufficient water, mixing it with seventy-two parts of sugar, rapidly evaporating with the steam bath and pulverizing the residue, and keeping in well-corked bottles. To make one hundred parts of the syrup, sixty-eight parts of the powder are dissolved with heat in twenty-four parts of water, and five parts of orange-flower water and three parts of bitter almond water added. (*A. J. P.*, 1874, p. 362.)

Off. Prep. Confectio Sulphuris, *Br.;* Trochisci Ipecacuanhæ, *U. S.*

SYRUPUS AURANTII FLORUM. *U. S.* *Syrup of Orange Flowers.*

(SY̦-RŬ'PU̦S ÂU-RĂN'TI̦-Ī FLŌ'RŬM—âw-răn'shẹ-ī.)

Syrupus Aurantii Floris, *Br.;* Sirop de Fleurs d'Oranges, *Fr.;* Pomeranzenblüthensyrup, *G.*

"Orange Flower Water, *thirty-five parts* [or half a pint]; Sugar, in coarse powder, *sixty-five parts* [or sixteen ounces av.], To make *one hundred parts* [or about one pint]. Dissolve the Sugar in the Orange Flower Water by agitation, without heat." *U. S.*

"Take of Orange-flower Water *eight fluidounces;* Refined Sugar *three pounds* [avoirdupois]; Distilled Water *sixteen fluidounces*, or *a sufficiency.* Dissolve the Sugar in the Distilled Water, by means of heat; strain, and when nearly cold add the Orange-flower Water, with a sufficient quantity of Distilled Water, if necessary, to make the product four pounds and a half [avoird.]. The sp. gr. should be 1·330." *Br.*

Percolation to dissolve the sugar may be advantageously substituted here for solution by agitation (see page 1391); this syrup is used chiefly for flavoring mixtures. The dose is a fluidrachm (3·75 C.c.).

SYRUPUS CALCII LACTOPHOSPHATIS. *U. S.* *Syrup of Lactophosphate of Calcium.*

(SY̦-RŬ'PU̦S CĂL'CI̦-Ī LĂC-TO̦-PHO̦S-PHĀ'TĬS.)

"Precipitated Phosphate of Calcium, *twenty-two parts* [or one ounce av.]; Lactic Acid, *thirty three parts* [or nine and a half fluidrachms]; Orange Flower Water, *eighty parts* [or three fluidounces]; Sugar, in coarse powder, *six hundred parts* [or twenty-eight ounces av.]; Hydrochloric Acid, Water of Ammonia, Water, each, *a sufficient quantity*, To make *one thousand parts* [or about two pints]. To the Precipitated Phosphate of Calcium, mixed with *three hundred parts* [or thirteen fluidounces] of cold Water, add enough Hydrochloric Acid to dissolve it. Filter the solution, dilute it with *twelve hundred parts* [or three pints] of cold Water, and then add Water of Ammonia, until it is slightly in excess. Transfer the mixture at once to a fine, wetted muslin strainer. As soon as the liquid has run off, return the magma to the vessel, mix it quickly with *twelve hundred parts* [or three pints] of cold Water, and again transfer it to the strainer. When it has drained, mix the magma at once with the Lactic Acid, and stir until it is dissolved. Then add the Orange Flower Water and enough Water to make the solution weigh about *three hundred and fifty parts* [or measure fourteen fluidounces], filter, and pass enough Water through the filter, to make the filtrate weigh *four hundred parts* [or measure seventeen fluidounces]. Lastly, add to this the Sugar, dissolve it by agitation, without heat, and strain." *U. S.*

This new officinal syrup is almost identical with the preparation proposed by Mr. William Neergaard. Freshly precipitated calcium phosphate is soluble in lactic acid, and this preparation is such a solution protected from change and rendered more agreeable to the taste by the addition of sugar and orange flower water. As made by this formula it will usually be found to contain a precipitate of a gelatinous character, which gradually forms in the course of a few days or weeks, and the remedy commonly used to prevent this precipitation is the addition of a fluidrachm of hydrochloric acid to a pint of the syrup; hydrochloric acid is a better solvent for calcium phosphate than lactic acid. The process of percolation to dissolve the sugar may be advantageously substituted here for that of agitation. The syrup is sometimes prepared by dissolving two hundred grains of lactophosphate of lime (which is now furnished by the manufacturing chemists) in a pint of syrup flavored with orange flower water, a fluidrachm of hydrochloric acid being added to prevent precipitation. This syrup affords an excellent means of administering phosphate of lime. The dose is two to four fluidrachms (7·5 to 15 C.c.), representing from 3 to 6 grains of the lime salt.

SYRUPUS CALCIS. *U. S.* *Syrup of Lime.*

(SY̧-RÛ'PU̧S CĂL'CI̧S.)

Liquor Calcis Saccharatus, *Br.;* Saccharated Solution of Lime; Sirop de Chaux, *Fr.;* Kalksyrup, *G.*

"Lime, *five parts* [or one ounce av.]; Sugar, in coarse powder, *thirty parts* [or six ounces av.]; Water, *a sufficient quantity*, To make *one hundred parts* [or twenty ounces av.]. Triturate the Lime and Sugar thoroughly in a mortar; then add the mixture to *fifty parts* [or ten fluidounces] of boiling Water, contained in a bright, copper or tinned-iron vessel, and boil the mixture for five minutes, constantly stirring. Dilute it with an equal volume of Water, and filter through white paper. Finally, evaporate the Syrup to *one hundred parts* [or twenty ounces av.]." *U. S.*

"Take of Slaked Lime *one ounce* [avoirdupois]; Refined Sugar, in powder, *two ounces* [avoird.]; Distilled Water *one pint* [Imperial measure]. Mix the Lime and the Sugar by trituration in a mortar. Transfer the mixture to a bottle containing the Water, and, having closed this with a cork, shake it occasionally for a few hours. Finally separate the clear solution with a siphon, and keep it in a stoppered bottle. The sp. gr. is 1·052. One fluidounce (460·2) requires for neutralization 254 grain-measures of the *volumetric solution of oxalic acid*, which corresponds to 7·11 grains of lime in one fluidounce." *Br.*

The British Saccharated Solution of Lime differs from the U. S. Syrup only in containing a smaller proportion of sugar. This newly officinal syrup is identical with that proposed by Dr. E. R. Squibb. (See 14th ed. U. S. D., page 1288.)

Sugar forms with lime certain definite compounds which may be looked upon as saccharates. According to M. S. Benedikt (*Journ. de Pharm.*, 4e sér., xix. 96), there are at least four of these combinations. Some, if not all, of them are much more soluble than the lime itself, so that in this way a much stronger solution of lime can be obtained than by the instrumentality of water alone. The syrup remains perfectly transparent, and is in no degree disturbed by dilution with water. It has a decidedly alkaline and even caustic taste, and should always be largely diluted when administered. It was first prepared by M. Beral; and its practical use was originally suggested by Dr. Capitaine, of Paris.*

Medical Properties. Dr. Charles E. Buckingham, of Boston, says, in relation to this syrup, that it should not be taken either in pill or dissolved in water, as it will occasion nausea or produce a caustic effect. He gives it in milk, and considers thirty drops (1·25 C.c.) every three hours as a sufficient dose. He has never known it to cause alkaline urine. (*Boston Med. and Surg. Journ.*, April 4, 1867, p. 186.) Dr. Buckingham has used the syrup of lime with great success in acute rheumatism; twelve cases having been treated with this remedy exclusively, with an average duration of ten days. (*Ibid.*, April 11, 1867, p. 105.) Others have tried the remedy with a similar experience. Trousseau employed it in the chronic diarrhœa of infants, and recommends adding about eight grains of the syrup to each quart of milk taken. He gives the saturated syrup of lime to a child in the quantity of fifteen or thirty grains (0·72 to 1·5 C.c.) in the course of the day; to an adult, five times the quantity. Saccharated solution of lime may be used in diarrhœa with acidity, in vomiting, in affections of the urinary organs requiring antacid treatment, and for all other therapeutical purposes to which lime is applied. The dose equivalent to a fluidounce of lime-water is twenty minims (1·25 C.c.).

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* *Liquid Glue.* It is stated that a very adhesive glue, remaining liquid at ordinary temperatures, may be prepared by dissolving glue in a solution of saccharate of lime. (*A. J. P.*, 1872, p. 562.)

SYRUPUS CHLORAL. *Br.* *Syrup of Chloral.*

(S̤Y̤-RÛ'PṲS ÇHLŌ'RA̤L.)

"Take of Hydrate of Chloral 80 *grains;* Distilled Water 4 *fluidrachms;* Simple Syrup *a sufficiency.* Dissolve the Hydrate of Chloral in the Water, and add the Syrup until the mixed product measures a fluidounce." *Br.*

The adult dose, two fluidrachms (7·5 C.c.), contains 20 grains of chloral.

SYRUPUS FERRI BROMIDI. *U.S.* *Syrup of Bromide of Iron.*

(SY̤-RÛ'PṲS FĔR'RĪ BRŌ'MI̤-DĪ.)

"A syrupy liquid containing 10 per cent. of Ferrous Bromide [**$FeBr_2$; 215·5.**—FeBr; 107·75].

"Iron, in the form of fine wire, and cut into small pieces, *thirty parts* [or one and a half ounces av.]; Bromine, *seventy-five parts* [or nine fluidrachms]; Sugar, in coarse powder, *six hundred parts* [or twenty-eight ounces av.]; Distilled Water, *a sufficient quantity*, To make *one thousand parts* [or about two pints]. Introduce the Iron into a flask of thin glass of suitable capacity, add to it *two hundred parts* [or nine fluidounces] of Distilled Water and afterward the Bromine. Shake the mixture occasionally, until the reaction ceases and the solution has acquired a green color and has lost the odor of Bromine. Place the Sugar in a porcelain capsule and filter the solution of bromide of iron into the Sugar. Rinse the flask and Iron wire with *ninety parts* [or four fluidounces] of Distilled Water, and pass the washings through the filter into the Sugar. Stir the mixture with a porcelain or wooden spatula, heat it to the boiling point on a sand-bath, and, having strained the Syrup through linen into a tared bottle, add enough Distilled Water to make the product weigh *one thousand parts* [or measure two pints]. Lastly, shake the bottle and transfer its contents to small vials, which should be completely filled, securely corked, and kept in a place accessible to daylight." *U. S.*

Although this newly officinal syrup is not so sensitive to the oxidizing action of the air as syrup of iodide of iron, it is preferable to filter the solution into hot syrup instead of into sugar in an open capsule.

Properties. It is officinally described as "a transparent, pale green liquid, odorless, having a sweet, strongly ferruginous taste, and a neutral reaction. With test-solution of ferricyanide of potassium it yields a blue precipitate. If a little disulphide of carbon be added to the syrup, then a few drops of chlorine water, and the whole agitated, the disulphide will separate with a yellow or brown color. It should not deposit a sediment on keeping, and should not tinge gelatinized starch yellow (abs. of free bromine). 5·39 Gm. of the Syrup should require for complete precipitation 50 C.c. of the volumetric solution of nitrate of silver (corresponding to 10 per cent. of ferrous bromide)." *U. S.*

Medical Properties. Bromide of iron has been recommended as a sedative chalybeate tonic, and has been especially praised by Dr. Da Costa in chorea. In an extended trial of it, however, in the Dispensary of the University Hospital, it failed entirely to be of service in St. Vitus's dance. It is not an eligible chalybeate. The dose of the syrup is half to one fluidrachm (1·9 to 3·75 C.c.) containing from about four to eight grains of the bromide.

SYRUPUS FERRI IODIDI. *U. S., Br.* *Syrup of Iodide of Iron.*

(SY̤-RÛ'PṲS FĔR'RĪ Ī-ŎD'I̤-DĪ.)

"A syrupy liquid containing 10 per cent. of Ferrous Iodide [**FeI_2; 309·1.**—FeI; 154·55]." *U. S.*

Syrupus Ferri Iodati, *P.G.;* Sirop d'Iodure de Fer, *Fr.;* Eisenjodürsyrup, *G.*

"Iron, in the form of fine wire, and cut into small pieces, *twenty-five parts* [or two hundred and sixty-six grains]; Iodine, *eighty-two parts* [or two ounces av.]; Sugar, in coarse powder, *six hundred parts* [or fourteen ounces av.]; Distilled Water, *a sufficient quantity*, To weigh *one thousand parts* [or measure one pint]. Introduce the Iron into a flask of thin glass of suitable capacity, add to it *two* *hundred parts* [or five fluidounces] of Distilled Water and afterward the Iodine. Shake the mixture occasionally, until the reaction ceases and the solution has acquired a green color and has lost the odor of Iodine. Place the Sugar in a porcelain capsule and filter the solution of iodide of iron into the Sugar. Rinse the flask and Iron wire with *ninety parts* [or two fluidounces] of Distilled Water, and pass the washings through the filter into the Sugar. Stir the mixture with a porcelain or wooden spatula, heat it to the boiling point on a sand-bath, and, having strained the Syrup through linen into a tared bottle, add enough Distilled Water to make the product weigh *one thousand parts* [or measure one pint]. Lastly, shake the bottle and transfer its contents to small vials, which should be completely filled, securely corked, and kept in a place accessible to daylight." *U. S.*

"Take of fine Iron Wire *one ounce* [avoirdupois]; Iodine *two ounces* [avoird.], Refined Sugar *twenty-eight ounces* [avoird.]; Distilled Water *thirteen fluidounces.* Prepare a syrup by dissolving the Sugar in ten [fluid]ounces of the Water with the aid of heat. Digest the Iodine and the Iron Wire in a flask, at a gentle heat, with the remaining three [fluid]ounces of the Water, till the froth becomes white; then filter the liquid, while still hot, into the syrup, and mix. The product should weigh two pounds eleven ounces [avoird.], and should have the sp. gr. 1·385. It contains 4·3 grains of iodide of iron in a fluidrachm." *Br.*

These preparations furnish solutions of ferrous iodide, rendered more permanent by sugar. The mode of making the iodide is precisely the same as that given under the head of *Ferri Iodidum.* The iodine should be dry; for, if moist, as commercial iodine often is, less iodide of iron will be formed and the syrup will be proportionably weaker. In both processes a large excess of iron is taken, being greatest in the British. A moderate excess is useful in preventing the solution of iodide of iron from undergoing any change from the absorption of oxygen during filtration, before it comes in contact with the sugar. The method adopted in the present Pharmacopœia, of filtering the unprotected solution of ferrous iodide into the sugar contained in an open capsule, and afterward straining the syrup through linen, is one which is directly opposed to the experience of many practical pharmacists, and to the views heretofore held of the action of the air upon the solution of ferrous iodide, and although with care, in skilful hands, oxidation may be avoided, nothing is gained in time, and there is no question as to the superiority of the process of the Pharmacopœia of 1870. We append in a foot-note* this process, and if the quantity of iodine be increased by adding eighty-six grains, the quantity of iodide of iron will be the same as that in the syrup now officinal. Assuming that the iodine without loss is all converted into iodide of iron, it is easy to calculate the strength of the officinal solutions. Thus, it will be found that the U. S. syrup contains about 8·35 grains, and that of the British Pharmacopœia 4·30 grains, of the dry iodide to the fluidrachm. In both preparations there is sufficient sugar to constitute a syrup; the present U. S. process differing in this respect from that of 1850, which was denominated a solution, because containing insufficient sugar to be entitled to the name of a syrup. Indeed, the proportion of sugar in the old formula was insufficient duly to protect the iodide, and was therefore increased. In the solution of 1850, a coil of iron wire, or a strip of bright iron, immersed in the solution, was found to assist in preserving it from change.

The plan of protecting the solution of ferrous iodide from change by saccharine matter originated with M. Frederking, of Riga, who published a formula for the purpose in *Buchner's Repertorium* in 1839. The same plan was proposed in a paper by Prof. Procter, contained in the *A. J. P.* for April, 1840. In the *Journal de Pharmacie* for March, 1841, Dr. Dupasquier, of Lyons, claims to have made a pure ferrous iodide, protected by syrup of gum, as early as 1838. In the *P. J. Tr.* for August, 1841, the late Dr. A. T. Thomson published a paper in which he confirmed the results of Frederking and Procter, and proposed a formula for a *strong syrup*, which is the basis of that adopted by the British Pharmacopœia. For a practical process for making this syrup on a large scale, see *N. R.*, March, 1880.

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* "Take of Iodine, *two troyounces;* Iron, in the form of wire and cut in pieces, *three hundred grains;* Distilled Water, *three fluidounces;* Syrup, *a sufficient quantity.* Mix the Iodine, Iron, and Distilled Water in a flask of thin glass, shake the mixture occasionally until the reaction ceases, and the solution has acquired a green color and lost the smell of iodine. Then, having introduced a pint of Syrup into a graduated bottle, heat it by means of a water-bath to 212°, and, through a small funnel inserted in the mouth of the bottle, filter into it the solution already prepared. When this has passed, close the bottle, shake it thoroughly, and, when the liquid has cooled, add sufficient Syrup to make the whole measure twenty fluidounces. Lastly, again shake the bottle, and transfer its contents to two-ounce vials, which must be well stopped." *U. S.* 1870.

Properties. The U. S. syrup of iodide of iron is a "transparent, pale green liquid, odorless, having a sweet, strongly ferruginous taste, and a neutral reaction. With test-solution of ferricyanide of potassium it yields a blue precipitate. If a little disulphide of carbon be added to the syrup, then a few drops of chlorine water, and the whole agitated, the disulphide will separate with a purple or violet color. It should not deposit a sediment on keeping and should not tinge gelatinized starch blue (abs. of free iodine). 7·73 Gm. of the Syrup should require for complete precipitation 50 C.c. of the volumetric solution of nitrate of silver (corresponding to 10 per cent. of ferrous iodide)." *U. S.* In regard to the former U. S. syrup, Prof. E. S. Wayne observed that, when kept for some time, it occasionally deposited grape sugar, into which the cane sugar was converted, probably through the agency of hydriodic acid. According to Prof. J. M. Maisch, the solution was decomposed not only by light, but also by the action of atmospheric oxygen in bottles partly filled and frequently opened. The oxidation of the iron and the evolution of the iodine were accelerated by the action of light, when the solution was thus insecurely kept; but, when the altered solution was transferred to air-tight bottles, completely filled, and exposed to the direct light of the sun, it resumed its transparency; and its original color was restored, or rendered much lighter. After this restoration the solution could not be the same; and it is probable that it contained some ferric iodate. The removal of the apparent defects of a solution of iodide of iron by the action of sunlight is, therefore, not an admissible expedient; because it changes the nature of the solution. The same may be said of the addition of tartaric or citric acid, which has been proposed for clearing the discolored syrup. Syrup of iodide of iron is rendered brown by sulphuric acid, and emits violet vapors when heated.

Dr. Squibb states, in a communication to the *A. J. P.* (March, 1868, p. 99), that, after considerable experience with the U. S. preparation, he has known it to become discolored only in one instance; so that with care to avoid all injurious exposure it may be expected to keep well. But, in consequence of the facility with which it undergoes decomposition, with the liberation of iodine, it is very liable to become discolored with the least want of care. He therefore proposes, as a remedy for this inconvenience, to add to the discolored syrup a very small proportion of a solution of hyposulphite of sodium, which, without injury to the preparation, removes the color, and in a great degree restores the transparency. For this purpose fifteen or twenty grains of the crystallized hyposulphite may be dissolved in a fluidounce of water; and from fifteen to twenty minims of the solution are sufficient for a pint of syrup, if not darker than brown sherry. The solution is simply added to the syrup, and shaken up with it in the bottle. If the discoloration be deeper, more will be required; and the quantity requisite for the effect is a measure of the amount of change that may have occurred. The objection to the use of this salt is that a precipitate of sulphur usually takes place, which is so fine that it is very difficult to separate. Prof. J. F. Judge (*A. J. P.*, 1876, p. 159) recommends hypophosphorous acid in small proportions to restore the pale green color. Charles Rice preserves syrup of the iodide of iron successfully on the large scale by storing it in vessels having a stop-cock at the bottom and pouring a small quantity of pure olive oil upon the surface to protect it from oxidation. A. G. Hammer proposes the addition of syrup to a boiling solution of ferrous iodide before filtering from the excess of iron, and attributes the success in preservation to the fact that a portion of the cane sugar is converted into grape sugar, which he believes has greater powers in preventing change. (*Pharmacist*, 1876, p. 99.) One of the latest suggestions to preserve the syrup, and to restore it when discolored, is that of Carles's, who recommends the addition of a small quantity of hydrated ferrous sulphide. (*A. J. P.*, 1881, p. 360.) Glycerin has been proposed as a substitute for sugar in this preparation, and it answers the same purpose, but it may be doubted whether more effectually.

When the syrup is concentrated it becomes brown, and, when evaporated to dryness, forms a mass which may be called *saccharine iodide of iron*, and which is not entirely soluble again, a little ferric oxide being left. This saccharine iodide, being protected by the sugar it contains, is not liable to the objections which apply to the pure solid salt, and may be made into pills, but this preparation is inferior to the officinal Ferri Iodidum Saccharatum (see page 674).

Medical Properties. These have been detailed under the head of *Ferri Iodidum*. The dose of the syrup is from 15 to 30 minims (0·9–1·9 C.c.), diluted with water. The dilution should be made at the moment it is taken; and, in order to guard against injury to the teeth, the mouth should be carefully washed after each dose.

Solution of iodide of iron is sometimes used as an external application; and when so employed, the necessary dilution should be made at the moment of applying it.

SYRUPUS FERRI QUININÆ ET STRYCHNINÆ PHOSPHATUM. *U. S.* *Syrup of the Phosphates of Iron, Quinine, and Strychnine.*

(SY̆-RŪ'PŬS FĔR'RĪ QUI-NĪ'NÆ ĔT STRY̆CH-NĪ'NÆ PHŎS-PHĀ'TŬM.)

"Phosphate of Iron, *one hundred and thirty-three parts* [or four hundred grains]; Quinine, *one hundred and thirty-three parts* [or four hundred grains]; Strychnine, *four parts* [or twelve grains]; Phosphoric Acid, *eight hundred parts* [or four fluidounces]; Sugar, in coarse powder, *six thousand parts* [or forty-two ounces av.]; Distilled Water, *a sufficient quantity*, To make *ten thousand parts* [or about three pints]. Add the Phosphate of Iron to *twenty-five hundred parts* [or one pint] of Distilled Water, in a tared bottle large enough to hold the finished Syrup, and agitate frequently until the salt is dissolved. Having added the Phosphoric Acid to the solution, triturate the Quinine and Strychnine gradually with the mixture, in a mortar, until they are dissolved, then return the solution to the bottle and add enough Distilled Water to make the liquid weigh *four thousand parts* [or measure twenty-four fluidounces]. Lastly, add the Sugar, dissolve it by agitation, without heat, and filter through paper. Keep the syrup in small, well-stopped vials, in a cool and dark place." *U. S.*

The phosphate of iron used in this preparation is the new scaled salt (see page 680), and the phosphoric acid the 50 per cent. solution (see page 93). Each fluiddrachm of the syrup contains about one grain of phosphate of iron, one grain of quinine, and $\frac{1}{32}$ of a grain of strychnine. An insoluble precipitate of basic phosphate of iron is apt to be produced when this syrup is kept. Percolation to dissolve the sugar, instead of agitation, will doubtless be preferred by many (see page 1391).

Medical Properties. This new officinal has the medicinal activities of its ingredients, but is a very ineligible preparation, and has not even an agreeable taste to excuse its polypharmacy. A teaspoonful (3·75 C.c.) contains $\frac{1}{32}$ of a grain of strychnine, and may be considered as the average dose.

SYRUPUS HYPOPHOSPHITUM. *U. S.* *Syrup of Hypophosphites.*

(SY̆-RŪ'PUS HY̆-PO-PHOS-PHĪ'TŬM.)

Sirop de Hypophosphites, *Fr.*

"Hypophosphite of Calcium, *thirty-five parts* [or seven hundred and twenty grains]; Hypophosphite of Sodium, *twelve parts* [or two hundred and forty grains]; Hypophosphite of Potassium, *twelve parts* [or two hundred and forty grains]; Citric Acid, *one part* [or twenty grains]; Spirit of Lemon, *two parts* [or fifty minims]; Sugar, in coarse powder, *five hundred parts* [or twenty-four ounces av.]; Water, *a sufficient quantity*, To make *one thousand parts* [or about two pints]. Mix the Hypophosphites, and dissolve them, by trituration, in *three hundred and fifty parts* [or one pint] of Water. Should there be a trifling residue undissolved, allow the solution to settle, pour off nearly all of it, and add the Citric Acid so that the residue may be dissolved. Then, having mixed the liquids, add the Spirit of Lemon, and filter through paper, adding through the filter enough Water to make the whole weigh *five hundred parts* [or measure twenty-one fluidounces]. In this liquid dissolve the Sugar, by agitation, without heat, and strain. Keep the Syrup in well-stopped bottles."

Although this syrup has been in use for many years, it is officinal now for the first time. It is a simple solution of the hypophosphites of lime, soda, and potassium in water, aided by citric acid, protected by sugar, and flavored with spirit of lemon. The hypophosphite of calcium will usually not entirely dissolve; hence the direction to use the citric acid to complete the solution. Hypophosphorous acid would probably be preferred, but it is not officinal, and the trifling amount of citric acid cannot be rationally objected to. Percolation will no doubt be preferred by many to agitation, for dissolving the sugar. Each fluidrachm of the syrup contains about three grains of hypophosphite of calcium, and one grain each of the sodium and potassium salts.

This syrup affords an excellent means of administering the hypophosphites. The dose is one to two fluidrachms (3·75 to 7·5 C.c.).

Off. Prep. Syrupus Hypophosphitum cum Ferro, *U. S.*

SYRUPUS HYPOPHOSPHITUM CUM FERRO. *U. S.* *Syrup of Hypophosphites with Iron.*

(SỴ-RŪ̂'PU̦S HȲ-PO̦-PHO̦S-PHĪ'TŬM CŬM FĔR'RŌ.)

Sirop d'Hypophosphite avec Fer, *Fr.*

"Lactate of Iron, *one part* [or ninety-six grains]; Syrup of Hypophosphites, *ninety-nine parts* [or one pint], To make *one hundred parts* [or one pint]. Dissolve the Lactate of Iron in the Syrup by trituration. Keep the Syrup in well-stopped bottles." *U. S.*

This syrup, which was made officinal in the U. S. P. 1880 for the first time, has been the subject of considerable pharmaceutical discussion because of the difficulty of selecting a salt of iron which would remain in solution and not form a precipitate with the other salts. The lactate has been selected as the least objectionable in this respect. The syrup of hypophosphites with iron now contains in each fluidrachm about three grains of hypophosphite of calcium, with one grain each of the hypophosphites of sodium and potassium, and three-fourths of a grain of lactate of iron. It unites the therapeutic powers of a chalybeate with those of the hypophosphites, and may be given in doses of one to two fluidrachms (3·75 to 7·5 C.c.).

SYRUPUS FERRI PHOSPHATIS. *Br.* *Syrup of Phosphate of Iron.*

(SỴ-RŪ̂'PU̦S FĔR'RĪ PHŎS-PHĀ'TĬS.)

Sirop de Phosphate de Fer, *Fr.*; Eisenphosphatsyrup, *G.*

"Take of Granulated Sulphate of Iron *two hundred and twenty-four grains*; Phosphate of Soda *two hundred grains*; Acetate of Soda *seventy-four grains*; Diluted Phosphoric Acid *five fluidounces and a half*; Refined Sugar *eight ounces* [avoirdupois]; Distilled Water *eight fluidounces.* Dissolve the Sulphate of Iron in four [fluid]ounces of the Water, and the Phosphate and Acetate of Soda in the remainder; mix the two solutions, and, after careful stirring, transfer the precipitate to a calico filter, and wash it with Distilled Water, till the filtrate ceases to be affected by chloride of barium. Then press the precipitate strongly between folds of bibulous paper, and add to it the Diluted Phosphoric Acid. As soon as the precipitate is dissolved, filter the solution, add the Sugar, and dissolve without heat. The product should measure exactly twelve fluidounces." *Br.*

The first part of this process is almost precisely a repetition of that of the Br. Pharmacopœia for phosphate of iron. (See *Ferri Phosphas.*) But after that salt has been prepared, instead of being dried, it is first strongly pressed, and then dissolved in the dilute phosphoric acid, and made into a syrup with sugar. As the phosphate of iron is insoluble in water, it was necessary to have recourse to an acid to effect its solution, and the phosphoric acid was selected as therapeutically coindicated. Each fluidrachm contains one grain of the phosphate of iron. (*Br.*) The syrup sometimes acquires a sherry wine color and deposits a reddish brown precipitate, which, according to Mr. T. B. Groves (*P. J. Tr.*, 2d ser., xi. 138), is an insoluble phosphate; it may be separated by filtration. The same authority also states that the color of the syrup is due to caramel, which may be removed by animal charcoal. The precipitated phosphate in the officinal process is exceedingly liable to oxidation during the protracted working required, and Mr. H. W. Jones (*Ibid.*, 3d ser., v. 541) proposes a formula in which the phosphate is made directly from metallic iron and phosphoric acid. For its properties and uses, see *Ferri Phosphas* (page 680). The dose is one or two fluidrachms (3·75–7·5 C.c.).

SYRUPUS HEMIDESMI. *Br.* *Syrup of Hemidesmus. Syrup of Indian Sarsaparilla.*

(SỴ-RÛ′PỤS HĔM-Ị-DĔṢ′MĪ.)

Sirop de Hemidesmus, *Fr.;* Hemidesmussyrup, *G.*

"Take of Hemidesmus Root, bruised, *four ounces* [avoirdupois]; Refined Sugar *twenty-eight ounces* [avoird.]; Boiling Distilled Water *one pint* [Imperial measure]. Infuse the Hemidesmus in the Water, in a covered vessel, for four hours, and strain. Set it by till the sediment subsides; then decant the clear liquor, add the Sugar, and dissolve by means of a gentle heat. The product should weigh two pounds ten ounces, and should have the specific gravity 1·335."

This is a very weak preparation. The dose is stated at one fluidrachm (3·75 C.c.), but the syrup may be taken almost ad libitum. (See *Hemidesmus.*)

SYRUPUS IPECACUANHÆ. *U.S.* *Syrup of Ipecac.*

(SỴ-RÛ′PỤS ĬP-Ẹ-CĂC-U̇-ĂN′HÆ—ĭp-ẹ-kăk-yụ-ăn′ē.)

Sirop d'Ipécacuanha, *Fr.;* Ipecacuanhasyrup, *G.*

"Fluid Extract of Ipecac, *five parts* [or two fluidounces]; Syrup, *ninety-five parts* [or twenty-nine fluidounces], To make *one hundred parts* [or about two pints]. Mix them." *U. S.*

By the former U. S. process of 1850, a tincture of ipecac was first formed with diluted alcohol, then reduced by evaporation so as to drive off the alcohol, and afterwards diluted with water and made into a syrup with sugar. The present process simply mixes the fluid extract, which is an officinal preparation, with syrup. The French Codex dissolves the alcoholic extract of ipecac in water, and then mixes it with syrup; but it is obvious that the U. S. plan is preferable, as it spares the continued heat requisite to reduce the tincture to dryness. The present U. S. syrup, which is very slightly stronger than that of 1870, is made in accordance with the suggestions of Mr. Laidley, of Richmond, Va., who found the syrup, as ordinarily prepared, to spoil by keeping. (*A. J. P.*, xxvi. 103, and July, 1879.) The substitution of glycerin for a portion of the syrup would further obviate the tendency to ferment, which still exists. (See a practical paper on this subject by A. Robbins in *A. J. P.*, Aug. 1879.) For formulæ in which the drug ipecac is employed, the reader may consult *A. J. P.*, 1870, p. 127; 1871, p. 104; May, 1881.

If strictly officinal (1880) fluid extract of ipecac is used in making this syrup, it will remain transparent; if commercial fluid extract be used, or the fluid extract has not been very carefully made, it will be necessary to modify the process somewhat to secure a transparent syrup. Prof. Grahame's method is the best and simplest that has been suggested. Two fluidounces of fluid extract are diluted with thirteen fluidounces of water, and thirteen ounces of sugar are added and agitated until dissolved; this is allowed to stand two days, then filtered, and an additional thirteen ounces of sugar added, and, when dissolved, the whole is strained.

One fluidounce of this syrup should contain the virtues of thirty grains of ipecac. The dose of it, as an emetic, is for an adult from four fluidrachms to a fluidounce (15–30 C.c.), for a child a year or two old, from thirty minims to a fluidrachm (1·9–3·75 C.c.), repeated every fifteen or twenty minutes till it acts. As an expectorant, the dose for an adult is thirty minims or a fluidrachm (1·9–3·75 C.c.), for a child from two to ten minims (0·12–0·6 C.c.).

SYRUPUS KRAMERIÆ. *U. S.* *Syrup of Krameria.*

(SỴ-RŪ'PỤS KRẠ-MĒ'RỊ-Æ.)

Syrupus Ratanhæ; Sirop de Ratanhia, *Fr.;* Ratanhasyrup, *G.*

"Fluid Extract of Krameria, *thirty-five parts* [or twelve fluidounces]; Syrup, *sixty-five parts* [or twenty fluidounces], To make *one hundred parts* [or two pints]. Mix them." *U. S.*

This syrup is more conveniently made by the present process than by those of the U. S. P. 1860. In the latter edition two processes were given: one, in which the powdered root was exhausted with water, the percolate evaporated, and the sugar dissolved in it by a gentle heat; in the second process, extract of krameria was dissolved in syrup. As krameria yields a variable proportion of extract, it follows that the syrup resulting from these two modes of preparation must differ. To obviate this evil as far as possible, care had to be taken, in following the first process, to select the best krameria, and preferably the small roots, as it was these only which would yield two ounces of good extract to the pound. We have found the syrup made from the officinal fluid extract perfectly transparent, and not a turbid mixture, as stated by some writers. This preparation affords a convenient mode of exhibiting krameria. The dose for an adult is half a fluidounce (15 C.c.), for a child a year or two old, twenty or thirty minims (1·25–1·9 C.c.).

SYRUPUS LACTUCARII. *U. S.* *Syrup of Lactucarium.*

(SỴ-RŪ'PỤS LĂC-TŪ-CĀ'RỊ-Ī.)

Sirop de Lactucarium, *Fr.;* Lactucariumsyrup, *G.*

"Fluid Extract of Lactucarium, *five parts* [or two fluidounces]; Syrup, *ninety-five parts* [or twenty-nine fluidounces], To make *one hundred parts* [or about two pints]. Mix them." *U. S.*

The formula of U. S. P. 1870 was very objectionable, and the syrup was rarely used on account of its want of transparency, and in some measure also from its disagreeable taste. The former of these objections it was proposed to obviate by the use of carbonate of magnesium, as in the former U. S. formula for Syrup of Tolu; the latter, by the addition of one of the aromatic Waters. The rubbing with carbonate of magnesium enabled the menstruum to take up, as far as it is capable of doing, the matter that would otherwise be deposited. The use of powdered pumice-stone instead of carbonate of magnesium, and rubbing this and a little sugar with the tincture after evaporation instead of previously, was recommended by Mr. James Kenworthy. The result was a beautifully clear syrup, with the flavor and appearance of Aubergier's, and the virtues of that of the U. S. Pharmacopœia. (*A. J. P.*, March, 1868, p. 113.)* But the present process, if officinal fluid extract of

* *Aubergier's Syrup of Lactucarium.* Though probably inferior in efficacy to the U. S. syrup, that of Aubergier has a great reputation on the continent of Europe, and is occasionally prescribed here instead of the officinal. It differs so much from ours, that, when it is prescribed, pharmacists who may not have it on hand should not substitute the officinal for it, unless with the full knowledge of the prescriber. In order to obviate this inconvenience, it is advisable that there should be a formula, readily accessible, by which a syrup may be prepared, sufficiently representing Aubergier's for all practical purposes. Prof. Procter, therefore, did the profession good service by preparing and publishing such a process, which we copy here. "Take of Lactucarium (German) *half an ounce;* Granulated Sugar *an ounce;* Simple Syrup *four and a half pints;* Citric Acid, in powder, *sixty grains;* Orange-flower Water *four fluidounces;* Diluted Alcohol, Water, each, *a sufficient quantity.* Triturate the Lactucarium with the Sugar until reduced to powder, put it into a funnel-shaped percolator, pour on Diluted Alcohol until the Lactucarium is nearly exhausted, or until ten fluidounces have passed, evaporate to two fluidounces, and add it to the Syrup, previously heated by boiling, and mix. Continue the ebullition slowly until the whole measures four pints and six fluidounces. Then add the Citric Acid and strain, and, lastly, when nearly cool, the Orange-flower Water, and mix them. Each fluidounce represents three and one-third grains of lactucarium. The syrup is light brown and transparent." (*A. J. P.*, 1866, p. 290.)

The French Codex has a syrup, called *Opiated Syrup of Lactucarium* (*Sirop de Lactucarium opiacé*), in which an alcoholic extract is used in double the quantity of extract of opium. One would suppose that, in such a proportion, the action of the opium would entirely overwhelm that of the lactucarium; but Dr. Geo. B. Wood was assured by M. Deschamps, as the well-ascertained result of experiments of his own and the late M. Debout, that lactucarium given with opium very decidedly opposes, even in small proportion, the unpleasant effects caused by opium, such as nausea, stomachic spasms, headache, etc. (*Ann. de Thérap.*, 1868, p. 17); and hence the advantage of a preparation in which the two narcotics are combined. But to gain all the good results of this lactucarium is used, is far preferable. The recommendations made by various pharmaceutical writers to add a solution of an alkali to cloudy syrup of lactucarium, to make it transparent, are inadmissible, for Aubergier has conclusively shown that alkalies destroy the bitter principles of lactucarium. The dose is two or three fluidrachms (7·5–11·25 C.c.).

SYRUPUS LIMONIS. *U. S., Br.* *Syrup of Lemon.*

(SY̆-RŪ′PŲS LĮ-MŌ′NĬS.)

Syrupus Succus Citri, *P.G.;* Sirop de Limons (de Citrons), *Fr.;* Citronensaftsyrup, *G.*

"Lemon Juice, recently expressed and strained, *forty parts* [or seventeen fluidounces]; Fresh Lemon Peel *two parts* [or one ounce av.]; Sugar, in coarse powder, *sixty parts* [or twenty-eight ounces av.]; Water, *a sufficient quantity*, To make *one hundred parts* [or about two pints]. Heat the Lemon Juice to the boiling point; then add the Lemon Peel, and let the whole stand, closely covered, until cold. Filter, add enough Water through the filter to make the filtrate weigh *forty parts* [or measure seventeen fluidounces], dissolve the Sugar in the filtered liquid by agitation, without heat, and strain." *U. S.*

"Take of Fresh Lemon Peel *two ounces* [avoirdupois]; Lemon Juice, strained, *one pint* [Imperial measure]; Refined Sugar *two pounds and a quarter* [avoird.]. Heat the Lemon Juice to the boiling point, and, having put it into a covered vessel with the Lemon Peel, let them stand until they are cold, then filter, and dissolve the Sugar in the filtered liquid with a gentle heat. The product should weigh three pounds and a half [avoird.], and should have the sp. gr. 1·34." *Br.*

These two syrups are now nearly identical. The addition of lemon peel to the preparation now officinal is an improvement, but the internal white portion of the peel should be carefully removed before adding to the hot lemon juice, or the finished syrup will have a bitter taste. (See *Limonis Cortex.*) As the syrup is used exclusively as a vehicle, and has no medical properties, the improvement of diluting the juice with an equal measure of water, which was introduced in the U. S. P. 1870, in our opinion should have been retained. This syrup forms a cooling and grateful addition to beverages in febrile complaints, and serves to conceal the taste of saline purgatives in solution.

SYRUPUS MORI. *Br.* *Syrup of Mulberries.*

(SY̆-RŪ′PŲS MŌ′RĪ.)

Syrupus Mororum; Sirop de Mûres, *Fr.;* Maulbeersaft, *G.*

"Take of Mulberry Juice *one pint* [Imperial measure]; Refined Sugar *two pounds* [avoirdupois]; Rectified Spirit *two fluidounces and a half.* Heat the Mulberry Juice to the boiling point, and when it has cooled filter it. Dissolve the Sugar in the filtered liquid with a gentle heat, and add the Spirit. The product should weigh three pounds six ounces [avoird.], and should have the sp. gr. 1·33." *Br.*

This may be used for the same purposes with lemon syrup. In like manner syrups may be prepared from various succulent fruits, such as *strawberries*, *raspberries*, *blackberries*, *currants*, *pineapples*, etc. When the juice is thick, it may be diluted with from one-third of its bulk to an equal bulk of water previously to the addition of the sugar. In the preparation of *raspberry syrup*, which, as ordinarily made, is apt to gelatinize, M. Blondeau recommends that the strained juice be allowed to stand from eight to fifteen hours, according to the temperature, in order to ferment. The juice separates into two portions, the upper thick, the lower clear. The latter is to be separated by straining, and made into a syrup with the usual proportion of sugar. (See *Syrupus Rubi Idæi.*) The process of the London College for Syrupus Mori, retained in the first British Pharmacopœia, is in accordance with this recommendation. These syrups are much used to flavor drinks, and as grateful additions to carbonic acid water.*

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experience, it is unnecessary to add a new syrup to the officinal list; all that is requisite being the addition of a little of the simple syrup of lactucarium to any preparation of opium, the anticipated unpleasant effects of which it is desirable to prevent.

* Some practical remarks in relation to these syrups, so much used with carbonic acid water, may prove useful to the inexperienced pharmaceutist. Care should be taken that the fruit em-

SYRUPUS PAPAVERIS. *Br.* *Syrup of Poppies.*

(SY̦-RŪ'PU̦S PA̦-PĀ'VE̦-RĬS.)

Syrupus Capitum Papaveris, Syrupus Diacodii; Sirop de Pavot blanc, *Fr.;* Beruhigungssaft, *G.*

"Take of Poppy Capsules, dried, freed from the seeds, and coarsely powdered, *thirty-six ounces* [avoirdupois]; Rectified Spirit *sixteen fluidounces;* Refined Sugar *four pounds* [avoird.]; Boiling Distilled Water *a sufficiency.* Mix the Poppy Capsules with four pints [Imperial measure] of the Water, and infuse for twenty-four hours, stirring them frequently; then pack them in a percolator, and adding more of the Water, allow the liquor slowly to pass until about two gallons [Imp. meas.] have been collected, or the poppies are exhausted. Evaporate the liquor by a water-bath until it is reduced to three pints [Imp. meas.]. When quite cold, add the Spirit, let the mixture stand for twelve hours, and filter. Distil off the spirit, evaporate the remaining liquor to two pints [Imp. meas.], and then add the Sugar. The product should weigh six pounds and a half [avoird.], and should have the sp. gr. 1·320." *Br.*

As the capsules contain variable proportions of the narcotic principle, the syrup prepared from them is necessarily of variable strength. It was, moreover, as formerly prepared, very apt to spoil. It is, we presume, to correct this tendency, that the direction is given in the Pharmacopœia to add alcohol to the infusion, by which coagulable matter may be separated; the alcohol itself being subsequently removed by distillation. The place, however, of this syrup might, with great propriety, be supplied by a syrup prepared from one of the salts of morphine, which would keep well, and have the advantage of uniform strength. Four grains of the sulphate of morphine dissolved in a pint of syrup would afford a preparation at least equal to the average strength of the syrup of poppies, and much more certain in its operation. Mr. Southall recommends that the syrup of poppies should be prepared with a cold infusion made by percolation; the same proportions being employed as directed by the late London Pharmacopœia. The virtues of the capsules are thus extracted without those principles which cause the syrup to ferment speedily. (See *A. J. P.*, xv. 140.) Mr. Southall, after preparing the infusion, evaporates it to the proper measure before adding the sugar. Mr. Stockton prefers adding the sugar before the concentration is completed, and afterwards evaporating to 32° of the saccharometer. (*P. J. Tr.*, xi. 299.) It is probable that a syrup prepared with diluted alcohol as the menstruum would keep better than that made on either of the above plans.*

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ployed be fully ripe, and free from all its natural attachments, as calyx, stem, etc., and from all other impurities. Without being previously crushed, it should be put into canvas or woollen bags, which should be about two-thirds full when placed under the press. The expressing force should be gradually increased, so as effectually to remove the juice with as little of the tissue of the fruit as possible. It is customary to make a pint of syrup from a pint measure of fruit, and, if the expressed juice is insufficient for the purpose, to dilute it with water; but this is obviously an arbitrary rule, which cannot be universally applied without injuriously affecting the character of the product. The rule in the text is better,—viz., to dilute the juice when too thick. In dissolving the sugar, as short an exposure to heat as possible is desirable. Some dissolve the sugar in a portion of the juice with heat, and add the remainder a few minutes before removal from the fire. Some fruits contain so much pectin that their syrups are apt to gelatinize. This is particularly the case with currants and raspberries. A mode of preventing this result has been mentioned in the text. Another method is to add to the juice, after expression, one-tenth of its bulk of the juice of sour cherries, allow the mixture to stand for fifteen hours, and then separate the coagulated pectin by very gentle pressure in a cloth. *Pineapple* syrup may be made either in the ordinary mode, or by slicing the fruit, alternating the slices with layers of powdered sugar, permitting them to stand twenty-four hours, and then expressing the syrup formed. Each pound of the pared fruit, with thirty ounces of sugar, should yield with the requisite quantity of water two pints of syrup. For some further practical remarks on the preparation of particular syrups, the reader is referred to a paper by Mr. Ambrose Smith, in *A. J. P.* (xxii. 212).

Cream Syrups. Under this name, there has come into use a variety of syrups, given with carbonic acid water, to which they impart an agreeable richness of flavor. To prepare them, a gallon of fresh sweet cream is made to dissolve, without heat, 14 pounds (avoird.) of powdered sugar; and the solution, having been immediately bottled, is placed on ice, in a cold cellar. It will keep from three to eight days, according to circumstances. It is added to other syrups, given with carbonic acid water, equal measures being employed. The use of cream syrups is said to have originated with Mr. C. A. Smith, of Cincinnati. Mr. A. B. Taylor, of Philadelphia, prepares *cream vanilla syrup* by mixing together three fluidrachms of strong fluid extract of vanilla, a pint of simple syrup, and a pint of cream syrup. (*A. J. P.*, xxvii. 407.)

* *Syrup of Poppies.* "Take of Poppy Capsules, deprived of their seeds, and ground into coarse powder, *eight troyounces;* Sugar, *fifteen troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten

The syrup of poppies is employed, chiefly in infantile cases, to allay cough, quiet restlessness, relieve pain, and promote sleep. It is uncertain in its strength, and one fluidrachm of it has caused death in a babe eighteen weeks old. (*P. J. Tr.*, ii. 354.) The dose is from half a fluidrachm to a fluidrachm (1·9–3·75 C.c.) for a child, from half a fluidounce to a fluidounce (15–30 C.c.) for an adult.

SYRUPUS PICIS LIQUIDÆ. *Syrup of Tar.*

(SỴ-RŨ'PỤS PĪ'CĬS LĬQ'UỊ-DÆ—lĭk'wẹ-dē.)

Sirop de Goudron, *Fr.;* Thersyrup, *G.*

"Tar, *six parts* [or three ounces av.]; Cold Water, *twelve parts* [or five fluidounces]; Boiling Distilled Water, *fifty parts* [or twenty fluidounces]; Sugar, in coarse powder, *sixty parts* [or twenty-eight ounces av.], To make *one hundred parts* [or about two pints]. Upon the Tar, contained in a suitable vessel, pour the Cold Water, and stir the mixture frequently during twenty-four hours; then pour off the water and throw it away. Pour the Boiling Distilled Water upon the residue, stir the mixture briskly for fifteen minutes, and set it aside for thirty-six hours, stirring occasionally. Decant the solution and filter. Lastly, in *forty parts* [or seventeen fluidounces] of the filtered solution dissolve the Sugar by agitation, without heat."

This syrup will probably be found one of the most useful additions to the list of new officinal syrups. In many sections of our country it has been largely used. The preliminary washing of the tar will doubtless be regarded by many as a useless refinement, but it should on no account be omitted, as a syrup which would be irritant rather than soothing might be produced, owing to the acid constituents always present in tar. (See *Pix Liquida.*) On account of there being no valuable constituents in tar which are volatile below 100° C. (212° F.), there would be no objection to dissolving the sugar in the tar water by a gentle heat, instead of using the more tedious process of agitation. This syrup affords an excellent method of administering tar. The dose is one to two fluidrachms (3·75 to 7·5 C.c.).

SYRUPUS PRUNI VIRGINIANÆ. *U. S.* *Syrup of Wild-cherry.*

(SỴ-RŨ'PỤS PRŨ'NĪ VĬR-ÇĬN-Ị-Ā'NÆ.)

Sirop d'Écorce de Cérisier, *Fr.;* Wildkirschenrindensyrup, *G.*

"Wild Cherry, in No. 20 powder, *twelve parts* [or five and a half ounces av.]; Sugar, in coarse powder, *sixty parts* [or twenty-eight ounces av.]; Glycerin, *five parts* [or two fluidounces]; Water, *a sufficient quantity*, To make *one hundred parts* [or about two pints]. Moisten the Wild Cherry thoroughly with Water, and macerate for twenty-four hours in a close vessel; then pack it firmly in a cylindrical glass percolator, and gradually pour Water upon it until *thirty-five parts* [or fifteen fluidounces] of percolate are obtained. Dissolve the Sugar in the liquid, by agitation, without heat, add the Glycerin, and strain." *U. S.*

This process affords a handsome syrup, with the virtues of the bark unimpaired by the injurious effects of heat. It is based upon a formula proposed by Messrs. Procter and Turnpenny in *A. J. P.* (xiv. 27). The suggestion made in the 14th edition of this work to substitute glycerin for a portion of the water has been adopted in the present process, although 5 per cent. is hardly sufficient to have much preservative effect; it should have been 15 or 20 per cent. This syrup should never be made by adding fluid extract to simple syrup, as the fluid extract is apt to vary greatly in quality, and frequently precipitates when mixed with syrup. The syrup when made by the above process is far superior in flavor and active properties, and is largely used as a basis for cough mixtures. The adult dose is half a fluidounce (15 C.c.).

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the powder with four fluidounces of the Diluted Alcohol, pack it firmly in a percolator, and pour Diluted Alcohol upon it until three pints have slowly passed. Distil off the alcohol until the residual liquid is reduced to half a pint, and filter. Allow sufficient Distilled Water to pass through the filter to make the filtrate measure half a pint; then add the Sugar, dissolve with heat, and strain."—Prof. Procter.

SYRUPUS RHAMNI. *Br.* *Syrup of Buckthorn.*

(SY̦-RŪ'PU̦S RHĂM'NĪ.)

Syrupus Rhamni Cathartici, s. Syr. Spinæ Cervinæ, s. Syr. Domesticus, *P.G.;* Sirop de Nerprun, *Fr.;* Kreuzdornbeerensyrup, *G.*

"Take of Buckthorn Juice *four pints* [Imperial measure]; Ginger, sliced, Pimento, bruised, of each *three-quarters of an ounce* [avoirdupois]; Refined Sugar *five pounds* [avoird.], or *a sufficiency;* Rectified Spirit *six fluidounces* [Imp. meas.]. Evaporate the Juice to two pints and a half [Imp. meas.], add the Ginger and Pimento, digest at a gentle heat for four hours, and strain. When cold add the Spirit, let the mixture stand for two days, then decant off the clear liquor, and in this dissolve the Sugar with a gentle heat, so as to make the specific gravity 1·32." *Br.*

This syrup was officinal with the Lond. and Ed. Colleges, and though dropped at the formation of the original British Pharmacopœia, seems to have had so strong a hold on practitioners that it was deemed expedient to resume it in the present code. Though a powerful cathartic, it has never been much used in this country, probably because, the plant not being indigenous or cultivated here, the fresh juice cannot be readily obtained. It is principally used as a cathartic for dogs. The dose is a fluidrachm (3·75 C.c.).

SYRUPUS RHEI. *U.S., Br.* *Syrup of Rhubarb.*

(SY̦-RŪ'PU̦S RHĒ'Ī.)

Sirop de Rhubarbe, *Fr.;* Rhabarbersaft, *G.*

"Rhubarb, sliced, *ninety parts* [or four ounces av.]; Cinnamon, bruised, *eighteen parts* [or three hundred and sixty grains]; Carbonate of Potassium, *six parts* [or one hundred and twenty grains]; Sugar, in coarse powder, *six hundred parts* [or twenty-eight ounces av.]; Water, *a sufficient quantity,* To make *one thousand parts* [or about two pints]. Mix the Rhubarb, Cinnamon, and Carbonate of Potassium with *four hundred and twenty parts* [or twenty fluidounces] of Water, and macerate the mixture in a glass or porcelain vessel for twelve hours. Then strain and filter, adding through the dregs, if necessary, enough Water to make the filtered liquid weigh *four hundred parts* [or measure seventeen fluidounces]. Lastly, add the Sugar, dissolve it by agitation, without heat, and strain." *U. S.*

"Take of Rhubarb Root, in coarse powder, Coriander Fruit, in coarse powder, of each *two ounces* [avoirdupois]; Refined Sugar *twenty-four ounces* [avoird.]; Rectified Spirit *eight fluidounces* [Imperial measure]; Distilled Water *twenty-four fluidounces* [Imp. meas.]. Mix the Rhubarb and Coriander; pack them in a percolator; pass the Spirit and Water, previously mixed, slowly through them; evaporate the liquid that has thus passed until it is reduced to thirteen fluidounces [Imp. meas.], and in this, after it has been filtered, dissolve the Sugar with a gentle heat." *Br.* This is a troublesome and imperfect method.

This syrup differs from that formerly officinal in several particulars, and, in our opinion, nothing has been gained either in convenience of manipulation or superiority of product. The syrup of rhubarb of the U. S. P. 1870 was made by adding 3 fluidounces of fluid extract of rhubarb to 29 fluidounces of syrup. In the present process sliced rhubarb and bruised cinnamon, with carbonate of potassium and water, are macerated together for twelve hours. Straining and filtering and washing of the dregs is now resorted to, to separate the macerate. It would have been more in accordance with modern pharmaceutical practice to reduce the drugs to No. 20 powder, then to macerate the powder with sufficient of the alkaline solution to satisfy the tendency of the rhubarb to swell, and finally to percolate the moistened drugs with the rest of the solution of carbonate of potassium; the sugar could then be dissolved by agitation. Or the drugs, after maceration and draining, could be mixed with the sugar and percolated. The syrup is a mild cathartic, adapted to the cases of infants, to whom it may be given in the dose of a fluidrachm (3·75 C.c.).

SYRUPUS RHEI AROMATICUS. *U. S.* *Aromatic Syrup of Rhubarb.*

(SỴ-RÛ′PỤS RHĒ′Ī ĂR-Ọ-MĂT′Ị-CŬS.)

Sirop de Rhubarbe aromatique, *Fr.;* Gewürzter Rhabarbersaft, *G.*

"Aromatic Tincture of Rhubarb, *ten parts* [or two fluidounces]; Syrup, *ninety parts* [or fourteen fluidounces], To make *one hundred parts* [or one pint]. Mix the Aromatic Tincture of Rhubarb with the Syrup." *U. S.*

This syrup is nearly identical with that officinal in the U. S. P. 1870. The aromatic tincture is identical with that formerly used in the preparation of this syrup. The addition of a small amount of alkali or filtration after the use of carbonate of magnesium has been recommended, to prevent the syrup from becoming turbid.

The substitution of glycerin for one-half of the syrup, as recommended in the 14th edition of this work, would certainly be an improvement.

The aromatic syrup of rhubarb is a warm stomachic laxative, too feeble for adult cases, but well calculated for the bowel-complaints of infants which are so frequent in our cities during the summer season, and as a remedy for which this preparation, or one analogous to it, has been long in use under the name of *spiced syrup of rhubarb.* The dose for an infant with diarrhœa is a fluidrachm (3·75 C.c.), repeated every two hours till the passages indicate by their color that the medicine has operated. It should be borne in mind that the syrup, as prepared by the present formula, contains one-seventh of diluted alcohol, which, though not injurious in most of the cases in which this syrup is used, might render it too stimulating in some instances of diarrhœa in the very young infant.

SYRUPUS RHŒADOS. *Br.* *Syrup of Red Poppy.*

(SỴ-RÛ′PỤS RHŒ′Ạ-DŎS—rē′ạ-dŏs.)

Sirop de Coquelicot de Pavot rouge, *Fr.;* Klatschrosensaft, *G.*

"Take of Fresh Red Poppy Petals *thirteen ounces* [avoirdupois]; Refined Sugar *two pounds and a quarter* [avoird.]; Distilled Water *one pint* [Imperial measure], or *a sufficiency;* Rectified Spirit *two fluidounces and a half.* Add the Petals gradually to the Water heated in a water-bath, frequently stirring, and afterwards, the vessel being removed, infuse for twelve hours. Then press out the liquor, strain, add the Sugar, and dissolve by means of heat. When nearly cold, add the Spirit, and as much Distilled Water as may be necessary to make up for loss in the process, so that the product shall weigh three pounds ten ounces. It should have the sp. gr. 1·330." *Br.*

The object of introducing the petals into water heated by a water-bath is that they may shrink by being scalded; as otherwise they could not be completely immersed in the quantity of water directed. After this has been accomplished, they should be immediately removed from the fire, lest the liquor become too thick and ropy. The fine red color of this syrup is its only recommendation. It is very liable to ferment; according to Dr. Enders, this can be obviated by evaporating the recently prepared syrup to dryness, keeping the powdered residue in well-stopped bottles, and dissolving it, as wanted, in four-fifths of its weight of water. The dose is stated in the Br. Pharmacopœia as a fluidrachm (3·75 C.c.).

SYRUPUS ROSÆ. *U. S.* *Syrup of Rose.*

(SỴ-RÛ′PỤS RŌ′ṢÆ.)

Syrupus Rosæ Gallicæ, *Br.;* Syrupus Rosarum Rubrarum; Syrup of Red Rose; Sirop de Roses rouges. *Fr.;* Rosensyrup, *G.*

"Fluid Extract of Rose, *ten parts* [or two fluidounces]; Syrup, *ninety parts* [or fourteen fluidounces], To make *one hundred parts* [or one pint]. Mix them." *U. S.*

"Take of dried Red Rose Petals *two ounces* [avoirdupois]; Refined Sugar *thirty ounces* [avoird.]; Boiling Distilled Water *one pint* [Imperial measure]. Infuse the Petals in the Water for two hours, squeeze through calico, heat the liquor to the boiling point, and filter. Dissolve the Sugar in the liquor by means of heat. The product should weigh two pounds fourteen ounces [avoird.], and should have the sp. gr. 1·335." *Br.*

Syrup of rose is mildly astringent, but is valued more for its fine red color, on account of which it is occasionally added to mixtures. Dose, a fluidrachm (3·75 C.c.).

SYRUPUS RUBI. *U. S.* *Syrup of Rubus.*

(SỴ-RÛ′PỤS RÛ′BĪ.)

Syrup of Blackberry Root; Sirop d'Écorce de Ronce noir, *Fr.;* Brombeerrindensyrup, *G.*

"Fluid Extract of Rubus, *twenty parts* [or four fluidounces]; Syrup, *eighty parts* [or twelve fluidounces], To make *one hundred parts* [or one pint]. Mix them." *U. S.*

This syrup might perhaps be improved by filtering the fluid extract before the addition of the sugar. It is useful in acute diarrhœa of relaxation, and in chronic diarrhœa. Dose, one to two fluidrachms (3·75–7·5 C.c.).

SYRUPUS RUBI IDÆI. *U. S.* *Syrup of Raspberry.*

(SỴ-RÛ′PỤS RÛ′BĪ Ī-DÆ′Ī—ī-dē′ī.)

"Fresh Ripe Raspberries, *any convenient quantity;* Sugar, *a sufficient quantity.* Reduce the Raspberries to a pulp, and let it stand at rest for three days. Separate the juice by pressing, and set it aside until it has completely fermented and become clear, and then filter. To *forty parts* [or one pint] of the filtered liquid add *sixty parts* [or twenty-five ounces av.] of Sugar, heat to boiling, avoiding the use of tinned vessels, and strain. Keep the Syrup in well-stopped bottles, in a cool and dark place." *U. S.*

This is a new officinal syrup, which has been introduced because of the large use of fruit syrups. A better selection could hardly have been made than that of the syrup of raspberry. The previous fermentation of the juice frees it from albuminous and pectinous substances, which interfere with the transparency of the syrup, and, if not separated, would seriously increase the risk of its spoiling. The flavor of the juice is not injured, although the process must be carefully watched to keep the fermentation from passing from the vinous to the acetous form.

SYRUPUS SARSAPARILLÆ COMPOSITUS. *U. S.* *Compound Syrup of Sarsaparilla.*

(SỴ-RÛ′PỤS SÄR-SẠ-PẠ-RĬL′LÆ CỌM-PŎŞ′Ị-TŬS.)

Sirop de Salseparcille composé, Sirop sudorifique, *Fr.;* Zusammengesetzter Sarsaparillsyrup, *G.*

"Sarsaparilla, in No. 30 powder, *one hundred and fifty parts* [or twelve and a half ounces av.]; Guaiacum Wood, in No. 30 powder, *twenty parts* [or one and a half ounces av.]; Pale Rose, in No. 30 powder, *twelve parts* [or one ounce av.]; Glycyrrhiza, in No. 30 powder, *twelve parts* [or one ounce av.]; Senna, in No. 30 powder, *twelve parts* [or one ounce av.]; Sassafras, in No. 20 powder, *six parts* [or half an ounce av.]; Anise, in No. 20 powder, *six parts* [or half an ounce av.]; Gaultheria, in No. 20 powder, *six parts* [or half an ounce av.]; Sugar, in coarse powder, *six hundred parts* [or fifty ounces av.]; Diluted Alcohol, Water, each, *a sufficient quantity*, To make *one thousand parts* [or three and a half pints]. Mix the solid ingredients, except the Sugar, with *three hundred parts* [or a pint and a half] of Diluted Alcohol, and macerate the mixture for forty-eight hours; then transfer it to a cylindrical percolator, pack it firmly, and gradually pour Diluted Alcohol upon it until *six hundred parts* [or three pints] of tincture have been obtained. Evaporate this portion, by means of water-bath, to *three hundred parts* [or a pint and a half], add *one hundred parts* [or half a pint] of Water, and filter, adding enough Water, through the filter, to make the whole weigh *four hundred parts* [or measure two pints]. Lastly, add the Sugar, dissolve it by agitation, without heat, and strain." *U. S.*

A change has been made in this syrup in the last revision, in the substitution of the powdered drugs, sassafras, anise, and gaultheria, for the volatile oils formerly used. There is nothing to recommend this change, in our opinion. The oils are far more likely to be of uniform quality, whilst the quantity of each volatile oil in the drugs, as found in commerce, varies greatly. The objection to the syrup of 1870 was probably that its transparency was somewhat interfered with by the addition of the oils to the finished syrup; yet if the oils be added in the proportion of three minims each of the oils of sassafras and anise and two of gaultheria (if the alternative formula above is used to the filtered percolate, and this liquid used to percolate the sugar with), no difficulty will be experienced. Robert F. Fairthorne (*A. J. P.*, Dec. 1881) proposes to make this syrup without the use of alcohol by intermittent percolation; *i.e.*, alternate maceration and percolation. His process is as follows, assuming that the quantities used are those of the alternative formula. Having taken the sarsaparilla in moderately fine powder and the other solid ingredients called for in the Pharmacopœia, with the exception of the sugar and sassafras, anise and gaultheria, he puts them loosely into a percolator which has previously been closed by means of a cork. Cold water is then poured on, and sufficient is added to saturate the ingredients. After standing 24 hours in a cool place, the cork is removed, the articles firmly pressed and packed in the percolator, and enough water allowed to pass through, to produce half a pint of liquid. After an interval of a day another half pint of fluid is obtained in the same way. Then, after setting aside for 24 hours, more water is passed through, so as to obtain another half pint. These percolates are mixed together and kept in a cool place. Percolation is then continued until two pints of liquid are obtained, which is evaporated to half a pint by means of a water-bath. When this is accomplished, the liquid is mixed with the reserved percolates, and, the sugar having been added, it is dissolved by the aid of heat, which should reach 162° F., so as to coagulate any albumen present, the whole strained, and the essential oils added.

In the original edition of the U. S. Pharmacopœia published in 1820, a process for a syrup of sarsaparilla was adopted, intended to represent the famous French *sirop de cuisinier.* This was very much improved in the revised edition published in 1830; and the amended process has been retained with little alteration in the subsequent editions; the process of percolation having been substituted in the present Pharmacopœia for simple maceration directed in the first of the two formulas of 1850. In the original process, the sarsaparilla was subjected to long decoction with water. It has been proved that diluted alcohol more thoroughly extracts the acrid principle of the root, upon which its activity probably depends, than water, and that this principle is either dissipated or destroyed by the long-continued application of a boiling heat. In the present formula, therefore, which employs diluted alcohol as the menstruum, the root is more completely exhausted of its active matter; while the heat applied to the concentration, being no higher than is requisite for the evaporation of the alcohol, is insufficient to injure the preparation. The spirituous menstruum has, moreover, the advantage of not dissolving the inert fecula, which encumbers the syrup prepared by decoction, and renders it liable to spoil. Yet it must be remembered, in this connection, that the constituents which are dissolved out by the alcohol are in great part afterward precipitated by water and filtered out, and thus do not enter into the preparation. In the Pharmacopœia of 1840, the pale or hundred-leaved roses were very properly substituted for the red, as their slightly laxative property accords better with the character of the preparation. The essential oils were intended solely to communicate an agreeable flavor, and were used in very small proportion. The only objection to this process is that a portion of the resin, extracted by the alcohol from the guaiacum wood, is deposited during the evaporation of the tincture; but this is separated by the filtration directed, and is therefore of no disadvantage to the preparation. But the practitioner should be aware that much of the sarsaparilla, as it exists in the market, is nearly or quite inert, and should be prepared to meet with disappointment in the use of this or any other preparation, unless satisfied of the good quality of the drug from which it is made.

Corrosive sublimate, which is often given in connection with this syrup, is said to be completely decomposed by it, being converted into calomel. M. Lepage, of Gisors, proposes as a substitute the iodohydrargyrate of potassium, which he has found not to undergo decomposition (see Part II., and *Sirop Gibert*, page 760.)

The dose of the syrup is half a fluidounce (15 C.c.), equivalent to somewhat less than a drachm (3·9 Gm.) of the root, to be taken three or four times a day.

SYRUPUS SCILLÆ. *U. S., Br.* *Syrup of Squill.*

(SỴ-RÛ′PỤS SCĬL′LÆ—sĭl′lē.)

Sirop de Scille, *Fr.;* Meerzwiebelsyrup, *G.*

"Vinegar of Squill *forty parts* [or one pint]; Sugar, in coarse powder, *sixty parts* [or twenty-six ounces av.]; Water, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Heat the Vinegar of Squill to the boiling point, in a glass or porcelain vessel, and filter while hot, adding, through the filter, enough Water to make the filtrate weigh *forty parts* [or one pint]. Add the Sugar, dissolve it by agitation, without heat, and strain." *U. S.*

"Take of Vinegar of Squill *one pint* [Imperial measure]; Refined Sugar *two pounds and a half* [avoirdupois]. Dissolve with the aid of heat." *Br.*

The present British formula is almost identical with the American, and differs from that of 1864 in taking the vinegar already formed, instead of preparing it as the first step of the process. The object of heating the vinegar to the boiling point is to coagulate albuminous matter, which is afterwards separated by filtration. The heating should be performed as quickly as possible, to prevent undue loss of acetic acid. Percolation, to dissolve the sugar, may be substituted here in place of agitation to advantage (see page 1391).

This syrup is much employed as an expectorant, especially in combination with a solution of tartarized antimony. The dose is about a fluidrachm (3·75 C.c.). In infantile cases of catarrh and other pectoral complaints, it is sometimes given, in the same dose, as an emetic.

SYRUPUS SCILLÆ COMPOSITUS. *U. S.* *Compound Syrup of Squill.*

(SỴ-RÛ′PỤS SCĬL′LÆ CỌM-PŎȘ′Ị-TŬS—sĭl′lē.)

Hive-Syrup; Sirop de Scille composé, *Fr.;* Zusammengesetzter Meerzweibelsyrup, *G.*

"Squill, in No. 30 powder, *one hundred and twenty parts* [or two and a half ounces av.]; Senega, in No. 30 powder, *one hundred and twenty parts* [or two and a half ounces av.]; Tartrate of Antimony and Potassium, *three parts* [or twenty-eight grains]; Sugar, in coarse powder, *twelve hundred parts* [or twenty-six ounces av.]; Precipitated Phosphate of Calcium, *nine parts* [or ninety grains]; Diluted Alcohol, Water, each, *a sufficient quantity*, To make *two thousand parts* [or about two pints]. Mix the Squill and Senega, and, having moistened the mixture with *three hundred parts* [or half a pint] of Diluted Alcohol, macerate for one hour; then transfer the mixture to a conical percolator, and gradually pour upon it Diluted Alcohol, until *nine hundred parts* [or one and a half pints] of tincture are obtained. Boil this portion for a few minutes, and then evaporate it, by means of a water-bath, to *three hundred and sixty parts* [or half a pint]; having added *one hundred and fifty parts* [or three fluidounces] of boiling Water, triturate the mixture with the Precipitated Phosphate of Calcium, filter, and add, through the filter, enough warm Water to make the whole weigh *seven hundred and fifty parts* [or measure one pint]. In this dissolve the Sugar, by agitation, without heat, and strain. Lastly, dissolve the Tartrate of Antimony and Potassium in *forty-seven parts* [or one fluidounce] of hot water, and mix the solution thoroughly with the Syrup." *U. S.*

This is intended as a substitute for the popular preparation called *Coxe's hive-syrup*, from which it differs chiefly in containing sugar instead of honey. Prepared as originally directed in the Pharmacopœia, it invariably fermented from the want of sufficient concentration. This defect was corrected at the revision of 1840, when sugar was substituted for honey, in consequence of the uncertain consistence and constitution of the latter. In the Pharmacopœia of 1850 two formulas were given for this syrup; in the first of which the virtues of the squill and senega were extracted by long boiling with water, in the second, by percolation with water to which a small portion of alcohol was added. The latter was preferable when skilfully performed, as it avoided in great measure the injurious influence of boiling upon the senega, exhausted both this and the squill more readily in consequence of the addition of alcohol to the menstruum, and afforded a solution of their active principles, less embarrassed with inert matters calculated to favor fermentation. In this process, the filtered liquor was raised to the boiling point in order to coagulate the albumen, after which the evaporation was conducted at a lower temperature. The present formula is a decided improvement upon the one just described; as, diluted alcohol being employed as the menstruum, less of the albuminous and mucilaginous matter is extracted, while any disadvantage from the spirituous addition is obviated by the subsequent evaporation of the alcohol and the addition of water; the provision being retained to boil the tincture for a short time to get rid of such albumen as has been taken up. Sometimes the amount of albuminous coagulum is so great as to render the process of filtration after the boiling very tedious. According to Mr. J. C. Wharton, this can be remedied by rubbing up the muddy liquid with magnesia (*A. J. P.*, xliii. 102), but to serve the same purpose precipitated phosphate of calcium has been substituted in the officinal formula. Percolation we have found very well adapted for dissolving the sugar and producing a transparent syrup.

The compound syrup of squill combines the virtues of senega, squill, and tartar emetic, of the last of which it contains one grain in every fluidounce. It is emetic, diaphoretic, expectorant, and frequently cathartic, and may be given with advantage in mild cases of croup, in the latter stages of severe cases when the object is to promote expectoration, and in other pectoral affections in which the same indication is presented. In croup, however, a mineral emetic is much to be preferred. The dose of this syrup is, for children, from ten drops to a fluidrachm (0·6–3·75 C.c.), according to the age, and it may be repeated in cases of croup every fifteen or twenty minutes till it vomits. As an expectorant for adults the dose is twenty or thirty drops (1·25–1·9 C.c.).

SYRUPUS SENEGÆ. *U. S.* *Syrup of Senega.*

(SỴ-RŪ′PỤS SĔN′Ẹ-ÇÆ—sĕn-ẹ′jē.)

Sirop de Polygala, *Fr.;* Senegasyrup, *G.*

"Fluid Extract of Senega, *one hundred and sixty parts* [or half a pint]; Water of Ammonia, *four parts* [or one and a half fluidrachms]; Sugar, in coarse powder, *six hundred parts* [or twenty-eight ounces av.]; Water, *a sufficient quantity*, To make *one thousand parts* [or about two pints]. Mix the Fluid Extract with *two hundred and fifty parts* [or eleven fluidounces] of Water, add the Water of Ammonia, shake the mixture well, and let it stand for a few hours; then filter through paper, adding, through the filter, enough Water to make the whole weigh *four hundred parts* [or measure seventeen fluidounces]. To the filtered solution add the Sugar, dissolve it by agitation, without heat, and strain." *U. S.*

The syrup affords a very convenient mode of exhibiting senega in pectoral complaints. Owing to the pectinous principle present in senega, the syrup made directly from the root as in the process of 1870 was always turbid. It has been frequently pointed out that the addition of an alkali rendered the syrup transparent, and the present process directs the use of a small quantity of water of ammonia, although if the officinal fluid extract of senega is used, this addition should be unnecessary, for water of ammonia has been added to it for the purpose of rendering it transparent. This syrup may be given as a stimulant expectorant in the dose of one or two fluidrachms (3·75–7·5 C.c.).

SYRUPUS SENNÆ. *U. S., Br.* *Syrup of Senna.*

(SỴ-RŪ′PỤS SĔN′NÆ.)

Sirop de Séné, *Fr.;* Sennasyrup, *G.*

"Senna, bruised, *thirty-three parts* [or sixteen ounces av.]; Sugar, in coarse powder, *sixty parts* [or twenty-nine ounces av.]; Alcohol, *four parts* [or two fluidounces]; Oil of Coriander. Water, each *a sufficient quantity*, To make *one hundred parts* [or about two pints]. Digest the Senna in *one hundred and sixty parts* [or five pints] of Water, at a temperature not exceeding 50° C. (122° F.), for twenty-four hours, express and strain the liquid. Digest the mass with *seventy parts* [or two pints] of Water, at the same temperature, for six hours, and again express and strain. Mix the strained liquids, and evaporate the mixture to *thirty parts* [or fifteen fluidounces]. When cold, add the Alcohol, previously mixed with *one per cent.* [or eight minims] of Oil of Coriander, and filter through paper, adding, through the filter, enough Water to make the whole weigh *forty parts* [or measure seventeen fluidounces]. Then add the Sugar, dissolve it by agitation, without heat, and strain." *U. S.*

"Take of Senna, broken small, *sixteen ounces* [avoirdupois]; Oil of Coriander *three minims;* Refined Sugar *twenty-four ounces* [avoird.]; Distilled Water *five pints* [Imperial measure], or *a sufficiency;* Rectified Spirit *two fluidounces.* Digest the Senna in seventy [fluid]ounces of the Water for twenty-four hours at a temperature of 120°; press out the liquor and strain it. Digest the marc in thirty [fluid] ounces of the Water for six hours at the same temperature; again press out the liquor and strain it. Evaporate the mixed liquors in a water-bath to ten fluidounces, and, when cold, add the Rectified Spirit, previously mixed with the Oil of Coriander. Clarify by filtration, and wash what remains on the filter with Distilled Water, until the washings make up the filtrate to sixteen fluidounces. Then add the Sugar, and dissolve by means of a gentle heat. The product should weigh two pounds ten ounces [avoird.], and should have the sp. gr. 1·310." *Br.*

This syrup was not officinal in the U. S. P. 1870 because it was deemed unnecessary, as it is nearly one-half the strength of the fluid extract. It is almost identical with the British syrup, which has superseded the former syrups of the London and Edinburgh Colleges; in prescribing it, physicians accustomed to the doses of the former syrups must be on their guard not very seriously to overdose their patients. The syrup, as made by the above formula, contains the strength of about thirty grains of senna in each fluidrachm, and should rank with the Fluid Extracts rather than the Syrups. There would seem to be no good reason why this syrup should not be made in the same way that the officinal syrups of Senega, Ipecac, and Krameria are. If one pint of fluid extract of senna be mixed with a pint of syrup, and eight minims of oil of coriander be added, a practically identical preparation would be formed: the amount of alcohol present in a dose would be too small to be therapeutically objectionable, but, if desired, it could be removed by evaporation. The dose for an adult is from one to four fluidrachms (3·75–15 C.c.); but for children, for whom it was originally intended, not more than from one-eighth to one-half of that quantity, according to the age.

SYRUPUS TOLUTANUS. *U. S., Br.* *Syrup of Tolu.*

(SỴ-RŪ̇′PỤS TŎL-Ụ̇-TĀ′NŬS.)

Sirop de Baume de Tolu, Sirop balsamique, *Fr.;* Tolubalsamsyrup, *G.*

"Balsam of Tolu, *four parts* [or one and three-quarter ounces av.]; Sugar, in coarse powder, *sixty-five parts* [or twenty-eight ounces av.]; Distilled Water, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Mix the Sugar with *thirty-five parts* [or thirteen fluidounces] of Distilled Water, add the Balsam, and digest the whole in a covered vessel, at a temperature not exceeding 82° C. (180° F.), for two hours. When cold, strain through a well-wetted muslin strainer, adding, through the strainer, enough Water to make the Syrup weigh *one hundred parts* [or measure two pints], and mix thoroughly." *U. S.**

"Take of Balsam of Tolu *one ounce and a quarter* [avoirdupois]; Refined Sugar *two pounds* [avoird.]; Distilled Water *one pint* [Imperial measure], or *a sufficiency.* Boil the Balsam in the Water for half an hour in a lightly covered vessel, stirring occasionally. Then remove from the fire, and add Distilled Water, if necessary, so that the liquid shall measure sixteen [fluid]ounces. Filter the solution when cold, add the Sugar, and dissolve with the aid of a steam or water-bath. The product should weigh *three pounds* [avoird.], and should have the sp. gr. 1·330." *Br.*

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* *Syrupus Tolutanus,* U.S. 1870. "Take of Tincture of Tolu *two fluidounces;* Carbonate of Magnesium *one hundred and twenty grains;* Sugar [refined], in coarse powder, *twenty-six troyounces;* Water *a pint.* Rub the Tincture of Tolu first with the Carbonate of Magnesium and two troyounces of the Sugar, then with the Water gradually added, and filter. To the filtered liquid add the remainder of the Sugar, and having dissolved it with the aid of a gentle heat, strain the solution while hot." *U. S.* 1870.

We regret the change in the process for this syrup. It is now directed to be made by digesting the balsam in a hot solution of sugar and straining when cold, and the result is a cloudy syrup instead of the transparent, highly flavored syrup of 1870. In the superseded process, the tincture of tolu was rubbed with carbonate of magnesium and a little sugar, and afterwards with the water, in order to enable this fluid to take from the tincture all that it is capable of dissolving; the carbonate of magnesium and the precipitated resin of the tincture being separated by filtration. The process was then completed by forming a syrup with the filtered liquid. It is in accordance with a formula proposed by Mr. J. D. Finley, and published in a note in the eleventh edition of the U. S. Dispensatory. The resulting syrup is beautifully and permanently clear, and has very decidedly the flavor of the balsam. In the present U. S. and British processes the soluble principles of the balsam are extracted by boiling it with water, but with great waste of the material, as the water dissolves but a small portion of the active matter. To obviate this waste, the same portion of balsam is, according to Mr. Brande, usually employed in successive operations; and it long continues to impart odor and taste to boiling water. Syrup of tolu is a feeble preparation, and is used chiefly to impart its agreeable flavor to mixtures. If a stronger syrup is desired, it is readily made by adding tincture of tolu in the desired quantity and directing the bottle to be shaken.

SYRUPUS ZINGIBERIS. *U. S., Br.* *Syrup of Ginger.*

(SY̤-RÛ'PṲS ZI̤N-ĢĬB'E̤-RĬS.)

Sirop de Gingembre, *Fr;* Ingwersyrup, *G.*

"Fluid Extract of Ginger, *two parts* [or one fluidounce]; Sugar, in coarse powder, *sixty-five parts* [or thirty ounces av.]; Water *a sufficient quantity*, To make *one hundred parts* [or about two pints]. Rub the Fluid Extract of Ginger with *twenty-five parts* [or twelve ounces av.] of Sugar, and expose the mixture to a heat not exceeding 60° C. (140° F.), until all the alcohol has evaporated. Then mix the residue thoroughly, by agitation, with *thirty-five parts* [or fifteen fluidounces] of Water, and filter the liquid, adding, through the filter, enough Water to make the whole weigh *sixty parts* [or measure twenty-two fluidounces]. Finally, add the remainder of the Sugar, dissolve it by agitation, without heat, and strain." *U. S.*

"Take of Strong Tincture of Ginger *six fluidrachms;* Syrup *nineteen fluidounces.* Mix with agitation." *Br.*

The U. S. process of 1870 for Syrup of Ginger was upon the same amended plan as that adopted for Syrup of Tolu, and yielded a fine preparation entirely free from turbidness. We do not regard the present officinal process as an improvement. It is more troublesome, and a transparent syrup can only be secured by passing the filtrate repeatedly through the filter. Percolation will doubtless be preferred to agitation in dissolving the sugar. The use of carbonate of magnesium was unobjectionable, and the process of the U. S. P. 1870 was preferable.* The British syrup, being made by the simple incorporation of the tincture with syrup, has of course all the strength of the ginger, but is inferior to the U. S. preparation in appearance and flavor. The old plan of using water as the menstruum has been entirely abandoned, as the syrup thus made is encumbered with mucilage and starch, and consequently rendered more liable to decomposition. In order that the preparation may be of the proper strength, it is necessary that the fluid extract should have been made with the best Jamaica ginger. The syrup of ginger is much used as a warm stomachic addition to tonic and purgative infusions or mixtures, and to impart flavor particularly to carbonic acid water. The dose is a fluidrachm (3·75 C.c.) or more.

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* *Syrupus Zingiberis*, U. S. 1870. "Take of Fluid Extract of Ginger *a fluidounce;* Carbonate of Magnesium *one hundred and sixty grains;* Sugar [refined], in coarse powder, *seventy-two troyounces;* Water *forty-two fluidounces.* Rub the Fluid Extract of Ginger first with the Carbonate of Magnesium and two troyounces of the Sugar, and then with the Water, gradually added, and filter. To the filtered liquor add the remainder of the Sugar, and, having dissolved it with the aid of a gentle heat, strain the solution while hot." *U. S.*

TABACUM. *U. S.* *Tobacco.*

(TĂB'Ạ-CŬM.)

"The commercial, dried leaves of Nicotiana Tabacum. Linné. (*Nat. Ord.* Solanaceæ.)" *U. S.* "The dried leaves of Virginian tobacco, Nicotiana Tabacum. (Linn. Steph. & Church, *Med. Bot.*, plate 37.) Cultivated in America." *Br.*

Tabaci Folia, *Br.;* Leaf Tobacco; Folia Nicotianæ, *P.G.;* Nicotiane, Tabac, *Fr.;* Tabak, Tabaksblätter, *G.;* Tobacco, *It.;* Tobaco, *Sp.*

Gen. Ch. Corolla funnel-shaped with the border plaited. *Stamens* inclined. *Capsules* two-valved, two-celled. *Willd.*

Nicotiana Tabacum. Willd. *Sp. Plant.* i. 1014; Bigelow, *Am. Med. Bot.* ii. 171; *B. & T.* 191. The tobacco is an annual plant, with a large fibrous root, and an erect, round, hairy, viscid stem, which branches near the top, and rises from three to six feet in height. The leaves are numerous, alternate, sessile, and somewhat decurrent, very large, ovate-lanceolate, pointed, entire, slightly viscid, and of a pale green color. The lowest are often two feet long, and six inches broad. The flowers are disposed in loose terminal panicles, and are furnished with long, linear, pointed bracts at the divisions of the peduncle. The calyx is bell-shaped, hairy, somewhat viscid, and divided at its summit into five pointed segments. The tube of the corolla is twice as long as the calyx, of a greenish hue, swelling at top into an oblong cup, and ultimately expanding into a five-lobed, plaited, rose-colored border. The whole corolla is very viscid. The filaments incline to one side, and support oblong anthers. The pistil consists of an oval germ, a slender style longer than the stamens, and a cleft stigma. The fruit is an ovate, two-valved, two-celled capsule, containing numerous reniform seeds, and opening at the summit. The leaves are the part employed. The seeds, examined by F. M. Brandt, yielded no narcotic principle, though a protein-like substance contained in them was thought, by its decomposition, to produce nicotine. (*Neues Jahrb. für Pharm.*, xxi. 42.) Prof. Procter also failed to find nicotine in the seeds. (*Proc. A. P. A.*, 1858, p. 296.)

There is good reason to believe that this plant is a native of tropical America, where it was found by the Spaniards upon their arrival. It is at present cultivated in most parts of the world, and nowhere more abundantly than within the limits of the United States. Virginia is, perhaps, the region most celebrated for its culture. The young shoots, produced from seeds thickly sown in beds, are transplanted into the fields during the month of May, and set in rows with an interval of three or four feet between the plants. Through the whole period of its growth, the crop requires constant attention. The development of the leaves is promoted by removing the top of each plant, and thus preventing it from running into flower and seed. The harvest is in August. The ripe plants, having been cut off above their roots, are dried under cover, and then stripped of their leaves, which are tied in bundles, and packed in hogsheads. While hung up in the drying houses, they undergo a curing process, consisting in exposure to a considerable degree of heat, through which they become moist, or in other words are said to sweat, after which they are dried for packing.

Two varieties of this species are mentioned by authors, one with narrow, the other with broad leaves; but they do not differ materially in properties. Great diversity in the quality of tobacco is produced by difference of soil and mode of cultivation; and several varieties are recognized in commerce. Other species also of Nicotiana are said to be cultivated, especially *N. rustica* and *N. paniculata*, the former of which is said to have been the first introduced into Europe, and is thought to have been cultivated by the aborigines of this country, as it is naturalized near the borders of some of our small northern lakes. The *N. quadrivalvis* of Pursh affords tobacco to the Indians of the Missouri and Columbia Rivers; and *N. fruticosa*, a native of China, was probably cultivated in Asia before the discovery of this continent by

Columbus. The latter species is said by Mr. John Le Conte to be that from which the best Cuba tobacco is obtained.* (*A. J. P.*, 1859.)

Properties. Tobacco, as it occurs in commerce, is of a yellowish brown color, a strong narcotic penetrating odor which is wanting in the fresh leaves, and a bitter, nauseous, and acrid taste. These properties are imparted to water and alcohol. They are injured by long boiling; and the extract is, therefore, relatively feeble. Officinally the leaves are described as "up to twenty inches (50 cm.) long, oval or ovate-lanceolate, acute, entire, brown, friable, glandular-hairy, of a heavy, peculiar odor, and a nauseous, bitter and acrid taste." *U. S.* An elaborate analysis of tobacco was made by Vauquelin, who discovered in it, among other ingredients, an acrid, volatile, colorless liquid, slightly soluble in water, very soluble in alcohol, and supposed to be the active principle. It was separated by a complicated process, of which, however, the most important step was the distillation of tobacco juice with potassa. In the results of this distillation, Vauquelin recognized alkaline properties, which he ascribed to ammonia, but which were, in part at least, dependent upon the acrid principle alluded to. To this principle the name of *nicotine* was given; but its alkalinity was not ascertained till a subsequent period. Another substance was obtained by Hermbstädt by simply distilling water from tobacco, and allowing the liquid to stand for several days. A white crystalline matter rose to the surface, which, upon being removed, was found to have the odor of tobacco, and to resemble it in effects. It was fusible, volatilizable, similar to the nicotine of Vauquelin in solubility, and without alkaline or acid properties. It was called *nicotianin* by Hermbstädt, and appears to partake of the nature of volatile oils. Flückiger, who made a study of this nicotianin, is of the opinion that it is simply a fatty acid contaminated with a little volatile oil. (*Pharmacographia*, 2d ed., p. 468.) Two German chemists, Posselt and Reimann, subsequently analyzed tobacco, and ascertained the alkaline nature of its active principle, which, however, neither they nor Vauquelin obtained in a state of purity. According to these chemists, 10,000 parts of the fresh leaves contain 6 parts of an alkaloid, which they call *nicotine*, 1 of the *nicotianin* of Hermbstädt, 287 of slightly bitter extractive, 174 of gum mixed with a little malate of calcium, 26·7 of green resin, 26 of albumen, 104·8 of a substance analogous to gluten, 51 of malic acid, 12 of malate of ammonium, 4·8 of sulphate of potassium, 6·3 of chloride of potassium, 9·5 of potassa, which was combined in the leaves with malic and nitric acids, 16·6 of phosphate of calcium, 24·2 of lime which had been combined with malic acid, 8·8 of silica, 496·9 of lignin, traces of starch, and 8828 parts of water. (Berzelius, *Traité de Chimie.*) According to M. E. Goupet, tobacco contains also a little citric acid. (*Chem. Gaz.*, Aug. 1846, p. 319.) The nicotine obtained by Vauquelin, and by Posselt and Reimann, was a colorless, volatile liquid, and, as subsequently ascertained by Henry and Boutron, was in fact an aqueous solution of the alkaline principle in connection with ammonia. It was reserved for these chemists to obtain nicotine in a state of purity. It exists in tobacco combined with an acid in excess, and in this state is not volatile.† It is easily extracted from tobacco by means of alcohol or water as a malate, from which the alkaloid can be separated by shaking it with caustic lye and ether. The ether is then expelled by warming the liquid, which finally has to be mixed with slaked lime and distilled in a stream of hydrogen, when the nicotine begins to come over at about 200° C. (392° F.). For a mode of estimating the proportion of nicotine in tobacco, see *P. J. Tr.* (Dec. 1873, p. 442). For an analysis of the ashes of Virginia tobacco, by Messrs. McD. Firby, of New Orleans, and J. A. Cahill, of Virginia, see *Chem. News* (Sept. 4, 1874, p. 117).

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* The latest researches indicate that the officinal species is a more exclusive source of the commercial tobacco than is indicated by the text, and also in the *Pharmacographia*, where it is stated that *N. rustica* furnishes *East India Tobacco* and the kinds known as *Latakia* and *Turkish Tobacco*, *N. Persica*, the tobacco of Shiraz, and *N. repanda*, a much valued Havana tobacco. Latakia tobacco seems, however, to be the product of the officinal plant, and Senator Vidal asserts that *N. repanda* is not found in Cuba, *N. Tabacum* being the only species there cultivated. (*P. J. Tr.*, viii. 710.)

† M. Liecke determines the proportion of nicotine in any specimen of tobacco as follows. He treats the dry leaves three times successively with water acidulated with sulphuric acid, and evaporates the liquid to the consistence of an extract. The extract is agitated with its volume of alcohol, and the tincture is filtered through paper previously washed with alcohol. It contains all the nicotine in the state of sulphate. After evaporating the alcohol, he decomposes the sulphate by caustic potassa in a distillatory apparatus of glass, which is heated gradually, by means of an oil-bath, to 260° C., and saturates the nicotine received by dilute sulphuric acid. (*Journ. de Pharm. et de Chim.*, Déc. 1867, p. 451.)

Nicotine. (*Nicotina* or *Nicotia.*) This is a colorless or nearly colorless fluid; of the sp. gr. 1·027; boiling at 247° C. (476·6° F.), and not solidifying at —15° C. (14° F.); of little smell when cold; of an exceedingly acrid burning taste, even when largely diluted; entirely volatilizable, and, in the state of vapor, very irritant to the nostrils, with an odor recalling that of tobacco; inflammable; very soluble in water, alcohol, ether, the fixed oils, and oil of turpentine; strongly alkaline in its reaction; and capable of forming crystallizable salts with the acids. These salts are deliquescent, having a burning and acrid taste, and, like the salts of ammonia, lose a portion of their base by heat. Nicotine contains a much larger proportion of nitrogen than most of the other organic alkalies. Its formula is $C_{10}H_{14}N_2$. In its action on the animal system, it is one of the most virulent poisons known. A drop of it, in the state of concentrated solution, was sufficient to destroy a dog; and small birds perished at the approach of a tube containing it. In man, it is said to destroy life, in poisonous doses, in from two to five minutes. Tannin forms with it a compound of but slight solubility, and might be employed as a counter-poison. It exists in tobacco in small proportion. Henry and Boutron found different varieties of tobacco to give products varying from 3·8 to 11·28 parts in 1000. It has been found in the seeds, and in very small proportion in the root. (See *Journ. de Pharm.*, xxii. 689.) There can be little doubt that tobacco owes its activity to this alkaloid.[*] It has been employed as a poison. For a very interesting account of it in all its toxicological relations, the reader is referred to a memoir by Orfila, translated by Dr. Lee, and published in the *N. Y. Journ. of Med.* (N. S., ix. 112, 219, and 369). A paper on the same subject, by Dr. A. S. Taylor, is contained in the *P. J. Tr.*, June, 1859 (p. 620). Nicotine has the remarkable property of resisting decomposition amid the decaying tissues of the body, and was detected by Orfila in the bodies of animals destroyed by it two or three months after their death. Prof. F. F. Mayer, of New York, has concluded from his experiments that nicotine is the active principle in all parts of the plant both before and after curing. (*Proc. A. P. A.*, 1865.)

Vohl and Eulenberg (*P. J. Tr.*, Jan. 1872, p. 567) made an interesting analysis of tobacco-smoke. The smoke analyzed was of strong tobacco, containing 4 per cent. of nicotine. Notwithstanding this large proportion of nicotine, none of it was found in the smoke; the authors differing in their results from most previous observers; Zeise alone having as early as 1843 declared its non-existence. The authors ascribe the mistake of others to the existence in the smoke of certain products closely resembling nicotine in sensible and physiological properties, namely, the nicotine bases, which have a high boiling point, such as parvoline.

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[*] M. Schloesing obtained a much larger proportion than that stated above, by the following process. Tobacco is exhausted by boiling water, the infusion evaporated to a semi-solid consistence, and the extract shaken with twice its volume of alcohol of 36°. Two layers form, of which the upper contains all the nicotine. This is decanted, most of the alcohol evaporated, and alcohol anew added in order to precipitate certain matters. The extract is treated with a concentrated solution of potassa, and, after cooling, is shaken with ether, which dissolves the nicotine. To the ethereal solution powdered oxalic acid is added, which unites with the nicotine, and separates in the form of a syrupy mass. This, being washed with ether, treated with potassa, taken up by water, and distilled in a water-bath, yields the nicotine, which may be obtained pure by rectification in a current of hydrogen. (*Journ. de Pharm.*, 3e sér., xii. 157.) Orfila, in his memoir on nicotine, states that Havana tobacco yields 2 per cent. of this alkaloid, Maryland 2·3 per cent., and Virginia 6·9 per cent. Laiblin's modification of Schloesing's process is as follows. "Coarsely-cut tobacco is digested for a day with cold water, and the mixture subsequently boiled by injection of superheated steam, filtered, and the residue pressed. The same series of operations is repeated, and the mixed filtrates are evaporated to one-third of their volume. A quantity of lime, one-tenth of the weight of the tobacco used, is now added, and the mixture distilled by a current of steam as long as nicotine (recognized by its odor) comes over. The distillate is exactly neutralized by oxalic acid, the amount used being noted, and evaporated to a thin syrup. The exact amount of potash necessary to neutralize the oxalic acid is now added, and the crude nicotine which separates is collected. The remaining liquid is exhausted with ether, and the nicotine thus extracted added to that first obtained. That portion of the crude base which distils over below 250° C. (482° F.) is converted into oxalate by adding powdered oxalic acid to its ethereal solution; and the purified oxalate, which separates as a syrup, after being washed with ether, is dissolved in water and again decomposed with potash as above. The product is finally heated to 110° C. (230° F.) for six hours by a paraffin-bath, and a slow stream of dry hydrogen passed through it to remove ammonia, ether, and water. The temperature is then gradually raised to 210° C. (410° F.), to complete the removal of the water, and on fractionally distilling the residue, pure nicotine comes over between 240° and 242° C. (464° and 467·6° F.). It must be preserved in sealed tubes. One centner (112 lbs.) of tobacco thus treated yielded 600 grammes of pure nicotine (= 1½ per cent.), besides impure base." (*A. J. P.*, Jan. 1880.) Kirchmann's process may be found in *N. R.*, 1876, p. 328.

When cigars were smoked, certain gases were given off, which, when collected and examined, proved to be oxygen, nitrogen, carbonic acid, and marsh-gas. The smoke was drawn first through a potassa solution to collect acids, and then through dilute sulphuric acid to collect bases. With the potassa solution, an oily substance appeared on the surface, having an almost intolerable odor of tobacco-smoke, and from this was obtained, by distillation at a gradually increasing temperature, at first a liquid and oily product, and, at the temperature of 300° C. (572° F.), a substance which on cooling became a laminated mass. This, on being repeatedly crystallized from ether, assumed the appearance of pearly white scales, melting between 94° C. and 95° C. (201·2° and 203° F.), and of a higher boiling point than mercury. From these characters, as well as its percentage composition, this substance appears to be identical with the hydrocarbon ($C_{19}H_{18}$) discovered by Kraut. The oily distillate before this, having been purified by repeated treatment with potassa and sulphuric acid, had a sp. gr. 0·8 to 0·87, and from its percentage composition (92 or 93 C., and 8 or 7 H.) appears to be a mixture of different hydrocarbons, belonging to the benzene or some analogous series. The potassa solution, after the separation of the oils, yielded, under appropriate treatment, a large amount of gas, consisting of carbon dioxide, and hydrogen cyanide and sulphide: consequently the statement that tobacco-smoke contains no cyanogen is a mistake. Upon a distillation of the potassa solution after the addition of sulphuric acid, several acids were found in the distillate; viz., acetic, propionic, butyric, valerianic, and carbolic, with a portion of creasote, more doubtfully caproic, caprylic, and succinic acids.

The sulphuric acid solution now only remained for examination. From this, which had become dark-colored and thick on standing, a *dark brown resin* was separated. By treatment with potassa, *ammoniacal vapors* escaped, and a *brown oil* with the odor of tobacco-smoke floated on the surface. From the residuary liquid, after distillation, saturation with caustic potassa, and redistillation, vapors escaped which proved to be *chloride of ammonium.* After further treatment, for which we refer to the original, the oily residue was divided by fractional distillation, and the whole series of picoline bases, analogous to the aniline bases, were obtained. The identity of the following was determined by their boiling point, percentage composition, and the composition of the double platinum salt: *pyridine*, C_5H_5N, boiling point 115° to 116° C. (239° to 240·8° F.); *picoline*, C_6H_7N, boiling point 134° to 135° C. (273·2° to 275° F.); *lutidine*, C_7H_9N, boiling point 155° C. (311° F.); *collidine*, $C_8H_{11}N$, boiling point 171·5° C. (341° F.) (isomeric with xylidine); *parvoline*, $C_9H_{13}N$, boiling point 187° to 188° C. (368·6° to 370·4° F.) (isomeric with cumidine); *coridine*, $C_{10}H_{15}N$, boiling point 211° C. (411·8 F.); *rubidine*, $C_{11}H_{17}N$; and probably *viridine*, $C_{12}H_{19}N$, boiling point 251° C. (483·8° F.). No trace of *nicotine* was to be found. The authors experimented physiologically with only a mixture, of those boiling below 160° C. (320° F.), and of those between 160° and 250° C. (320° and 482° F.); and these were found, like nicotine, to cause contraction of the pupil, dyspnœa, general convulsions, and death.

When distilled at a temperature above that of boiling water, tobacco affords an empyreumatic oil, which Mr. Brodie proved to be a most virulent poison. A single drop, injected into the rectum of a cat, occasioned death in about five minutes, and double the quantity, administered in the same manner to a dog, was followed by the same result. This oil is of a dark brown color, and an acrid taste, and has a very disagreeable odor, exactly resembling that of tobacco-pipes which have been much used. It has been stated to contain nicotine. (*Ann. de Chim. et de Phys.*, 3e sér., ix. 465.)

It is quite certain that tobacco leaves undergo considerable chemical changes during the processes of curing and preparation for use. Thus, the characteristic odor of ordinary tobacco is entirely different from that of the fresh leaves, and must be owing to the generation of a new volatile principle. It has also been asserted that the proportion of nicotine in prepared tobacco is greater than in the fresh. It has even been made a question, whether nicotine exists at all in the fresh growing leaves; but this question has been experimentally decided in the affirmative by Prof. Procter (*Proc. A. P. A.*, 1858, p. 300); and Prof. Mayer, of New York, has experimentally determined that the nicotine exists as largely in the plant before as after curing; indeed, he believes that it is somewhat diminished in the process, probably in part if not altogether by volatilization. (*Ibid.*, 1865.)

The distinguishing character of tobacco, as given in the Br. Pharmacopœia, is that, when distilled with solution of potassa, it yields an alkaline fluid, having the peculiar odor of nicotine, and giving precipitates with platinic chloride and tincture of galls.

Medical Properties and Uses. Tobacco is a powerful sedative poison, which is locally irritant. Snuffed up the nostrils, it excites violent sneezing and a copious secretion of mucus; chewed, it irritates the mucous membrane of the mouth, and increases the flow of saliva; when injected into the rectum, it sometimes operates as a cathartic; and the alkaloid nicotine injected into the cellular tissue of animals evidently produces much pain. Moderately taken, it quiets restlessness, calms mental and corporeal inquietude, and produces a state of general languor or repose, which has great charms for those habituated to the impression. In larger quantities, it gives rise to confusion of the head, vertigo, stupor, faintness, nausea, vomiting, and general depression of the nervous and circulatory functions, which, if increased, eventuates in alarming and even fatal prostration. The symptoms of its excessive action are severe retching, with the most distressing and continued nausea, great feebleness of pulse, coolness of the skin, fainting, and sometimes convulsions. We are singularly deficient in exact knowledge as to how these various symptoms are produced. In accordance with the experimental evidence at hand, the convulsions are spinal; and it seems well determined that the paralysis is due to a depressant action upon the motor nerve trunks, which immediately after death are found to be inexcitable. How the circulatory phenomena are brought about is not clear, but it would appear that the heart-muscle is not itself directly affected, as Benham found that the direct application of the poison to the viscus does not arrest its pulsations.

The use of tobacco was adopted by the Spaniards from the American Indians. In the year 1560, it was introduced into France by the ambassador of that country at the court of Lisbon, whose name—Nicot—has been perpetuated in the generic title of the plant. Sir Walter Raleigh is said to have introduced the practice of smoking into England. In the various modes of smoking, chewing, and snuffing, the drug is now largely consumed in every country on the globe. It must have properties peculiarly adapted to the propensities of our nature, to have thus surmounted the first repugnance to its odor and taste, and to have become the passion of so many millions. When employed in excess, it enfeebles digestion, produces emaciation and general debility, and lays the foundation of serious nervous disorders. The most common of these is undoubtedly disturbance of the innervation of the heart, with consequent palpitations and cardiac distress. Amaurosis and even color-blindness are occasionally produced, and even insanity has been ascribed to chronic tobacco poisoning. In many cases of "nervous break-down" attributed to overwork, the excessive use of tobacco has certainly been an important etiological factor. In the form of snuff, tobacco is sometimes so much contaminated with lead, in consequence of being kept in leaden boxes, as to produce the poisonous effects of that metal. In different kinds of snuff, Dr. A. Vogel has found from 0·014 to 1·025 per cent. of lead. (See *A. J. P.*, 1864, p. 422.)

Formerly much used as a relaxant, tobacco has been superseded by safer and more efficacious remedies, so that it is at present never employed as an internal medicine, unless it be in chronic asthma. Locally the remedy is still used to some extent in various skin diseases, in hemorrhoids, and in various spasmodic or painful affections. It should always be borne in mind that its active principle is absorbed readily by the skin, and that serious or even fatal poisoning may result from its too free application to the surface of the body. A case of death is on record, occurring in a child eight years old, in consequence of the application of the expressed juice of the leaves to the head, for the cure of tinea capitis. Death has also been produced by the inhalation of the smoke.

Five or six grains (0·33–0·4 Gm.) of powdered tobacco will generally act as an emetic; but the remedy ought never to be used for such purpose.

Off. Prep. Enema Tabaci, *Br.*

TAMARINDUS. *U. S., Br.* *Tamarind.*

(TĂM-Ạ-RĬN′DỤS.)

"The preserved pulp of the fruit of Tamarindus Indica. Linné. (*Nat. Ord.* Leguminosæ, Cæsalpinieæ.)" *U. S.* "The preserved pulp of the fruit." *Br.*

Pulpa Tamarindorum Cruda, s. Fructus Tamarindorum, *P.G.;* Tamarin, Tamarins, *Fr.;* Tamarinden, *G.;* Tamarindi, *It.;* Tamarindos, *Sp.*

Gen. Ch. Calyx four-parted. *Petals* three. *Nectary* with two short bristles under the filaments. *Legume* filled with pulp. *Willd.*

Tamarindus Indica. Willd. *Sp. Plant.* iii. 577; *B. & T.* 92. The tamarind tree is the only species of this genus. It rises to a great height, sends off numerous spreading branches, and has a beautiful appearance. The trunk is erect, thick, and covered with a rough, ash-colored bark. The leaves are alternate and pinnate, composed of many pairs of opposite leaflets, which are almost sessile, entire, oblong, obtuse, unequal at their base, about half an inch long by a sixth of an inch broad, and of a yellowish green color. The flowers, which are in small lateral racemes, have a yellowish calyx, and yellow petals beautifully variegated with red veins. The fruit is a broad, compressed, reddish ash-colored pod, much curved, from two to six inches long, with numerous brown, flat, quadrangular seeds, contained in cells formed by a tough membrane. Exterior to this membrane is a light-colored acid pulpy matter, between which and the shell are several somewhat branched tough ligneous strings, running from the stem to the extremity of the pod, the attachment of which they serve to strengthen. The shells are fragile and easily separated.

Tamarindus Indica appears to be a native of the East and West Indies, Egypt, and Arabia, though believed by some to have been imported into America. Dr. Barth, the African traveller, found it abundant in the interior of Africa. (*Travels in Africa*, Am. ed., 1857, i. 418.) De Candolle is doubtful whether the East and West India trees are of the same species. It is stated by writers that the pods of the former are much larger than those of the latter, and have a greater number of seeds; the East India tamarinds containing six or seven, those from the West Indies rarely more than three or four. In a parcel of the latter in the possession of the authors of the Dispensatory there were, however, numerous pods with from eight to ten seeds, and the number generally exceeded four.

Tamarinds are brought to us chiefly from the West Indies, where they are prepared by placing the pods, previously deprived of their shell, in layers in a cask, and pouring boiling syrup over them. A better mode, sometimes practised, is to place them in stone jars, with alternate layers of powdered sugar. They are said to be occasionally prepared in copper boilers. In the East Indies tamarinds are often prepared for market by stripping off the outer shell and pressing the pulpy interiors into a mass; sometimes they are packed as in the West Indies.

Properties. Fresh tamarinds, which are sometimes, though rarely, brought to this country, have an agreeable sour taste, without any mixture of sweetness. As we usually find them, in the preserved state, they form a dark-colored adhesive mass, consisting of syrup mixed with the pulp, membrane, strings, and seeds of the pod, and having a sweet acidulous taste. The brown, flattish, quadrangular seeds, each enclosed in a tough membrane, should be hard, clean, and not swollen, the strings tough and entire, and the smell without mustiness. From the analysis of Vauquelin, it appears that in 100 parts of the pulp of tamarinds, independently of the sugar added to them, there are 9·40 parts of citric acid, 1·55 of tartaric acid, 0·45 of malic acid, 3·25 of bitartrate of potassium, 4·70 of gum, 6·25 of jelly, 34·35 of parenchymatous matter, and 27·55 of water; so that the acidity is owing chiefly to citric acid. It is said that copper may sometimes be detected in preserved tamarinds, derived from the boilers in which they are occasionally prepared. Its presence may be ascertained by the reddish coat which it imparts to the blade of a knife immersed in the tamarinds.

Medical Properties and Uses. Tamarinds are laxative and refrigerant, and infused in water form a highly grateful drink in febrile diseases. Convalescents often find the pulp a pleasant addition to their diet, and useful by preserving the bowels in a loose condition. It is sometimes prescribed in connection with other mild cathartics, and is one of the ingredients in the confection of senna. Though frequently given with infusion of senna to cover its taste, it is said to weaken its purgative power; and the same observation has been made of its influence upon the resinous cathartics in general. From a drachm to an ounce (3·9–31·1 Gm.) or more may be taken at a dose.

Off. Prep. Confectio Sennæ.

TANACETUM. *U. S.* *Tansy.*

(TĂN-Ạ-CĒ'TŬM.)

"The leaves and tops of Tanacetum vulgare. Linné. (*Nat. Ord.* Compositæ.)" *U. S.*

Summitates Tanaceti; Herbe aux Vers, Tanaisie, *Fr.;* Gemeiner Rainfarrn, Wurmkraut, *G.;* Tanaceto, *It., Sp.*

Gen. Ch. Receptacle naked. *Pappus* somewhat emarginate. *Calyx* imbricate, hemispherical. *Corolla* rays obsolete, trifid. *Willd.*

Tanacetum vulgare. Willd. *Sp. Plant.* iii. 1814; Woodv. *Med. Bot.* p. 66, t. 27. This is a perennial herbaceous plant, rising two or three feet in height. The stems are strong, erect, obscurely hexagonal, striated, often reddish, branched towards the summit, and furnished with alternate, doubly pinnatifid leaves, the divisions of which are notched or deeply serrate. The flowers are yellow, and in dense terminal corymbs. Each flower is composed of numerous florets, of which those constituting the disk are perfect and five-cleft, those of the ray very few, pistillate, and trifid. The calyx consists of small, imbricated, lanceolate leaflets, having a dry scaly margin. The seeds are small, oblong, with five or six ribs, and crowned with a membranous pappus.

Tansy is cultivated in our gardens, and grows wild in the roads and in old fields, but was introduced from Europe, where it is indigenous. It is in flower from July to September. There is a variety of the plant with curled leaves, which is said to be more grateful to the stomach than that above described, but has less of the peculiar sensible properties of the herb, and is probably less active.

Properties. "Leaves about six inches (15 cm.) long; bipinnatifid, the segments oblong, obtuse, serrate or incised, smooth, dark green, and glandular; flower-heads corymbose, with an imbricated involucre, a convex, naked receptacle, and numerous yellow, tubular florets." *U. S.* The odor is strong, peculiar, and fragrant, but much diminished by drying; the taste is warm, bitter, somewhat acrid, and aromatic. These properties are imparted to water and alcohol. According to Leppig (*Dissertation*, Dorpat, 1882), both the flowers and the leaves contain the following constituents: *tanacetin*, tannic acid (*tanacetum-tannic acid*), traces of gallic acid, volatile oil, a wax-like substance, albuminoids, tartaric, citric, and malic acids, traces of oxalic acid, a lævogyrate sugar, resin, metarabic acid, pararabin, and woody fibre. Of these the most important are the bitter principle *tanacetin*, to which Leppig gives the formula $C_{11}H_{16}O_4$, a compound first discovered by Homolle (1845), the tannic acid, to which he gives the formula $C_{23}H_{29}O_{31}$, and the volatile oil, of which the flowers yielded 1·49 per cent. and the leaves 0·66 per cent. The *tanacetic acid* of Peschier he considers to be impure malic acid, an opinion shared by Husemann. (*Pflanzenstoffe*, p. 537.) The bitter principle tanacetin forms a very hygroscopic brownish amorphous mass, easily soluble in alcohol and water, insoluble in ether. It possesses a taste at first characteristically bitter like willow bark, and then cooling and caustic. The essential oil has been investigated by Bruylants (*Ber. Chem. Ges.*, xi., p. 449), who finds it to consist of a terpene, $C_{10}H_{16}$, boiling at 155°–160° C., of which 1 per cent. only is present, an aldehyd, $C_{10}H_{16}O$, boiling at 195°–196° C., of which 70 per cent. was obtained, and an alcohol, $C_{10}H_{18}O$, boiling at 203°–205° C., of which 26 per cent. was present.

Medical Properties and Uses. Tansy adds to the medical properties of the aromatic bitters those of an irritant narcotic. It has been recommended in intermittents, hysteria, amenorrhœa, and as a preventive of arthritic paroxysms, but in this country is little employed, for any purpose, in regular practice. The seeds are said to be most effectual as a vermifuge. The dose of the powder is from thirty grains to a drachm (1·95–3·9 Gm.) two or three times a day; but the infusion is more frequently administered. A fatal case of poisoning with half an ounce of oil of tansy is recorded in the *Medical Magazine* for November, 1834. Frequent and violent clonic spasms were experienced, with much disturbance of respiration; and the action of the heart gradually became weaker till death took place from its entire suspension. No inflammation of the stomach or bowels was discovered upon dissection. (*Am. Journ. of the Med. Sci.*, xvi. 256.) Two other fatal cases have since been recorded, one in which more than a fluidounce was taken, the other only a fluidrachm. In both death followed speedily, preceded by coma and violent convulsions. In two of the three cases above referred to, the oil seems to have been taken to produce abortion, but no such effect followed in either. (*Ibid.*, xxiii. 136, and xxiv. 279.) Dr. Pendleton records a case, in which death resulted to a negress of twenty-one from a considerable quantity of strong decoction of tansy taken internally. In the *Journal de Pharmacie* (Avril, 1870, p. 321) mention is made of a girl who, having taken half an ounce of the oil with the intent to produce abortion, was seized with convulsions with foaming of the mouth, followed by profound coma, dilated pupils, frequent and feeble pulse, etc.; but in this case recovery took place after vomiting, maintained by warm drinks, sassafras, and a dose of castor oil.

TARAXACUM. *U. S.* *Taraxacum.* [*Dandelion.*]

(TẠ-RĂX′Ạ-CŬM—tạ-răks′ạ-kŭm.)

Taraxaci Radix, *Br.;* Dandelion Root; Pissenlit, Dent de Lion, *Fr.;* Löwenzahn, *G.;* Tarassaco, *It.;* Diente de Leon, *Sp.*

"The root of Taraxacum Dens-leonis, Desfontaines (*Nat. Ord.* Compositæ), gathered in autumn." *U. S.* "The fresh and dried roots of Taraxacum Dens Leonis, D. C.; Woodv. *Med. Bot.* (*Leontodon Taraxacum*), plate 3, gathered between September and February, from meadows and pastures in Britain." *Br.*

Gen. Ch. Receptacle naked. *Calyx* double. *Seed-down* stipitate, hairy. *Willd.*

Leontodon Taraxacum. Willd. *Sp. Plant.* iii. 1544.—*Taraxacum Dens-leonis.* De Cand. *Prodrom.* vii. 145.—*Taraxacum officinale.* Wiggers. *B. & T.* 159. The dandelion is an herbaceous plant, with a perennial fusiform root. The leaves, which spring immediately from the root, are long, pinnatifid, generally runcinate, with the divisions toothed, smooth, and of a fine green color. The common name of the plant was derived from the fancied resemblance of its leaves to the teeth of a lion. The flower-stem rises from the midst of the leaves, six inches or more in height. It is erect, simple, naked, smooth, hollow, fragile, and terminated by a large golden-colored flower, which closes in the evening, and expands with the returning light of the sun. The calyx is smooth and double, with the outer scales bent downwards. The florets are very numerous, ligulate, and toothed at their extremities. The receptacle is convex and punctured. The seed-down is stipitate, and at the period of maturity is disposed in a spherical form, and is so light and feathery as to be easily borne away by the wind, with the seeds attached.

This species of Leontodon grows spontaneously in most parts of the globe. It is abundant in this country, adorning our grass-plats and pasture-grounds with its bright yellow flowers, which, in moist places, show themselves with the first opening of spring, and continue to appear till near the close of summer. In India, the plant is cultivated in various parts of the country, and its root collected for use between the months of September and February. (*P. J. Tr.*, Dec. 1871, p. 523.) All parts of the plant contain a milky bitterish juice, which exudes when they are broken or wounded. The leaves, when very young and blanched by the absence of light during their growth, are tender and not unpleasant to the taste, and are sometimes used as a salad. When older and of their natural color, they are medicinal. The Pharmacopœias recognize only the root, which is by far the most efficacious part. It should be full grown when collected, and should be employed in the recent state, as it is then most active. It does not, however, as stated by Duncan, lose nearly all its bitterness by drying; and the root dug up in the warmer seasons might, if dried with care, be employed with propriety in the succeeding winter. The juice of the root is thin and watery in the spring; milky, bitter, and spontaneously coagulable in the latter part of summer and autumn; and sweet and less bitter in the winter when affected by the frost. The months of July, August, and September are, therefore, the proper periods for collecting it.

Mr. Henry Barton, of Brighton, England, prepares the juice from the flower-stalks by crushing and pressure, adding 25 per cent. of spirit, and, after allowing it to stand for some weeks in glass bottles, filters to separate a very small quantity of deposit, and sets aside for use. According to Mr. Barton, it remains bright, and retains its characteristic taste. Though not so rich in solid constituents as the juice of the root, yet, having an equal bitterness, it is probably not less efficacious as a medicine, if it be true, as stated by Prof. Bentley, that the efficacy of the medicine does not depend solely on the amount of its solid constituents, but principally if not entirely on the bitter principle it contains. Mr. Barton states that it is certainly one of the best preparations of taraxacum. (*A. J. P.*, 1872, p. 509.)

The fresh full-grown root of the dandelion is several inches in length, as thick as the little finger or thicker, round and tapering, somewhat branched, of a light brown color externally, whitish within, having a yellowish ligneous cord running through its centre, and abounding in a milky juice. In the dried state it is dark brown, much shrunk, wrinkled longitudinally, brittle, and when broken presents a shining somewhat resinous fracture. A transverse section exhibits an exterior cortical portion, thick, spongy, whitish, and marked with concentric rings, and a smaller central portion, ligneous and yellow; though in very old roots the latter is sometimes wanting. It is without smell, but has a sweetish, mucilaginous, bitterish, herbaceous taste. "It should be free from the root of *Cichorium Intybus* (Linné), which closely resembles it, but is usually paler, and has the milk-vessels in radiating lines." *U. S.* Its active properties are yielded to water by boiling, and do not appear to be injured in the process. Dragendorff obtained from the root gathered in October and dried at 100° C. (212° F.), 24 per cent. of *inulin* and some sugar. The root gathered in March from the same place yielded 1·74 per cent. of inulin, 17 of uncrystallizable sugar, and 18·7 of *levulin.* This last-named substance, discovered by Dragendorff, has the same composition as inulin, but dissolves in cold water, and is devoid of any rotatory power. Mannit, which has been found in the infusion of the root, has been demonstrated by the Messrs. Smith, of Edinburgh, not to pre-exist in the root, but to be formed by spontaneous changes consequent on exposure. A crystallizable principle has been extracted from the juice of the root by M. Pollex, who has named it *taraxacin.* It is bitter and somewhat acrid, fusible but not volatile, sparingly soluble in cold water, but very soluble in boiling water, alcohol, and ether. It is obtained by boiling the milky juice in distilled water, filtering the concentrated liquor, and allowing it to evaporate spontaneously in a warm place. The taraxacin crystallizes, and may be purified by repeated solution and crystallization in alcohol or water. Kromayer (*Arch. Pharm.* (2), cv. 6) also obtained taraxacin, and, in addition, a second crystalline principle, *taraxacerin*, $C_8H_{16}O$, insoluble in water, but soluble in alcohol. According to Vogel, the intra-cellular substance of the root consists chiefly of pectose, which is the result of a metamorphosis of the substance constituting the membrane of the cells. (*Journ. de Pharm.*, Avril, 1864, p. 362.)

The root of *Aspargia hispida* has been largely substituted for dandelion in England by the herb-gatherers (*P. J. Tr.*, xi. 107); and we are informed that a similar fraudulent substitution is not unfrequent, in this country, of the root of *Cichorium Intibus*, or *chicory.* This is distinguishable from the genuine root by its lighter color and greater bitterness. For a particular account of the characteristics by which the root may be distinguished from all others, see *P. J. Tr.*, xvi. 304.

Medical Properties and Uses. Taraxacum is slightly tonic, diuretic, and aperient, and is thought to have a specific action upon the liver, exciting it when languid to secretion, and resolving its chronic engorgements. It has been much employed in Germany, and is a popular remedy with many practitioners in this country. The diseases to which it appears to be especially applicable are those connected with derangement of the hepatic apparatus, and of the digestive organs generally. In congestion and chronic inflammation of the liver and spleen, in cases of suspended or deficient biliary secretion, and in dropsical affections dependent on obstruction of the abdominal viscera, it appears to be capable of doing good, if employed with a due regard to the degree of excitement. Our own experience is in its favor. An irritable condition of the stomach and bowels, and the existence of acute inflammation, contraindicate its employment. It is usually given in the form of extract or decoction, though some prefer the infusion. Bitartrate of potassium is sometimes added to the decoction when an aperient effect is desired; and aromatics will occasionally be found useful in correcting a tendency to griping or flatulence. The dried root is sometimes mixed, in powder, with ground coffee, the taste of which covers that of the dandelion. It is also used as a substitute for coffee, being powdered and roasted, and then prepared in the same manner.

Off. Prep. Decoctum Taraxaci, *Br.;* Extractum Taraxaci; Extractum Taraxaci Fluidum, *U. S.;* Succus Taraxaci, *Br.*

TEREBINTHINA. *U. S.* *Turpentine.*

(TĔR-Ẹ-BĬN'THỊ-NẠ.)

"A concrete oleoresin obtained from Pinus australis, Michaux, and from other species of Pinus. (*Nat. Ord.* Coniferæ.)" *U. S.* "The concrete turpentine of Pinus Tæda, the Frankincense pine, and Pinus palustris, the Swamp pine. From the Southern States of North America." *Br.*

Thus Americanum, *Br.;* Common Frankincense; Terebinthina Communis; Crude Turpentine; Térébenthine commune, *Fr.;* Gemeiner Terpentin, *G.*

TEREBINTHINA CANADENSIS. *U. S.*, *Br.* *Canada Turpentine.* [*Balsam of. Fir.*]

(TĔR-Ẹ-BĬN'THỊ-NẠ CĂN-Ạ-DĔN'SỊS.)

"A liquid oleoresin obtained from Abies balsamea. Marshall. (*Nat. Ord.* Coniferæ.)" *U. S.* "The turpentine obtained by incision from the stem of Abies balsamea, Aiton, *Hort. Kew.* Balm of Gilead Fir. Lambert, *Pinus* (*Pinus balsamea*), plate 31. From Canada." *Br.*

Canada Balsam; Balsamum Canadense; Térébenthine du Canada, Baume de Canada, Térébenthine, *Fr.;* Terpentin, Canadischer Terpentin, *G.;* Trementina, *It.*, *Sp.*

The term *turpentine* is usually applied to certain vegetable juices, liquid or concrete, which consist of resin combined with a peculiar essential oil, called *oil of turpentine.* They are generally procured from different species of pine, fir, or larch; though other trees afford products which are known by the same general title, as, for instance, *Pistacia Terebinthus*, which yields the Chian turpentine. Some French writers extend the name of turpentine to other juices consisting of resin and essential oil, without benzoic or cinnamic acid, as copaiba, balm of Gilead, etc. We shall describe particularly, in this place, only the turpentines which are either now officinal, or have but recently ceased to be so. A brief botanical view of the plants from which they are respectively derived, will be in accordance with the plan of this work. It is proper first to observe that the original genus Pinus of Linnæus has been divided into the three genera, Pinus, Abies, and Larix, which are now very generally recognized, though Lindley unites the two latter in his Flora Medica.

PINUS. *Gen. Ch. Flowers* monœcious. MALES. *Catkins* racemose, compact, and terminal; squamose; the scales staminiferous at the apex. *Stamens* two; the *anthers* one-celled. FEMALES. *Catkins* or *cones* simple, imbricated with acuminate scales. *Ovaries* two. *Stigmas* glandular. *Scales* of the cone oblong, club-shaped, woody; umbilicato-angular at the apex. *Seeds* in pairs, covered with a sharp-pointed membrane. *Cotyledons* digitato-partite. *Leaves* two or many, in the same sheath. (*Pereira's Mat. Med.;* from *Bot. Gall.*)

1. *Pinus palustris.* Willd. *Sp. Plant.* iv. 499.—*P. Australis.* Michaux, *N. Am. Sylv.* iii. 133; *B. & T.* 258. "Leaves in threes, very long; stipules pinnatifid, ramentaceous, persistent; strobiles subcylindrical, armed with sharp prickles."

This is a very large indigenous tree, growing in dry, sandy soils, from the southern part of Virginia to the Gulf of Mexico. Its mean elevation is sixty or seventy feet, and the diameter of its trunk about fifteen or eighteen inches for two-thirds of this height. The leaves are about a foot in length, of a brilliant green color, and united in bunches at the ends of the branches. The names by which the tree is known in the Southern States are *long-leaved pine*, *yellow pine*, and *pitch pine;* but the first is most appropriate, as the last two are applied also to other species. This tree furnishes by far the greater proportion of the turpentine, tar, etc., consumed in or exported from the United States. (See *Pix Liquida.*)

2. *Pinus Tæda.* Willd. *Sp. Plant.* iv. 498; Michaux, *N. Am. Sylv.* iii. 156; *B. & T.* 259. "Leaves in threes, elongated, with elongated sheaths; strobiles oblong-conical, deflexed, shorter than the leaf; spines inflexed."

This is the *loblolly* or *old field pine* of the Southern States. It is abundant in Virginia, where it occupies the lands exhausted by cultivation. It exceeds eighty feet in height, has a trunk two or three feet in diameter, and expands into a wide spreading top. The leaves are about six inches long, and of a light green color. It yields turpentine in abundance, but less fluid than that which flows from the preceding species.

3. *Pinus sylvestris.* Willd. *Sp. Plant.* iv. 494; Michaux, *N. Am: Sylv.* iii. p. 125; *B. & T.* 257. "Leaves in pairs, rigid; strobiles ovate-conical, of the length of the leaves; scales echinate."

This tree, when of full size, is eighty feet high, with a trunk four or five feet in diameter. It inhabits the northern and mountainous parts of Europe. In Great Britain it is called the *wild pine* or *Scotch fir;* the latter name having been given to it from its abundance on the mountains of Scotland. It yields a considerable proportion of the common European turpentine.

In Germany a fibrous substance is prepared from the leaves of this and other species of Pinus and Abies, called *fir-wool*, and a volatile oil is distilled from them called *fir-wool oil*, which is considerably used, both internally and locally, as a remedy for rheumatism, palsy, chronic catarrh, chronic skin diseases, etc.,—indeed, for the same purposes generally as the oil of turpentine. (See *A. J. P.*, May, 1863, p. 274.) This oil resinifies on exposure, like oil of turpentine, and varies in sp. gr. from 0·876 to 0·912, according to its source. Its dose, when it is used internally, is from fifteen to twenty drops. An extract of the leaves, denominated *fir-wool extract*, is used for similar purposes. The leaves are made also into wadding and clothing, designated as *fir-wool* from their origin, which are supposed to have some merit in the treatment of rheumatic affections. (*Ibid.*, March, 1867, p. 178.)

Besides the pines above described, various others yield medicinal products. *Pinus maritima* (*P. Pinaster* of Aiton and Lambert), growing in the southern and maritime parts of Europe, yields much of the turpentine, pitch, and tar consumed in France, and is admitted among the officinal plants in the French Codex. From the branches of *Pinus Pumilio*, which inhabits the mountains of eastern and south-eastern Europe, a terebinthinate juice exudes spontaneously, called *Hungarian balsam*. *Pinus Cembra*, or the *Siberian stone-pine* of the Alps and Carpathian Mountains, is said to afford the product called *Carpathian balsam;* and the seeds both of that species, and of *Pinus Pinea*, or *stone-pine* of the south of Europe and north of Africa, are used in Europe in desserts, under the name of *pine nuts*. *Pinus Lambertiana*, of California, produces by exudation a saccharine matter which has been found to contain a peculiar sweet principle called *pinit*. (*Comptes-Rendus*, Sept. 1855.) Still another species, *Pinus Sabiniana*, Dougl., indigenous in California, where it inhabits the sides of the foot-hills of the Sierra Nevada ranges, and known as the *nut-pine* or *digger pine*, because the fruit, which is an edible nut, is largely consumed by the Digger Indians, yields, on being notched, a terebinthinate exudation, which is largely distilled for the sake of its volatile oil, extensively used in California under the name of *abietene*,[*] and other less appropriate designations. The *Pinus rigida*, or *pitch pine* of this country, and probably others besides those mentioned, are sometimes employed in the preparation of tar.

ABIES. See *Pix Burgundica.*

Abies balsamea. Lindley, *Flor. Med.* p. 554.—*A. balsamifera.* Michaux, *N. A. Sylv.* iii. 191.—*Pinus balsamea.* Willd. *Sp. Plant.* iv. 504. "Leaves solitary, flat, emarginate or entire, glaucous beneath, somewhat pectinate, sub-erect above, recurved spreading; cones cylindrical, erect; bracts abbreviate, obovate, conspicuously mucronate, sub-serrulate.

This is the *American silver fir*, or *balm of Gilead tree*, inhabiting Canada, Nova Scotia, Maine, and the mountainous regions farther south. It is an elegant tree, seldom rising more than forty feet, with a tapering trunk, and numerous branches, which diminish in length in proportion to their height, and form an almost perfect pyramid. The leaves are six or eight lines long, inserted in rows on the sides and tops of the branches, narrow, flat, rigid, bright green on their upper surface, and of a silvery whiteness beneath. The cones are large, erect, nearly cylindrical, of a purplish color, and covered with a resinous exudation, which gives them a glossy, rich, and beautiful appearance. It is from this tree that the *Canada balsam* is obtained.

Several other species of Abies are officinal. *Abies excelsa* of Europe, and *A. Canadensis* of the United States, have already been described as the sources respectively of Burgundy and Canada pitch. (See *Pix Burgundica* and *Pix Canadensis.*) The *A. Picea* (*Abies pectinata* of De Candolle, *A. taxifolia* of the French Codex, *Pinus Picea* of Linnæus), or *European silver fir*, growing in the mountainous regions of Switzerland, Germany, and Siberia, yields the *Strasburg turpentine*, which is much used in some parts of Europe. By the distillation of its cones with water, it also affords a variety of oil of turpentine called in France *essence de templine.* The *Abies nigra* (*Pinus nigra*), or *black spruce* of this country, yields a product which, though not recognized by the Pharmacopœia, is considerably employed. The substance alluded to is the *essence of spruce*, prepared from the young branches by boiling them in water and evaporating the decoction. It is a thick liquid, having the color and consistence of molasses, with a bitterish, acidulous, astringent taste. It is used in the preparation of the beverage commonly known by the name of *spruce beer*, which is a pleasant and wholesome drink in summer, and useful in long sea-voyages as a preventive of scurvy.[†]

LARIX. *Gen. Ch.* As in Abies, except that the *cotyledons* are simple, and never lobed; the *cones* lateral; the *leaves*, when first expanding, in tufted fascicles, becoming somewhat solitary by the elongation of the new branch.

Larix Europæa. De Cand. *Flor. Fr.* 2064.—*Abies Larix.* Lamb. *Illust.* t. 785, f. 2.—*Pinus Larix.* Willd. *Sp. Plant.* iv. 503; Woodv. *Med. Bot.* p. 7, t. 4. "Leaves fascicled, deciduous; cones ovate-oblong; margins of the scales reflexed, lacerated; bracts panduriform."

The *European larch* is a large tree, inhabiting the mountains of Siberia, Switzerland, Germany, and the east of France. It yields the *Venice turpentine* of commerce, and a peculiar sweetish substance called in France *Briançon manna*, which exudes spontaneously, and concretes upon its bark. When the larch forests of Russia take fire, a juice exudes from the trunk during their combustion, which concretes, and is called *Orenburg gum.* It is wholly soluble in water.[‡]

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[*] For description of chemical constitution of abietene, see *Oleum Terebinthinæ.*

[†] The following is the formula. Take of essence of spruce *half a pint;* pimenta bruised, ginger bruised, hops, each, *four ounces;* water *three gallons.* Boil for five or ten minutes; then strain, and add of warm water *eleven gallons;* yeast *a pint;* molasses *six pints.* Mix, and allow the mixture to ferment for twenty-four hours.

[‡] *Coniferin.* This name has been given to a principle discovered by M. Hartig in the cambium of several of the Coniferæ. The species in which it has been found are *Pinus Strobus* and *P. Cembra, Abies excelsa* and *A. pectinata*, and *Larix Europæa;* and it probably exists in many others. It is obtained by removing the outer bark, scraping the cambium from the surface of the wood, subjecting this to pressure, boiling the viscid juice to coagulate the albumen, filtering, and evaporating the filtered liquid to one-fifth of its volume. The coniferin is deposited in crystals. The mother-water is very sweet, and contains a saccharine substance closely allied to cane sugar.

PISTACIA. See *Mastiche.*

Pistacia Terebinthus. Willd. *Sp. Plant.* iv. 752; Woodv. *Med. Bot.* p. 29, t. 12. This is a small tree with numerous spreading branches, bearing alternate, pinnate leaves, which consist of three or four pairs of ovate-lanceolate, entire, acute, smooth, and shining leaflets, with an odd one at the end. The male and female flowers are diœcious, small, and in branching racemes. It is a native of Barbary and Greece, and flourishes in the islands of Cyprus and Chio, the latter of which has given its name to the *Chian turpentine* obtained from the tree. A gall, produced upon this plant by the puncture of an insect, has been used in Eastern Europe in pectoral affections.

We shall treat of the several varieties of turpentine under distinct heads.

1. WHITE TURPENTINE.

Thus Americanum, *Br.;* Common Frankincense; Térébenthine de Boston, *Fr.*

"The *common American* or *white turpentine* (*Terebinthina, U. S.*). The concrete turpentine of Pinus Tæda, Linn., the Frankincense Pine, and Pinus palustris, *Miller's Dict.*, the Swamp Pine, Lambert, *Pinus,* plates 10, 19, and 20. From the Southern States of N. America." *Br.*

In former times, large quantities were collected in New England; but the turpentine trees of that section of the Union are entirely exhausted, and our commerce has been until recently almost exclusively supplied from North Carolina and the southeastern parts of Virginia. Within a few years, however, attention has been turned to the collection of this valuable product in Georgia and Florida; and there is no doubt that, in time, an abundant supply will be derived from the vast pine forests which occupy the southern portion of our country bordering on the Gulf of Mexico. During the winter, deep notches or excavations of the capacity of about three pints are made in the trunk of the tree three or four inches from the ground, and for about three feet above these so-called "boxes" the tree is deprived of its bark and some of the wood scraped off. Into these the juice or "crude" begins to flow about the middle of March, and continues to flow throughout the warm season, slowly at first, rapidly in the middle of summer, and more slowly again in the autumn, the tree being scraped every eight or ten days to prevent clogging. The liquid is removed from the "boxes" as they fill, and transferred into casks, where it, if left, gradually thickens, and ultimately acquires a soft solid consistence; but most of it is separated at once by distillation into the rosin and the volatile oil.

White turpentine, as found in commerce, is yellowish white, of a peculiar somewhat aromatic odor, and a warm, pungent, bitterish taste. It is somewhat translucent, and of a consistence varying with the temperature. In the middle of summer, it is almost semi-fluid and very adhesive, though brittle; in the winter, it is often so firm and hard as to be incapable of being made into pills without heat. "Brittle in the cold, crummy-crystalline in the interior, of a terebinthinate odor and taste." *U. S.* Exposed to the air it ultimately becomes perfectly hard and dry. In the recent state it affords about 17 per cent. of volatile oil. It is apt to contain small pieces of bark, wood, or other impurity.

2. COMMON EUROPEAN TURPENTINE.

Térébenthine de Bordeaux, Térébenthine commune, *Fr.;* Gemeiner Terpentin, *G.;* Trementina comune, *It.;* Trementina comun, *Sp.*

This is the *Terebinthina vulgaris* of the former London Pharmacopœia. It is furnished by several species of pine, but chiefly by *P. sylvestris* and *P. maritima.*

The crystals are purified by dissolving them in water, decolorizing by animal charcoal, and finally crystallizing from weak alcohol. Coniferin was chemically examined by M. W. Kubel, and later by Tiemann and Haarmann, who established clearly its chemical composition and relations.

Coniferin is a glucoside, and as crystallized from the juice has the composition $C_{16}H_{22}O_8 + 2H_2O$. When treated with dilute acids or ferments it is decomposed as follows: $C_{16}H_{22}O_8 + H_2O = C_6H_{12}O_6 + C_{10}H_{12}O_3$. When this latter compound is oxidized (or coniferin itself) by bichromate of potassium and sulphuric acid *vanillin* is obtained, $C_6H_3(OH)\left\{\begin{matrix}OCH_3\\CHO\end{matrix}\right.$. Vanillin has been thus made commercially, but is now made preferably from the eugenol of oil of cloves, or from benzoin.

From the latter tree it is obtained largely in the maritime districts of the southwest of France, especially in the department of the Landes, and is exported from Bordeaux. Hence it is called in commerce *Bordeaux turpentine.* It is procured by making incisions into the trunk, or removing portions of the bark, and receiving the juice which flows out in small troughs, or in holes dug at the foot of the tree. It is purified by heating, and filtering it through straw, or by exposing it to the sun in a barrel, through holes in the bottom of which the melted turpentine escapes. Thus prepared, it is whitish, turbid, thickish, and separates, upon standing, into two parts, one liquid and transparent, the other of a consistence and appearance like that of thickened honey. As found in European commerce, it often consists wholly of this latter portion. It speedily hardens on exposure to the air in thin layers. The most liquid specimens are completely solidified by the addition of one part of magnesia to thirty-two parts of the turpentine. (*Journ. de Pharm.*, xxv. 499.) It is scarcely ever given internally, but furnishes large quantities of oil of turpentine and resin. We do not import it into this country. The substance which the French call *galipot*, or *barras*, is that portion of the turpentine which concretes upon the trunk of the tree when wounded, and is removed during the winter. (*Thenard.*) This, when purified by melting with water and straining, takes the name of *yellow* or *white pitch*, or *Burgundy pitch.* When turpentine, whether the European or the American, has been deprived of its oil by distillation, the resin which remains is called *rosin*, and sometimes *colophony*, from the Ionian city of Colophon, where it was formerly prepared. It is the officinal resin (*resina*), and is sometimes called yellow resin (*resina flava*). White resin (*resina alba*) is prepared by incorporating this, while in fusion, with a certain proportion of water. (See *Resina.*) Tar (*pix liquida*) is the turpentine extracted from the wood by slow combustion, and chemically altered by heat. Common pitch (*pix nigra*, or *resina nigra*) is the solid residue left after the evaporation by boiling of the liquid parts of tar.

3. CANADA TURPENTINE.

Baume de Canada, *Fr.;* Canadischer Balsam, Canadischer Terpentin, *G.;* Trementina del Canada, *It.*

TEREBINTHINA CANADENSIS, U. S., Br., is collected in Canada and the State of Maine from the *Abies balsamea*, by breaking the vesicles which naturally form upon the trunk and branches, and receiving their liquid contents in a bottle. "A yellowish or faintly greenish, transparent, viscid liquid, of an agreeable terebinthinate odor, and a bitterish, slightly acrid taste; slowly drying on exposure, and then forming a transparent mass; completely soluble in ether, chloroform, or benzol." *U. S.* By time and exposure it becomes thicker and more yellow, and finally solid. It is usually brought into market in bottles, and is kept in the shops under the name of *Canada balsam*, or *balsam of fir.* Under the microscope the hard balsam is entirely free from any granular or crystalline structure. In Europe, it is sometimes called *balm of Gilead*, from its supposed resemblance to that celebrated medicine. The term *balsam*, as at present understood, is improperly applied to it, as it contains no benzoic or cinnamic acid, and is in fact a true turpentine, consisting chiefly of resin and volatile oil. Bonastre obtained, from 100 parts of Canada turpentine, 18·6 parts of volatile oil, 40·0 of resin easily dissolved by alcohol, 33·4 of sub-resin of difficult solubility in that fluid, 4·0 of caoutchouc similar to sub-resin, and 4·9 of bitter extractive and salts, besides traces of acetic acid. Flückiger found in 100 parts 24 parts of an essential oil, $C_{10}H_{16}$, with a very small proportion of an oxygenated oil, 60 parts of a resin soluble in boiling alcohol, and 16 parts of a resin soluble only in ether. (*Pharmacographia*, 2d ed., p. 614.) The chief distinction between it and *Strasburg turpentine*, which is sometimes sold for it in commerce, is to be found in the odor.

4. VENICE TURPENTINE.

Térébenthine de Mélèze, Térébenthine de Venise, *Fr.;* Venetianischer Terpentin, *G.;* Trementina di Venezia, *It.;* Trementina de Venecia, *Sp.*

This turpentine was named from the circumstance that it was formerly an extensive article of Venetian commerce. It is procured in Switzerland, and in the French province of Dauphiny, from the *Larix Europæa*, or larch, which grows abundantly upon the Alps and the Jura Mountains. The peasants bore holes into the trunk about two feet from the ground, and conduct the juice by means of wooden gutters into small tubs, placed at a convenient distance. It is afterwards purified by filtration through a leather sieve. Genuine Venice turpentine is a viscid liquid, of the consistence of honey, flowing with difficulty, cloudy or imperfectly transparent, yellowish or slightly greenish, of a strong not disagreeable odor, and a warm, bitterish, and acrid taste. It does not readily concrete on exposure, is not solidified by one-sixteenth of magnesia, and is entirely soluble in alcohol. (Guibourt, *Journ. de Pharm.*, xxv. 500.) It yields on an average 15 per cent. of essential oil, of the composition $C_{10}H_{16}$. The residual resin is soluble in two parts of warm alcohol of 75 per cent., and more copiously in absolute alcohol. What is sold under the name of Venice turpentine, in commerce, is usually quite brown, and is a factitious substance, prepared by dissolving rosin in oil of turpentine. Dr. A. T. Thomson states that much of the Venice turpentine of the shops of London is obtained from America. It is probably the same preparation as that which passes under the name in this country.

5. CHIAN TURPENTINE.

Térébenthine de Chio, *Fr.;* Cyprischer Terpentin, *G.;* Trementina Cipria, *It.*

This variety of turpentine is collected chiefly in the island of Chio, or Scio, from the *Pistacea Terebinthus.* During the summer the juice flowing spontaneously, or from incisions in the bark, falls upon smooth stones placed at the foot of the tree, from which it is scraped with small sticks, and allowed to drop into bottles. The annual product of each tree is very small; and the turpentine, therefore, commands a high price even in the place where it is procured. Very little of it reaches this country. It is said to be frequently adulterated with the other turpentines. It is a thick, tenacious liquid, of a greenish yellow color, a peculiar penetrating odor* more agreeable than that of the other substances of the same class, and a mild taste without bitterness or acrimony. Flückiger found nearly 14½ per cent. of essential oil, which contained a small quantity of an oxygenated oil. It leaves a glutinous residue when treated with strong alcohol. (*Guibourt.*) Its alcoholic solution does not redden litmus paper. (*Martindale.*) On exposure to the air it speedily thickens, and ultimately concretes into a translucent solid, yellowish or yellowish brown when in small pieces, greenish brown in mass.

Besides the turpentines mentioned, various others are noticed in books on materia medica, though not found in commerce in this country. There are the *Strasburg turpentine*, much used in France, and obtained from the *Abies Picea* (*Abies pectinata* of De Candolle), or European silver fir, which grows on the mountains of Switzerland and Germany, and bears a close resemblance, as well in its appearance as its product, to *Abies balsamea* of Canada; the *Russian turpentine*, from *Pinus sylvestris;*† the *Damarra turpentine*, which speedily concretes into a very hard resin, and is derived from the *Pinus Damarra* of Lambert, the *Agathis Damarra* of Richard, growing in the East India Islands; the *cowrie* or *cowdie* resin, procured by incision from another species of Damarra (*D. australis*) in New Zealand; and the *Dombeya turpentine*, a glutinous, milky-looking fluid, of a strong odor and taste, derived from *Dombeya excelsa*, the *Araucaria Dombeyi* of Richard, which inhabits Chili, and is said to be identical with the Norfolk Island pine. These, with one or two other turpentines scarcely known, or having a doubtful claim to the title, are all that belong properly to this class of vegetable products.*

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* The odor of Chian turpentine is variously described. As the only tests we now have of the purity of the drug are its physical characteristics, and of these the odor is most important, we give the following description by Mr. Wm. Martindale. (*P. J. Tr.*, April, 1880.) Chian turpentine "has when fresh a distinctive odor, slightly like the pinaceous turpentines, but much more agreeable and aromatic, according to some resembling citron and jasmine; but there is always a background smell like that of mastic, which becomes more developed and distinct with age, when it has lost the more volatile portion, the essential oil. According to Pereira, the turpentine-like odor is combined with the odor of fennel, and Guibourt says, when kept in a covered glass vessel the odor is strong and agreeable, analogous to that of fennel or the resin of elemi. It probably loses this rapidly. A specimen, bearing Guibourt's name, in the Society's Museum, has now no trace of it, but the mastic odor is very persistent. If the fennel odor be very evident in it I should fear the sample was not genuine, as in a statement made in the *Lancet* the writer says what is sold as Chian turpentine 'is either greatly adulterated or a wholly factitious article, manufactured from black resin, Canada balsam, and the essential oils of fennel and juniper.' The taste of genuine Chian turpentine resembles that of mastic; it is agreeable and free from the characteristic bitterness and acridity of the pinaceous turpentines."

† For details as to varieties of European turpentine and the methods of procuring them, consult *A. J. P.*, 1878, 69, 479; *Proc. A. P. A.*, xxiv. 203; *P. J. Tr.*, viii. 283; x. 447.

General Properties. The turpentines resemble one another in odor and taste, though distinguished by shades of difference. Liquid at first, they become thick and gradually solid by exposure, in consequence partly of the volatilization, partly of the oxidation of their essential oil. They are rendered more liquid or softened by heat, and at a high temperature take fire, burning with a white flame and much smoke. Water extracts only a minute proportion of their volatile oil. They are almost wholly soluble in alcohol and ether, and readily unite with the fixed oils. They yield by distillation a volatile oil, called *oil of turpentine*, the composition of which is essentially uniform, it being composed of several terpenes of the formula $C_{10}H_{16}$; the residue consisting exclusively of resin. (See *Oleum Terebinthinæ* and *Resina.*) A minute proportion of succinic or acetic acid passes over with the oil. From the experiments of M. Faure, of Bordeaux, it appears that some of the liquid turpentines, like copaiba, may be solidified by the addition of magnesia. (*Journ. de Chim. Méd.*, 1830, p. 94.) According to M. Thierry, the same result is obtained by the addition of one part of hydrate of lime to thirty-two parts of common European turpentine. (*Journ. de Pharm.*, 3e sér., i. 315.)

Medical Properties and Uses. The effects of the turpentines upon the system are dependent entirely on their volatile oil. They are stimulant, diuretic, anthelmintic, and in large doses laxative. When taken internally, or applied to the skin, they communicate a violet odor to the urine, and, if continued for some time, produce an irritation of the mucous membrane of the urinary passages, amounting frequently to strangury. The last effect is less apt to be experienced when they operate upon the bowels. Externally applied they act as rubefacients. Their medical virtues were known to the ancients. At present they are less used than formerly, having been superseded by their volatile oils. They are, however, occasionally prescribed in leucorrhœa, gleet, and other chronic diseases of the urinary passages; in piles and chronic inflammation or ulceration of the bowels; in chronic catarrhal affections; and in various forms of rheumatism, especially sciatica and lumbago. The white turpentine is usually employed in this country. It may be given in the shape of pill made with powdered liquorice root; in emulsion with gum arabic or yolk of egg, loaf sugar, and water; or in electuary formed with sugar or honey. The dose is from a scruple to a drachm (1·3–3·9 Gm.). In the quantity of half an ounce or an ounce (15·5 or 31·1 Gm.), triturated with the yolk of an egg, and mixed with half a pint of mucilaginous liquid, it forms an excellent injection in cases of ascarides, and of constipation with flatulence.

Paracelsus is said to have used *Chian turpentine* in the treatment of cancer (Tweedy, *London Lancet*, 1880, i. 582), and Mr. Clay, of London, has recently commended it very highly. We have knowledge of one case of supposed cancer of the womb, where its use has seemingly been of great service, and would advise further trial of the remedy, although failures have been reported. It should be given in emulsion in doses of five grains, increased as rapidly as the patient will bear it. The pill form is ineligible.† It may also be applied locally.

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* The product of *Abies Picea*, referred to in the text as *Strasburg turpentine*, is, according to Guibourt, nearly as liquid as olive oil, at first turbid and whitish, but becoming by filtration or long standing transparent and almost colorless, of an agreeable odor, analogous to that of the citron, and of a taste moderately acrid and bitter. It dries quickly in the air, is solidified by a sixteenth of magnesia, and is not entirely soluble in alcohol. It is procured by incisions into the vesicles which form upon the surface of the tree, beneath the outer bark. Guibourt states that this is the true *Venice turpentine*, while that described in the text, and generally recognized by authors as Venice turpentine, is in fact the *Strasburg*. (*Journ. de Pharm.*, xxv. 487.)

† Mr. Clay uses pills containing each 3 grains of Chian turpentine and 2 grains of sulphur, but they are apt to lose their shape. Three grains of Chian turpentine and 1½ grains of light magnesia make a pill which retains its shape tolerably well; but it is perfectly insoluble, losing, according to Martindale, barely one-tenth of its weight in passing through the body. The pill made with lycopodium is also said to be indigestible.

The vapor of turpentine, employed as a vapor-bath, has been highly recommended in obstinate chronic rheumatism. According to M. A. Chevandier, it is borne well for about twenty-five minutes, at a temperature of from 60° C. to 71·1° C., 140° F. to 160° F.), producing acceleration of the pulse, and copious sweating, sometimes accompanied with a confluent eruption. (*Arch. Gén.*, 4e sér., xxviii. 80.)

Off. Prep. of Turpentine. Emplastrum Galbani, *U. S.* *Of White Turpentine.* (*Thus Americanum, Frankincense, Br.*) Emplastrum Picis, *Br.* *Of Canada Turpentine.* Charta Cantharidis, *U. S.;* Charta Epispastica, *Br.;* Collodium Flexile.

THERIACA. *Br.* *Treacle.*

(THE̱-RĪ'A̩-CA̩.)

"The uncrystallized residue of the refining of sugar." *Br.*

Syrupus Fuscus, *U. S.* 1870; Molasses; Sacchari Fæx, *Lond.;* Syrupus Communis, s. Hollandicus; Pyromel; Mélasse, *Fr.;* Zuckersatz, Zuckersyrup, Melasse, Brauner Syrup, *G.;* Melazzo, *It.;* Melaza, *Sp.*

For a description of this substance, see *Saccharum*, page 1257.

THUJA. *U. S.* *Thuja.* [*Arbor Vitæ.*]

(THŪ'JA̩—thū'ya̩.)

"The fresh tops of Thuja occidentalis. Linné. (*Nat. Ord.* Coniferæ.)" *U. S.*

Gen. Ch. Flowers monœcious on different branches, in very small, terminal, ovoid catkins. *Stamens* with a scale-like filament or connective, bearing four anther-cells. Fertile catkins of few imbricated scales, fixed by the base, each bearing two erect ovules, dry and spreading at maturity. *Cotyledons* two. *Gray.*

Thuja occidentalis, L. Michaux, *N. American Sylva*, pl. clvi. This tree is specifically characterized by the peculiarities of the leaves, the pointless cone-scales, and the broad wings extending all around the seeds. It attains a height of fifty feet and a diameter of three feet, but is usually much smaller, and grows in swampy grounds from Pennsylvania northward and westward, often forming extensive "cedar swamps." In Canada and the extreme northern parts of the United States it is commonly called *white cedar*, a name more correctly applied to the *Cupressus Thujoides.* The wood is reddish, soft, fine-grained, and very durable.

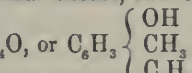
Properties. The leaves, or small twigs invested with the leaves, are the parts used. They have an agreeable balsamic odor, especially when rubbed, and a strong, balsamic, camphoraceous, bitter taste, and are flattish, two-edged, with the scale-like leaves appressed and closely imbricate in four rows, rhombic-ovate, obtusely pointed, with a roundish gland upon the back. They were analyzed by A. Kawalier, of Vienna, and found to contain volatile oil, a bitter principle called *pinipicrin*, $C_{22}H_{18}O_{11}$, found also in *Pinus sylvestris*, sugar, gelatinous matter, a variety of wax, resin, and tannic acid. (See *Chem. Gaz.*, Feb. 1, 1855, p. 45.) In a more recent analysis, Kawalier discovered in the leaves a peculiar crystallizable coloring principle, which he names *thujin.* It is of a citron-yellow color and astringent taste, soluble in alcohol, inflammable, and separable, through the agency of sulphuric acid, into glucose, and another yellow substance, which he calls *thujetin*, $C_{14}H_{14}O_8$. A third substance, *thujigenin*, was also obtained, apparently a result of some change in thujin. The formula of thujin is $C_{20}H_{22}O_{12}$. When thujin is heated with barium hydrate, instead of thujetin is obtained another product, *thujetic acid*, $C_{28}H_{22}O_{13}$. The same chemist determined that the tannic acid of this plant is identical with *pinitannic acid*, which he had previously obtained from the leaves of *Pinus sylvestris.* (See, for details, *Chem. Gaz.*, Nos. 392, 393, 1859.)

Medical Properties. In the form of decoction, thuja has been used in intermittent fever, and, according to Schoepf, in coughs, fevers, scurvy, and rheumatism. Dr. J. R. Leaming, of New York, has employed it internally, with supposed advantage, in affections believed to be cancerous; also locally, with prompt effect, in venereal excrescences. (*N. Y. Journ. of Med.*, etc., N. S., xiv. 406.) Dr. Benedict has found a saturated tincture useful as an emmenagogue, given in the dose of a teaspoonful three times a day. (*Ibid.*, Nov. 1856, p. 395.) Made into an ointment with lard or other animal fat, the leaves are said to form a useful local application in rheumatic complaints. The distilled water is praised by Boerhaave as a remedy in dropsy. (*Schoepf.*) A yellowish green volatile oil, which may be obtained from the leaves by distillation, has been used with success in worms. The dose of a saturated tincture or fluid extract is a fluidrachm (1·9 C.c.) three to six times a day.

THYMOL. *U.S.* *Thymol.*

$C_{10}H_{13}HO$; 150. (THȲ'MŎL.) $C_{20}H_{13}O, HO$; 150.

This substance, which is officinal for the first time, has recently attracted considerable attention from its possession of antiseptic properties analogous to those of carbolic and salicylic acids and creasote, with which it is also analogous in composition. It may be obtained by submitting the volatile oils of several plants to a prolonged refrigeration, under the influence of which it crystallizes; but in this solid state it is less convenient for use than as a liquid. Thus it has been obtained from *Monarda didyma*, Linn., *M. punctata*, *Ammi Copticum*, and *Ptychotis ajowan*. The phenol of the oil of *Thymus serpyllum*, Linn., closely resembles thymol, but differs in not congealing at 10° C. (50° F.), in its solution in diluted alcohol turning green with ferric chloride, and in the potassium salt with its sulpho-acid being amorphous. (*A. J. P.*, 1878, p. 453.) *Ocymum viride*, Willd., a plant used in Liberia as an antiperiodic, so resembles thyme in its odor that it has been thought to contain thymol. (*Proc. A. P. A.*, xxvi. 168.)

Properties. It appears that there are two isomeric forms of thymol, one the crystalline product above referred to, the other a liquid, obtained by treating the oil of thyme with an aqueous solution of potassa or soda, which separates it from a principle called *thymene*, $C_{10}H_{16}$, with which it is mixed in the oil, and which is not affected by the alkalies. The *thymate*, or *sodium thymol*, thus formed is decomposed by an acid, and the liberated thymol is purified by repeated washings, desiccation, and finally distillation. In this state it may be exposed to a very low temperature, without crystallizing, even though some crystals of the other variety be thrown in for a nucleus. In a concentrated state it has an acrid and caustic taste; but when much diluted, the only taste perceptible is that of thyme, and a sense of coolness in the mouth like that caused by the oil of peppermint. In the crystalline state it melts at 44° C. (111·2° F.), but does not readily re-solidify unless touched by a solid body, or a crystal of thymol. It boils at 220° C. to 230° C. (428° F. to 446° F.). When once melted, it often has the peculiarity of remaining indefinitely in the liquid state. It is only very slightly soluble in water, but is very soluble in alcohol, and more freely in proportion to the concentration of the menstruum. It is dissolved by ether and the fixed oils, and has no rotatory power as regards polarized light. The alkalies unite with it to form soluble salts. Like creasote, it has the property of combining with animal tissues, and thus protecting them against putrefaction. Its formula is $C_{10}H_{14}O$, or  $C_6H_3\left\{\begin{array}{l}OH\\CH_3\\C_3H_7\end{array}\right.$; while *thymene*, with which it is associated in the oil, is a hydrocarbon, isomeric with the oil of turpentine, and having the composition $C_{10}H_{16}$. Thymol is officinally described as in "large crystals of the hexagonal system, nearly or quite colorless, having an aromatic, thyme-like odor, a pungent, aromatic taste, with a very slight caustic effect upon the lips, and a neutral reaction. Soluble in about 1200 parts of water, and in 1 part of alcohol at 15° C. (59° F.); in 900 parts of boiling water; freely soluble in boiling alcohol, also in ether, chloroform, benzol, benzin, glacial acetic acid, and in fixed or volatile oils. It liquefies with camphor. Its sp. gr., as a solid, is 1·028; after fusion it is lighter than water. It melts at about 50° C. (122° F.), remaining liquid at lower temperatures, and boils at about 230° C. (446° F.). A portion mixed with half its volume of glacial acetic acid, then with an equal or somewhat greater volume of sulphuric acid, and gently heated, gives a bright, reddish-violet color. Water saturated with Thymol, when treated with a few drops of test-solution of ferric chloride, should not give a blue color (abs. of carbolic acid)." *U. S.*

Medical Properties. The disagreeable odor of carbolic acid induced M. Bouilhon, a French pharmaceutist, to search among the analogous chemical products, in the hope of finding some one which might have the important practical properties of carbolic acid without disagreeable smell. Such a substance he found in thymol. In a concentrated state it has caustic properties, which render it very useful for the cauterization of the dental nerves. Dissolved in water in the proportion of one to 1000, with the addition of a little alcohol, it is useful in the dressing of unhealthy wounds, and is peculiarly indicated in cases in which the tincture of iodine and other antiseptic remedies have proved unavailing. Combined in the proportion of 4 parts of the acid with 4 of tannin, 2 of aniline, and 100 of glycerin, it has been used with great success by Dr. Paquet, for the preservation of anatomical specimens. For the dressing of wounds, it may be used in the form of a lotion composed of 1 part of the acid, 4 of alcohol of 85°, and 995 of distilled water. In the form of ointment, it may be employed incorporated with lard in the proportion of from 2 to 20 grains to an ounce. If taken internally, it may either be formed into an emulsion, or dissolved in alcohol, or made into pills with 2 parts of the acid and 4 parts of medicinal soap, and any desirable excipient; the soap being necessary for the proper division of the acid. (*Journ. de Pharm. et de Chim.*, Août, 1868, p. 147.) It has been used to a considerable extent by surgeons, but has in practice been found less advantageous than salicylic acid. Its fragrant odor, whilst fitting it for use about the mouth, is often a great nuisance in the hospital ward, on account of attracting flies. It has been exhibited internally as antipyretic by Balz in the amount of 30 grains (1·95 Gm.) a day, causing ringing in the ears, deafness, sweating, and in some cases alarming collapse. Injected into the veins of dogs, it produces death by failure of respiration. It probably will not be used in internal medicine, whilst its costliness and lack of advantage over salicylic acid militate against its external employment, except in the preparation of mouth washes.

TINCTURÆ. *Tinctures.*

(TĬNC-TŪ′RÆ.)

Teintures, *Fr.;* Tinkturen, *G.*

Tinctures, in the pharmaceutical sense of the term, are alcoholic solutions of medicinal substances, prepared by maceration, digestion, or percolation. Solutions in spirit of ammonia and ethereal spirit are embraced under the same denomination, but are severally distinguished by the titles of *ammoniated tinctures* and *ethereal tinctures.* The advantages of alcohol as a menstruum are, that it dissolves principles which are sparingly or not at all soluble in water, and contributes to their preservation when dissolved; while it leaves behind some inert substances which are dissolved by water. In no instance, however, is absolute alcohol employed. The U. S. Pharmacopœia directs it of the sp. gr. 0·820, the British, 0·838. When of these densities it contains water, and is capable of dissolving more or less of substances which are insoluble in anhydrous alcohol; while its solvent power, in relation to bodies soluble in that fluid, is sufficient for all practical purposes. Diluted alcohol or proof spirit is often preferable to officinal alcohol; as it is capable of extracting a larger proportion of those active principles of plants which require an aqueous menstruum, whilst at the same time it is strong enough to prevent spontaneous decomposition, and has the advantages of being cheaper and less stimulating, although a few tinctures when prepared with proof spirit or diluted alcohol undergo some deterioration in time, in consequence of acetous fermentation taking place in the alcoholic fluid. The tinctures most prone to this change are those of senna, rhubarb, calumba, digitalis, hops, bark, aloes, etc. The best preventive is to keep them in full and well-closed bottles, at a low temperature. The diluted alcohol of the different Pharmacopœias is not of the same strength; that of the United States consists of equal weights of officinal alcohol and water, and has the sp. gr. 0·928; while that of the British, called *Spiritus Tenuior* or Proof Spirit, has the sp. gr. 0·920. The difference, however, is not very material. Alcohol or rectified spirit is preferred as the solvent when the substance to be extracted or dissolved is nearly or quite insoluble in water, as in the instances of the resins, guaiac, camphor, and the essential oils. The presence of water is here injurious, not only by diluting the menstruum, but by exercising an affinity for the alcohol which interferes with its solvent power. Thus, water added to an alcoholic solution of one of these bodies produces a precipitate by abstracting the alcohol from it. Diluted alcohol or proof spirit is employed when the substance is soluble both in alcohol and water; or when one or more of the ingredients are soluble in the one fluid, and one or more in the other, as in the case of those vegetables which contain extractive or tannin, or the native salts of the organic alkalies, or gum united with resin or essential oil. As these include the greater number of medicines from which tinctures are prepared, diluted alcohol is most frequently used. In the preparation of the tinctures, the medicine should be in the dry state, and properly comminuted by being bruised, sliced, or pulverized. It is usually better in the condition of a moderately fine than of a very fine powder; the proper degree of fineness depends, however, upon the ease with which the menstruum extracts the soluble principles.

Tinctures were formerly universally prepared by maceration or digestion. Our own Pharmacopœia formerly directed maceration at ordinary temperatures, and extended the period to two weeks. The latter plan was preferable, as it was more convenient and equally effectual, the lower temperature being compensated by the longer maceration. In several instances in which maceration is ordered in the Pharmacopœia, it is still continued for seven days; but the period is very properly altered to suit the character of the substance acted on, and sometimes continued no longer than is necessary for its solution, when it is wholly soluble, as in the tinctures of iodine and tolu. When circumstances require that the tincture should be speedily prepared, digestion may be resorted to. Care should always be taken to keep the vessels well stopped, in order to prevent the evaporation of the alcohol. The materials should be frequently shaken during the digestion or maceration; and this caution is especially necessary when the substance acted on is in the state of powder. The tincture should not be used till the maceration is completed; when it should be separated from the dregs either by simply filtering it through paper, or, when force is requisite, by first expressing it through linen, and subsequently filtering.

The plan of preparing tinctures by percolation has been extensively adopted, and has been found to answer well when skilfully executed. In the present edition of our Pharmacopœia, percolation has been adopted as the rule; maceration being directed in a few instances in which it was deemed preferable. The Br. Pharmacopœia, preferring maceration or digestion in several instances, has adopted percolation as a general rule, but, as if unprepared to trust this process alone, has combined with it a preliminary maceration of forty-eight hours, and a final expression, so as to separate the last remains of the tincture from the dregs. Perhaps these modifications may be desirable in instances where the operator is insufficiently skilful; but percolation, properly managed, is of itself adequate to all the desired purposes, even to the removal of almost the last drop of impregnated menstruum from the dregs; and in our Pharmacopœia it is taken for granted that the apothecary has acquired the requisite skill. Where the operator cannot trust himself in this respect, it would be better to recur to the old method of maceration for two weeks. The reader will find rules for the proper management of the process of percolation at page 574. It has been objected to this process that it yields tinctures of variable strength, according to the skill with which it is conducted; but, from numerous experiments performed, in reference to this point, by M. H. Buignet, of Paris, it appears that the tinctures made by percolation are quite as equable in strength as those prepared by maceration, while they uniformly contain more of the soluble matter of the drug in proportion to the quantity of menstruum. The same writer states that he has constantly found three parts of alcohol, used in this method, to one of the material acted on, sufficient almost wholly to exhaust drugs of their soluble matter. He has derived no advantage from the preliminary maceration usually practised. M. Personne, however, has inferred, from his own observation, that five parts of alcohol are required by most substances. Our own Pharmacopœia generally adopts this. Mr. R. F. Fairthorne (*A. J. P.*, 1881, p. 308), in the preparation of hydro-alcoholic tinctures, prefers to macerate the ingredients for twenty-four hours alone, in the alcohol, then filter, and mix the filtrate with the required quantity of water, and percolate the dregs with the mixture. This plan might be of service in the case of a few drugs which are difficult to exhaust of their activity, but it would involve a useless expenditure of labor and time if used in the majority of officinal tinctures, and precipitation would be more common. It has been contended in opposition to percolation, applied to the preparation of tinctures, that the menstruum is apt to load itself with substances which, after the preparation of the tincture, are deposited, carrying down with them more or less of the active matter; but M. Vauflart asserts that more than twenty years of observation has demonstrated to him that tinctures by displacement, properly filtered, deposit no more than, at the end of a certain period, those deposit prepared by maceration. Besides, upon the same authority, this tendency to deposition may be easily obviated by mixing all the liquids proceeding from the percolation, and allowing the mixture to stand for a day before filtering. The tinctures thus obtained are, he states, richer than those furnished by ordinary maceration, and time produces in them only insignificant changes. (*Journ. de Pharm.*, 4e sér., iv. 411, 1866.) Finally, all agree that the percolated tinctures are apt to contain more of the soluble matter of the drug; and the objections resolve themselves altogether into a question of skill on the part of the operator.

Another mode of exhausting medicines by spirit has been proposed by Dr. H. Burton. It consists in suspending in the solvent, immediately under its surface, the solid matter contained loosely in a bag. The liquid in contact with the bag, becoming heavier by impregnation with the matters dissolved, sinks to the bottom; its place is supplied with a fresh portion, which in its turn sinks; and thus a current is established, which continues until the solid substance is exhausted, or the liquid saturated. During the maceration, the bag should be occasionally raised above the surface of the liquor in the bottle, allowed to drain, and then again immersed. It is asserted that the period of maceration is much shortened in this way. For this mode of preparing tinctures, Mr. Samuel Gale has proposed the use of a cylindrical stone-ware vessel, with a diaphragm capable of being supported at different heights by projections from the inner surface of the jar, with corresponding notches in the diaphragm, to permit its easy passage to the lower ledges. The material is to be placed upon the diaphragm, and kept covered with the menstruum. (*A. J. P.*, xxii. 381.) The infusion jars described and figured on page 789 may be used also for preparing tinctures by maceration.

Tinctures prepared by adding alcohol to the expressed juices of plants have been long in use on the continent of Europe, and have been brought into notice in Great Britain. They are sometimes called in England *preserved vegetable juices.* The tinctures of some of the narcotic plants might no doubt be advantageously prepared in this way, as those of conium, hyoscyamus, and belladonna. Mr. Squire and Mr. Bentley have paid particular attention to these preparations. According to Mr. Squire, the leaves only of the plants should be used, and, in the case of biennial plants, those exclusively of the second year; and they should be preferably collected when the plant is in full flower. Mr. Bentley recommends the following mode of preparation. To the expressed juice, after it has stood for 24 hours, and deposited its feculent matter, alcohol of 0·838 is to be added in the proportion of one part by measure to four parts of the juice; and, after another period of 24 hours, the liquor is to be filtered. This proportion of alcohol has been found sufficient for the preservation of the juice, while it causes the precipitation of the suspended mucilaginous matter. But, though these preserved juices are often energetic, yet it is obvious that tinctures prepared from the fresh plant must be still more so; as they contain necessarily not only the soluble active matter of the juice, but that also which, when the juice is expressed, is left in the solid residue of the plant.

Tinctures should be kept in bottles accurately stopped, in order to prevent evaporation, which might, in some instances, be attended with serious inconvenience, by increasing their strength beyond the officinal standard.

Medicines are most conveniently administered in tinctures, which act in small doses; as the proportion of alcohol in which they are dissolved is insufficient to produce an appreciable effect. Those which must be given in large doses should be cautiously employed in this form, lest the injury done by the menstruum should more than counterbalance their beneficial operation. This remark is particularly applicable to chronic cases, in which the use of tinctures is apt to lead to the formation of habits of intemperance. The tinctures of the weaker medicines are more frequently given as adjuvants of other remedies than with the view of obtaining their own full effects upon the system.

In the revision of the Pharmacopœia of 1880, wherever practicable, the proportion of drug to finished tincture has been made either 20, 15, 10, or 5 per cent. by weight. In the case of very strong or poisonous tinctures it was not deemed advisable to make too great a change in strength, for fear of dangerous results; indeed, it may be questioned by many, whether too much change has not been made in the tinctures which do not belong to the dangerous class. Yet progressive pharmacy demands greater uniformity and simplicity in the processes, and eventually it is believed that all of the tinctures can be brought into two classes, 20 and 10 per cent.

The officinal Preparations formerly belonging to this class, which have been omitted in the present U. S. Pharmacopœia, are *Tinctura Castorei*, *Tinctura Hellebori*, *Tinctura Iodinii Composita*, *Tinctura Jalapæ*, *Tinctura Lupulinæ*, *Tinctura Opii Acetata*, *Tinctura Rhei et Sennæ;* whilst the additions are as follows, *Tinctura Ferri Acetatis*, *Tinctura Gelsemii*, *Tinctura Hydrastis*, *Tinctura Ignatiæ*, *Tinctura Ipecacuanhæ et Opii*. *Tinctura Matico*, *Tinctura Moschi*, *Tinctura Physostigmatis*, *Tinctura Pyrethri*, *Tinctura Rhei Aromatica*, *Tinctura Rhei Dulcis*, *Tinctura Saponis Viridis*, *Tinctura Sumbul*, *Tinctura Vanillæ*.

TINCTURA ACONITI. *U. S., Br.* *Tincture of Aconite.*

(TĬNC-TŪ'RA̤ ĂC-O̤-NĪ'TĪ.)

Tinctura Aconiti Radicis, *U. S.* 1870; Tincture of Aconite Root; Tinctura Aconiti, *P. G.;* Teinture de Racine d'Aconit, *Fr.;* Eisenhuttinktur, *G.*

"Aconite, in No. 60 powder, *four hundred parts* [or eleven ounces av.]; Tartaric Acid, *four parts* [or forty-eight grains]; Alcohol, *a sufficient quantity*, To make *one thousand parts* [or two pints]. Moisten the powder with *two hundred parts* [or six fluidounces] of Alcohol, in which the Tartaric Acid has previously been dissolved, and macerate for twenty-four hours; then pack it firmly in a cylindrical glass percolator, and gradually pour Alcohol upon it, until *one thousand parts* [or two pints] of Tincture are obtained." *U. S.*

"Take of Aconite Root, in coarse powder, *two ounces and a half* [avoirdupois]; Rectified Spirit *one pint* [Imperial measure]. Macerate the Aconite Root for forty-eight hours, in *fifteen* [*fluid*]*ounces* of the Spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and, when the fluid ceases to pass, continue the percolation with the remaining five [fluid]ounces of Spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient Rectified Spirit to make one pint [Imp. meas.]." *Br.*

The tincture of the U. S. Pharmacopœia has three times the strength of the British, and the title has been changed from *Tinctura Aconiti Radicis* to *Tinctura Aconiti*. It is much stronger than the Tincture of Aconite Leaves, which is still used occasionally, and made of the strength of two troyounces of powdered aconite leaves in a pint of diluted alcohol; and too much caution cannot be observed to avoid mistaking one tincture for the other. In preparing it, each step of the process must be carefully attended to. The root should be thoroughly comminuted, and very carefully packed in the percolator, and the displacing menstruum very gradually added. As annoyance is often occasioned in powdering aconite by the irritating dust which is apt to rise, it is best prepared by grinding in a mill; and if powdered in a mortar, sufficient alcohol should be added to the root to prevent the rising of the dust. The officinal tincture is slightly weaker than that of the U. S. P. 1870. Tartaric acid is used in accordance with the researches of Duquesnel. (See *Abstractum Aconiti*, page 6.) The dose to begin with is from one to three drops (0·06–0·18 C.c.), repeated, and gradually increased, if necessary, until its peculiar effects are experienced. That of the British tincture is three times as much. The external use of the tincture requires care, as serious symptoms have followed its too free employment. (Case, *Bost. Med. and Surg. Journ.*, Feb. 1872, p. 74.)*

TINCTURA ALOES. *U.S., Br.* *Tincture of Aloes.*

(TĬNC-TŪ′RẠ ĂL′Ọ-ĒṢ.)

Teinture d'Aloès, *Fr.;* Aloetinktur, *G.*

"Purified Aloes, in moderately fine powder, *ten parts* [or three ounces av.]; Extract of Glycyrrhiza, in moderately fine powder, *ten parts* [or three ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Mix the powders with *eighty parts* [or one and a half pints] of Diluted Alcohol, and macerate the mixture for seven days, in a closed vessel; then filter through paper, adding, through the filter, enough Diluted Alcohol to make the Tincture weigh *one hundred parts* [or measure two pints]."

"Take of Socotrine Aloes, in coarse powder, *half an ounce* [avoirdupois]; Extract of Liquorice *one ounce and a half* [avoird.]; Proof Spirit *a sufficiency.* Macerate the Aloes and Extract of Liquorice in fifteen fluidounces of the Spirit for seven days, in a closed vessel, with occasional agitation, then filter, and add sufficient Proof Spirit to make one pint [Imp. meas.]." *Br.*

The original tincture of aloes of the U. S. Pharmacopœia was prepared with the officinal diluted alcohol, without the addition of water. The preparation of the U. S. P. 1870 was little more than an infusion, with the addition of sufficient alcohol to prevent spontaneous decomposition. This change was made in the U. S. formula of 1870 so as to produce conformity with the British Colleges, but in the last British Pharmacopœia the old formula was abandoned, and the one forsaken by us adopted. The formula of the present 1880 Pharmacopœia directs three times the quantity of aloes ordered in the former Pharmacopœia, and is now properly entitled to be classed among the tinctures. The proportion of liquorice remains about the same, and the dose is now not so bulky. The liquorice is in both formulas added to cover the taste of the aloes; but it answers the end imperfectly, and the preparation, on account of its unpleasant bitterness, is little used, aloes being generally administered in the form of pill. M. Ménière says of the tincture of aloes that it deposits crystals of aloïn, which adhere to the sides of the bottle, and in the upper part of it a yellow resinous matter. (*Journ. de Pharm.*, Avril, 1861, p. 289.) The dose as a purgative is from two to four fluidrachms (7·5 to 15 C.c.), as a laxative from a half to one fluidrachm (1·9 to 3·75 C.c.). Tincture of aloes is highly recommended by M. Delioux as a local remedy in old atonic ulcers, bed-sores, and suppurating wounds, applied on lint. (*P. J. Tr.*, July, 1864, p. 38.)

TINCTURA ALOES ET MYRRHÆ. *U. S.* *Tincture of Aloes and Myrrh.*

(TĬNC-TŪ′RẠ ĂL′Ọ-ĒṢ ĔT MŸR′RHÆ—mĭr′rē.)

Tinctura Aloes Composita, *Lond.;* Elixir Proprietatis Paracelsi, *P.G.;* Elixir de Propriété, *Fr.;* Aloëelixir, *G.*

"Purified Aloes, in moderately fine powder, *ten parts* [or three ounces av.]; Myrrh, in moderately fine powder, *ten parts* [or three ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Mix the powders with *eighty parts* [or one and a half pints] of Alcohol, and macerate the mixture for seven days in a closed vessel; then filter through paper, adding, through the filter, enough Alcohol to make the Tincture weigh *one hundred parts* [or measure two pints]." *U. S.*

This tincture is a modification of the *elixir proprietatis* of Paracelsus. The present officinal tincture is practically identical with that formerly officinal. Saffron, which was long retained in compliance with former prejudices, can add little to the efficacy of a preparation, and, being very expensive, has with great propriety been omitted in the U. S. formula. It served, however, to impart a richness to the tincture, the want of which may be considered by some a defect.

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* *Fleming's Tincture of Aconite.* This should always be expressly designated when prescribed. It is considerably stronger than the officinal; and several deaths have occurred from the use of it. The following is his formula. Take of the root, carefully dried and finely powdered, *sixteen* (*troy*) *ounces;* Alcohol *sixteen fluidounces.* Macerate for four days, put into a percolator, and add alcohol until twenty-four fluidounces are obtained. Not more than two drops of this should be given as a commencing dose, to be increased till its peculiar effects are experienced.

The tincture is purgative, tonic, and emmenagogue, and is considerably employed in chlorosis, and other disordered states of health in females, connected with suppressed, retained, or deficient menstruation, and with a constipated state of bowels. It may also be used as a stomachic laxative in cold, languid habits, independently of menstrual disorder. The dose is from one to two fluidrachms (3·75–7·5 C.c.).

TINCTURA ARNICÆ FLORUM. *U. S.* *Tincture of Arnica Flowers.*

(TĬNC-TŪ'RẠ ÄR'NỊ-ÇÆ FLŌ'RŬM.)

Tinctura Arnicæ, *Pharm.* 1870: Teinture d'Arnica, *Fr.;* Arnikatinktur, *G.*

"Arnica Flowers, in No. 20 powder, *twenty parts* [or six ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *forty parts* [or twelve fluidounces] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia gives directions for preparing this tincture from *an avoirdupois ounce* of Arnica Root, in coarse powder, and *an Imperial pint* of Rectified Spirit, precisely the same as those for preparing Tincture of Aconite Root.

There are two tinctures of arnica now officinal, and it is necessary to add to the title of each "Florum" and "Radicis," to distinguish them. The tincture of arnica flowers differs from that formerly officinal in the menstruum selected, which is now diluted alcohol in place of alcohol. The change was advocated by numerous pharmaceutical writers, and there is no question of the ability of the menstruum to exhaust the arnica flowers, if they are tightly packed in the percolator. The principal objection to the change is the greater difficulty that will be experienced now in mixing the tincture with liniments containing oily and alcoholic liquids.

In the article upon Arnica, it is stated that arnica is poisonous in overdoses. In the *Lancet* for Nov. 19, 1864 (page 570), Mr. H. Bertin details a case in which a middle-aged man, ten hours after having taken by mistake an ounce of tincture of arnica, was in a state approaching collapse, with sunken and glassy eyes, dilated and insensible pupils, pulse fluttering and over a hundred, skin cold but dry, low and wiry voice, and severe pain in the epigastrium, which was the first striking symptom that he had experienced, and had come on upon awaking from sleep, about eight hours after he swallowed the poison. The mind was apparently clear. Though in great danger, he recovered, under the use of opium and brandy with external heat.

Either alone, or diluted with water, soap liniment, etc., tincture of arnica is often applied popularly to bruises, sprains, tumors, and local rheumatic pains, under the impression that it has extraordinary healing powers. It probably acts favorably in some instances as a general irritant. In some skins it produces a violent eczematous inflammation. If given internally, the dose would be from ten to thirty minims (0·6–1·9 C.c.), increased until some effect was produced.

TINCTURA ARNICÆ RADICIS. *U. S.* *Tincture of Arnica Root.*

(TĬNC-TŪ'RẠ ÄR'NỊ-ÇÆ RẠ-DĪ'CỊS.)

"Arnica Root, in No. 40 powder, *ten parts* [or three ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *ten parts* [or three fluidounces] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

This is a new officinal tincture. It has been introduced for the purpose of furnishing a liquid preparation of arnica root of a convenient strength for internal administration. In our opinion there seemed to be little necessity for its introduction. for the fluid extract is more largely used, and the tincture is exactly identical with it except in the one particular of strength. The dose is from twenty minims to half a fluidrachm (1·25–1·9 C.c.).

TINCTURA ASAFŒTIDÆ. *U. S., Br.* *Tincture of Asafetida.*

(TĬNC-TŪ′RẠ ĂS-Ạ-FŒT′Ị-DÆ—ăs-ạ-fĕt′ẹ-dē.)

Teinture d'Asefétide, *Fr.;* Stinkasanttinktur, *G.*

" Asafetida, bruised, *twenty parts* [or six ounces av.] ; Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Mix the Asafetida with *eighty parts* [or one and a half pints] of Alcohol, and macerate for seven days, in a closed vessel; then filter through paper, adding, through the filter, enough Alcohol to make the Tincture weigh *one hundred parts* [or measure two pints]." *U. S.*

"Take of Assafœtida, in small fragments, *two ounces and a half* [avoirdupois]; Rectified Spirit *a sufficiency*. Macerate the Assafœtida in fifteen fluidounces of the Spirit for seven days in a close vessel, with occasional agitation, then filter, and add sufficient Rectified Spirit to make one pint [Imperial measure]." *Br.*

This tincture becomes milky on the addition of water, in consequence of the separation of the resin. It is somewhat stronger than the tincture formerly officinal, and this is an improvement, particularly in view of the gradual decline in the quality of the drug. It possesses all the virtues of asafetida. The dose is from thirty minims to a fluidrachm (1·9–3·75 C.c.).

Off. Prep. Mistura Magnesiæ et Asafœtidæ. *U. S.*

TINCTURA AURANTII AMARI. *U. S., Br.* *Tincture of Bitter Orange Peel.*

(TĬNC-TŪ′RẠ ÂU-RĂN′TỊ-Ī Ạ-MĀ′RĪ—âw-răn′shẹ-ī.)

Tinctura Aurantii, *Pharm.* 1870; Teinture d'Écorce d'Oranges amères, *Fr.;* Pomeranzenschalentinktur, *G.*

" Bitter Orange Peel, in No. 30 powder, *twenty parts* [or six ounces av.] ; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *twenty parts* [or six fluidounces] of Diluted Alcohol, and macerate for twenty-four hours; then pack it moderately in a conical percolator, and gradually pour Diluted Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

"Take of Bitter Orange Peel, cut small and bruised, *two ounces* [avoirdupois]; Proof Spirit *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation, then strain, press, and filter, and add sufficient Proof Spirit to make one pint [Imp. meas.]." *Br.*

It is the peel of the Seville orange which is directed in this process; and the outer part only is active. The substitution of fresh for dried orange peel has been proposed in England, and its propriety considerably discussed. (See *P. J. Tr.*, Nov. 9, 1872, also April 4, 1874.) Indeed, it met with so much favor as to be introduced among the Addenda to the British Pharmacopœia. The tincture from the fresh peel is less powerful as a bitter than this preparation, but is much superior in aroma and flavor. (See *Tinctura Aurantii Dulcis.*) Six ounces of the fresh peel have been found to yield only two ounces of the dried peel, and are, therefore, required to make a pint of the tincture. The tincture of orange peel is employed as a grateful addition to infusions, decoctions, and mixtures. The dose is one to two fluidrachms (3·75–7·5 C.c.).

Off. Prep. Mistura Ferri Aromatica, *Br.;* Syrupus Aurantii, *Br.;* Tinctura Quiniæ, *Br.*

TINCTURA AURANTII DULCIS. *U. S.* *Tincture of Sweet Orange Peel.*

(TĬNC-TŪ′RẠ ÂU-RĂN′TỊ-Ī DŬL′CỊS—âw-răn′shẹ-ī.)

"Sweet Orange Peel, recently separated from the fresh fruit, and deprived of the inner, white layer, *twenty parts* [or six ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Mix the Orange Peel, previously cut into small pieces, with *eighty parts* [or one and a half pints] of Alcohol, and macerate for twenty-four hours; then pack it moderately in a conical percolator, and gradually pour Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

This is a new officinal tincture, and is designed to furnish a highly flavored alcoholic preparation of orange. The peel should be *grated;* and the officinal direction to *cut it into small pieces* is not definite enough if a successful percolation is desired. This tincture has no peculiar medicinal properties, but is used as a pleasant adjuvant.

TINCTURA AURANTII RECENTIS. *Br.* *Tincture of Fresh Orange Peel.*

(TĬNC-TŪ′RẠ ÂU-RĂN′TỊ-Ī RẸ-CĔN′TỊS—âw-răn′shẹ-ī.)

"Take of Bitter Orange, Rectified Spirit, of each, *a sufficiency.* Carefully cut from the orange the colored parts of the rind in thin slices, and macerate six ounces of this in a pint of the spirit for a week, with frequent agitation. Then pour off the liquid, press the dregs, mix the liquid products, and filter; finally, add sufficient Spirit to make one pint." *Br.*

Dose, one to two fluidrachms (3·75–7·5 C.c.).

TINCTURA BELLADONNÆ. *U. S., Br.* *Tincture of Belladonna.*

(TĬNC-TŪ′RẠ BĔL-LẠ-DŎN′NÆ.)

Teinture de Belladone, *Fr.;* Belladonnatinktur, *G.*

"Belladonna Leaves, in No. 60 powder, *fifteen parts* [or five ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *twenty parts* [or six fluidounces] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia directs this tincture to be prepared from *one avoirdupois ounce* of Belladonna Leaves, in coarse powder, and *one Imperial pint* of Proof Spirit, in the same manner precisely as the Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.) "This Tincture has about half the strength of Tinctura Belladonnæ, *Lond.*, *Dub.*" *Br.*

According to Ménière, this tincture deposits on standing a gray pulverulent substance, starch and gum, and cubical crystals of an undetermined character. (*Journ. de Pharm.*, Avril, 1861, p. 289.) The U. S. tincture is an efficient preparation when made from the recently-dried leaves; but the imported leaves are of very uncertain strength, and a tincture prepared from them is to be less relied upon than the extract. The dose is from fifteen to thirty drops (0·9 to 1·9 C.c.). That of the British tincture is at least twice as much.

TINCTURA BENZOINI. *U. S.* *Tincture of Benzoin.*

(TĬNC-TŪ′RẠ BĔN-ZỌ-Ī′NĪ.)

Tinctura Benzoës, *P.G.;* Teinture de Benjoin, *Fr.;* Benzoëtinktur, *G.*

"Benzoin, in moderately coarse powder, *twenty parts* [or six ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Mix the powder with *eighty parts* [or one and a half pints] of Alcohol, and macerate for seven days, in a closed vessel; then filter through paper, adding, through the filter, enough Alcohol to make the Tincture weigh *one hundred parts* [or measure two pints]." *U. S.*

This tincture may be exhibited in doses of twenty drops to half a fluidrachm (1·25–1·9 C.c.), but was, no doubt, introduced into the Pharmacopœia chiefly or solely for the purpose of adding to ointments to prevent rancidity.

TINCTURA BENZOINI COMPOSITA. *U. S., Br.* *Compound Tincture of Benzoin.*

(TĬNC-TŪ′RA̤ BĔN-ZO̤-Ī′NĪ CO̤M-PŎŞ′I̤-TA̤.)

Tinctura Balsamica, Balsamum Commendatoris, Elixir Traumaticum; Teinture balsamique, Baume du Commandeur de Permes, *Fr.;* Persischer Wundbalsam, *G.*

"Benzoin, in coarse powder, *twelve parts* [or three and a half ounces av.]; Purified Aloes, in coarse powder, *two parts* [or two hundred and sixty grains]; Storax, *eight parts* [or two and a half ounces av.]; Balsam of Tolu, *four parts* [or one and a quarter ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Mix the Benzoin, Aloes, Storax, and Balsam of Tolu with *seventy-five parts* [one and a half pints] of Alcohol, and macerate the mixture for seven days, in a closed vessel; then filter through paper, adding, through the filter, enough Alcohol to make the Tincture weigh *one hundred parts* [or measure two pints]." *U. S.*

"Take of Benzoin, in coarse powder, *two ounces* [avoirdupois]; Prepared Storax *one ounce and a half* [avoird.]; Balsam of Tolu *half an ounce* [avoird.]; Socotrine Aloes *one hundred and sixty grains;* Rectified Spirit *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation, then filter, and add sufficient Rectified Spirit, if required, to make one pint [Imp. meas.]." *Br.*

This tincture is a stimulating expectorant, occasionally used in chronic catarrhal affections. It has been recommended also in chronic dysentery, with a view to its alterative action on the ulcerated surface of the colon; but it is most employed as a local application to indolent ulcers, chapped nipples, etc. It has been found useful injected into the nostrils in obstinate epistaxis. (*Braithwaite*, No. 37, p. 58.) It is the *balsamum traumaticum* of the older Pharmacopœias, and may be considered as a simplified form of certain complex compositions, such as *baume de commandeur*, *Wade's balsam*, *Friar's balsam*, *Jesuits' drops*, *Turlington's balsam*,* etc., which were formerly in repute, and are still esteemed among the vulgar, as pectorals and vulneraries. The compound tincture of benzoin is decomposed by water. The dose is from thirty minims to two fluidrachms (1·9–7·5 C.c.). A variety of *court plaster* is made by applying to black silk, by means of a brush, first a solution of isinglass, and afterwards an alcoholic solution of benzoin.

TINCTURA BUCHU. *Br.* *Tincture of Buchu.*

(TĬNC-TŪ′RA̤ BŪ′ÇHŪ—bū′kū.)

Teinture de Bucco, *Fr.;* Buchutinktur, *G.*

This tincture is directed, in the British Pharmacopœia, to be prepared from *two and a half avoirdupois ounces* of Buchu Leaves, in coarse powder, and *one Imperial pint* of Proof Spirit, in the same manner precisely as Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.) This tincture has the virtues of buchu leaves, and may be given in the dose of from one to four fluidrachms (3·75–15 C.c.), either simply diluted with water, or as an addition to the infusion of the leaves.

TINCTURA BRYONIÆ. *U. S.* *Tincture of Bryonia.*

(TĬNC-TŪ′RA̤ BRȲ-Ō′NI̤-Æ.)

Teinture de Bryone, *Fr.;* Zaunrübetinktur, *G.*

"Bryonia, recently dried and in No. 40 powder, *ten parts* [or two and three-quarter ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *ten parts* [or three fluidounces] of Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

This new tincture has doubtless been introduced into the Pharmacopœia on probation. It is used as a cathartic in doses of one to two fluidrachms (3·75–7·5 C.c.).

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* The following is the formula for *Turlington's balsam* adopted by the Philadelphia College of Pharmacy. "Take of Alcohol Oviij, Benzoin ℥xij, Liquid Storax ℥iv, Socotrine Aloes ℥j, Peruvian Balsam ℥ij, Myrrh ℥j, Angelica Root ℥ss, Balsam of Tolu ℥iv, Extract of Liquorice Root ℥iv. Digest for ten days, and strain." (*Journ. of the Phila. Coll. of Pharm.*, v. 28.)

TINCTURA CALENDULÆ. *U. S.* *Tincture of Calendula.*

(TĬNC-TŪ'RA CA-LĔN'DŮ-LÆ.)

Teinture de Fleurs de Tous-les-Mois, *Fr.;* Ringelblumetinktur, *G.*

"Calendula, in No. 20 powder, *twenty parts* [or six ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *forty parts* [or twelve fluidounces] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

This is a new officinal tincture. It is used externally for the same purposes as tincture of arnica. When made with diluted alcohol, some precipitation takes place, and alcohol would be preferable as a menstruum.

TINCTURA CALUMBÆ. *U. S., Br.* *Tincture of Calumba.*

(TĬNC-TŪ'RA CA-LŬM'BÆ.)

Tinctura Colombo; Teinture de Colombo, *Fr.;* Kolombotinktur, *G.*

"Calumba, in No. 20 powder, *ten parts* [or three ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Mix Alcohol and Water in the proportion of *three parts* [or one and a half pints] of Alcohol to *two parts* [or twelve fluidounces] of Water, and, having moistened the powder with *ten parts* [or three fluidounces] of the mixture, macerate for twenty-four hours; then pack it in a cylindrical percolator, and gradually pour menstruum upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia directs this tincture to be prepared from *two and a half avoirdupois ounces* of Calumba Root, cut small, and *one Imperial pint* of Proof Spirit, in the same manner precisely as directed for the Tincture of Aconite Root.

Mr. Jos. Ince recommends that the tincture should be prepared from the root as found in the shops, without further slicing or powdering it. Made as he proposes, the tincture is clear and bright; while if the powdered root is used it will be very turbid, even after filtration. (*P. J. Tr.*, xiv. 491.) No. 20 powder is now directed in preference to No. 50 powder used in U. S. P. 1870.* The tincture of calumba may be added to tonic infusions or decoctions, to increase their stimulant power, but, like all the other bitter tinctures, should be used with caution. The dose is from one to four fluidrachms (3·75–15 C.c.).

TINCTURA CANNABIS INDICÆ. *U. S.* *Tincture of Indian Cannabis.*

(TĬNC-TŪ'RA CĂN'NA-BĬS ĬN'DI-ÇÆ.)

Tinctura Cannabis, *Pharm.* 1870; Tincture of Hemp; Tincture of Indian Hemp; Tinctura Cannabis Indicæ, *P.G.;* Teinture de Chanvre Indien, *Fr.;* Indischhanftinktur, *G.*

"Indian Cannabis, in No. 40 powder, *twenty parts* [or five and a half ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *twenty parts* [or six fluidounces] of Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Alcohol upon it until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

"Take of Extract of Indian Hemp *one ounce* [avoirdupois]; Rectified Spirit *one pint* [Imperial measure]. Dissolve the Extract of Hemp in the Spirit." *Br.*

The American reader must take care not to confound the Indian Hemp, here alluded to, with Apocynum Cannabinum, known by the same name in this country.

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* *Tincture of Calumba.* J. B. Moore recommends the following process. Calumba, in powder No. 20, 4 troy oz.; alcohol, 22 fl. oz.; glycerin and water, each 5½ fl. oz.; dilute alcohol, q. s. Mix the alcohol, glycerin, and water, moisten the powdered calumba with the mixture, pack in a close vessel, and set aside to macerate for 6 hours; then pack in a glass funnel prepared for percolation, and gradually pour upon it the remainder of the menstruum, and, when this has passed from the surface, continue the percolation with dilute alcohol until 32 fl. oz. of tincture are obtained. (*Druggists' Circular*, May, 1877.)

The strength of the present tincture is about one-third less than that of 1870. The dose is thirty minims (1·9 C.c.), or about fifty drops, to be gradually increased till its effects are experienced.

TINCTURA CANTHARIDIS. *U. S., Br.* *Tincture of Cantharides. Tincture of Spanish Flies.*

(TĬNC-TŪ'RẠ CẠN-THĂR'Ị-DĬS.)

Tinctura Cantharidum, *P.G.;* Teinture de Cantharides, *Fr.;* Spanischfliegentinktur, *G.*

"Cantharides, in No. 60 powder, *five parts* [or six hundred grains]; Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *three parts* [or six fluidrachms] of Alcohol, and pack it firmly in a cylindrical percolator; then gradually pour Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

"Take of Cantharides, in coarse powder, *one-quarter of an ounce* [avoirdupois], Proof Spirit *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation, strain, press, filter, and add sufficient Proof Spirit to make one pint [Imp. meas.]." *Br.*

An improvement has been made in this tincture in the last revision in the substitution of alcohol for diluted alcohol. It is frequently used in mixtures of castor oil and alcohol in the so-called hair tonics, and when made with diluted alcohol turbidity results. The new tincture is slightly stronger than that of U. S. P. 1870.

This tincture is one of the most convenient forms for the internal use of Spanish flies, the virtues of which it possesses to their full extent. (See *Cantharis.*) If made with diluted alcohol, when long kept, it deposits fatty matter, cantharidin in rhomboidal tables, and other crystals of a quite different form. (Ménière, *Journ. de Pharm.*, Avril, 1861, p. 289.) It is occasionally employed externally as a rubefacient; but its liability to vesicate should be taken into consideration. The British tincture is too feeble, containing the virtues of only 0·68 of a grain of cantharides in a fluidrachm. The dose of the U. S. tincture is from three to ten drops (0·07 to 0·30 C.c.), repeated three or four times a day.

TINCTURA CAPSICI. *U. S., Br.* *Tincture of Capsicum. Tincture of Cayenne Pepper.*

(TĬNC-TŪ'RẠ CĂP'SỊ-CĪ.)

Teinture de Piment des Jardins, *Fr.;* Spanischpfeffertinktur, *G.*

"Capsicum, in No. 30 powder, *five parts* [or six hundred grains]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Mix Alcohol and Water in the proportion of *nineteen parts* [or two pints] of Alcohol to *one part* [or one and a half fluidounces] of Water, and, having moistened the powder with *three parts* [or five fluidrachms] of the mixture, pack it firmly in a cylindrical percolator; then gradually pour menstruum upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia directs this tincture to be prepared from *three-quarters of an avoirdupois ounce* of Bruised Capsicum Fruit, and *one Imperial pint* of Rectified Spirit, in the same manner precisely as directed for the Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

The officinal tincture is slightly stronger than that of the U. S. P. 1870, and has been improved by the substitution of alcohol for diluted alcohol, as suggested by G. W. Kennedy (*A. J. P.*, March, 1876) and others.

This preparation of capsicum is a useful stimulant in very low states of the system with gastric insensibility, as in malignant scarlet and typhus fevers, and in the cases of drunkards. It may also be used as a gargle, diluted with rose-water or some mucilaginous fluid. (See *Capsicum.*) Applied by means of a camel's-hair pencil to the relaxed uvula, it sometimes produces contraction and relieves prolapsus of that part. The dose is from a half to one fluidrachm (1·9 to 3·75 C.c.).

TINCTURA CARDAMOMI. *U. S.* *Tincture of Cardamom.*

(TĬNC-TŪ′RA CĂR-DA-MŌ′MĪ.)

Teinture de Cardamome, ***Fr.;*** **Kardamomentinktur,** ***G.***

"Cardamom, in No. 30 powder, *fifteen parts* [or five ounces av.]; Diluted Alcohol, *a sufficient quantity,* To make *one hundred parts* [or two pints]. Moisten the powder with *fifteen parts* [or four fluidounces] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

This tincture is an agreeable but strong aromatic, and may be advantageously added to tonic and purgative infusions. The dose is one fluidrachm (3·75 C.c.).

TINCTURA CARDAMOMI COMPOSITA. *U.S., Br.* *Compound Tincture of Cardamom.*

(TĬNC-TŪ′RA CĂR-DA-MŌ′MĪ COM-PŎŞ′I-TA.)

Teinture de Cardamome composée, ***Fr.;*** **Zusammengesetzte Kardamomentinktur,** ***G.***

"Cardamom, *twenty parts* [or two hundred and eighty grains]; Cinnamon, *twenty parts* [or two hundred and eighty grains]; Caraway, *ten parts* [or one hundred and forty grains]; Cochineal, *five parts* [or seventy grains]; Glycerin, *sixty parts* [or one and a half fluidounces]; Diluted Alcohol, *a sufficient quantity,* To make *one thousand parts* [or two pints]. Mix the Cardamom, Cinnamon, Caraway, and Cochineal, and reduce them to a moderately coarse (No. 40) powder. Having moistened the powder with *twenty-five parts* [or six fluidrachms] of Diluted Alcohol, pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until *nine hundred and forty parts* [or thirty and a half fluidounces] of Tincture are obtained. Then add the Glycerin and mix them." *U. S.*

The British Pharmacopœia takes of Cardamom Seeds, freed from the pericarps and bruised, and Caraway Fruit, bruised, each, *a quarter of an avoirdupois ounce;* Raisins, freed from their seeds, *two avoirdupois ounces;* Cinnamon Bark, bruised, *half an avoirdupois ounce;* Cochineal, in powder, *sixty grains;* and Proof Spirit, *one Imperial pint;* and directs that the tincture should be prepared in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti,* page 1437.)

This is a very agreeable aromatic tincture, occasionally used as a carminative in the dose of one or two fluidrachms (3·75 or 7·5 C.c.), but more frequently as an addition to mixtures, infusions, etc., which it renders pleasant to the taste and acceptable to the stomach. The substitution of honey in the U. S. formula of 1870 for the raisins in that of 1850 was an improvement, as it facilitated the process, and gave more precision to the result; but a still greater improvement was made in the present process in the substitution of glycerin, which increases the stability of the preparation and replaces a liquid which is usually found adulterated in commerce.

Off. Prep. Decoctum Aloes Compositum, *Br.;* Mistura Ferri Aromatica, *Br.;* Mistura Sennæ Composita, *Br.;* Tinctura Chloroformi Composita, *Br.*

TINCTURA CASCARILLÆ. *Br.* *Tincture of Cascarilla.*

(TĬNC-TŪ′RA CĂS-CA-RĬL′LÆ.)

Teinture de Cascarille, ***Fr.;*** **Kaskarilltinktur,** ***G.***

The British Pharmacopœia directs this tincture to be prepared from *two and a half avoirdupois ounces* of bruised Cascarilla, and *one Imperial pint* of Proof Spirit, in the same manner precisely as directed for the Tincture of Aconite Root. (See *Tinctura Aconiti,* page 1437.)

This tincture has the properties of cascarilla, but is seldom if ever used in this country. The dose is from thirty minims to two fluidrachms (1·9–7·5 C.c.).

TINCTURA CASTOREI. *Br.* *Tincture of Castor.*

(TĬNC-TŪ′RA̩ CA̩S-TŌ′RE̩-Ī.)

Teinture de Castoreum, *Fr.;* Bibergeiltinktur, *G.*

"Take of Castor, in coarse powder, *one ounce* [avoirdupois]; Rectified Spirit *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation; strain, press, filter, and add sufficient Rectified Spirit to make one pint [Imp. meas.]." *Br.*

Tincture of castor is no longer officinal. The formula of the U. S. P. 1870 was to macerate two troyounces of bruised castor for seven days in two pints of alcohol, express, and filter through paper.

As castor yields little if any of its virtues to water, alcohol is a better solvent than proof spirit. It is said also to form a more grateful preparation. The Russian castor should always be preferred when attainable. It deposits on standing a yellow organic substance, which, when moistened with water, exhibits animalcules under the microscope. (*Ménière.*) This tincture is employed for the same purposes as castor. The dose is from thirty minims to two fluidrachms (1·9–7·5 C.c.).

TINCTURA CATECHU COMPOSITA. *U.S.*, *Br.* *Compound Tincture of Catechu.*

(TĬNC-TŪ′RA̩ CĂT′E̩-CHŪ CO̩M-PŎS′I̩-TA̩.)

Tinctura Catechu, *Pharm.* 1870; Teinture de Cachou, *Fr.;* Katechutinktur, *G.*

"Catechu, in No. 40 powder, *twelve parts* [or four ounces av.]; Cinnamon, in No. 40 powder, *eight parts* [or two ounces av. and three hundred grains]; Diluted Alcohol, *a sufficient quantity,* To make *one hundred parts* [or two pints]. Mix the powders, and, having moistened the mixture with *fifteen parts* [or four fluidounces] of Diluted Alcohol, macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

"Take of Pale Catechu, in coarse powder, *two and a half ounces* [avoirdupois]; Cinnamon Bark, bruised, *one ounce* [avoird.]; Proof Spirit *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation; strain, press, filter, and add sufficient proof spirit to make one pint [Imp. meas.]." *Br.*

The name of this tincture has been changed, so that it more accurately indicates its composition. Cinnamon has been present in the tincture of catechu of former Pharmacopœias in the same relatively large proportion—2 parts of cinnamon to 3 parts of catechu—and has been usually overlooked. The present officinal tincture contains the virtues of about 54 grains of catechu in the fluidounce, whilst that of U. S. P. 1870 represented but 45 grains to the fluidounce.

This is a grateful astringent tincture, useful in all cases to which catechu is applicable and in which small quantities of spirit are not objectionable. It may often be advantageously added to cretaceous mixtures in diarrhœa. The dose is from thirty minims to three fluidrachms (1·9 to 11·25 C.c.), which may be given with sweetened water or some mucilaginous liquid, or in port wine when this is not contraindicated. It sometimes gelatinizes when kept, and becomes unfit for use.

TINCTURA CHIRATÆ. *U. S.*, *Br.* *Tincture of Chirata.* [*Tincture of Chiretta.*]

(TĬNC-TŪ′RA̩ C̸HI̩-RĀ′TÆ.)

Teinture de Chirette, *Fr.;* Chirettatinktur, *G.*

"Chirata, in No. 40 powder, *ten parts* [or three ounces av.]; Diluted Alcohol, *a sufficient quantity,* To make *one hundred parts* [or two pints]. Moisten the powder with *ten parts* [or two and a half fluidounces] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia takes *two and a half avoirdupois ounces* of Chiretta, cut small and bruised, and *one Imperial pint* of Proof Spirit, and proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

This is a new officinal tonic tincture, which is largely used in some sections of our country. It is not quite so strong as the British tincture. The dose is one or two fluidrachms (3·75 or 7·5 C.c.), three or four times a day.

TINCTURA CHLOROFORMI COMPOSITA. *Br.* *Compound Tincture of Chloroform.*

(TĬNC-TŪ′RA̤ ÇHLŌ-RO̤-FÖR′MĪ CO̤M-PŎS̜′I̤-TA̤.)

"Take of Chloroform *two fluidounces;* Rectified Spirit *eight fluidounces;* Compound Tincture of Cardamoms *ten fluidounces.* Mix." *Br.*

A convenient form for the internal use of chloroform. The dose is from twenty minims to a fluidrachm (1·25–3·75 C.c.) diluted with water.

TINCTURA CIMICIFUGÆ. *U. S.* *Tincture of Cimicifuga.*

(TĬNC-TŪ′RA̤ CĬM-I̤-CĬF′U̇-G̜Æ.)

"Cimicifuga, in No. 60 powder, *twenty parts* [or five and a half ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *fifteen parts* [or four and a half fluidounces] of Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

This is a new officinal tincture, which is inferior to the fluid extract, because the medical powers of the menstruum are almost equal to those of the drug, although dissimilar. The dose is a fluidrachm to half a fluidounce (3·75 to 15· C.c.).

TINCTURA CINCHONÆ. *U. S.* *Tincture of Cinchona.*

(TĬNC-TŪ′RA̤ CĬN-ÇHŌ′NÆ.)

Tinctura Cinchonæ Flavæ, *Br.;* Tincture of Yellow Cinchona; Tincture of Peruvian Bark; Tinctura Chinæ, *P.G.;* Teinture de Quinquina, *Fr.;* Chinatinktur, *G.*

"Yellow Cinchona, in No. 60 powder, *twenty parts* [or six ounces av.]; Glycerin, *ten parts* [or two and a quarter fluidounces]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Mix the Glycerin with *sixty-five parts* [or twenty-three fluidounces] of Alcohol and *twenty-five parts* [or seven fluidounces] of Water, and, having moistened the powder with *twenty parts* [or five and a half fluidounces] of the mixture, macerate for twenty-four hours; then pack it firmly in a cylindrical glass percolator, and gradually pour on the remainder of the mixture. When the liquid has disappeared from the surface, gradually pour on more of the mixture of Alcohol and Water, using the same proportions as before, and continue the percolation, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia takes *four avoirdupois ounces* of Yellow Cinchona Bark, in moderately fine powder, and *one Imperial pint* of Proof Spirit, and proceeds as in Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

This tincture is very properly made with a large proportion of bark; as, in the bitter tinctures, it is important that the alcohol should bear as small a proportion to the tonic principle as possible. Even when strongest, however, it cannot, in ordinary cases, be given in doses sufficiently large to obtain the full effect of the bark, without stimulating too highly. A deposit is apt to form in the tincture when kept, consisting in chief of cinchonic red holding probably a portion of the alkaloids in combination. This was found by Mr. J. Adams to be perfectly dissolved by heat, though it uniformly reappeared on the cooling of the tincture. The addition of diluted sulphuric acid did not cause its solution; and, even though it was removed by filtering the tincture, the deposition was afterwards renewed. (*P. J. Tr.*, April, 1863, p. 470.) In reference to a mode of obviating in some measure this tendency to deposition, the reader is referred to the statements of M. Vauflart on the subject of deposition in the tinctures prepared by percolation. Mr. A. B. Taylor, in experimenting on this subject, prepared a tincture in which the menstruum consisted of two parts of alcohol, one part of water, and one of glycerin, and which was kept three months without undergoing deposition. (*A. J. P.*, Jan. 1865, p. 50.) This suggested the addition of glycerin to the officinal formula, and there is no doubt that the tincture has been improved, experience having proved the utility of glycerin in liquid preparations of cinchona. The officinal tincture is slightly weaker than that of the U. S. P. 1870. Tincture of cinchona is rarely employed, but may be used as a tonic in dose of from one to four fluidrachms (3·75–15 C.c.).

TINCTURA CINCHONÆ COMPOSITA. *U. S., Br.* *Compound Tincture of Cinchona. Compound Tincture of Peruvian Bark.*

(TĬNC-TŪ′RA̤ CĬN-ÇHŌ′NÆ CO̤M-PŎŞ′I̤-TA̤.)

Tinctura Chinæ Composita, *P.G.;* Huxham's Tincture of Bark; Teinture de Quinquina composée, Elixir fébrifuge d'Huxam, *Fr.;* Zusammengesetzte Chinatinktur, *G.*

"Red Cinchona, *ten parts* [or three ounces av.]; Bitter Orange Peel, *eight parts* [or two and a half ounces av.]; Serpentaria, *two parts* [or half an ounce av.]; Glycerin, *ten parts* [or two and a quarter fluidounces]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Mix the Glycerin with *eighty parts* [or twenty-eight fluidounces] of Alcohol and *ten parts* [or three fluidounces] of Water. Having mixed the Cinchona, Orange Peel, and Serpentaria, reduce them to a fine (No. 60) powder. Moisten the powder with *twenty parts* [or five and a half fluidounces] of the menstruum, and macerate for twenty-four hours; then pack it firmly in a cylindrical glass percolator, and gradually pour on the remainder of the menstruum. When the liquid has disappeared from the surface, gradually pour upon it enough of a mixture of Alcohol and Water, using the same proportions as before, and continue the percolation, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia takes of Pale Cinchona Bark, in moderately fine powder, *two avoirdupois ounces*, Bitter Orange Peel, cut small and bruised, *one avoirdupois ounce*, Serpentaria, bruised, *half an avoirdupois ounce*, Saffron *sixty grains*, Cochineal, in powder, *thirty grains*, and Proof Spirit *one Imperial pint;* and proceeds, with these ingredients, in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

This is the preparation commonly known by the name of *Huxham's tincture of bark.* It differs from that officinal in U. S. P. 1870 principally in the alcoholic strength of the menstruum, which is now about in the proportion of 9 volumes of alcohol to 1 volume of water; it was formerly 3 volumes of alcohol to 1 volume of water. The use of glycerin is an improvement, precipitation being thus largely prevented. It will be observed that the drugs are not directed in the powdered state, the intention being to mix the drugs together and then to reduce the mixture to a *uniform* powder; in this way the volatile principles in the Serpentaria and Orange Peel are retained, and thorough exhaustion by percolation is secured. It is unfortunate that the British Council, following the London and Dublin Colleges, should have selected the feeblest of the officinal varieties of bark for this important tincture. The compound tincture of bark is an excellent stomachic cordial tonic, too feeble, however, in the principles of cinchona to serve as a substitute for the alkaloids when a full effect is required. Huxham was in the habit of uniting with it *elixir of vitriol*, the aromatic sulphuric acid of the Pharmacopœias. The dose is from one to four fluidrachms (3·75–15 C.c.).

TINCTURA CINNAMOMI. *U. S., Br.* *Tincture of Cinnamon.*

(TĬNC-TŪ′RA̤ CĬN-NA̤-MŌ′MĪ.)

Teinture de Cannelle, *Fr.;* Zimmttinktur, *G.*

"Cinnamon, in No. 40 powder, *ten parts* [or three ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Mix Alcohol and Water in the proportion of *three parts* [or one and a half pints] of Alcohol to *two parts* [or fourteen fluidounces] of Water, and, having moistened the powder with *five parts* [or one and a half fluidounces] of menstruum, pack it in a conical percolator, and gradually pour menstruum upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia takes *two and a half avoirdupois ounces* of Cinnamon Bark, in coarse powder, and *one Imperial pint* of Proof Spirit, and proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

This tincture has the aromatic and astringent properties of cinnamon, and may be used as an adjuvant to cretaceous mixtures and astringent infusions or decoctions. By long keeping it is apt to gelatinize and become unfit for use. According to Mr. Greenish, this can be remedied by using a menstruum composed of six parts of alcohol and two parts of water. (*P. J. Tr.*, Feb. 1872, p. 641.) The dose is from one to three or four fluidrachms (3·75–11·25 or 15 C.c.).

TINCTURA COCCI. *Br.* *Tincture of Cochineal.*

(TĬNC-TŪ'RẠ CŎC'ÇĪ.)

Teinture de Cochenille, *Fr.;* Cochenilletinktur, *G.*

"Take of Cochineal, in powder, *two ounces and a half* [avoirdupois]; Proof Spirit *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation; strain, press, filter, and add sufficient Proof Spirit to make one pint [Imp. meas.]." *Br.*

This is valued chiefly for imparting color to liquid preparations. It may, however, be given internally in nervous affections in doses varying from twenty drops to a fluidrachm (1·25–3·75 C.c.).

TINCTURA COLCHICI. *U. S.* *Tincture of Colchicum.*

(TĬNC-TŪ'RẠ CŎL'ÇHỊ-CĪ—kŏl'kẹ-sī.)

Tinctura Colchici Seminum, *Br.;* Tincture of Colchicum Seeds; Teinture de Semences de Colchique, *Fr.;* Zeitlosentinktur, *G.*

"Colchicum Seed, in No. 30 powder, *fifteen parts* [or five ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *fifteen parts* [or four fluidounces] of Diluted Alcohol and macerate for twenty-four hours; then pack it moderately in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia takes *two and a half avoirdupois ounces* of bruised Colchicum Seeds, and *one Imperial pint* of Proof Spirit, and proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

It was at one time supposed that the tincture was quite as effective made from the unbruised as from the bruised seeds; but the opinion has been shown to be erroneous. (*A. J. P.*, xxvi. 120.) See also a paper by Mr. N. Rosenwasser, *Ibid.*, 1877, p. 436. Subsequently Mr. L. I. Morris showed that if the whole seeds were *digested* with hot diluted alcohol, they could be perfectly exhausted. (*A. J. P.*, 1881, p. 6.) Prof. Maisch recommends, as a convenient method of comminuting the seeds, to macerate them for two or three days in a portion of the menstruum, then to remove them and bruise them in a clean iron mortar, taking care that none of the menstruum or the seeds should be wasted. (*Ibid.*, xxviii. 514.)

This tincture possesses the properties of colchicum, and may be given whenever that medicine is indicated; but the wine, containing less alcohol, is generally preferred. The dose is from half a fluidrachm to two fluidrachms (1·9–7·5 C.c.).

TINCTURA CONII. *U. S., Br.* *Tincture of Conium.*

(TĬNC-TŪ'RẠ CỌ-NĪ'Ī.)

Tinctura Conii Fructus, *Br.* 1874; Tincture of Hemlock; Tincture of Hemlock Fruit; Teinture de Ciguë, *Fr.;* Schierlingstinktur, *G.*

"Conium, in No. 30 powder, *one hundred and fifty parts* [or five ounces av.]; Diluted Hydrochloric Acid, *four parts* [or one fluidrachm]; Diluted Alcohol, *a sufficient quantity*, To make *one thousand parts* [or two pints]. Moisten the powder with *forty-five parts* [or two fluidounces] of Diluted Alcohol, previously mixed with the Diluted Hydrochloric Acid, and macerate for twenty-four hours; then pack it moderately in a conical glass percolator, and gradually pour Diluted Alcohol upon it, until *one thousand parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia takes *two and a half avoirdupois ounces* of bruised Hemlock Fruit, and *one Imperial pint* of Proof Spirit, and proceeds as directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

A very important change has been made in this preparation in the substitution of conium fruit for the leaves, which are no longer officinal. The diluted hydrochloric acid is used to fix the volatile alkaloid conine. A preparation made by adding one measure of alcohol to three of the expressed juice has been used in England under the name of *preserved juice of hemlock*, and has been adopted in the British Pharmacopœia with the title of *Succus Conii*, or *Juice of Hemlock.* (See page 1375.) A strong odor of conine should be emitted by the tincture upon the addition of potassa. M. Ménière states that it lets fall, on standing, a yellow miliary deposit, resembling drops of oil, the form of which is modified under pressure. According to the experiments of Dr. John Harley, of London (*P. J. Tr.*, Jan. 1867, p. 414), the British tincture is an uncertain preparation, two fluidounces of it failing to produce any effect. The U. S. P. tincture is now, however, about 30 per cent. stronger than the British, and cannot be considered inert if care is taken to select the conium fruit properly. The commencing dose is thirty minims (1·9 C.c.), to be increased as necessary.

TINCTURA CROCI. *U. S., Br.* *Tincture of Saffron.*

(TĬNC-TŪ'RA CRŌ'CĪ.)

Teinture de Safrain, *Fr.;* Safrantinktur, *G.*

"Saffron, *ten parts* [or three ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the Saffron with *ten parts* [or two and a half fluidounces] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia takes *one avoirdupois ounce* of Saffron, and *one Imperial pint* of Proof Spirit, and proceeds as directed for the Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

This tincture possesses all the properties of saffron; it was first introduced into the U. S. P. in the revision of 1880, but is of little other use than to give color to mixtures. The dose is from one to three fluidrachms (3·75–11·25 C.c.).

TINCTURA CUBEBÆ. *U. S., Br.* *Tincture of Cubeb.*

(TĬNC-TŪ'RA CŪ-BĒ'BÆ.)

Tincture of Cubebs; Teinture de Cubèbes, *Fr.;* Kubebentinktur, *G.*

"Cubeb, in No. 30 powder, *ten parts* [or three ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *ten parts* [or two and a half fluidounces] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia takes *two and a half avoirdupois ounces* of Cubebs, in powder, and *one Imperial pint* of Rectified Spirit, and proceeds as directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

The old London tincture was nearly three times as strong as the Dublin; but the preparation, on its introduction into the British Pharmacopœia, was greatly reduced in strength. The present U. S. P. tincture is about 25 per cent. weaker than that of U. S. P. 1870, a change which is very unfortunate, and almost destroys any therapeutical value the preparation may have had. It undoubtedly represents cubebs, but is too weak in cubebs and too strong in alcohol for other than very special uses. The dose is from one to two fluidrachms (3·75–7·5 C.c.) or more.

TINCTURA DIGITALIS. *U.S., Br.* *Tincture of Digitalis.*

(TĬNC-TŪ′RA̤ DĬǴ-I̤-TĀ′LĬS.)

Tincture of Foxglove; Teinture de Digitale, *Fr.;* Fingerhuttinktur, *G.*

"Digitalis, recently dried and in No. 60 powder, *fifteen parts* [or five ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *fifteen parts* [or four fluidounces] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia takes *two and a half avoirdupois ounces* of Digitalis Leaves, in coarse powder, and *one Imperial pint* of Proof Spirit, and proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

In preparing this tincture, great attention should be paid to the selection of the leaves, according to the rules laid down under the head of Digitalis. From a neglect of these it is apt to be weak or inefficient. The expressed juice of the leaves, preserved by means of alcohol, prepared as the British Succi, would probably be found a powerful preparation. (See page 1375.) The tincture of foxglove possesses all the virtues of that narcotic, and affords a convenient method of administering it, especially in mixtures. It is said by M. Ménière to deposit on standing a green oily matter, and some white lance-shaped crystals soluble in an excess of acid. (*Journ. de Pharm.*, Avril, 1861, p. 289.) The present U. S. preparation is slightly stronger than that of 1870. The ordinary dose is from ten to twenty drops (0·6–1·25 C.c.), repeated two or three times a day, and increased if necessary, but with caution; a fluidrachm, representing about 8 grains of Digitalis, may be given on occasion as a single dose.

TINCTURÆ HERBARUM RECENTIUM. *U. S.* *Tinctures of Fresh Herbs.*

(TĬNC-TŪ′RÆ HĔR-BĀ′RŬM RE̤-CĔN′TI̤-ŬM—re̤-sĕn′she̤-ŭm.)

"These Tinctures, when not otherwise directed, are to be prepared by the following formula: Take of the Fresh Herb, bruised or crushed, *fifty parts* [or sixteen ounces]; Alcohol, *one hundred parts* [or two and a quarter pints]. Macerate the Herb with the Alcohol for fourteen days; then express the liquid and filter." *U. S.*

This is a general formula introduced for the guidance of the pharmacist for the purpose of securing some degree of uniformity in this class of tinctures. Tinctures from fresh herbs are coming into use to some extent, and the fresh herb is to be preferred to the dried drug where a very volatile or easily dissociated substance is the active principle. It is evident that the relative strength must vary, however, with the degree of freshness of the drug and the amount of water contained in it, which depends upon the time of collection, state of the weather when gathered, and amount of exposure to atmosphere subsequently; for these reasons an accurate or uniform relation cannot be obtained. It is asserted that the fresh tinctures of thuja and gelsemium are more active than the tinctures from the dried drug. (*Proc. A. P. A.*, 1878, p. 755.)

TINCTURA ERGOTÆ. *Br.* *Tincture of Ergot.*

(TĬNC-TŪ′RA̤ E̤R-GŌ′TÆ.)

Tinctura Secalis Cornuti, *P.G.;* Teinture de Seigle ergoté, *Fr.;* Mutterkorntinktur, *G.*

The British Pharmacopœia takes *five avoirdupois ounces* of Ergot, in coarse powder, and *one Imperial pint* of Proof Spirit, and proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

The dose of this tincture is from thirty minims to two fluidrachms (1·9–7·5 C.c.).

TINCTURA FERRI ACETATIS. *U. S., Br.* *Tincture of Acetate of Iron.* [*Tincture of Ferric Acetate.*]

(TĬNC-TŪ′RA̤ FĔR′RĪ ĂÇ-E̤-TĀ′TĬS.)

Teinture d'Acétate de Fer, *Fr.;* Essigsaure Eisentinktur, *G.*

"Solution of Acetate of Iron, *fifty parts* [or four fluidounces]; Alcohol, *thirty* *parts* [or three fluidounces and three fluidrachms]; Acetic Ether, *twenty parts* [or two fluidounces], To make *one hundred parts* [or about nine fluidounces]. Mix the Alcohol and Acetic Ether, and gradually add the Solution of Acetate of Iron, taking care that the mixture remains cool. Keep the Tincture in glass-stoppered bottles, in a cool and dark place." *U. S.*

"Take of Solution of Persulphate of Iron *two and a half fluidounces* [Imperial measure]; Acetate of Potash *two ounces* [avoirdupois]; Rectified Spirit *a sufficiency.* Dissolve the Acetate of Potash in ten fluidounces, and add the [Solution of] Persulphate of Iron to eight fluidounces of the Spirit, then mix the two solutions in a two-pint bottle and shake them well together, repeating the agitation several times during an hour. Put the tincture, with the precipitated salt contained in it, upon a filter, and when the liquid has ceased to run through, put as much Rectified Spirit upon the filter as will make the filtered product measure one pint." *Br.*

This is a new officinal tincture. It is based upon the *Tinctura Ferri Acetici Ætherea* of the German Pharmacopœia, which is made by mixing 9 parts of solution of acetate of iron, 2 parts of alcohol, and 1 part of acetic ether. The U. S. tincture contains the excessive proportion of 20 per cent. of acetic ether, the German containing but 8 per cent. This is an objection in our opinion; the eructations occurring after its administration are to most patients very unpleasant. The proportion of solution of acetate of iron is greater in the German formula, but it is not as strong as the U. S. solution, and the two preparations, therefore, do not differ very greatly in the percentage of acetate of iron. The British tincture is weaker, and is made by mixing alcoholic solutions of ferric sulphate and potassium acetate.[*]

A double decomposition of the salts takes place, resulting in the formation of ferric acetate which dissolves in the spirit, and potassium sulphate which precipitates, being insoluble in that menstruum. By filtration, therefore, the potassium sulphate is removed, and the clear liquid constitutes the tincture under notice.

Properties. The U. S. tincture is "a clear, dark reddish brown liquid, transparent in thin layers, having the odor of acetic ether, an acidulous and astringent taste, and a slightly acid reaction. Sp. gr. about 0·950. It is miscible, in all proportions, with water, without becoming turbid. The Tincture, diluted with water, affords a brownish red precipitate with water of ammonia, and a blue one with test-solution of ferrocyanide of potassium. When mixed with sulphuric acid, and gently warmed, it evolves acetous vapors. If the iron be completely precipitated from a portion of the diluted tincture by excess of water of ammonia, the filtrate should not yield either a white or a dark colored precipitate with hydrosulphuric acid (abs. of zinc, copper). Another portion of the filtrate should not leave any fixed residue on evaporation and gentle ignition (abs. of fixed alkalies). A few drops added to freshly-prepared test-solution of ferricyanide of potassium should impart to the latter a pure greenish brown color without a trace of blue (abs. of ferrous salt). 20 Gm. of the Tincture carefully evaporated and, after addition of a few drops of nitric acid, ignited, should yield a residue weighing 1·12 Gm." *U. S.* The British tincture is a transparent liquid, of a deep red color, and strong ferruginous taste. It is said to be an agreeable chalybeate, but is subject to the very serious objection that it is unstable, commencing usually to undergo serious change[†] in from two to three weeks after its preparation. The best way of remedying this would be by having, as suggested by Messrs. Deane and Jefferson (*P. J. Tr.*, 2d ser., xi. 196), a liquor from which the tincture should be prepared as wanted, by the addition of alcohol; this plan has been adopted in the U. S. and German formulas. The dose of the officinal tincture is from twenty drops to a teaspoonful (1·25–3·75 C.c.), sufficiently diluted with water.

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[*] *Tincture of Acetate of Iron* (*Rademacher*). 1. Triturate 23 parts of pure ferrous sulphate and 24 parts of acetate of lead in a porcelain mortar until a thick magma results, then add gradually 48 parts of distilled water and 96 parts of vinegar, pour the whole into a flask, which is to be lightly closed, and digest for three days at a temperature of 30° to 40° C. (86° to 104° F.), repeatedly agitating. Filter, and let the filtrate stand for 30 days, occasionally shaking in a wide-mouthed flask only half filled and loosely covered with a plate of glass. Then add 80 parts of alcohol. Let it stand 10 days more in the same flask, and finally filter. The tincture is clear, has a reddish brown color and a spec. gr. between 0·960 and 0·970. (Wilms, *N. R.*, 1881, p. 273.)

[†] For elaborate experiments on the causes of these changes, see *P. J. Tr.*, Sept. 1874, p. 241.

TINCTURA FERRI CHLORIDI. *U. S.* *Tincture of Chloride of Iron.* [*Tincture of Ferric Chloride.*]

(TĬNC-TŪ'RA̤ FĔR'RĪ ȻHLŌ'RI̤-DĪ.)

Tinctura Ferri Perchloridi, *Br.:* Tinctura Ferri Muriatis; Tincture of Perchloride of Iron, Tincture of Muriate of Iron; Tinctura Ferri Sesquichloridi; Teinture de Perchlorure de Fer, *Fr.;* Eisenchloridtinktur, *G.*

"Solution of Chloride of Iron, *thirty-five parts* [or half a pint]; Alcohol, *sixty-five parts* [or twenty-five fluidounces], To make *one hundred parts* [or about two pints]. Mix the Solution with the Alcohol, and let it stand, in a closely covered vessel, at least three months; then transfer it to glass-stoppered bottles." *U. S.*

"Take of Strong Solution of Perchloride of Iron *five fluidounces;* Rectified Spirit *fifteen fluidounces.* Mix, and preserve in a stoppered bottle. Sp. gr. 0·992. This Tincture has about one-third the strength of Tinctura Ferri Sesquichloridi, *Dub.*" *Br.*

As directed in the U. S. Pharmacopœia of 1850, this preparation was made with the subcarbonate of iron of the Pharmacopœia, which is a hydrated sesquioxide, containing a small but uncertain proportion of ferrous carbonate. This was treated with hydrochloric acid, which caused some effervescence in consequence of the escape of the carbonic acid of the carbonate, and the result was a solution of ferric chloride with a little ferrous chloride. As the proportions of subcarbonate and of acid were so arranged in the formula as to leave a slight excess of the former, provided that the acid were duly saturated, there could of course be no excess of acid in the tincture, when completed by the addition of the alcohol. But, in consequence of the presence of a small proportion of ferrous chloride, absorption of oxygen from the air took place, and the chloride was converted into ferric chloride and ferric oxide, the latter of which, not finding any free hydrochloric acid to dissolve it, was precipitated. Hence the officinal tincture was apt to deposit a little ferric oxide, with the effect of losing somewhat of its chalybeate strength; and this was an objection to the old U. S. formula, though a slight one, as it was easily obviated, if thought advisable, by the addition of a little more of the acid. But there were other difficulties incident to the formula, which led to its frequent partial failure, not only in incompetent hands, but even with skilful pharmacists. In the first place, the hydrochloric acid could not always be obtained of the proper officinal strength (sp. gr. 1·16), and this often proved the cause of a comparatively feeble preparation. In the second place, difficulty was often experienced in effecting the solution of the subcarbonate of iron. Properly prepared, and in its recent state, it is easily dissolved in hydrochloric acid; but it is exceedingly liable to undergo changes, either in its molecular condition or in its state of hydration, which impair its solubility, or even render it partially insoluble. Incessant complaints of the imperfection of the formula were heard in consequence; and though these might not be theoretically well founded, as the formula properly executed might yield the due result, yet practically they were so, and it was certainly desirable to have a formula which should be less liable to miscarriage. Accordingly, at the 1860 revision of the U. S. Pharmacopœia, a new process was introduced, in which the objections to the old one appeared to be in great measure obviated, but which in turn was so far modified in the revision of 1870 as to be divided into two distinct processes.

The U. S. formula of 1870 appeared, in respect to the precise method of proceeding, to be copied from that of Dr. Squibb, published in *A. J. P.* (1857, p. 290).* Iron wire was chosen as the form of iron to be used, because it is generally the purest. This, which was in very slight excess, was first treated with a portion of the hydrochloric acid, which formed with it ferrous chloride, with the escape of hydrogen, producing effervescence. The action was allowed to go on spontaneously until effervescence ceased, and was then aided by heat, which caused the saturation of the acid used. The solution being filtered, the remainder of the hydrochloric acid was added, and afterwards the nitric acid gradually, the liquid having been heated to the boiling point before the latter addition. The nitric acid was decomposed, with the escape of nitrous fumes producing effervescence, while, through the influence of a portion of its oxygen and the additional portion of hydrochloric acid, the ferrous chloride was converted into ferric chloride, the conversion being completed when the effervescence ceased, and the previous green color had been changed to a reddish brown. The precise reactions by which these changes are effected have been explained elsewhere. (See *Ferri Chloridum*, page 660.) At this point, in the revision of 1870, the process was divided into two, and a new preparation, the *liquor ferri chloridi*, introduced. When this is added to the alcohol, the latter reacts gradually with the acid, producing a small proportion of an ether, which gives a peculiar flavor to the tincture, and probably modifies in some degree its influence on the system. For this reason it is preferable to keep the tincture a year before dispensing, and the officinal direction is to keep it at least three months.

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* This process of Dr. Squibb was given in a note in the eleventh edition of the U.S. Dispensatory, page 1052.

Properties. Tincture of chloride of iron is "a bright, brownish liquid of a slightly ethereal odor, a very astringent, styptic taste, and an acid reaction. Sp. gr. about 0·980. The Tincture affords a brownish red precipitate with water of ammonia, a blue one with test-solution of ferrocyanide of potassium, and a white one, insoluble in nitric acid, with test-solution of nitrate of silver. If the iron be completely precipitated from a portion of the Tincture by excess of water of ammonia, the filtrate should not yield either a white or a dark colored precipitate with hydrosulphuric acid (abs. of zinc, copper). Another portion of the filtrate should leave no fixed residue on evaporation and gentle ignition (abs. of fixed alkalies). On adding a clear crystal of ferrous sulphate to a cooled mixture of equal volumes of concentrated sulphuric acid and the moderately diluted Tincture, the crystal should not become brown, nor should there be a brownish black zone developed around it (abs. of nitric acid). A few drops added to freshly-prepared test-solution of ferricyanide of potassium should impart to the latter a pure greenish brown color without a trace of blue (abs. of ferrous salt). On diluting 8 parts of the Tincture with distilled water to 100 parts, and boiling in a test-tube, the liquid should remain clear (abs. of oxychloride). 10 Gm. of the Tincture, when completely precipitated by excess of water of ammonia, yield a precipitate which, when washed, dried, and ignited, should weigh 0·652 Gm." *U. S.* The specific gravity of the English preparation is officially stated at 0·992, and the American tincture does not vary much from this, having the sp. gr. 0·980.* The tincture is decomposed by the alkalies, alkaline earths and their carbonates, astringent vegetable infusions, and mucilage of gum arabic, which produces with it a brown semi-transparent jelly. All these substances are, therefore, incompatible with it in prescriptions.†

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* Mr. J. C. Wharton has noticed in the tincture silky asbestos-like crystals, which he believes are due to an action of the acids upon the glass in which the drug is prepared. (*A. J. P.*, xlii. 107.) Dr. Battey believes these crystals to be the sulphate of calcium. (*Ibid.*, xlii. 207.)

† *Bestuchef's tincture*, which is much used in Europe, is simply a solution of ferric chloride in a mixture of one measure of ether and three or four measures of alcohol. Fr. Mayer recommends that the ferric chloride should be prepared by passing chlorine through a solution of ferrous chloride, until a solution of the ferricyanide of potassium no longer produces a blue precipitate, and then evaporating by a water-bath. In this mode crystals of ferric chloride are obtained, one ounce of which is to be dissolved in twelve ounces of ether, mixed with four times its bulk of alcohol. The solution may be rendered colorless, if desired, by exposure to the direct rays of the sun. (*N. Y. Journ. of Pharm.*, i. 233.) This decolorization, however, is effected by a chemical change, which somewhat alters the character of the preparation. The ferric chloride becomes ferrous chloride by the loss of a portion of its chlorine, which, by abstracting hydrogen from the alcohol, becomes hydrochloric acid; and this reacts with unaltered alcohol to form hydrochloric ether.

Mr. A. Cushman recommends the following process for the above tincture. He first prepares the crystals of the sesquichloride by dissolving two ounces of iron filings in a mixture of eight fluidounces of hydrochloric acid and four of distilled water, then adding four fluidrachms of nitric acid, evaporating to a pellicle, and setting aside to crystallize. The crystals, having been washed in alcohol, and afterwards redissolved and crystallized, are to be dissolved in a mixture of two parts of alcohol and one of ether; the proportion being an ounce of the crystals to twelve fluidounces of the mixture. After solution, the liquid is to be filtered, and exposed for 48 hours to the direct rays of the sun. (*A. J. P.*, xxix. 461; from *Am. Med. Gaz.*)

Tasteless Tincture of Chloride of Iron. Mr. J. Creuse introduced this preparation. We have used the following formula for it. Solution of Chloride of Iron, U. S. P., 1 fluidounce; Citric Acid, 544 grains; Sodium Carbonate, 1000 grains or q. s.; Water, distilled, 1 fluidounce; Alcohol, q. s. Dissolve the citric acid in the distilled water, and heat to the boiling point, gradually adding the sodium carbonate until the acid is saturated. Mix this with the iron solution, which will now assume a beautiful green color, and make up the measure to 4 fluidounces with alcohol.

Medical Properties and Uses. This is one of the most active and certain preparations of iron, usually acceptable to the stomach, and much employed for the purposes to which the chalybeates generally are applied. It has been particularly commended as a tonic in scrofula, in which it was formerly often given, jointly with the solution of chloride of calcium, or chloride of barium. It is supposed to be diuretic, and to have a peculiar influence on the urinary passages. Hence it has been employed in gleet, old gonorrhœa, and leucorrhœa, and is said to be useful in dysury dependent on spasmodic stricture of the urethra, in the dose of ten drops repeated every ten minutes till some effect is experienced. In hemorrhages from the uterus, kidneys, and bladder, it is thought to act advantageously, but should be confined to those of a passive character, or employed only after sufficient depletion. Upon the recommendation of Dr. Bell, of Edinburgh, it has recently been much employed in erysipelas, with great supposed advantage, and, upon the same principle, that of improving the condition of the blood, has been used in various other diseases, as scarlatina, diphtheria, and purulent infection of the blood. Externally it is sometimes used for the destruction of venereal warts, and as a styptic in cancerous and fungous ulcers. It has been employed, with asserted success, as an injection in aneurismal tumors. (See *Ranking's Abstract*, xviii. 120.) The dose of the U. S. tincture is from ten to thirty minims (0·6–1·9 C.c.), which may be gradually increased to one or even two fluidrachms (3·75 or 7·5 C.c.) two or three times a day. In acute febrile diseases, as erysipelas, the dose should be repeated every two hours. It is given well diluted, and is very prone to injure the teeth.

Off. Prep. Mistura Ferri et Ammonii Acetatis, *U. S.*

TINCTURA GALLÆ. *U. S., Br. Tincture of Nutgall. Tincture of Galls.*

(TĬNC-TŪ′RA̤ GĂL′LÆ.)

Tinctura Gallarum, *P.G.;* Teinture de Noix de Galle, *Fr.;* Galläpfeltinktur, *G.*

"Nutgall, in No. 40 powder, *twenty parts* [or six ounces av.]; Glycerin, *ten parts* [or two and a quarter fluidounces]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Mix the Glycerin with *ninety parts* [or thirty fluidounces] of Diluted Alcohol, and, having moistened the powder with ten parts of the mixture, pack it in a conical glass percolator; then gradually pour upon it, first, the remainder of the mixture, and afterward, Diluted Alcohol, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia takes *two and a half avoirdupois ounces* of Galls, in coarse powder, and *one Imperial pint* of Proof Spirit, and proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

The tincture of galls is powerfully astringent, but is more used as a test than as a medicine. The present officinal tincture is about one-third stronger than that of U. S. P. 1870. When long kept, it ceases to evince the reactions of tannic acid, in consequence of the conversion of this into gallic acid. The dose is from one to three fluidrachms (3·75–11·25 C.c.).

TINCTURA GELSEMII. *U. S. Tincture of Gelsemium.*

(TĬNC-TŪ′RA̤ ḈE̤L-SĔM′I̤-Ī.)

"Gelsemium, in No. 60 powder, *fifteen parts* [or four and a half ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *ten parts* [or three fluidounces] of Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

This is a new officinal tincture, which will prove a valuable addition, and will be preferred to the fluid extract for internal administration, as it is safer, and can be used more satisfactorily in extemporaneous combination. The dose is from ten to twenty minims (0·6–1·25 C.c.).

TINCTURA GENTIANÆ COMPOSITA. *U. S., Br.* *Compound Tincture of Gentian.*

(TĬNC-TŪ′RA̤ G̦ĔN̦-TI̤-Ā′NÆ CO̤M-PŎȘ′I̤-TA̤—jĕn-shḙ-ā′nē.)

"Gentian, *eight parts* [or five ounces av.]; Bitter Orange Peel, *four parts* [or two and a half ounces av.]; Cardamom, *two parts* [or one and a quarter ounces av.]; Diluted Alcohol, *a sufficient quantity*. To make *one hundred parts* [or four pints]. Mix the Gentian, Orange Peel, and Cardamom, and reduce the mixture to a moderately coarse (No. 40) powder. Moisten the powder with *ten parts* [or six fluidounces] of Diluted Alcohol, and macerate for twenty-four hours; then pack it in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until *one hundred parts* [or four pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia takes *one and a half avoirdupois ounces* of Gentian Root, cut small and bruised, *three-quarters of an avoirdupois ounce* of Bitter Orange Peel, cut small and bruised, *a quarter of an avoirdupois ounce* of Cardamom Seeds, freed from the pericarps and bruised, and *one Imperial pint* of Proof Spirit, and proceeds with these ingredients in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

An improvement has been made in the process for this tincture, in directing the drugs to be mixed and powdered together: the pulverization is facilitated, and the odorous principles of the cardamom and orange peel are absorbed by the gentian.

This is an elegant bitter, much used in dyspepsia, and as an addition to tonic mixtures in debilitated states of the digestive organs, or of the system generally. There is, however, much danger of its abuse, especially in chronic cases. The dose is one or two fluidrachms (3·75 or 7·50 C.c.).

TINCTURA GUAIACI. *U. S.* *Tincture of Guaiac.*

(TĬNC-TŪ′RA̤ GUĀ′IA̤-CĪ—gwā′ya̤-sī.)

Tinctura Guajaci, *P.G.;* Teinture de Résine de Gaïac, *Fr.;* Guajaktinktur, *G.*

"Guaiac, in coarse powder, *twenty parts* [or five and a half ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Mix the powder with *eighty parts* [or a pint and a half] of Alcohol, and macerate for seven days, in a closed vessel; then filter through paper, adding, through the filter, enough Alcohol to make the Tincture weigh *one hundred parts* [or measure two pints]." *U. S.*

Although this tincture can be prepared by percolation if care and skill are used, maceration will doubtless be preferable.

This tincture is given in chronic rheumatism and gout, in the dose of from one to three fluidrachms three or four times a day. As it is decomposed by water, it is most conveniently administered in mucilage, sweetened water, or milk, by which the separated guaiac is held in temporary suspension. The following is a form of tincture of guaiac which the late Dr. Dewees found very efficient in the cure of suppression of the menses and dysmenorrhœa. "Take of the best Guaiac, in powder, *four ounces;* Carbonate of Soda or of Potassa *one drachm and a half;* Pimenta, in powder, *an ounce;* Diluted Alcohol *a pint.* Digest for a few days." Dr. Dewees directed a drachm or two of the spirit of ammonia to be added, "*pro re nata*," to four fluidounces of the tincture. (*Treatise on Diseases of Females*, 1826, page 81.) The dose is a teaspoonful (3·75 C.c.) three times a day, to be gradually increased if necessary. Within our own experience, this remedy has seemed highly useful in painful menstruation, given in the intervals of the attacks. The quantity of alkaline addition is too small to produce any other effect than to render the resin more soluble, whilst the pimenta can act only as a spice; so that the virtues of the tincture reside in the guaiac, and the officinal ammoniated tincture is probably equally effectual.

TINCTURA GUAIACI AMMONIATA. *U. S., Br.* *Ammoniated Tincture of Guaiac.*

(TĬNC-TŪ′RA̤ GUĀ′IA̤-CĪ A̤M-MŌ-NI̤-Ā′TA̤.)

Tinctura Guaiaci Composita; Teinture de Gaïac ammoniacale, *Fr.;* Ammoniakalische Guajaktinktur, *G.*

"Guaiac, in coarse powder, *twenty parts* [or five and a half ounces av.]; Aromatic Spirit of Ammonia, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Mix the powder with *eighty parts* [or a pint and a half] of Aromatic Spirit of Ammonia, and macerate for seven days, in a closed vessel; then filter through paper, adding, through the filter, Aromatic Spirit of Ammonia, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

"Take of Guaiacum Resin, in powder, *four ounces* [avoirdupois]; Aromatic Spirit of Ammonia *a sufficiency*. Macerate the Guaiacum in fifteen fluidounces [Imperial measure] of the Aromatic Spirit of Ammonia for seven days in a well-closed vessel, with occasional agitation, and filter, then add sufficient Aromatic Spirit of Ammonia to make one pint [Imp. meas.]." *Br.*

This tincture is celebrated in the treatment of chronic rheumatism, and is frequently also used in amenorrhœa. It is more stimulating, and is probably more effectual, than the preceding, on account of the presence of the alkali. It is precipitated by water, and should be administered emulsified with gum, so that the guaiac may be held in suspension. The dose is one or two fluidrachms (3·75 or 7·5 C.c.).

TINCTURA HUMULI. *U.S.* *Tincture of Hops.*

(TĬNC-TŪ'RA̤ HŪ'MŪ-LĪ.)

Tinctura Lupuli, *Br.;* Teinture de Houblon, *Fr.;* Hopfentinktur, *G.*

"Hops, well dried and in No. 20 powder, *twenty parts* [or six ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *forty parts* [or twelve fluidounces] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia takes *two and a half avoirdupois ounces* of Hops, and *one Imperial pint* of Proof Spirit, and proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

This is a tincture which might well have been omitted in the last revision of the Pharmacopœia; it has little to recommend it from either a therapeutical or a pharmaceutical point of view.

Hops are so light and bulky that, in the proportion directed, and as prepared by the U. S. process of 1850, they absorbed almost all the spirit, which, after the requisite maceration, could be separated only by strong pressure. As this absorption of the spirit obstructed its proper action on the hops, it was necessary that the mixture should be frequently stirred during the maceration. This remark is not applicable to the present U. S. process, but continues so to that of the Br. Pharmacopœia. By thoroughly drying the hops and rubbing them between the hands, or by cutting and bruising them, they may be brought to a state of division which will in a great measure obviate the disadvantages alluded to. Yet it is well known that the narcotic virtues of hops are injured by a thorough drying. As the virtues of hops depend chiefly on the lupulin, and as the quantity of this substance is different in different parcels, the tincture is necessarily unequal in strength; and the tincture of lupulin itself is preferable. (See *Tinctura Lupulinæ*.)* According to M. Ménière, tincture of hops deposits, on standing, a yellow precipitate, and a large quantity of a white crystalline substance, which he thinks may be malate of calcium.

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* *Tinctura Lupulinæ.* U.S. *Tincture of Lupulin. Teinture de Lupuline*, Fr.; *Lupulintinktur*, G. "Take of Lupulin *four troyounces;* Alcohol *a sufficient quantity*. Pack the Lupulin in a narrow cylindrical percolator, and gradually pour Alcohol upon it until two pints of tincture are obtained." *U. S.* 1870.

This is much superior to the tincture of hops of the first U. S. Pharmacopœia, in the place of which it was introduced into the second edition. In the original preparation, a certain quantity of hops was directed, from which the lupulin was to be separated by beating, and then digested in alcohol. As hops contain a variable proportion of lupulin, the tincture thus made must be of unequal strength; an objection to which the tincture of hops, even as now prepared, is in some measure liable. Besides, the amount of lupulin, contained in any quantity of hops upon which alcohol can conveniently act, is too small in proportion to the alcohol to afford a tincture of the due strength. The tincture of lupulin is, therefore, greatly preferable. The dose is one or two fluidrachms (3·75 or 7·5 C.c.). to be given in sweetened water or some mucilaginous fluid. Under the name of *Ammoniated Tincture of Lupulin*, Dr. Dyce Duckworth proposes as the best preparation a tincture made by macerating for seven days two ounces of lupulin in a pint of aromatic spirit of ammonia, and then filtering. The dose is from half a fluidrachm to a fluidrachm (1·9–3·75 C.c.). (*A. J. P.*, xli. 416.)

Tincture of hops is tonic and narcotic, and has been proposed as a substitute for laudanum when the latter disagrees with the patient; but little reliance can be placed upon it. The condition of disease to which it appears to be best adapted is the wakefulness, attended with tremors and general nervous derangement, to which habitual drunkards are liable, and which frequently precedes an attack of delirium tremens. The dose is from one to three fluidrachms (3·75–11·25 C.c.).

TINCTURA HYDRASTIS. *U.S.* *Tincture of Hydrastis.*

(TĬNC-TŪ′RẠ HȲ-DRĂS′TỊS.)

"Hydrastis, in No. 60 powder, *twenty parts* [or six ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *fifteen parts* [or four and a half fluidounces] of Diluted Alcohol, and macerate for twenty-four hours; then pack it in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

This is a new officinal tincture, which will probably prove useful in combination with other tinctures, or as an addition to extemporaneous mixtures where the fluid extract would not be so eligible. Dose, half to one fluidrachm (1·9–3·75 C.c.).

TINCTURA HYOSCYAMI. *U.S., Br.* *Tincture of Henbane. Tincture of Hyoscyamus.*

(TĬNC-TŪ′RẠ HȲ-Ọ S-CȲ′Ạ-MĪ.)

Teinture de Jusquiame, *Fr.*; Bilsenkrauttinktur, *G.*

"Hyoscyamus, recently dried and in No. 60 powder, *fifteen parts* [or five ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *fifteen parts* [or four and a half fluidounces] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia takes *two and a half avoirdupois ounces* of Hyoscyamus Leaves, in coarse powder, and *one Imperial pint* of Proof Spirit, and proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

This tincture possesses the activities of hyoscyamus.* When it purges, as it sometimes does, it may be united with a very small proportion of laudanum. The dose is a fluidrachm (3·75 C.c.). The expressed juice preserved by means of alcohol may be used for the same purposes as the tincture.

TINCTURA IGNATIÆ. *U. S.* *Tincture of Ignatia.*

(TĬNC-TŪ′RẠ ĬG-NĀ′TỊ-Æ—ĭg-nā′shẹ-ē.)

"Ignatia, in No. 60 powder, *ten parts* [or eight ounces av.]; Alcohol, Water, each, *a sufficient quantity*. Mix Alcohol and Water in the proportion of *eight parts* [or four and a half pints] of Alcohol to *one part* [or half a pint] of Water. Moisten the powder with *ten parts* [or half a pint] of the menstruum, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour menstruum upon it, until the Ignatia is exhausted. Reserve the first *ninety parts* [or four and a half pints] of the percolate, evaporate the remainder to *ten parts* [or half a pint], and mix with the reserved portion. Of this Tincture take any convenient number of parts, and, by means of a water-bath, evaporate it to dryness. Weigh the resulting extract, and from its weight calculate the quantity of extract contained in the one hundred parts of Tincture obtained, then dissolve the dried extract in the remainder of the Tincture, and add enough of the above menstruum to make the product weigh so many parts that each *one hundred parts* of Tincture shall contain *one part* of dry extract. Lastly, mix thoroughly, and filter through paper. Tincture of Ignatia thus prepared represents about *ten parts* of Ignatia in *one hundred parts*." *U. S.*

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* According to M. Donovan, the tincture, when made of leaves of only one year's growth, is inert. (*P. J. Tr.*, 1871, p. 907.)

A tincture equivalent to the officinal preparation may be made by dissolving sixty grains of dry alcoholic extract of ignatia in a mixture of fourteen fluidounces of alcohol and one and a half fluidounces of water. This tincture is used for the same purposes as tincture of nux vomica; for an explanation of the process see *Tinctura Nucis Vomicæ.* The dose is fifteen to twenty minims (0·9 to 1·25 C.c.).

TINCTURA IODI. *U.S., Br.* *Tincture of Iodine.*

(TĬN̦C-TŪ'RA̦ Ī-Ō'DĪ.)

Tinctura Iodinii, *Pharm.* 1870; Tinctura Iodi, *Br., P.G.;* Teinture d'Iodi, *Fr.;* Jodtinktur, *G.*

"Iodine, *eight parts* [or two hundred and fifty grains]; Alcohol, *ninety-two parts* [or half a pint], To make *one hundred parts* [or about half a pint]. Dissolve the Iodine in the Alcohol." *U. S.*

"Take of Iodine *half an ounce* [avoirdupois]; Iodide of Potassium *a quarter of an ounce* [avoird.]; Rectified Spirit *one pint* [Imperial measure]. Dissolve the Iodine and the Iodide of Potassium in the Spirit." *Br.*

This tincture has very nearly the strength of the tincture of Coindet, which contained one part of iodine to twelve parts of alcohol by weight; while the U. S. tincture contains one part of the former to 11·5 parts of the latter. The British tincture contains iodide of potassium, which is added to increase the solubility of the iodine, so that it shall not be precipitated when added to water; this result is only partially effected, and it was deemed best not to introduce iodide of potassium into the simple tincture of iodine of the U. S. P. 1880, and to omit the compound tincture of iodine of the U. S. P. 1870,* as it was frequently mistaken for the compound solution, and there was no necessity for having both officinal. The compound solution of iodine is retained, and is most suitable for internal administration. (See *Liquor Iodi Compositus.*) It is best to prepare the tincture in small quantities at a time; as the iodine reacts with the alcohol, especially when exposed to solar light, giving rise to chemical changes. The iodine should be thoroughly dried before being weighed out. The tincture should be kept in well-stopped bottles, in order to prevent the evaporation of the alcohol, and the consequent crystallization of the iodine.

The tincture of iodine has a deep brown color. One grain of iodine is contained in about fifteen minims or thirty drops. "6·33 Gm. of the Tincture, mixed with a solution of 2 Gm. of iodide of potassium in 25 C.c. of water and a little gelatinized starch, should require, for complete decoloration, 40 C.c. of the volumetric solution of hyposulphite of sodium." *U. S.* It is at present less used internally than it formerly was, in consequence of an impression that it is apt to irritate the stomach. Water decomposes the tincture, and, when this is swallowed, it is supposed that the iodine is precipitated upon the mucous membrane. Besides, the tincture undergoes a gradual change when kept, owing, according to Guibourt, to a reaction between the alcohol and the iodine. A portion of the latter is supposed to take hydrogen from the former, producing hydriodic acid, which dissolves another portion of the iodine to form ioduretted hydriodic acid; while the place of the hydrogen in the alcohol is supplied by iodine, giving rise to ethyl iodide and similar products. The new products are soluble in water; and consequently the tincture gradually loses by time the property of being precipitated on dilution. (*Journ. de*

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* *Tinctura Iodinii Composita.* U. S. 1870. *Compound Tincture of Iodine.* "Take of Iodine *half a troyounce;* Iodide of Potassium *a troyounce;* Alcohol *a pint.* Dissolve the Iodine and Iodide of Potassium in the Alcohol." *U. S.* 1870. U. S. tincture of 1870 was rather stronger than the British, the troyounce being heavier than the avoirdupois; while the wine pint employed in the former contains about one-fifth less than the Imperial pint employed in the latter. A much more important difference was in the much larger amount of iodide of potassium in the U. S. preparation. The British tincture contains so little of the salt that the iodine precipitates on the addition of water. The advantage of this tincture over the simple tincture above described is, that the former may be diluted with water without decomposition; so that, when it is swallowed, iodine is not precipitated upon the mucous coat of the stomach, and will not, therefore, be so likely to produce gastric irritation. This is a good theoretical recommendation; but we are by no means confident that the difference of the two preparations in irritating properties will be found very striking in practice. The compound tincture of iodine may be given internally for all the purposes which iodine is capable of answering. The dose is from fifteen to thirty drops (0·9–1·9 C.c.), to be gradually increased if necessary.

Pharm., 3e sér., x. 113.) Dr. A. Göpel found the change to be so slow when the tincture is kept in the dark and at a low temperature, that in three months a specimen thus treated had lost but one per cent. of iodine. (*Pharm. Centralb.*, No. 13, 1850.) M. Commaille, in 1859, confirmed the labors of the last-mentioned investigator. Subsequent experiments have, however, given results somewhat at variance with those of Guibourt. M. Carles has found that the tincture, after exposure in a transparent glass flask to diffuse daylight for ten months, contained only one-twelfth per cent. of hydriodic acid. He was also unable to find any of the ethyl iodide which, according to Guibourt, is formed simultaneously with the acid. (*P. J. Tr.*, 3d ser., v. 88.) On account of its liability to precipitation in the stomach, the tincture of iodine is now almost exclusively employed locally. Locally used, if undiluted, it acts as a powerful irritant to the skin, producing inflammation, desquamation of the cuticle, etc. Nevertheless, it is much used in this state in erysipelas, chilblains, and other cases of cutaneous and subcutaneous inflammation, and with happy effects. But its application requires some caution; and, in erysipelas, it is better to surround the inflamed surface with a border of the tincture, embracing a portion of both the sound and the diseased skin, so as to prevent the progress of the inflammation, than to attempt a complete cure by covering the whole surface affected. It has been found useful in rendering the variolous eruption abortive. It is most conveniently applied by means of a camel's-hair pencil. Diluted with camphorated tincture of soap, or other alcoholic liquid, it is sometimes employed as an embrocation in scrofulous tumors and other affections requiring the use of iodine. It is much used in the radical cure of hydrocele, as an injection into the sac; and a similar employment of it has been extended to other serous cavities morbidly distended with fluid, as in ovarian dropsy, ascites, and empyema; but in these latter affections it should be resorted to, if at all, with great caution. In hydrocele, M. Velpeau employed it diluted with double its volume of water. In the other cases referred to, it has been variously diluted with from three to ten times its bulk of water, or some demulcent liquid. To prevent the precipitation of the iodine, iodide of potassium is generally added in the proportion of from two scruples to a drachm to each fluidounce of the tincture. The *Tinctura Iodi Decolorata* of the German Pharmacopœia is made by digesting at a gentle heat ten parts, each, of iodine, hyposulphite of sodium, and distilled water until solution is effected, adding sixteen parts of spirit of ammonia, shaking for a few moments, then adding seventy-five parts of alcohol, and allowing the mixture to stand for three days in a cool place and filtering. This preparation, and all similar ones having this name, are calculated to mislead practitioners, for they contain no free iodine, but are variable mixtures, consisting principally of ammonium iodide; the officinal German tincture contains in addition some ethyl iodide, iodide of triethylammonium, and traces of sodium iodide and sulphate.* M. Luc has found the inhalation of the fumes from the slightly warmed tincture very useful in coryza. (*Ann. de Thérap.*, 1866, p. 236.)

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* *Tinctura Iodinii Decolorata. Colorless Tincture of Iodine.* Under this name a preparation is described by Dr. N. J. Aiken, of St. Louis, Mo., which is made by mixing equal measures of Compound Tincture of Iodine and Strong Water of Ammonia. The mixture in time becomes colorless, and, if not at the end of 24 hours, more ammonia may be added, even to the extent of one-fourth if necessary. When wanted weak, it may be diluted to any desired extent by water or glycerin. In consequence of the chemical changes which take place, it is no longer tincture of iodine, but a hydro-alcoholic solution of iodides of potassium and ammonium, with more or less ammonia and a trace of iodoform. It is recommended for external use whenever a discutient is required, and has also been used for its revulsive effects in inflammatory diseases, as pneumonia and rheumatism. It is recommended also topically in erysipelas, furuncles, sprains, bruises, and neuralgic affections. (*Am. J. Med. Sci.*, Oct. 1865, p. 398.) It is stated that on the addition of ammonia, some iodide of nitrogen is generally precipitated; and, as this is an explosive compound, some caution is necessary. The deposit, however, disappears upon the completion of the decolorization. (*A. J. P.*, July, 1869.) Dr. Chas. O. Curtman gives the following formula (*A. J. P.*, xli. 364). Take of Iodine *one ounce and a quarter;* Alcohol *thirteen fluidounces;* Strong Water of Ammonia *three fluidounces.* Dissolve the Iodine in the Alcohol, and add the Ammonia. Allow to stand for four weeks, with occasional agitation, so that the precipitate may dissolve. A rapid preparation may be made by using an excess of ammonia, and afterwards adding, cautiously, hydrochloric acid until the reaction is only feebly alkaline. Mr. Jos. L. Macmillan finds that 5·3 decigrammes of a solution of caustic soda of sp. gr. 1·07 at 15·55° C. will decolorize 3·6 grammes of the tincture (*B. P.*). (*A. J. P.*, xliii. 360.)

The dose of the tincture is from five to fifteen drops, but Lugol's solution is a much preferable preparation for the internal administration of iodine. M. Debauque, an apothecary of Mons, has ascertained that tannic acid has the property of rendering iodine soluble in water, and states that an ounce of syrup of orange-peel, in four or six ounces of water, will form a clear solution with a quantity of tincture of iodine containing five or six grains of the medicine. (*Journ. de Pharm.*, 3e sér., xx. 34.) Owing to the caustic effect of the iodine, and the coagulating action of the alcohol, where it is desired to get an absorption of iodine. as in the case of enlarged glands, a solution in glycerin or olive oil is preferable to the tincture. (See *Iodum*, page 810.)

TINCTURA IPECACUANHÆ ET OPII. *U. S. Tincture of Ipecac and Opium.*

(TĬNC-TŪ′RẠ ĬP-Ẹ-CĂC-U̇-ĂN′HÆ ĔT Ō′PỊ-Ī.)

"Deodorized Tincture of Opium, *one hundred parts* [or ten fluidounces]; Fluid Extract of Ipecac, *ten parts* [or one fluidounce]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or ten fluidounces]. Evaporate the Deodorized Tincture of Opium, on a water-bath, until it weighs *eighty-five parts* [or measures half a pint]. When it has become cold, add to it the Fluid Extract of Ipecac, filter the mixture and pass enough Diluted Alcohol through the filter to make the Tincture weigh *one hundred parts* [or measure ten fluidounces]." *U. S.*

This new officinal tincture is intended to represent Dover's powder in a liquid form. Ten minims (0·6 C.c.), the adult dose, contains the activity of one grain of powdered opium and one grain of ipecac.

TINCTURA JALAPÆ. *Br. Tincture of Jalap.*

(TĬNC-TŪ′RẠ JẠ-LĀ′PÆ.)

Teinture de Jalap, *Fr.;* Jalapentinktur, *G.*

This tincture is no longer officinal. The tincture of jalap of U. S. P. 1870 was made by percolating six troyounces of powdered jalap with a mixture of two measures of alcohol and one of water until two pints of tincture were obtained.

The British Pharmacopœia takes *two and a half avoirdupois ounces* of Jalap. in coarse powder, and *one Imperial pint* of Proof Spirit, and proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

In 1860 the alcoholic strength of the menstruum was considerably increased in the U. S. process, which was an improvement in view of the resinous character of the purgative principle of jalap. The tincture possesses the medical virtues of jalap, and is sometimes added to cathartic mixtures in the quantity of one or two fluidrachms (3·75–7·5 C.c.), to increase their activity.

TINCTURA KINO. *U. S., Br. Tincture of Kino.*

(TĬNC-TŪ′RẠ KĪ′NỌ.)

Teinture de Kino, *Fr.;* Kinotinktur, *G.*

"Kino, *ten parts* [or three hundred and sixty grains]; Glycerin, *fifteen parts* [or one fluidounce]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred parts* [or half a pint]. Mix the Glycerin with *sixty parts* [or six fluidounces] of Alcohol and *fifteen parts* [or ten fluidrachms] of Water. Rub the Kino in a mortar, adding, gradually, *thirty parts* [or three fluidounces] of this menstruum, until a smooth paste is made; transfer this to a bottle, add the remainder of the menstruum, and macerate for twenty-four hours, occasionally shaking the bottle; then filter through paper, adding, through the filter, enough of a mixture of Alcohol and Water, made in the proportion of *four parts* [or five fluidrachms] of Alcohol to *one part* [or one fluidrachm] of Water, to make the Tincture weigh *one hundred parts* [or measure half a pint]. Keep the Tincture in well-stopped bottles." *U. S.*

"Take of Kino, in coarse powder, *two ounces* [avoirdupois]; Rectified Spirit *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation, filter, and add sufficient rectified spirit to make one pint [Imp. meas.]." *Br.*

Much inconvenience is caused by the tendency of this tincture to gelatinize and gradually lose its astringency. The present officinal formula is believed to furnish a tincture free from objection; it is a slight modification of the process proposed by P. P. Fox (*A. J. P.*, June, 1877). A specimen in our possession made with the above menstruum has successfully withstood exposure for three years, retaining its original limpid condition. It is probable that different specimens of kino vary in their tendency to gelatinize. Mr. Groves states that fresh kino will not gelatinize, and Mr. Martindale that the Botany Bay kino is much more apt to do so than the East India drug. The character of the chemical reaction which takes place remains to be investigated. The air has some effect; for if this is entirely excluded the tincture keeps for a long time without undergoing the change. It should be introduced, when prepared, into very small bottles, which should be kept well corked, and only opened when wanted for use. Mr. J. D. Wood obtains a handsome preparation, which he believes to keep perfectly and not gelatinize, by using a menstruum of 2 parts of alcohol 0·835, and 1 part each of water and glycerin. L. Myers Connor gets rid of the gelatinizing property by using carbonate of magnesium in making the tincture, but it is most probable that a large part of the kino-tannic acid is removed at the same time. (*A. J. P.*, xlv. 260.) Mr. P. F. Smith, of Louisville, furnished the following formula. "Take of Kino *one ounce and a half;* Ground Logwood *half an ounce;* Diluted Alcohol *a sufficient quantity.* Moisten the Logwood with a portion of the Diluted Alcohol, and introduce it into a displacement apparatus. Dissolve the Kino by triturating with successive portions of Dil. Alcohol, and percolate the solution through the Logwood until a pint of tincture is obtained." We have used this process and have not noticed gelatinization to take place in any instance. The dose of tincture of kino is one or two fluidrachms (3·75 or 7·5 C.c.). It is used chiefly as an addition to cretaceous and other astringent mixtures in diarrhœa.

TINCTURA KRAMERIÆ. *U.S.*, *Br.* *Tincture of Krameria.*

(TĬNC-TŪ′RA KRA-MĒ′RI-Æ.)

Tinctura Ratanhæ, *P.G.;* Teinture de Ratanhia, *Fr.;* Ratanhatinktur, *G.*

"Krameria, in No. 40 powder, *twenty parts* [or six ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *twenty parts* [or six fluidounces] of Diluted Alcohol, and macerate for twenty-four hours; then pack it in a cylindrical percolator, and gradually pour Diluted Alcohol, until *one hundred parts* [or two pints] of tincture are obtained." *U. S.*

The British Pharmacopœia takes *two and a half avoirdupois ounces* of Rhatany Root, in coarse powder, and *one Imperial pint* of Proof Spirit, and proceeds as directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

According to F. Boudet, the tincture of krameria sometimes gelatinizes (*Journ. de Pharm.*, 3e sér., i. 338); and the same observation has been made by others, but we have never observed the change. The same precaution, however, should be observed, in the mode of keeping it, as is recommended for tincture of kino. This is a good preparation in cases which admit of the use of small quantities of alcohol. The dose is one or two fluidrachms (3·75 or 7·5 C.c.).

TINCTURA LARICIS. *Br.* *Tincture of Larch.*

(TĬNC-TŪ′RA LA-RĪ′CĬS.)

Teinture d'Écorce de Mélèze, *Fr.;* Lärchenrindentinktur, *G.*

"Take of Larch Bark, in coarse powder, *two and a half ounces* [avoirdupois]; Rectified Spirit *one pint* [Imperial measure]. Macerate the Larch Bark for forty-eight hours in fifteen fluidounces [Imp. meas.] of the Spirit in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of Spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquid, and add sufficient Rectified Spirit to make one pint." *Br.*

The dose of this new officinal of the British Pharmacopœia is from 20 to 30 minims (1·25–1·90 C.c.).

TINCTURA LAVANDULÆ COMPOSITA. *U.S., Br.* *Compound Tincture of Lavender.*

(TĬNC-TŪ'RẠ LẠ-VĂN'DŪ-LÆ CỌM-PŎṢ'Ị-TẠ.)

Spiritus Lavandulæ Compositus, *U. S.* 1870; Compound Spirit of Lavender; Lavender Drops; Teinture de Lavande composée, *Fr.;* Zusammengesetzte Lavendeltinktur, *G.*

"Oil of Lavender, *eight parts* [or one fluidounce]; Oil of Rosemary, *two parts* [or two fluidrachms]; Cinnamon, in coarse powder, *eighteen parts* [or two and a quarter ounces av.]; Cloves, *four parts* [or half an ounce av.]; Nutmeg, *ten parts* [or one and a quarter ounces av.]; Red Saunders, in coarse powder, *eight parts* [or one ounce av.]; Alcohol, *six hundred and eighty parts* [or six pints]; Water, *two hundred and seventy parts* [or two pints]; Diluted Alcohol, *a sufficient quantity,* To make *one thousand parts* [or eight pints]. Dissolve the Oils in the Alcohol and add the Water. Crush the Nutmeg in a mortar, mix it with the Cinnamon, Cloves, and Red Saunders, and reduce the mixture, by grinding, to a coarse (No. 20) powder. Moisten the mixture with a sufficient quantity of the alcoholic solution of the Oils, pack it firmly in a cylindrical percolator, gradually pour upon it the remainder of the alcoholic solution, and afterward Diluted Alcohol, until *one thousand parts* [or eight pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia takes *a fluidrachm and a half* of Oil of Lavender, *ten minims* of Oil of Rosemary, *one hundred and fifty grains* of Bruised Cinnamon, *the same quantity* of Bruised Nutmeg, *three hundred grains* of Red Saunders, and *two pints* (Imperial measure) of Rectified Spirit; macerates the solids in the Spirit for seven days; then expresses, filters, dissolves the Oils, and adds sufficient Rectified Spirit to make *two pints.*

This is the preparation so long known as Compound Spirit of Lavender, the title having been made to conform with that of the British Pharmacopœia.

When properly prepared, this is a delightful compound of spices. It is much employed as an adjuvant and corrigent of other medicines, and as a remedy for gastric uneasiness, nausea, flatulence, and general languor or faintness. The dose is from thirty drops to a fluidrachm (1·9–3·75 C.c.), and is most conveniently administered on a lump of sugar, or mixed with sugar and water in a wineglass.

Off. Prep. Liquor Arsenicalis, *Br.;* Liquor Potassii Arsenitis, *U. S.*

TINCTURA LIMONIS. *Br.* *Tincture of Lemon Peel.*

(TĬNC-TŪ'RẠ LỊ-MŌ'NĬS.)

Teinture de Zeste de Limon, *Fr.;* Citronenschalentinktur, *G.*

"Take of Fresh Lemon Peel, sliced thin, *two and a half ounces* [avoirdupois]; Proof Spirit *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation; strain, press, and filter; then add sufficient Proof Spirit to make one pint [Imp. meas.]." *Br.*

This tincture forms a grateful aromatic addition to tonic and purgative infusions, mixtures, etc. It may be used in the dose of one or two fluidrachms (3·75–7·5 C.c.).

TINCTURA LOBELIÆ. *U. S., Br.* *Tincture of Lobelia.*

(TĬNC-TŪ'RẠ LỌ-BĒ'LỊ-Æ.)

Teinture de Lobélie, *Fr.;* Lobeliatinktur, *G.*

"Lobelia, in No. 40 powder, *twenty parts* [or six ounces av.]; Diluted Alcohol, *a sufficient quantity,* To make *one hundred parts* [or two pints]. Moisten the powder with *twenty parts* [or six fluidounces] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia prepares this Tincture from *two and a half avoirdupois ounces* of Lobelia, in coarse powder, and *one Imperial pint* of Proof Spirit, in the same manner as Tincture of Aconite Root. (See *Tinctura Aconiti,* page 1437.)

The strength of this tincture has been increased one-third at the last revision; it possesses the emetic and narcotic properties of lobelia, and is much used in asthma, in the dose of from a half to one fluidrachm (1·9 to 3·75 C.c.), repeated every two or three hours till its effects are experienced. The emetic dose is two fluidrachms (7·5 C.c.), but it frequently acts dangerously. A saturated tincture is strongly recommended by Dr. A. Livezey as a local application in erysipelas, and the eczematous eruption of Rhus poisoning. (*Bost. Med. and Surg. Journ.*, lv. 262.)

TINCTURA LOBELIÆ ÆTHEREA. *Br.* *Ethereal Tincture of Lobelia.*

(TĬNC-TŪ′RẠ LỌ-BĒ′LỊ-Æ Æ-THĒ′RẸ-Ạ.)

"Take of Lobelia, in coarse powder, *two ounces and a half* [avoirdupois]; Spirit of Ether *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation; then strain, press, filter, and add sufficient Spirit of Ether to make one pint [Imp. meas.]." *Br.*

The stimulant operation of the ether in this preparation can scarcely favor the relaxing and nauseating action for which lobelia is usually employed. The dose is the same as that of the alcoholic tincture.

TINCTURA MATICO. *U. S.* *Tincture of Matico.*

(TĬNC-TŪ′RẠ MẠ-TÎ′CŌ—mạ-tē′kō.)

"Matico, in No. 40 powder, *ten parts* [or three ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the Matico with *ten parts* [or three fluidounces] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

This is a new officinal tincture, which cannot be as generally useful as the fluid extract, but will be preferable in some cases when used in combination with other liquids. The dose is a fluidrachm (3·9 C.c.).

TINCTURA MOSCHI. *U. S.* *Tincture of Musk.*

(TĬNC-TŪ′RẠ MŎS′ÇHĪ.)

"Musk, *ten parts* [or three hundred and forty grains]; Alcohol, *forty-five parts* [or four fluidounces]; Water, *forty-five parts* [or three and a half fluidounces]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or half a pint]. Rub the Musk in a mortar, first, with a little of the Water, until a smooth mixture is made, and then, with the remainder of the Water. Transfer the whole to a bottle, add the Alcohol, and macerate the mixture for seven days, occasionally shaking the bottle. Then filter through paper, adding, through the filter, enough Diluted Alcohol to make the Tincture weigh *one hundred parts* [or measure half a pint]." *U. S.*

This is a needed addition to the list of tinctures. Musk will yield its virtues to the above menstruum if the process is followed; if wanted for its odor it will be economy to add a minim of solution of potassa to the water, used to rub the musk into a smooth paste, in making the quantity of the alternative formula. Care should be especially taken to use pure grain musk in this preparation. The dose is from thirty minims to two fluidrachms (1·9 to 7·5 C.c.).

TINCTURA MYRRHÆ. *U. S., Br.* *Tincture of Myrrh.*

(TĬNC-TŪ′RẠ MY̆R′RHÆ—mĭr′rē.)

Teinture de Myrrhe, *Fr.;* Myrrhentinktur, *G.*

"Myrrh, in moderately coarse powder, *twenty parts* [or five and a half ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Mix the powder with *eighty parts* [or a pint and a half] of Alcohol, and macerate for seven days, in a closed vessel; then filter through paper, adding, through the filter, enough Alcohol to make the Tincture weigh *one hundred parts* [or measure two pints]." *U. S.*

The British Pharmacopœia takes *two and a half avoirdupois ounces* of Myrrh, in coarse powder, and *one Imperial pint* of Rectified Spirit, and proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

Officinal alcohol is preferable, as a solvent of myrrh, to that fluid mixed with water; because it forms a perfectly clear solution, which is not attainable with the latter menstruum. The addition of water to the tincture renders it turbid. According to E. B. Shuttleworth (*A. J. P.*, xliii. 369), the gum which is left behind in making the tincture may be utilized for making mucilage. The tincture of myrrh is scarcely ever used internally. As a local application it is employed to stimulate indolent and foul ulcers and promote the exfoliation of bones, and, diluted with water, is applied to spongy gums, aphthous sore mouth, and ulcerations of the throat. The dose, as a stimulant expectorant and emmenagogue, is from fifteen to thirty minims (0·9–1·9 C.c.).

The strength of this tincture has been considerably increased, from 5·6 gr. to 7·5 gr. in one fluidrachm, in order to bring it into the class of 20 per cent. tinctures. It is now of the same strength as the tincture of myrrh of the German Pharmacopœia.

TINCTURA NUCIS VOMICÆ. *U. S., Br.* *Tincture of Nux Vomica.*

(TĬNC-TŪ′RA NŪ′CIS VŎM′I-ÇÆ.)

Tinctura Strychni, *P.G.;* Teinture de Noix-Vomique, *Fr.;* Krähenaugentinktur, *G.*

"Nux Vomica, in No. 60 powder, *twenty parts* [or sixteen ounces av.]; Alcohol, Water, each, *a sufficient quantity.* Mix Alcohol and Water in the proportion of *eight parts* [or four and a half pints] of Alcohol to *one part* [or half a pint] of Water. Moisten the powder with *twenty parts* [or one pint] of the menstruum, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour menstruum upon it, until the Nux Vomica is exhausted. Reserve the first *ninety parts* [or four and a half pints] of the percolate, evaporate the remainder to *ten parts* [or half a pint], and mix with the reserved portion. Of this Tincture take any convenient number of parts, and, by means of a water-bath, evaporate to dryness; weigh the resulting extract, and from its weight calculate the quantity of dry extract contained in the one hundred parts of Tincture; then dissolve the dried extract in the remainder of the Tincture, and add enough of the above menstruum to make the product weigh so many parts, that each *one hundred parts* of Tincture shall contain *two parts* of dry extract. Lastly, mix thoroughly, and filter through paper. Tincture of Nux Vomica thus prepared represents about 20 parts of Nux Vomica in 100 parts." *U. S.*

The British Pharmacopœia takes *two avoirdupois ounces* of Nux Vomica, and *one Imperial pint* of Rectified Spirit, and, having softened by steam, quickly dried, and then powdered the Nux Vomica, proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

The object of the present officinal process is to secure a more reliable and definite tincture than was possible under the old process of 1870, though the present tincture is about 40 per cent. weaker theoretically. The difference practically must be far less, because of the uncertainty of thoroughly exhausting the large proportion of drug with the menstruum by the U. S. P. 1870 process. On account of the very tough structure of nux vomica, percolation is accomplished usually with varying results; the amount of extract present in the percolate is to a great extent a measure of its activity, hence, if a weighed portion of the percolate is evaporated to dryness, and the percentage of dry extract is noted, it is easy to calculate the amount present in the whole quantity. One hundred parts by weight must contain two parts of dry extract. It is probable that many pharmacists will prefer to evaporate or distil all of the alcohol from the percolate, and thus make the dry extract, keep it on hand, and then dissolve 120 grains of this extract in 14 fluidounces of alcohol and 1½ fluidounces of water when the tincture is needed. Mr. R. Rother (*A. J. P.*, Jan. 1883), after experimenting with various substances, found that chloride of sodium aided greatly in softening the bassorin-like substance in which the alkaloidal principles of nux vomica are embedded, and he proposes its use by adding it to the menstruum of diluted alcohol in the proportion of 120 grains to the pint. This process is given in the foot-note.* The alcoholic extract, or strychnine, is preferable to the tincture, when the pill form is practicable. Mr. Geo. W. Kennedy has noticed the crystallization of strychnine in the tincture, seemingly due to the formation of ammonia in it. (*A. J. P.*, xlii. 299, 392.) The dose of the tincture is twenty minims (1·25 C.c.), to be increased if necessary.

TINCTURA OPII. *U. S.*, *Br.* *Tincture of Opium. Laudanum.*

(TĬNC-TŪ'RA̤ Ō'PI̤-Ī.)

Tinctura Opii Simplex, *P.G.;* Tinctura Thebaica, Tinctura Meconii; Teinture d'Opium, Teinture thébaique, *Fr.;* Einfache Opiumtinktur, *G.*

"Powdered Opium, *ten parts* [or one ounce av.]; Water, *forty parts* [or four fluidounces]; Alcohol, *forty parts*† [or four and a half fluidounces]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or ten fluidounces]. Rub the Opium in a mortar, with the Water, previously heated to the temperature of 90° C. (194° F.), until a smooth mixture is made, and macerate for twelve hours; then add the Alcohol, mix thoroughly, and transfer the whole to a conical percolator. Return to the percolator the first portion of percolate, until it becomes clear, and, when the liquid ceases to drop, gradually pour on Diluted Alcohol, continuing the percolation until *one hundred parts* [or ten fluidounces] of Tincture are obtained." *U. S.*

"Take of Opium, in coarse powder, *one ounce and a half* [avoirdupois]; Proof Spirit *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation, then strain, press, filter, and add sufficient Proof Spirit to make one pint [Imp. meas.]. It contains the soluble matter of 33 grains of opium, nearly, in one fluidounce." *Br.*‡

The proportion of opium in these formulas is not the same, the U. S. P. tincture containing about ten grains more of opium in the fluidounce than the British. The drying and powdering of the opium is clearly a useful provision, as it insures greater uniformity in the strength of the tincture. Crude opium contains variable proportions of water; and laudanum prepared from a moist specimen will be weaker than that from an equal weight of the dried. The pulverization insures the previous drying of the drug, and is thus useful independently of the greater facility which it gives to the action of the menstruum; it is, however, often neglected. Deviation from the officinal strength in so important a preparation is certainly a great evil. There can be little doubt, we think, that the present U. S. formula insures a more complete exhaustion of the opium than the former simple procedure of maceration for six days, whilst the saving in time is apparent.

In the United States and Great Britain, this tincture is universally known by the name of *laudanum*. As this term was formerly applied to other preparations of opium, and still continues to be so on the continent of Europe, the tincture is sometimes distinguished by the epithet *liquidum*, which, however, is seldom used in this country. *Tinctura Thebaica* is another title by which the preparation is known.

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* *Rother's Tincture of Nux Vomica.* Take of Nux Vomica, in fine powder, *eight troyounces;* Sodium Chloride, *six drachms;* Alcohol, Water, of each, *one and a half pints.* Dissolve the Sodium Chloride in the Water; then add the Alcohol, and mix them. Upon 2 troyounces of the Nux Vomica, contained in a large capsule, pour 2 fluidounces of the menstruum, and mix them by means of a pestle; then gradually add the remainder of the Nux Vomica, and thorougbly mix the whole as before. Pack this mixture very firmly into a cylindrical glass percolator, and pour on the menstruum little by little until, in the course of six to eight hours, the liquid has descended to the bottom of the column. Now suspend the operation, and after twelve hours pour on more of the menstruum, and regulate the flow at the exit so that after twenty-four hours 2 pints of percolate may be obtained. To avoid a trace of turbidity, which is liable to appear in the first fluidounce of percolate when the menstruum is added too rapidly at first, 1½ drachms of the Sodium Chloride may be mixed with the Nux Vomica before packing, and the remainder dissolved as before. The finished tincture contains ¼ grain of Sodium Chloride in 15 minims.

† By an oversight, in the first imprints of the U. S. Pharmacopœia 1880 the quantity of water and alcohol was printed four instead of forty; whilst this error would not alter the strength of the finished tincture, it prevented the directions, "when the liquid ceases to drop, gradually pour on Diluted Alcohol," from being understood, because of the entire absorption of the water and alcohol in the quantities directed.

‡ *Tinctura Opii Muriatica.* Under this name is sometimes prescribed a preparation made by the following formula. Powdered Opium *one ounce;* Muriatic Acid *one fluidounce;* Distilled Water *fifteen fluidounces.* Macerate 14 days, filter, and add sufficient water to make a pint.

About two-thirds of the opium used in the preparation of the tincture are dissolved, the residue consisting chiefly of inert matter. Allowing the opium to be wholly exhausted of its active principles, one grain would be represented by very nearly 11 minims, according to the U. S. formula of 1880; in the U. S. P. 1870 one grain was represented by 12·8 minims; but a minute quantity of morphine has been detected in the residuary matter, so that the tincture is rather weaker than the proportion of opium employed would indicate. This difference, however, is insufficient to be of any practical importance. Estimating the morphine strength of opium according to the average requirements of the present U. S. Pharmacopœia, the tincture should contain six grains of morphine in every ounce. The U. S. P. of 1870 required powdered opium to contain *not less* than 10 per cent. of morphine; the better grades of opium yielded a powder which often exceeded this limit, and there is no doubt that tincture of opium made in the proportions directed by the U. S. P. 1870 (when the powdered opium was not assayed and the tincture made of a definite degree of strength) frequently exceeded the morphine strength of four grains in the ounce, owing to the general improvement in the quality of opium of late years. The adoption of a definite standard, as proposed by Dr. E. R. Squibb (*Ephemeris*, Nov. 1882), making the tincture contain six grains of morphine in a fluidounce, renders the dosage more accurate. In general practice, however, laudanum very rarely fully comes up to the officinal standard, and a large proportion of that in the market is far below it. This is especially the case with the cheap laudanums which are so extensively sold to country stores.

The tincture of opium is used for all the purposes to which opium itself is applied. (See *Opium*.) The dose, equivalent to a grain of opium, is about eleven minims (0·65 C.c.), or twenty-two drops. It should be recollected that a fluidrachm or teaspoonful of laudanum (60 minims) will yield, on an average, about 120 drops. Laudanum when long kept, with occasional exposure to the air, becomes thick from the evaporation of a portion of the alcohol, and the deposition of opium. If given in this state, it often acts with unexpected energy; and death has resulted in infants from doses which would have been entirely safe if the tincture had been clear.

Denarcotized laudanum may be prepared by substituting the denarcotized opium for the opium itself.

Off. Prep. Mistura Magnesiæ et Asafœtidæ, *U. S.;* Enema Opii, *Br.;* Linimentum Opii, *Br.*

TINCTURA OPII AMMONIATA. *Br.* *Ammoniated Tincture of Opium.*

(TĬNC-TŪ'RA̩ Ō'PI̩-Ī A̩M-MŌ-NI̩-Ā'TA̩.)

Teinture d'Opium ammoniacale, *Fr.;* Ammoniakalischeopiumtinktur, *G.*

"Take of Opium, in coarse powder, *one hundred grains;* Saffron, cut small, Benzoic Acid, of each, *one hundred and eighty grains;* Oil of Anise *one fluidrachm;* Strong Solution of Ammonia *four fluidounces* [Imperial measure]; Rectified Spirit *sixteen fluidounces* [Imp. meas.]. Macerate for seven days, in a well-closed vessel, with occasional agitation, then strain, press, filter, and add sufficient Rectified Spirit to make one pint." *Br.*

This is an old preparation of the Edinburgh Pharmacopœia, formerly used in Scotland under the name of Paregoric Elixir. It differs, however, both in composition and in strength, from the very popular preparation known by the same common name in the United States. As ammonia precipitates morphine from its solutions, it was doubted whether the tincture contained any of that alkaloid; but if the ammonia be in sufficient excess it will redissolve the morphine. At best, however, the preparation is of doubtful propriety; as, if the ammoniacal addition should not happen to have the requisite strength, or if the ammonia should escape or become carbonated by exposure, the strength of the tincture might be affected. Influenced, we presume, by considerations of this kind, the editors of the first British Pharmacopœia rejected the preparation altogether. But popular preference, although local, led to its readmission into the Br. Pharmacopœia, though in a slightly modified form; strong solution of ammonia and rectified spirit being substituted for the Edinburgh spirit of ammonia, which is not officinal in the Br. Pharmacopœia. The dose is stated at from thirty minims to a fluidrachm (1·9–3·75 C.c.).

TINCTURA OPII CAMPHORATA. *U.S.* *Camphorated Tincture of Opium.*

(TĬNC-TŪ′RA Ō′PI-Ī CĂM-PHO-RĀ′TA.)

Tinctura Camphoræ Composita, *Br.;* Compound Tincture of Camphor, Paregoric Elixir; Tinctura Opii Benzoica, *P.G.;* Elixir Paregoricum; Elixir parégorique, *Fr.;* Benzoësaure-haltige Opiumtinktur, *G.*

"Powdered Opium, *four parts* [or thirty-five grains]; Benzoic Acid *four parts* [or thirty-five grains]; Camphor, *four parts* [or thirty-five grains]; Oil of Anise, *four parts* [or half a fluidrachm]; Glycerin, *forty parts* [or five fluidrachms]; Diluted Alcohol, *a sufficient quantity*, To make *one thousand parts* [or twenty fluidounces]. Add *nine hundred parts* [or eighteen fluidounces] of Diluted Alcohol to the other ingredients contained in a suitable vessel, and macerate for seven days, frequently stirring; then filter through paper in a well-covered funnel, and pass enough Diluted Alcohol through the filter to make the product weigh *one thousand parts* [or measure twenty fluidounces]." *U. S.*

"Take of Opium, in coarse powder, Benzoic Acid, of each, *forty grains;* Camphor *thirty grains;* Oil of Anise *half a fluidrachm;* Proof Spirit one pint [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation, then filter, and add sufficient Proof Spirit to make one pint [Imperial measure]." *Br.*

This is the well-known *paregoric.* It is a very pleasant anodyne, much used to allay cough, to relieve nausea and slight pains in the stomach and bowels, to check diarrhœa, and, in infantile cases, to procure sleep. Half a fluidounce of the U.S. and British tincture contains rather less than a grain of powdered opium. The substitution of glycerin for the honey of the U. S. P. 1870 is an improvement which will aid in retaining the transparency of the filtered tincture. The proportion of camphor has been slightly increased in the last revision; it now contains half a grain more camphor in the fluidounce than the tincture of U. S. P. 1870 did. Liquorice was omitted in 1840, in consequence of giving the dark color of laudanum, and thus leading to mistake. The dose for an infant is from five to twenty drops (0·3–1·25 C.c.), for an adult from one to four fluidrachms (3·75–15 C.c.).*

Off. Prep. Mistura Glycyrrhizæ Composita, *U. S.*

TINCTURA OPII DEODORATA. *U.S.* *Deodorized Tincture of Opium.*

(TĬNC-TŪ′RA Ō′PI-Ī DE-Ō-DO-RĀ′TA.)

"Powdered Opium, *ten parts* [or four hundred and fifty grains]; Ether, *twenty*

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* The following formulas were adopted by the Philadelphia College of Pharmacy in 1833, for the preparation of the old compound tinctures of opium so much used under the names of *Bateman's drops* and *Godfrey's cordial.* So long as these nostrums are employed, it is important that they should be prepared in a uniform manner and of a certain strength, as serious consequences may happen from diversity in the formulas, when so active a substance as opium is the chief ingredient. Such diversity has existed to a very great extent; so much so that in one formula for Bateman's drops the quantity of opium was seven and a half grains to the pint, while in another it exceeded one hundred grains. It was in order to remedy this evil that the College was induced to adopt the formulas here presented.

"*Bateman's Pectoral Drops.* Take of Diluted Alcohol Cong. iv, Red Saunders, rasped, ℥ij. Digest for twenty-four hours, filter, and add of Opium, in powder, ℥ij, Catechu, in powder, ℥ij, Camphor ℥ij, Oil of Anise f℥iv. Digest for ten days." This preparation is about equal in strength to the camphorated tincture of opium or paregoric elixir of the U. S. Pharmacopœia, containing about two grains of opium to the fluidounce.

"*Godfrey's Cordial.* Take of Tincture of Opium, Oiss, Molasses (from the sugar refiners) Oxvj, Alcohol Oij, Water Oxxvj, Carbonate of Potassium ℥iiss, Oil of Sassafras f℥iv. Dissolve the Carbonate of Potassium in the Water, add the Molasses, and heat over a gentle fire till they simmer; take off the scum which rises, and add the Laudanum, Alcohol, and Oil of Sassafras, having previously mixed them well together. This preparation contains the strength of rather more than one grain of opium in a fluidounce." (*Journ. of the Phila. Coll. of Pharm.*, v. 26 and 27.) Death has been produced by it in the infant. (*P. J. Tr.*, 3d ser., i. 199.)

parts [or two and a half fluidounces]; Alcohol, *twenty parts* [or two and a quarter fluidounces]; Water, *a sufficient quantity*, To make *one hundred parts* [or about ten fluidounces]. Rub the Opium in a mortar with *forty parts* [or four fluidounces] of Water, gradually added, until thoroughly softened, and macerate for twelve hours; then express, and repeat the operation twice, using the same amount of Water each time. Mix the expressed liquids, evaporate the mixture to *ten parts* [or one fluidounce], and, when it has cooled, shake it repeatedly with the Ether in a bottle. When the ethereal solution has separated by standing, pour it off, and evaporate the remaining liquid until all traces of Ether have disappeared. Mix the residue with *fifty parts* [or five fluidounces] of Water, and filter the mixture through paper. When the liquid has ceased to pass, add enough Water, through the filter, to make the filtered liquid weigh *eighty parts* [or measure half a pint]. Lastly, add the Alcohol and mix them.." *U. S.*

This is an excellent preparation of opium, calculated to supersede various extra-officinal *elixirs* or *solutions*, which have had more or less use, based upon the real advantages they afforded, in offering liquid preparations of opium exempt from certain noxious ingredients in the crude drug and in the officinal tinctures, which rendered them so offensive to some constitutions, and in some conditions of disease, as almost to forbid their use. A liquid watery extract is first made, in which are left behind all the ingredients of opium soluble in alcohol and not in water; and this, being well shaken with ether, is further deprived of all the principles soluble in this fluid, including narcotina, and the noxious odorous matter, which is probably one of the most offensive and least useful constituents of opium. The ether is then entirely separated, and, the residue having been dissolved in water, the solution is filtered, and mixed with enough alcohol to preserve it. This tincture may be used in all cases in which laudanum is indicated, and in the same dose.

Off. Prep. Tinctura Ipecacuanhæ et Opii, *U. S.*

TINCTURA PHYSOSTIGMATIS. *U. S.* *Tincture of Physostigma.*

(TĬNC-TŪ′RẠ PHȲ-SỌ-STĬG′MẠ-TĬS.)

"Physostigma, in No. 40 powder, *ten parts* [or two and three-quarter ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *ten parts* [or three fluidounces] of Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

This new *tincture of Calabar Bean* is much weaker than that proposed by Dr. Fraser, which was nearly as strong as a fluid extract,—five minims representing three grains of drug. (See page 1099.) The dose of the officinal tincture is from twenty to forty minims (1·25–2·5 C.c.).

TINCTURA PYRETHRI. *U. S., Br.* *Tincture of Pyrethrum. Tincture of Pellitory.*

(TĬNC-TŪ′RẠ PȲ-RĒ′THRĪ.)

Teinture de Pyrèthre, *Fr.;* Bertramwurzeltinktur, *G.*

"Pyrethrum, in No. 40 powder, *twenty parts* [or five and a half ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *fifteen parts* [or five fluidounces] of Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia takes *four avoirdupois ounces* of Pellitory Root, in coarse powder, and *one Imperial pint* of Rectified Spirit, and proceeds in the manner directed for Tincture of Aconite. (See *Tinctura Aconiti*, page 1437.)

This is a new U. S. P. officinal. It is a powerful local irritant, and is an ingredient in several well-known mouth- and tooth-washes. For its uses, which are purely external, the reader is referred to the article on Pyrethrum.

TINCTURA QUASSIÆ. *U. S., Br.* *Tincture of Quassia.*

(TĬNC-TŪ'RẠ QUAS'SỊ-Æ—kwŏsh'ẹ-ē.)

Teinture de Quassie, *Fr.;* Quassiatinktur, *G.*

"Quassia, in No. 40 powder, *ten parts* [or three ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *ten parts* [or three fluidounces] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

"Take of Quassia Wood, in chips, *three-quarters of an ounce* [avoirdupois]; Proof Spirit *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation, then strain, press, filter, and add sufficient Proof Spirit to make one pint [Imp. meas.]." *Br.*

This tincture was omitted in the first British Pharmacopœia, but has been resumed in the present. The proportion of the quassia, though somewhat greater than in the old Edinburgh formula, is still much too small. In the edition of the U. S. Pharmacopœia of 1840, the proportion of the quassia to the menstruum was very judiciously doubled, and in the revision of 1880 it has been nearly doubled again, so that the present U. S. tincture is nearly three times the strength of the British preparation. A tonic tincture can scarcely contain too large a proportion of the active ingredient. The tincture may be employed as an addition to tonic infusions or mixtures in the dose of one fluidrachm (3·75 C.c.). It is a pure and intense bitter.

TINCTURA QUINIÆ. *Br.* *Tincture of Quinia.*

(TĬNC-TŪ'RẠ QUĪ'NỊ-Æ.)

"Take of Sulphate of Quinia *one hundred and sixty grains;* Tincture of Orange Peel *one pint* [Imperial measure]. Dissolve the Sulphate of Quinia in the Tincture with the aid of a gentle heat; then allow the solution to remain for three days in a closed vessel, shaking it occasionally; and afterwards filter." *Br.*

A fluidrachm (3·75 C.c.) of this preparation, containing a grain of sulphate of quinine, may be given for a tonic dose.

TINCTURA RHEI. *U. S., Br.* *Tincture of Rhubarb.*

(TĬNC-TŪ'RẠ RHĒ'Ī.)

Teinture de Rhubarbe, *Fr.;* Rhabarbertinktur, *G.*

"Rhubarb, *twelve parts* [or four ounces av.]; Cardamom, *two parts* [or two hundred and ninety grains]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Mix the Rhubarb and Cardamom, and reduce the mixture to a moderately coarse (No. 40) powder; moisten the powder with *ten parts* [or three fluidounces] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia takes of Rhubarb Root, in coarse powder, *two avoirdupois ounces;* of Cardamom Seeds, freed from their pericarps, and bruised, Coriander Fruit, bruised, and Saffron, of each, *a quarter of an avoirdupois ounce*, and *one Imperial pint* of Proof Spirit; and with these ingredients proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

The tincture of rhubarb on standing lets fall a yellow deposit. This has been shown by Mr. Jas. T. King (*A. J. P.*, xlii.) in most cases to be largely composed of chrysophanic acid. He proposed to remedy this by the use of a stronger alcohol, or, as recommended by Mr. J. B. Moore (*A. J. P.*, xlv. 306), by the substitution of glycerin for a portion of the alcohol. We have not found that either of these plans entirely prevents precipitation. Dose, one to two fluidrachms (3·75 to 7·5 C.c.).

TINCTURA RHEI AROMATICA. *U.S. Aromatic Tincture of Rhubarb.*

(TĬNC-TŪ′RẠ RHĒ′Ī ĂR-Ọ-MĂT′Ị-CẠ.)

"Rhubarb, *twenty parts* [or six and a half ounces av.]; Cinnamon, *four parts* [or one and a quarter ounces av.]; Cloves, *four parts* [or one and a quarter ounces av.]; Nutmeg, *two parts* [or two hundred and seventy-three grains]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Mix the Rhubarb, Cinnamon, Cloves, and Nutmeg, and reduce the mixture to a moderately coarse (No. 40) powder; moisten the powder with *fifteen parts* [or four fluidounces] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

This is not a new officinal preparation, although it appears for the first time in the class of tinctures; it is the tincture which was formerly used in making the aromatic syrup of rhubarb. It is preferable to separate the preparations, as it is occasionally desirable to prescribe the tincture without the admixture with syrup, whilst the pharmacist will always prefer to make the tincture in quantity, and keep it on hand, since it is permanent, and add it to syrup, to make the aromatic syrup, when needed. The dose is for an adult from a half to one fluidrachm (1·9–3·75 C.c).

Off. Prep. Syrupus Rhei Aromaticus, *U. S.*

TINCTURA RHEI DULCIS. *U.S. Sweet Tincture of Rhubarb.*

(TĬNC-TŪ′RẠ RHĒ′Ī DŬL′CỊS.)

"Rhubarb, *eight parts* [or two and a half ounces av.]; Glycyrrhiza, *four parts* [or one and a quarter ounces av.]; Anise, *four parts* [or one and a quarter ounces av.]; Cardamom, *one part* [or one hundred and forty grains]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Mix the Rhubarb, Glycyrrhiza, Anise, and Cardamom, and reduce the mixture to a moderately coarse (No. 40) powder; moisten the powder with *fifteen parts* [or four fluidounces] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

This is a new officinal tincture, which has been frequently used in Philadelphia and other sections of our country; it is preferable to the simple tincture for administration to children on account of its more agreeable taste. The dose is two to three fluidrachms (7·5–11·25 C.c.).

TINCTURA SABINÆ. *Br. Tincture of Savin.*

(TĬNC-TŪ′RẠ SẠ-BĪ′NÆ.)

Teinture de Sabine, *Fr.;* Sadebaumtinktur, *G.*

The British Pharmacopœia directs this Tincture to be prepared from *two and a half avoirdupois ounces* of Savin Tops, dried and coarsely powdered, and *one Imperial pint* of Proof Spirit, in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

This was introduced in the British Pharmacopœia in 1867. The dose is from twenty minims to a fluidrachm (1·25–3·75 C.c.).

TINCTURA SANGUINARIÆ. *U.S. Tincture of Sanguinaria. Tincture of Bloodroot.*

(TĬNC-TŪ′RẠ SĂN-GUỊ-NĀ′RỊ-Æ.)

Teinture de Sanguinaire, *Fr.;* Blutwurzeltinktur, *G.*

"Sanguinaria, in No. 60 powder, *fifteen parts* [or four and a half ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Mix Alcohol and Water in the proportion of *two parts* [or twenty-five fluidounces] of Alcohol to *one part* [or eleven fluidounces] of Water. Moisten the powder with *ten parts* [or two fluidounces] of the mixture, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour menstruum upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

This will prove emetic in the dose of three or four fluidrachms (11·25–15 C.c.); but it is rather intended to act as an expectorant, or an alterative, for which purpose from thirty to sixty drops (1·9–3·75 C.c.) may be given.

TINCTURA SAPONIS VIRIDIS. *U. S.* *Tincture of Green Soap.*

(TĬNC-TŪ′RA̤ SA̤-PŌ′NĬS VĬR′I̤-DĬS.)

"Green Soap, *sixty-five parts* [or ten ounces av.]; Oil of Lavender, *two parts* [or three fluidrachms]; Alcohol, *a sufficient quantity*, To make *one hundred parts* [or fifteen fluidounces]. Mix the Soap and Oil of Lavender with *thirty-three parts* [or six fluidounces] of Alcohol, and macerate the mixture until the Soap is dissolved; then filter through paper, adding Alcohol, through the filter, until *one hundred parts* [or fifteen fluidounces] of Tincture are obtained." *U. S.*

This is a new officinal tincture. It was first proposed by Prof. Hebra, and has been largely used by dermatologists.

TINCTURA SCILLÆ. *U. S., Br.* *Tincture of Squill.*

(TĬNC-TŪ′RA̤ SCĬL′LÆ—sĭl′lē.)

Teinture de Scille, *Fr.;* Meerzwiebeltinktur, *G.*

"Squill, in No. 30 powder, *fifteen parts* [or five ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *twenty parts* [or six fluidounces] of Diluted Alcohol, and macerate for twenty-four hours; then pack it moderately in a conical percolator, and gradually pour Diluted Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia directs this Tincture to be prepared from *two and a half avoirdupois ounces* of bruised Squill, and *one Imperial pint* of Proof Spirit, in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

This tincture yields a grayish, rose-colored, very bitter and acrid deposit, consisting of silky tufts (*Ménière*), possesses all the virtues of squill, and may be given for the same purposes, whenever the spirituous menstruum is not objectionable. The dose as an expectorant or diuretic is from ten to twenty minims (0·6–1·25 C.c.) (twenty to forty drops), and the latter quantity frequently nauseates.

TINCTURA SENEGÆ. *Br.* *Tincture of Senega.*

(TĬNC-TŪ′RA̤ SĔN′E̤-GÆ.)

Teinture de Polygala de Virginie, *Fr.;* Senegatinktur, *G.*

The British Pharmacopœia prepares this Tincture from *two and a half avoirdupois ounces* of Senega Root, in coarse powder, and *one Imperial pint* of Proof Spirit, in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

The tincture of senega was introduced into the British Pharmacopœia of 1864. It is no doubt an efficient preparation, but is hardly needed while recourse can be had to the fluid extract or syrup. The dose is from thirty minims to two fluidrachms (1·9–7·5 C.c.).

TINCTURA SENNÆ. *Br.* *Tincture of Senna.* *Compound Tincture of Senna.*

(TĬNC-TŪ′RA̤ SĔN′NÆ.)

Tinctura Sennæ Composita; Elixir Salutis; Teinture de Séné aromatique, Elixir de Salut, *Fr.;* Sennatinktur, *G.*

"Take of Senna, broken small, *two and a half ounces* [avoirdupois]; Raisins, freed from seeds, *two ounces* [avoird.]; Caraway Fruit, bruised, Coriander Fruit, bruised, of each, *half an ounce* [avoird.]; Proof Spirit *one pint* [Imperial measure]."

With these ingredients the British Pharmacopœia prepares the tincture in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

This tincture is the *elixir salutis* of the old Pharmacopœias. It is a warm cordial purgative, useful in costiveness attended with flatulence, and in atonic gout, especially when occurring in intemperate persons. It is also added to cathartic infusions and mixtures. The dose is from two fluidrachms to a fluidounce (7·5–30 C.c.) or more. Tincture of senna gives a yellow deposit, disposed in plates, containing starch and white crystals of calcareous salts. (*Ménière.*)

Off. Prep. Mistura Sennæ Composita, *Br.*

TINCTURA SERPENTARIÆ. *U. S., Br.* *Tincture of Serpentaria. Tincture of Virginia Snakeroot.*

(TĬNC-TŪ′RA SĔR-PEN-TĀ′RI-Æ.)

Teinture de Serpentaire, *Fr.;* Schlangenwurzeltinktur, *G.*

"Serpentaria, in No. 40 powder, *ten parts* [or three ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *ten parts* [or three fluidounces] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia takes *two and a half avoirdupois ounces* of Serpentary Root, in coarse powder, and *one Imperial pint* of Proof Spirit, and prepares the Tincture like Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

This tincture, the strength of which was injudiciously decreased one-third at the late U. S. revision, possesses in some degree the properties of the root, but is now little other than an alcoholic stimulant, which may be added to tonic infusions in low states of the system. The dose is one to four fluidrachms (3·75 to 15 C.c.).

TINCTURA STRAMONII. *U. S., Br.* *Tincture of Stramonium.*

(TĬNC-TŪ′RA STRA-MŌ′NI-Ī.)

Teinture de Semences de Stramoine, *Fr.;* Stechapfelsamentinktur, *G.*

"Stramonium Seed, in No. 40 powder, *ten parts* [or three ounces av.]; Diluted Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *ten parts* [or three fluidounces] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia takes *two and a half avoirdupois ounces* of bruised Stramonium Seeds, and *one Imperial pint* of Proof Spirit, and prepares the tincture as directed for the Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

This tincture, which is one-third weaker than that of U. S. P. 1870, may be used for all the purposes for which stramonium is given, in the dose of from twenty to thirty minims (1·25–1·9 C.c.), repeated twice or thrice a day, and gradually increased till it affects the system.

TINCTURA SUMBUL. *U. S., Br.* *Tincture of Sumbul.*

(TĬNC-TŪ′RA SŬM′BŬL.)

Teinture de Sumbul, *Fr.;* Moschuswurzeltinktur, *G.*

"Sumbul, in No. 30 powder, *ten parts* [or two and three-quarter ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *ten parts* [or two and a half fluidounces] of Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia directs this Tincture to be prepared from *two and a half avoirdupois ounces* of Sumbul Root, in coarse powder, and *an Imperial pint* of

Proof Spirit, in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

This is a new officinal, very little if at all employed in this country. An account of its medical properties will be found under Sumbul. The dose is from twenty minims to a fluidrachm (1·2–3·7 C.c.).

TINCTURA TOLUTANA. *U.S., Br.* *Tincture of Tolu.*

(TĬNC-TŪ′RA̤ TŌ-LŪ-TĀ′NA̤.)

Teinture de Baume de Tolu, *Fr.;* Tolubalsamtinktur, *G.*

"Balsam of Tolu, *ten parts* [or three ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Add the Balsam of Tolu to *ninety parts* [or thirty fluidounces] of Alcohol, and macerate until dissolved; then filter through paper, adding, through the filter, enough Alcohol to make the Tincture weigh *one hundred parts* [or measure two pints]." *U. S.*

"Take of Balsam of Tolu *two ounces and a half* [avoirdupois]; Rectified Spirit *a sufficiency*. Macerate the Balsam of Tolu in fifteen fluidounces of the Spirit, in a closed vessel, with occasional agitation, for six hours, or until the Balsam is dissolved, then filter, and add sufficient Rectified Spirit to make one pint [Imperial measure]." *Br.*

The tincture of tolu has the properties of the balsam, and may be employed as an addition to expectorant mixtures in chronic catarrhal affections; but the proportion of alcohol is too large to allow of its advantageous use in some cases. The dose is one or two fluidrachms (3·75 or 7·5 C.c.). In smaller quantities it is often employed to flavor cough mixtures. It is decomposed by water.

Off. Prep. Syrupus Tolutanus, *U. S.;* Trochisci Acidi Tannici, *Br.;* Trochisci Morphiæ, *Br.;* Trochisci Morphiæ et Ipecacuanhæ, *Br.;* Trochisci Opii, *Br.*

TINCTURA VALERIANÆ. *U. S., Br.* *Tincture of Valerian.*

(TĬNC-TŪ′RA̤ VA̤-LĒ-RI̤-Ā′NÆ.)

Teinture de Valériane, *Fr.;* Baldriantinktur, *G.*

"Valerian, in No. 60 powder, *twenty parts* [or six ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Mix Alcohol and Water in the proportion of *two parts* [or twenty-five fluidounces] of Alcohol to *one part* [or eleven fluidounces] of Water. Moisten the powder with *fifteen parts* [or five fluidounces] of the mixture, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour menstruum upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia takes *two and a half avoirdupois ounces* of Valerian Root, in coarse powder, and *one Imperial pint* of Proof Spirit, and proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

The proportion of alcohol has been increased in U. S. tincture to prevent precipitation; the menstruum is now two parts of alcohol to one part of water, where formerly diluted alcohol was used; the proportion of valerian has been increased one-third.

This tincture possesses the properties of valerian, but cannot be given in some cases, so as to produce the full effects of the root, without stimulating too highly, in consequence of the large proportion of spirit. The dose is from one to four fluidrachms (3·75–15 C.c.). It deposits on standing a black, very cohesive precipitate, with starch, and a yellow extractive matter. (*Ménière.*)

TINCTURA VALERIANÆ AMMONIATA. *U. S., Br.* *Ammoniated Tincture of Valerian.*

(TĬNC-TŪ′RA̤ VA̤-LĒ-RI̤-Ā′NÆ A̤M-MŌ-NI̤-Ā′TA̤.)

Tinctura Valerianæ Composita; Teinture de Valériane ammoniacale, *Fr.;* Ammoniakalische Baldriantinktur, *G.*

"Valerian, in No. 60 powder, *twenty parts* [or six ounces av.]; Aromatic Spirit of Ammonia, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *twenty parts* [or six fluidounces] of Aromatic Spirit of Ammonia, and macerate for twenty-four hours, in a closed vessel; then pack it firmly in a cylindrical glass percolator, and gradually pour Aromatic Spirit of Ammonia upon it until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

"Take of Valerian Root, in coarse powder, *two ounces and a half* [avoirdupois]; Aromatic Spirit of Ammonia *one pint* [Imperial measure]. Macerate for seven days, in a well-closed vessel, with occasional agitation, then strain, press, filter, and add sufficient Aromatic Spirit of Ammonia to make one pint [Imp. meas.]." *Br.*

The ammonia in this preparation is thought to assist the solvent powers of the alcohol, while it co-operates with the valerian in medical action. The quantity of valerian was very judiciously increased one-third in the U. S. revision of 1880. The tincture is employed as an antispasmodic in hysteria and other nervous affections. The dose is from thirty minims to a fluidrachm (1·9–3·75 C.c.), and should be given in sweetened water, milk, or some mucilaginous fluid.

TINCTURA VANILLÆ. *U. S.* *Tincture of Vanilla.*

(TĬNC-TŪ'RA̤ VA̤-NĬL'LÆ.)

"Vanilla, cut into small pieces and bruised, *ten parts* [or three ounces av.]; Sugar, in coarse powder, *twenty parts* [or six ounces av.]; Alcohol, Water, each, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Mix Alcohol and Water in the proportion of *two parts* [or twenty-five fluidounces] of Alcohol to *one part* [or eleven fluidounces] of Water, macerate the Vanilla in *fifty parts* [or one pint] of this mixture for twelve hours, then drain off the liquid and set it aside. Transfer the Vanilla to a mortar, beat it with the Sugar into a uniform powder, then pack it in a percolator, and pour upon it the reserved liquid; when this has disappeared from the surface, gradually pour on menstruum, and continue the percolation, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

This is a new officinal tincture, which will be easily recognized as the so-called *fluid extract of vanilla.* The object of the preliminary maceration of the cut vanilla is to soften it, so that it may be easily disintegrated when beaten up with the sugar; if the details of the above process be carefully carried out and the alcohol be pure, a very satisfactory preparation will result. It is used as a flavoring agent and to make vanilla syrup, by adding one ounce of the tincture to sufficient syrup to make one pint.

TINCTURA VERATRI VIRIDIS. *U. S., Br.* *Tincture of Veratrum Viride. Tincture of Green Hellebore.*

(TĬNC-TŪ'RA̤ VE̤-RĀ'TRĪ VĬR'I̤-DĬS.)

Tincture of American Hellebore.

"Veratrum Viride, in No. 60 powder, *fifty parts* [or fourteen ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *fifteen parts* [or five fluidounces] of Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Alcohol upon it until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia takes of Green Hellebore Root, in coarse powder, *four ounces* (avoirdupois), and of Rectified Spirit *one pint* (Imperial measure), and prepares the Tincture in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

The U. S. tincture of American hellebore of 1870 was of the same strength as Dr. Norwood's tincture, which, when prepared by its author, was supposed to be saturated. This may be true of certain ingredients of the root, though probably not in reference to the active principle or principles which it may contain. The present tincture is one-tenth weaker, and in our opinion should have been dropped at the last revision, the fluid extract being officinal; there is no necessity of having two strong liquid preparations of veratrum viride in the Pharmacopœia. The commencing dose should not exceed from three to eight minims (0·18–0·5 C.c.). The British tincture is much weaker: the proportion of the root to the menstruum being, in the American tincture about as one to two, in the British about as one to five.

TINCTURA ZINGIBERIS. *U. S., Br.* *Tincture of Ginger.*

(TĬNC-TŪ′RẠ ZỊN-ḈĬB′Ẹ-RĬS.)

Teinture de Gingembre, *Fr.;* Ingwertinktur, *G.*

"Ginger, in No. 40 powder, *twenty parts* [or five and a half ounces av.]; Alcohol, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the Ginger with *five parts* [or one and a half fluidounces] of Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Alcohol upon it, until *one hundred parts* [or two pints] of Tincture are obtained." *U. S.*

The British Pharmacopœia prepares this Tincture from *two and a half avoirdupois ounces* of Ginger, in coarse powder, and *one Imperial pint* of Rectified Spirit, in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1437.)

The strength of this tincture has been reduced one-third to bring it into the 20 per cent. class; this is not a disadvantage, however, in view of the introduction of the fluid extract, and the dose is not now inconveniently large.

The tincture of the British Pharmacopœia, though more than twice as strong as was that of the London and Edinburgh Colleges, is still too weak in the proportion of ginger. In consequence of the mucilaginous matter contained in ginger, the tincture made with diluted alcohol or proof spirit is apt to be turbid. Alcohol or rectified spirit is, therefore, properly preferred. Officinal Jamaica ginger only should be used; for, whilst a darker colored preparation is made when the inferior varieties are substituted, the apparent increase in strength is due to coloring matter and not to the presence of a larger amount of volatile oil or resin.

The tincture of ginger is a useful carminative, and may often be beneficially added to tonic and purgative infusions or mixtures, in debilitated states of the alimentary canal. The dose is from eight to forty minims (0·5–2·5 C.c.). It is in this country largely used for the preparation of a syrup of ginger, for which purpose, however, the fluid extract is officinal, and is better even than the strong tincture of the U. S. Pharmacopœia.

Off. Prep. Trochisci Zingiberis, *U. S.*

TINCTURA ZINGIBERIS FORTIOR. *Br.* *Strong Tincture of Ginger.* *Essence of Ginger.*

(TĬNC-TŪ′RẠ ZỊN-ḈĬB′Ẹ-RĬS FÖR′TỊ-ỌR.)

"Take of Ginger, in fine powder, *ten ounces* [avoirdupois]; Rectified Spirit *a sufficiency.* Pack the Ginger tightly in a percolator, and pour over it carefully *half a pint* [Imperial measure] of the Spirit. At the expiration of two hours add more Spirit, and let it percolate slowly until one pint [Imp. meas.] has been collected." *Br.*

This is a new officinal of the Br. Pharmacopœia. The strengths of the three tinctures, the English, the American, and the strong English, are respectively 1 to 8, 1 to 6, 1 to 2. The dose is from five to twenty minims (0·3–1·25 C.c.). It is, however, chiefly used in the preparation of the Syrup.

Off. Prep. Syrupus Zingiberis, *Br.*

TRAGACANTHA. *U. S., Br.* *Tragacanth.*

(TRĂG-Ạ-CĂN′THẠ.)

"A gummy exudation from Astragalus gummifer, Labillardière, and from other species of Astragalus. (*Nat. Ord.* Leguminosæ, Papilionaceæ.)" *U. S.* "A gummy exudation from the stems of Astragalus verus, Olivier, *Voy.* D. C.; Nees, *Plant. Med.*, plate 239; and possibly other species. Collected in Asia Minor." *Br.*

Gummi Tragacantha; Gomme Adraganthe, *Fr.;* Tragant, Traganth, *G.;* Dragante, *It.;* Gomo Tragacanto, *Sp.*

Gen. Ch. *Legume* two-celled, more or less gibbous, with the lower suture turned inwards. *Carina* blunt. *Loudon's Encyc. of Plants.*

Numerous species belonging to this genus yield a gummy matter having the properties of tragacanth. The drug known in commerce by that name was at first erroneously supposed to be obtained from *A. tragacantha* of Linnæus (*A. Massiliensis* of Lamarck), which grows in the south of Europe and north of Africa, and is now said to yield no gum. It was afterwards ascribed, on the authority of Tournefort, to a species (*A. Creticus* of Lamarck) which grows in Crete and Ionia, and on that of Olivier, to *A. verus*, which inhabits Asia Minor, Armenia, and Northern Persia. Labillardière described a species by the name of *A. gummifer*, which he found growing on Mount Libanus in Syria, and from which tragacanth exudes, though not that of commerce. Sieber denies that any one of these species yields the officinal tragacanth, which he ascribes to *A. aristatus*, growing in Anatolia, especially upon Mount Ida, where the gum is most abundantly collected. This plant, however, is not the *A. aristatus* of Villars, which, according to Sibthorp, furnishes tragacanth in Greece. (*Merat and De Lens.*) Professor Lindley received two specimens of plants, said to be those which furnish tragacanth in Turkestan, one of which proved to be *A. gummifer* of Labillardière, which was said to yield a white variety, and the other a new species, which he called *A. strobiliferus*, and which was said to yield a red and inferior product. The fact seems to be, that the commercial drug is collected from various sources; and it is affirmed that all the species of Astragalus with thorny petioles are capable of producing it. These form a natural group, and so closely resemble one another that botanists have found some difficulty in distinguishing them. They are very abundant on the mountains of Asia Minor, and, according to information received by M. J. Léon Soubeiran from M. Balansa, a scientific traveller who derived his knowledge from personal observation, the gum-producing species are closely analogous to the *A. Creticus* of Lamarck. It is in the chain of Anti-Taurus that the gum is chiefly collected. Transverse incisions are made, near the base of the stem, into the medullary part, which alone yields juice. This exudes very slowly, flowing at night, and ceasing during the day; and two weeks usually elapse before the pieces are large enough for collection. The shape of the pieces is influenced by the rapidity of the exudation, and the lines on their surface indicate the daily concretion. (*Journ. de Pharm.*, Feb. 1856, p. 117, and Feb. 1857, p. 149.)*

Properties. Tragacanth is either in flaky, leaf-like pieces, irregularly oblong or roundish, or in tortuous vermicular filaments, rounded or flattened, rolled up or extended, of a whitish, yellowish white, or slightly reddish color, marked by parallel lines or ridges, somewhat translucent, and resembling horn in appearance. It is hard and more or less fragile, but difficult of pulverization, unless exposed to a freezing temperature, or thoroughly dried, and powdered in a heated mortar. Tragacanth has no smell, and very little taste. Its sp. gr. is 1·384. Introduced into water, it absorbs a certain proportion of that liquid, swells very much, and forms a soft adhesive paste, but does not dissolve. If agitated with an additional quantity of water, this paste forms a uniform mixture; but in the course of one or two days the greater part separates, and is deposited, leaving a portion dissolved in the supernatant fluid. The gelatinous mass is tinged blue by test-solution of iodine, and the fluid portion is not precipitated on the addition of alcohol. Tragacanth is wholly insoluble in alcohol. It appears to be composed of two different constituents, one soluble in water and resembling gum arabic, the other swelling in water, but not dissolving. The former is said to differ from gum arabic in affording no precipitate with silicate of potassium or ferric chloride. The latter, which, according to Bucholz, constitutes 43 per cent. of tragacanth, is ranked by some among the peculiar proximate principles, with the title of *tragacanthin*. It is probably identical with *bassorin*.† It has the property of becoming blue with iodine, which is not the case with bassorin; but this property is ascribed to the presence of a small quantity of insoluble starch. According to M. Guérin, 100 parts of tragacanth contain 53·3 parts of arabin or pure gum, 33·1 of bassorin and insoluble starch, and 11·1 of water, and yield when burned 2·5 parts of ashes. To separate the soluble from the insoluble part, requires agitation, with separate portions of water; the solutions are to be decanted and filtered, and the process is to be continued till water ceases to dissolve anything. According to Giraud (*Archiv. de Pharm.*, Dec. 1877; *A. J. P.*, 1878, p. 127), tragacanth does not contain arabin, but the principal constituent is a pectinous principle, which is apparently identical with Frémy's pectose, and has the following average composition: 60 parts of pectinous principle, 8 to 10 parts of soluble gum, 3 of cellulose, 2 or 3 of starch, 3 of mineral constituents, and 20 of water. Examined by Dr. Kützing, by means of the microscope, tragacanth was found to consist of organized cells. (See *A. J. P.*, xxv. 37.) In conformity with this statement is the remarkable fact, discovered by Hugo von Mohl, and confirmed by Wigand, that tragacanth is not a secretion of the plant, but the result of the transformation of the cells of the pith, and those of the medullary rays which traverse the ligneous part of the stem and older branches. (*Ibid.*, xxxi. 243.)

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* In California, poisoning of domestic animals by a species of Astragalus is asserted to occur; but in a series of careful experiments in the laboratories of the medical department of the University of Pennsylvania it was determined that specimens of the so-called "loco plants," sent from infected districts, belonging to the genus Astragalus, although the species could not be determined, were not toxic; the symptoms described may possibly be due to indigestion, but it is probable that some plant other than an Astragalus is the cause. (See article on *Loco Plants* in Part II.)

† *Bassorin* is insoluble in water, alcohol, and ether, but softens and swells up in hot or cold water. Diluted nitric and hydrochloric acids, with the aid of heat, dissolve it almost entirely. The acidulous solution, concentrated by evaporation, and treated with alcohol, lets fall a flocculent precipitate which has all the characters of pure gum, into which the bassorin appears to have been converted by the action of the acid. This does not, however, constitute more than a tenth part of the bassorin dissolved. By gradually evaporating the alcoholic acidulous solution, a thick, bitterish liquid is obtained, which exhales a strong odor of ammonia when treated with potassa. Strong nitric acid converts bassorin into mucic and oxalic acids; and, treated with sulphuric acid, it yields a

It is stated by Mr. S. H. Maltass that tragacanth is adulterated, in the Levant, with worthless gums brought from Armenia and Caramania, which, as they are originally of a dark color, and destitute of the flaky form of the genuine gum, are broken into small fragments, and whitened by means of carbonate of lead, before being mixed with the tragacanth. Mr. Hanbury states, in confirmation of this, that he has detected lead in the *small tragacanth* imported into London. (*P. J. Tr.*, xv. 20.)

Medical Properties and Uses. Tragacanth is demulcent, but, on account of its difficult solubility, is not often given internally. The great viscidity which it imparts to water renders it useful for the suspension of heavy insoluble powders; and it is also employed in pharmacy to impart consistence to troches, for which it answers better than gum arabic.

Off. Prep. Confectio Opii, *Br.;* Mucilago Tragacanthæ; Pulvis Opii Compositus, *Br.;* Pulvis Tragacanthæ Compositus, *Br.;* Trochisci Acidi Tannici, *U. S.;* Trochisci Ipecacuanhæ, *U. S.;* Trochisci Potassii Chloratis, *U. S.;* Trochisci Santonici, *U. S.;* Trochisci Zingiberis, *U. S.*

TRITICUM. *U.S.* *Triticum.* [*Couch-grass.*]

(TRĬT'Ị-CỤM.)

"The rhizome of Triticum repens, Linné (*Nat. Ord.* Graminaceæ), gathered in the spring and deprived of the rootlets." *U. S.*

. Rhizoma Graminis, *P.G.;* Radix Graminis, Couch-grass, Quick-grass, Quitch, Dog-grass; Chiendent, Petit Chiendent, *Fr.;* Queckenwurzel, Grasswurzel, *G.*

Gen. Ch. Spikelets three, several flowered, single at each joint, and placed with the side against the rhachis. *Glumes* transverse (*i.e.*, right and left), nearly equal and opposite, herbaceous, nerved. *Lower palea* very like the glumes, convex on the back, pointed or awned from the tip; the upper flattened, bristly ciliate on the nerves, free or adherent to the groove of the grain. *Stamens* three. *Gray's Manual.*

The genus Triticum is naturally divided into two groups,—one composed of annual plants, of which wheat is the type, and the other of perennials, led by the officinal species.

T. repens. L. This grass, originally a native of Europe, now abounds in meadows and cultivated grounds in the Northern United States, where it is often very troublesome as a weed. It is specifically characterized by its creeping rootstock,

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sweet crystalline substance which is incapable of the vinous fermentation. (*Guérin.*) Vauquelin was the first to call attention to this principle, upon which he conferred its present name, from having first observed it in the Bassora gum. Bucholz afterwards discovered the same or a closely analogous principle in tragacanth; and John, a principle which was supposed to be the same, in the gum of the cherry-tree. Hence it has sometimes been called *tragacanthin* and *cerasin.* M. Guérin, however, has demonstrated that the insoluble principle of the cherry gum is essentially different from bassorin. Berzelius considered the latter as belonging to the class of substances which he associated under the name of mucilage, and of which the mucilages of flaxseed and quince seed are examples. (See *Linum.*)

by its awns being absent or not more than half the length of the flower, and by its rough flat leaves.

Properties. Couch-grass is officinally described as follows. "Very long, but, as met with in the shops, cut into sections about two-fifths of an inch (1 c.m.) long, and about one-twelfth of an inch (2 mm.) thick; creeping, smooth, hollow in the centre, straw-yellow, inodorous, and of a sweet taste." *U. S.*

Medical Properties. Triticum is never exhibited for the purpose of affecting the general system, but for its influence upon the genito-urinary organs. It is very much used by some surgeons in irritable bladder, and also in cystitis. It is one of the least stimulant of the remedies of its class, and may be employed very freely. In Europe its decoction is said to be used to a considerable extent as a diluent and slightly nutritious drink. It may be taken *ad libitum*, or the fluid extract may be given in doses of a fluidrachm (3·75 C.c.) taken every 3 hours in five or six ounces of water.

Off. Prep. Extractum Tritici Fluidum, *U. S.*

TRITURATIONES. *U. S.* *Triturations.*

(TRĬT-Ū-RĀ-TỊ-Ō′NĒṢ—trĭt-yụ-rā-shẹ-ō′nēz.)

"Triturations are to be prepared by the following formula: Take of the Substance, *ten parts;* Sugar of Milk, in moderately fine powder, *ninety parts*, To make *one hundred parts.* Weigh the Substance and Sugar of Milk, separately; then place the Substance, previously reduced, if necessary, to a moderately fine powder, into a mortar; add about an equal bulk of Sugar of Milk, mix well by means of a spatula and triturate them thoroughly together. Add fresh portions of the Sugar of Milk, from time to time, until the whole is added, and continue the trituration until the Substance is intimately mixed with the Sugar of Milk and finely comminuted." *U. S.*

This general formula has been introduced into the Pharmacopœia in order that a definite and uniform method be authorized of making a class of powders which has come into use in various sections of our country. Whilst the necessity of giving recognition to the class may be questioned by many, the importance of securing uniformity in composition is apparent.

TRITURATIO ELATERINI. *U. S.* *Trituration of Elaterin.*

(TRĬT-Ū-RĀ′TỊ-Ō ĔL-Ạ-TẸ-RĪ′NĪ.)

"Elaterin, *ten parts;* Sugar of Milk, in moderately fine powder, *ninety parts*, To make *one hundred parts.* Mix them thoroughly by trituration." *U. S.*

This is probably the best representative of the class of triturations that could be selected for introduction into the national authority. Elaterium is at the best a substance of variable quality, whilst the crystalline principle is a definite product, and accurate dosage can be secured more effectually through the use of this trituration than by the employment of commercial elaterium. The dose is one-half to five-eighths of a grain (0·03 to 0·040 Gm.).

TROCHISCI. *Troches.*

(TRỌ-ÇHĬS′CĪ—trọ-kĭs′sī.)

Tabellæ; Lozenges; Tablettes, Pastilles, *Fr.;* Pastillen, Zeltchen, *G.*

Troches or *lozenges* are small, dry, solid masses, usually of a flattened shape, consisting for the most part of powders incorporated with sugar and mucilage. They are designed to be held in the mouth, and dissolved slowly in the saliva, and are, therefore, adapted for the administration of those medicines only which do not require to be given in large quantities and are destitute of any very disagreeable flavor. They were formerly much more used and more skilfully prepared in Europe than in this country, but at present those manufactured here are fully equal to the imported lozenges. Tragacanth, from the greater tenacity of its mucilage, is better suited for their formation than gum arabic. The following directions for preparing them are taken from the *Dictionnaire des Drogues.* A mucilage of tragacanth is first prepared with cold water and strained. With this the powders, including sugar, are thoroughly mixed by rubbing upon a marble slab, and are thus formed into a paste, which is spread out by means of a roller upon the surface of the marble, previously powdered over with a mixture of sugar and starch. The thickness of the mass is rendered uniform by a frame upon which the ends of the roller rest. The upper surface is now dusted with sugar and starch, and the mass is divided into small cakes by means of a punch. These cakes are placed upon paper, and, having been exposed to the air for twelve hours, are carried into a drying-room moderately heated. When perfectly dry, they are thrown upon a sieve to separate the sugar and starch, and are then enclosed in boxes. Lozenges may be prepared from almost any medicine which it is advisable to administer in this form. The following general formula may be found useful. Take of citric acid, in powder, a drachm; powdered sugar eight ounces; oil of lemon twelve minims; mucilage of tragacanth a sufficient quantity. Form them in the manner above directed into troches of twelve grains each. Lozenges are sometimes made by saturating blank lozenges with aromatic spirits. Currant paste or jelly has come into use of late years largely as a basis for troches.* Lozenges of a cylindrical shape are largely used, having a basis of liquorice, gum, and sugar, and the manufacture of these is now an important industry. Franklin C. Hill devised an improved machine for making Liquorice and Wistar's lozenges. (See *A. J. P.*, 1874, p. 401.) For Slocum's and Harrison's improved forms of lozenge boards, rollers, etc., see *A. J. P.*, 1879, p. 589; 1880, p. 255. Mr. A. D. Marcy has figured an instrument for shaping troches in *N. R.*, Feb. 1882.

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* *Currant Paste Lozenges.* These lozenges have been largely employed. They were introduced by Dr. Morell Mackenzie, Senior Physician to the London Hospital for Diseases of the Throat, and differ from ordinary lozenges in the use as a basis of currant paste (or jelly), of which they contain from 70 to 80 per cent.; this may usually be obtained from wholesale confectioners or grocers.

Trochisci Acidi Benzoici. Benzoic Acid, in powder, 175 grains; Tragacanth, in powder, 70 grains; Refined Sugar, in powder, 280 grains; Red Currant Paste, as much as is sufficient. Mix the dry ingredients, then add the Red Currant Paste until the whole mass weighs 1 pound; divide into 350 lozenges of 20 grains each, and dry them in a hot-air chamber at a moderate heat. Each lozenge contains about one-half grain of Benzoic Acid, and is marked B. A. Dose, one lozenge every four hours. If used as a "voice lozenge," one should be taken a quarter of an hour before using the voice.

Trochisci Acidi Carbolici. Pure Carbolic Acid, 350 grains; Gum Acacia, in powder, 220 grains; Refined Sugar, in powder, 5468 grains (12½ ounces); Mucilage of Gum Acacia, 1 ounce; Distilled Water, as much as is sufficient. Mix the Carbolic Acid with the powders, add the Mucilage and Water to form a mass weighing 1 pound, and divide into 350 lozenges and dry them in a hot-air chamber at a moderate heat. Each lozenge contains about one grain of Carbolic Acid, and is marked C. A. Dose, one lozenge four or five times daily. Use, antiseptic and stimulant.

Trochisci Acidi Tannici. Tannic Acid, in powder, 525 grains; Tragacanth, in powder, 70 grains; Refined Sugar, in powder, 280 grains; Black Currant Paste, as much as is sufficient. Prepare and divide into 350 lozenges. (See *Trochisci Acidi Benzoici.*) Each lozenge contains 1½ grains of Tannic Acid, and is marked T. Dose, one lozenge every three or four hours.

Trochisci Aconiti. Tincture of Aconite (B. P.), 175 minims; Tragacanth, in powder, 70 grains; Refined Sugar, in powder, 280 grains; Black Currant Paste, as much as is sufficient. Prepare and divide into 350 lozenges. (See *Trochisci Acidi Benzoici.*) Each lozenge contains the equivalent of half a minim of Tincture of Aconite, B. P. (or quarter of a minim, U. S. P.), and is marked A. C. Dose, one lozenge every half-hour or hour. Use, in tonsillitis and febrile affections of the throat.

Trochisci Ammonii Chloridi. Chloride of Ammonium, in powder, 700 grains; Tragacanth, in powder, 140 grains; Refined Sugar, in powder, 280 grains; Black Currant Paste, as much as is sufficient. Prepare and divide into 350 lozenges. (See *Trochisci Acidi Benzoici.*) Each lozenge contains about 2 grains of Chloride of Ammonium, and is marked M. A. Dose, one lozenge every three hours.

Trochisci Althææ. Powdered decorticated Marsh-Mallow Root, 400 grains; Refined Sugar, in powder, ¾ pound; Gum Acacia, in powder, ½ pound; Orange Flower Water and White of Egg, as much as is sufficient to make into 350 soft lozenges. Macerate the Marsh-Mallow Root in a sufficient quantity of Orange Flower Water for 12 hours, strain, then add the Gum Acacia and Sugar; dissolve and evaporate to the consistence of honey with constant stirring; add gradually the White of Egg beaten up with more Orange Flower Water. Evaporate with stirring till the paste will not adhere to the hand; then divide into lozenges. Dose, one lozenge every half-hour or hour. Use, emollient. Valuable after excision of tonsils or uvula.

Trochisci Boracis. Borax, in powder, 1050 grains; Tragacanth, in powder, 140 grains; Refined Sugar, in powder, 280 grains; Black Currant Paste, as much as is sufficient. Prepare and divide into 350 lozenges. (See *Trochisci Acidi Benzoici.*) Each lozenge contains 3 grains of Borax, and is marked B. O. Dose, one lozenge every three or four hours.

Trochisci Catechu. Pale Catechu, 700 grains; Tragacanth, in powder, 70 grains; Refined Sugar, in powder, 280 grains; Black Currant Paste, as much as is sufficient. Prepare and divide into 350 lozenges. (See *Trochisci Acidi Benzoici.*) Each lozenge contains 2 grains of Catechu, and is marked C. T. Dose, one lozenge every three hours. Use, astringent, but less powerful than the Tannin.

Trochisci Cubebæ. Cubebs, in powder, 200 grains; Extract of Liquorice, 1225 grains; Tragacanth, in powder, 70 grains; Refined Sugar, 200 grains; Black Currant Paste, as much as is sufficient. Prepare and divide into 350 lozenges. (See *Trochisci Acidi Benzoici.*) Each lozenge contains about one-half grain of Cubebs, and is marked C. B. Dose, one lozenge every three or four hours. Use, very serviceable in diminishing excessive secretion of mucus from pharynx, larynx, or trachea. These lozenges closely resemble the *Brown's Bronchial Troches*, but Black Currant Paste is employed, and less gum and sugar.

The troches, formerly officinal, which are omitted in the present Pharmacopœias, are those of *Tartaric Acid*, *Gum Arabic*, *Lactucarium*, and *Liquorice*, all of the late Ed. Pharmacopœia, and *Trochisci Santonini* of the U. S. Pharmacopœia. The following have been added to the list in the U. S. Pharmacopœia, those of *Chloride of Ammonium*, *Catechu*, *Krameria*, and *Santoninate of Soda*.

TROCHISCI ACIDI TANNICI. *U.S.*, *Br.* *Troches of Tannic Acid. Tannin Lozenges.*

(TRO̤-ȻHĬS'CĪ ĂÇ'I̤-DĪ TĂN'NI̤-CĪ.)

Pastilles de Tannin, *Fr.;* Tanninpastillen, *G.*

"Tannic Acid, *one hundred grains* (6·50 Gm.); Sugar, in fine powder, *one thousand grains* (65·00 Gm.); Tragacanth, in fine powder, *twenty-five grains* (1·60 Gm); Orange Flower Water, *a sufficient quantity*, To make *one hundred troches*. Rub the powders together until they are thoroughly mixed; then, with Orange Flower Water, form a mass, to be divided into *one hundred troches*." *U. S.*

Trochisci Guaiaci. Guaiacum Resin, in powder, 700 grains; Tragacanth, in powder, 70 grains; Refined Sugar, in powder, 280 grains; Black Currant Paste, as much as is sufficient. Prepare and divide into 350 lozenges. (See *Trochisci Acidi Benzoici.*) Each lozenge contains 2 grains of Guaiacum, and is marked G. Dose, one lozenge every two hours in acute inflammation; three times a day in chronic affections. Use, a specific for arresting crescent inflammation of the tonsils, and useful both in acute and subacute inflammation of the pharynx, and in acute follicular disease of the tonsils, etc.

Trochisci Kino. Kino, in powder, 700 grains: Tragacanth, in powder, 70 grains; Refined Sugar, in powder, 280 grains; Black Currant Paste, as much as is sufficient. Prepare and divide into 350 lozenges. (See *Trochisci Acidi Benzoici.*) Each lozenge contains 2 grains of Kino, and is marked K. Dose, one lozenge every three or four hours. Use, astringent; rather less powerful than Rhatany.

Trochisci Krameriæ. Extract of Rhatany, in powder, 1050 grains; Tragacanth, in powder, 70 grains; Refined Sugar, in powder, 280 grains; Red Currant Paste, as much as is sufficient. Mix and divide into 350 lozenges. (See *Trochisci Acidi Benzoici.*) Each lozenge contains 3 grains of Extract of Rhatany, and is marked R. Dose, one lozenge every three or four hours. Use, a very useful astringent. Rhatany does not disagree with the stomach, as is often the case with Tannic Acid, nor does it cause constipation to the same extent as Kino and Catechu.

Trochisci Lactucæ. Extract of Lettuce 350 grains; Tragacanth, in powder, 100 grains; Refined Sugar, in powder, 280 grains; Black Currant Paste, as much as is sufficient. Prepare and divide into 350 lozenges. (See *Trochisci Acidi Benzoici.*) Each lozenge contains 1 grain of Extract of Lettuce, and is marked L. Dose, one lozenge every hour or two. Use, soothing and mildly sedative.

Trochisci Potassæ Chloratis. Chlorate of Potash, in powder, 1050 grains; Tragacanth, in powder, 140 grains; Refined Sugar, in powder, 280 grains; Black Currant Paste, sufficient. Prepare and divide into 350 lozenges. (See *Trochisci Acidi Benzoici.*) Each lozenge contains 3 grains of Chlorate of Potash, and is marked P. Dose, one lozenge every three or four hours. Use, stimulant and antiseptic. Useful in thrush and aphthous ulceration.

Trochisci Potassæ Citratis. Citrate of Potash, in powder, 1050 grains; Tragacanth, in powder, 140 grains; Refined Sugar, in powder, 280 grains; Red Currant Paste, as much as is sufficient. Prepare and divide into 350 lozenges. (See *Trochisci Acidi Benzoici.*) Each lozenge contains 3 grains of Citrate of Potash, and is marked C. P. Dose, one lozenge every three or four hours. Use, topical sialogogue.

Trochisci Potassæ Tartratis Acidæ. Acid Tartrate of Potash, 1050 grains; Tragacanth, in powder, 140 grains; Refined Sugar, in powder, 280 grains; Red Currant Paste, as much as is sufficient. Prepare and divide into 350 lozenges. (See *Trochisci Acidi Benzoici.*) Each lozenge contains 3 grains of Acid Tartrate of Potash, and is marked T. P. Dose, one lozenge every two or three hours. Use, topical sialogogue.

Trochisci Pyrethri. Pellitory Root, in powder, 350 grains; Tragacanth, in powder, 70 grains; Refined Sugar, in powder, 280 grains; Black Currant Paste, as much as is sufficient. Prepare and divide into 350 lozenges. (See *Trochisci Acidi Benzoici.*) Each lozenge contains 1 grain of Pellitory, and is marked P. Y. Dose, one lozenge every two or three hours. Use, a very valuable sialogogue.

Trochisci Sedativi. Extract of Opium, in powder, 35 grains; Tragacanth, in powder, 100 grains; Refined Sugar, in powder, 280 grains; Black Currant Paste, as much as is sufficient. Prepare and divide into 350 lozenges. (See *Trochisci Acidi Benzoici.*) Each lozenge contains one-tenth grain of Extract of Opium, and is marked S. Dose, one lozenge every three or four hours. Use, sedative, for irritative coughs and painful conditions of the pharynx. (From the Pharmacopœia of the Hospital for the Diseases of the Throat, 4th ed., 1881.)

"Take of Tannic Acid *three hundred and sixty grains;* Tincture of Tolu *half a fluidounce;* Refined Sugar, in powder, *twenty-five ounces* [avoirdupois]; Gum Acacia, in powder, *one ounce* [avoird.]; Mucilage of Gum Acacia *two fluidounces;* Distilled Water *one fluidounce.* Dissolve the Tannic Acid in the Water, add first the Tincture of Tolu, previously mixed with the mucilage, then the Gum and the Sugar, also previously well mixed. Form the whole into a proper mass; divide it into 720 lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains half a grain of Tannic Acid." *Br.*

These are useful in relaxation of the uvula, and chronic inflammation of the fauces, being held in the mouth and allowed slowly to dissolve. Each U. S. troche contains one grain (0·065 Gm.) of the acid.

TROCHISCI AMMONII CHLORIDI. *U.S.* *Troches of Chloride of Ammonium.*

(TRO̩-ȻHĬS′CĪ A̩M-MŌ′NI̩-Ī ȻHLŌ′RI̩-DĪ.)

Pastilles de Chlorure d'Ammonium, *Fr.;* Chlorammoniumpastillen, *G.*

"Chloride of Ammonium, in fine powder, *two hundred grains* (13·00 Gm.); Sugar, in fine powder, *one thousand grains* (65·00 Gm.); Tragacanth, in fine powder, *twenty-five grains* (1·60 Gm.); Syrup of Tolu, *a sufficient quantity*, To make *one hundred troches.* Rub the powders together until they are thoroughly mixed; then, with Syrup of Tolu, form a mass, to be divided into *one hundred troches.*" *U. S.*

These troches are largely used in congested conditions of the pharynx and larynx.

TROCHISCI BISMUTHI. *Br.* *Bismuth Lozenges.* *Troches of Bismuth.*

(TRO̩-ȻHĬS′CĪ BĬS-MŪ′THĪ.)

Pastilles de Sous-nitrate de Bismuth, *Fr.;* Wismuthpastillen, *G.*

"Take of Subnitrate of Bismuth *fourteen hundred and forty grains;* Carbonate of Magnesia *four ounces* [avoirdupois]; Precipitated Carbonate of Lime *six ounces* [avoird.]; Refined Sugar *twenty-nine ounces* [avoird.]; Gum Acacia, in powder, *one ounce* [avoird.]; Mucilage of Gum Acacia *two fluidounces;* Rose Water *a sufficiency.* Mix the dry ingredients, then add the Mucilage, and form the whole into a proper mass with Rose Water. Divide the mass into 720 lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains two grains of Subnitrate of Bismuth." *Br.*

These may be used to obtain the effects of subnitrate of bismuth on the stomach, as well as of the carbonates of magnesium and of calcium as an antacid; two or more being administered for a dose. They may also be found useful in chronic inflammation of the throat and œsophagus, by giving the mucous membrane a coating as the insoluble ingredients pass.

TROCHISCI CATECHU. *U.S., Br.* *Troches of Catechu.* *Catechu Lozenges.*

(TRO̩-ȻHĬS′CĪ CĂT′E̩-ȻHŪ.)

Tabellæ cum Catechu, *F.P.;* Pastilles de Cachou, *Fr.;* Katechupastillen, *G.*

"Catechu, in fine powder, *one hundred grains* (6·50 Gm.); Sugar, in fine powder, *one thousand grains* (65·00 Gm.); Tragacanth, in fine powder, *twenty-five grains* (1·60 Gm.); Orange Flower Water, *a sufficient quantity*, To make *one hundred troches.* Rub the powders together until they are thoroughly mixed; then, with Orange Flower Water, form a mass, to be divided into *one hundred troches.*" *U. S.*

"Take of Pale Catechu [Gambir], in powder, *seven hundred and twenty grains;* Refined Sugar, in powder, *twenty-five ounces* [avoirdupois]; Gum Acacia, in powder, *one ounce* [avoird.]; Mucilage of Gum Acacia *two fluidounces;* Distilled Water *a sufficiency.* Mix the Catechu, Sugar, and Gum, and add the Mucilage and Water to form a proper mass. Divide into 720 lozenges, and dry these in a hot-air chamber with a moderate heat." *Br.*

These, like the troches of tannic acid, are useful in prolapsus of the uvula, and other forms of relaxation of the fauces; and may also be used, in the number of three or more at a dose, to obtain the effects of catechu on the primæ viæ and on the system. Each troche contains one grain (0·065 Gm.) of catechu.

TROCHISCI CRETÆ. *U.S.* *Troches of Chalk.*

(TRO-CHĬS'CĪ CRĒ'TÆ.)

Pastilles de Craie préparée, *Fr.;* Kreidepastillen, *G.*

"Prepared Chalk, *four hundred grains* (26·00 Gm.); Acacia, in fine powder, *one hundred grains* (6·50 Gm.); Nutmeg, in fine powder. *fifteen grains* (1·00 Gm.); Sugar, in fine powder, *six hundred grains* (39·00 Gm.), To make *one hundred troches.* Rub them together until they are thoroughly mixed; then, with water, form a mass, to be divided into *one hundred troches.*" *U. S.*

These contain each four grains (0·26 Gm.) of chalk, and are used as a gentle, astringent antacid in diarrhœa.

TROCHISCI CUBEBÆ. *U.S.* *Troches of Cubeb.*

(TRO-CHĬS'CĪ CŪ-BĒ'BÆ.)

Pastilles de Cubèbe, *Fr.;* Kubebenpastillen, *G.*

"Oleoresin of Cubeb, *fifty grains* (3·25 Gm.); Oil of Sassafras, *fifteen grains* (1·00 Gm.); Extract of Glycyrrhiza, in fine powder, *four hundred grains* (26·00 Gm.); Acacia, in fine powder, *two hundred grains* (13·00 Gm.); Syrup of Tolu, *a sufficient quantity*, To make *one hundred troches.* Rub the powders together until they are thoroughly mixed; then add the Oleoresin and Oil, and incorporate them with the mixture. Lastly, with Syrup of Tolu, form a mass, to be divided into *one hundred troches.*" *U. S.*

Each lozenge contains half a grain (0·06 C.c.) of the oleoresin of cubeb, being about half the strength of the troche of 1870. The preparation is intended chiefly for effect upon the fauces and other parts of the upper alimentary passages, and may be used advantageously in some cases of chronic cough, and in ulceration or chronic inflammation of the fauces.

TROCHISCI FERRI. *U. S.* *Troches of Iron.*

(TRO-CHĬS'CĪ FĔR'RĪ.)

Pastilles d'Oxide de Fer, *Fr.;* Eisenoxydpastillen, *G.*

"Hydrated Oxide of Iron, dried at a temperature not exceeding 80° C. (176° F.), *five hundred grains* (32·50 Gm.); Vanilla, cut into slices, *ten grains* (0·65 Gm.); Sugar, in fine powder, *fifteen hundred grains* (97·50 Gm.); Mucilage of Tragacanth, *a sufficient quantity*, To make *one hundred troches.* Rub the Vanilla, first, with a portion of the Sugar to a uniform powder, and afterward, with the Oxide of Iron and the remainder of the Sugar, until they are thoroughly mixed. Then, with Mucilage of Tragacanth, form a mass, to be divided into *one hundred troches.*" *U. S.*

Each lozenge contains five grains (0·33 Gm.) of hydrated oxide of iron, and from one to six may be given, according to the effects desired. (See *Ferri Oxidum Hydratum.*)

TROCHISCI FERRI REDACTI. *Br.* *Reduced Iron Lozenges.*

(TRO-CHĬS'CĪ FĔR'RĪ RE-DĂC'TĪ.)

Pastilles de Fer, Tablettes chalybées, *Fr.;* Eisenpastillen, *G.*

"Take of Reduced Iron *seven hundred and twenty grains;* Refined Sugar, in powder, *twenty-five ounces* [avoirdupois]; Gum Acacia, in powder, *one ounce* [avoird.]; Mucilage of Gum Acacia *two fluidounces;* Distilled Water *one fluidounce*, or *a sufficiency.* Mix the Iron, Sugar, and Gum, and add the Mucilage and Water to form a proper mass. Divide into 720 lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains one grain of reduced iron." *Br.*

From one to five of the lozenges may be taken for a dose.

TROCHISCI GLYCYRRHIZÆ ET OPII. *U.S. Troches of Glycyrrhiza and Opium.*

(TRỌ-ÇHĬS′CĪ GLY̆Ç-ỴR-RHĪ′ZÆ ĔT Ō′PỊ-Ī.)

Trochisci Opii, *Br.;* Opium Lozenges; Pastilles d'Opium, Pastilles de Réglisse opiacées, *Fr.;* Opiumpastillen, *G.*

" Extract of Glycyrrhiza, in fine powder, *two hundred grains* (13·00 Gm.); Extract of Opium, in fine powder, *five grains* (0·32 Gm.); Acacia, in fine powder, *two hundred grains* (13·00 Gm.); Sugar, in fine powder, *three hundred grains* (19·50 Gm.); Oil of Anise, *three grains* (0·20 Gm.), To make *one hundred troches.* Rub the powders together until they are thoroughly mixed; then add the Oil of Anise, and incorporate it with the mixture. Lastly, with water, form a mass, to be divided into *one hundred troches.*" *U. S.*

" Take of Extract of Opium *seventy-two grains;* Tincture of Tolu *half a fluidounce;* Refined Sugar, in powder, *sixteen ounces* [avoirdupois]; Gum Acacia, in powder, *two ounces* [avoird.]; Extract of Liquorice *six ounces* [avoird.]; Distilled Water, *a sufficiency.* Add the Extract of Opium, first softened by means of a little Water, and the Tincture of Tolu, to the Extract of Liquorice heated in a water-bath. When the mixture is reduced to a proper consistence, remove it to a slab, add the Sugar and Gum previously rubbed together, and mix thoroughly. Divide the mass into 720 lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains one-tenth of a grain of Extract of Opium." *Br.*

A preparation equivalent to the above is much used in Philadelphia and elsewhere under the name of *Wistar's cough lozenges.* Sometimes sulphate of morphine is substituted in equivalent proportion for the opium, and occasionally a little tartar emetic is added; but these modifications of the officinal formula are not admissible without a change of title. Each U. S. troche contains one-twentieth grain of the extract, the English each one-tenth of a grain.

These troches are demulcent and anodyne, and useful in allaying cough, when the case admits of the employment of opium, of which each of them, prepared according to the U. S. formula, contains about one-tenth of a grain (0·006 Gm.).

TROCHISCI IPECACUANHÆ. *U.S., Br. Troches of Ipecac. Ipecacuanha Lozenges.*

(TRỌ-ÇHĬS′CĪ ĬP-Ẹ-CĂC-U̇-ĂN′HÆ.)

Pastilles d'Ipécacuanha, *Fr.;* Brechwurzelpastillen, *G.*

" Ipecac, in fine powder, *twenty-five grains* (1·60 Gm.); Tragacanth, in fine powder, *twenty-five grains* (1·60 Gm.); Sugar, in fine powder, *one thousand grains* (65·00 Gm.); Syrup of Orange, *a sufficient quantity*, To make *one hundred troches.* Rub the powders together until they are thoroughly mixed; then, with Syrup of Orange, form a mass, to be divided into *one hundred troches.*" *U. S.*

" Take of Ipecacuanha, in powder, *one hundred and eighty grains;* Refined Sugar, in powder, *twenty-five ounces* [avoirdupois]; Gum Acacia, in powder, *one ounce* [avoird.]; Mucilage of Gum Acacia *two fluidounces;* Distilled Water *one fluidounce*, or *a sufficiency.* Mix the powders and add the Mucilage and Water to form a proper mass. Divide into 720 lozenges, and dry these in a hot-air chamber with a moderate heat. Each powder contains one-fourth of a grain of ipecacuanha." *Br.*

These are useful expectorant lozenges in catarrhal complaints. Each of the U. S. lozenges contains about one-quarter of a grain (0·016 Gm.) of ipecac.

TROCHISCI KRAMERIÆ. *U. S. Troches of Krameria.*

(TRỌ-ÇHĬS′CĪ KRẠ-MĒ′RỊ-Æ.)

Pastilles de Ratanhia, *Fr.;* Ratanhapastillen, *G.*

" Extract of Krameria, *one hundred grains* (6·50 Gm.); Sugar, in fine powder, *one thousand grains* (65·00 Gm.); Tragacanth, in fine powder, *twenty-five grains* (1·60 Gm.); Orange Flower Water, *a sufficient quantity*, To make *one hundred troches.* Rub the powders together until they are thoroughly mixed; then, with Orange Flower Water, form a mass, to be divided into *one hundred troches.*" *U. S.*

These troches were made officinal in the U. S. P. 1880; they have been recommended by Dr. Morell Mackenzie (see page 1481) as useful astringent lozenges, and as not so likely to disagree with the stomach as those made from tannic acid.

TROCHISCI MAGNESIÆ. *U. S.* *Troches of Magnesia.*

(TRỌ-ÇHĬS'CĪ MĂG-NĒ'ṢI-Æ.)

Trochisci Magnesiæ Ustæ, *P.G.;* Pastilles absorbantes, Pastilles de Magnésie, *Fr.;* Magnesiapastillen, *G.*

"Magnesia, *three hundred grains* (19·50 Gm.); Nutmeg, in fine powder, *fifteen grains* (1·00 Gm.); Sugar, in fine powder, *nine hundred grains* (58·50 Gm.); Mucilage of Tragacanth, *a sufficient quantity,* To make *one hundred troches.* Rub the Magnesia and the powder together until they are thoroughly mixed; then, with Mucilage of Tragacanth, form a mass, to be divided into *one hundred troches.*" *U. S.*

These each contain three grains (0·20 Gm.) of magnesia, and are useful in acidity of the stomach, especially when attended with constipation.

TROCHISCI MENTHÆ PIPERITÆ. *U. S.* *Troches of Peppermint.*

(TRỌ-ÇHĬS'CĪ MĔN'THÆ PĪ-PẸ-RĪ'TÆ.)

Pastilles de Menthe anglaises, *Fr.;* Pfefferminzpastillen, *G.*

"Oil of Peppermint, *fifteen grains* (1·00 Gm.); Sugar, in fine powder, *twelve hundred grains* (78·00 Gm.); Mucilage of Tragacanth, *a sufficient quantity,* To make *one hundred troches.* Rub the Oil of Peppermint and the Sugar together until they are thoroughly mixed; then, with Mucilage of Tragacanth, form a mass, to be divided into *one hundred troches.*" *U. S.*

Useful in slight gastric or intestinal pains, nausea, and flatulence, but employed more for their agreeable flavor than for their medicinal effects.

TROCHISCI MORPHIÆ. *Br.* *Morphia Lozenges.*

(TRỌ-ÇHĬS'CĪ MÖR'PHI-Æ.)

Pastilles de Morphine, *Fr.;* Morphinepastillen, *G.*

"Take of Hydrochlorate of Morphia *twenty grains;* Tincture of Tolu *half a fluidounce;* Refined Sugar, in powder, *twenty-four ounces* [avoirdupois]; Gum Acacia, in powder, *one ounce* [avoird.]; Mucilage of Gum Acacia *a sufficiency;* Distilled Water *half a fluidounce.* Dissolve the Hydrochlorate of Morphia in the Water; add this solution to the Tincture of Tolu, previously mixed with *two fluidounces* of the Mucilage; then add the Gum and Sugar, previously mixed, and more Mucilage if necessary to form a proper mass. Divide into 720 lozenges, and dry these in a hot-air chamber with a moderate heat." *Br.*

Useful for alleviating cough, and for other purposes which are answered by minute doses of morphine, of the hydrochlorate of which each lozenge contains about one-thirty-sixth of a grain (0·0018 Gm.).

TROCHISCI MORPHINÆ ET IPECACUANHÆ. *U. S., Br.* *Troches of Morphine and Ipecac.* *Morphia and Ipecacuanha Lozenges.*

(TRỌ-ÇHĬS'CĪ MÖR-PHĪ'NÆ ĔT ĬP-Ẹ-CĂC-Ū-ĂN'HÆ.)

Pastilles de Morphine et d'Ipécacuanha, *Fr.;* Morphinpastillen mit Brechwurzel, *G.*

"Sulphate of Morphine, *five grains* (0·32 Gm.); Ipecac, in fine powder, *sixteen grains* (1·00 Gm.); Sugar, in fine powder, *two thousand grains* (130·00 Gm.); Oil of Gaultheria, *two grains* (0·13 Gm.); Mucilage of Tragacanth, *a sufficient quantity,* To make *two hundred troches.* Rub the powders together until they are thoroughly mixed; then add the Oil of Gaultheria, and incorporate it with the mixture. Lastly, with Mucilage of Tragacanth, form a mass, to be divided into *two hundred troches.*" *U. S.*

"Take of Hydrochlorate of Morphia *twenty grains;* Ipecacuanha, in fine powder, *sixty grains;* Tincture of Tolu *half a fluidounce;* Refined Sugar, in powder, *twenty-four ounces* [avoirdupois]; Gum Acacia, in powder, *one ounce* [avoird.]; Mucilage of Gum Acacia *a sufficiency;* Distilled Water *half a fluidounce.* Dissolve the Hydrochlorate of Morphia in the Water; add this solution to the Tincture of Tolu, previously mixed with two fluidounces of the Mucilage; then add the Ipecacuanha, Gum, and Sugar, previously mixed, and more Mucilage if necessary to form a proper mass. Divide into 720 lozenges, and dry these in a hot-air chamber with a moderate heat." *Br.*

Expectorant and anodyne, useful especially in allaying cough. The U. S. and the Br. lozenges contain each respectively one-fortieth (0·0018 Gm.) and one-thirty-sixth of a grain (0·0019 Gm.) of morphine salt, and one-twelfth of a grain (0·005 Gm.) of ipecacuanha. From one to six may be given for a dose.

TROCHISCI POTASSII CHLORATIS. *U. S.* *Troches of Chlorate of Potassium.*

(TRỌ-ȻHĬS'CĪ PỌ-TĂS'SỊ-Ī ȻHLỌ-RĀ'TỊS.)

Trochisci Potassæ Chloratis, *Br.;* Chlorate of Potash Lozenges; Pastilles de Chlorate de Potasse, *Fr.;* Pastillen von Chlorsaurem Kali, *G.*

"Chlorate of Potassium, in fine powder, *five hundred grains* (32·50 Gm.); Sugar, in fine powder, *nineteen hundred grains* (124·00 Gm.); Tragacanth, in fine powder, *one hundred grains* (6·50 Gm.); Spirit of Lemon, *ten grains* (0·65 Gm.), To make *one hundred troches.* Mix the Sugar with the Tragacanth and the Spirit of Lemon by trituration, in a mortar; then transfer the mixture to a sheet of paper, and, by means of a bone spatula, mix with it the Chlorate of Potassium, being careful to avoid trituration and pressure, to prevent the mixture from igniting or exploding. Lastly, with water, form a mass, to be divided into *one hundred troches.*" *U. S.*

"Take of Chlorate of Potash *thirty-six hundred grains;* Refined Sugar, in powder, *twenty-five ounces* [avoirdupois]; Gum Acacia, in powder, *one ounce* [avoird.]; Mucilage of Gum Acacia *two fluidounces;* Distilled Water, *one fluidounce,* or *a sufficiency.* Mix the powders and add the Mucilage and Water to form a proper mass. Divide into 720 lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains five grains of Chlorate of Potash." *Br.*

These lozenges are very largely employed, and are locally useful in cases of sore throat. If dissolved slowly in the mouth they may be used almost continuously.

TROCHISCI SODII BICARBONATIS. *U. S.* *Troches of Bicarbonate of Sodium.*

(TRỌ-ȻHĬS'CĪ SŌ'DỊ-Ī BĪ-CÄR-BỌ-NĀ'TĬS.)

Trochisci Sodæ Bicarbonatis, *Br.;* Bicarbonate of Sodium Lozenges; Trochisci Natri Bicarbonici, *P.G.;* Pastilles de Bicarbonate de Soude, P. de Vichy, P. digestives, *Fr.;* Natronpastillen. *G.*

"Bicarbonate of Sodium, *three hundred grains* (19·50 Gm.); Sugar, in fine powder, *nine hundred grains* (58·50 Gm.); Nutmeg, in fine powder, *fifteen grains* (1·00 Gm.); Mucilage of Tragacanth, *a sufficient quantity,* To make *one hundred troches.* Rub the Bicarbonate of Sodium with the powders until they are thoroughly mixed; then, with Mucilage of Tragacanth, form a mass, to be divided into *one hundred troches.*" *U. S.*

"Take of Bicarbonate of Soda, in powder, *thirty-six hundred grains;* Refined Sugar, in powder, *twenty five ounces* [avoirdupois]; Gum Acacia, in powder, *one ounce* [avoird.]; Mucilage of Gum Acacia *two fluidounces;* Distilled Water *one fluidounce.* Mix the powders, and add the Mucilage and Water, to form a proper mass. Divide into 720 lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains five grains of Bicarbonate of Soda." *Br.*

The U. S. troche contains three grains (0·20 Gm.) of the alkaline salt. Antacid and antilithic, useful in heartburn and uric acid gravel. From one to six may be given for a dose.

TROCHISCI SODII SANTONINATIS. *U. S.* *Troches of Santoninate of Sodium.*

(TRỌ-ȻHĬS'CĪ SŌ'DỊ-Ī SĂN-TỌ-NỊ-NĀ'TĬS.)

"Santoninate of Sodium, in fine powder, *one hundred grains* (6·50 Gm.); Sugar, in fine powder, *two thousand grains* (130·00 Gm.); Tragacanth, in fine powder, *fifty* *grains* (3·25 Gm.); Orange Flower Water, *a sufficient quantity*, To make *one hundred troches.* Rub the powders together until they are thoroughly mixed; then, with Orange Flower Water, form a mass, to be divided into *one hundred troches.* Troches of Santoninate of Sodium should be kept in dark amber-colored vials." *U. S.*

These troches have been introduced into the U. S. P. 1880 to take the place of the former troches of santonin. The santoninate of sodium is more soluble than santonin, and each lozenge contains one grain. For reasons given under Santoninum (see page 1272), we are of the opinion that the troches of santonin, U. S. P. 1870, are greatly preferable.* If the physician direct troches of santoninate of sodium, he of course assumes all the responsibility, and the officinal lozenge should be supplied; but on no account should the apothecary supply these troches when santonin lozenges are called for.

TROCHISCI ZINGIBERIS. *U. S.* *Troches of Ginger.*

(TRO̤-CHĬS'CĪ ZI̤N-G̦ĬB'E̤-RĬS.)

Pastilles de Gingembre, *Fr.;* **Ingwerpastillen,** *G.*

"Tincture of Ginger, *two hundred grains* (13·00 Gm.); Tragacanth, in fine powder, *fifty grains* (3·25 Gm.); Sugar, in fine powder, *two thousand grains* (130·00 Gm.); Syrup of Ginger, *a sufficient quantity*, To make *one hundred troches.* Mix the Tincture of Ginger with the Sugar, and, having exposed the mixture to the air until dry, reduce it to a fine powder; to this add the Tragacanth, and mix thoroughly. Lastly, with Syrup of Ginger, form a mass, to be divided into *one hundred troches.*" *U. S.*

Each lozenge contains two minims (0·12 C.c.) of the tincture, and they may be taken as required, being especially calculated to relieve gastric pains from flatulence.

ULMUS. *U. S.* *Elm.* [*Slippery Elm.*]

(ŬL'MU̦S.)

"The inner bark of Ulmus fulva. Michaux. (*Nat. Ord.* Urticaceæ, Ulmeæ.)" *U. S.*

Ulmi Cortex, *Br.;* **Écorce d'Orme,** *Fr.;* **Ulmenrinde, Rüsterrinde,** *G.*

Ulmus fulva. Michaux, *Flor. Americ.* i. 172.—*Ulmus rubra.* F. Andrew Michaux, *N. Am. Sylv.* iii. 89; *B. & T.* 233. The *slippery elm*, called also *red elm*, is a lofty tree, rising fifty or sixty feet in height, with a stem fifteen or twenty inches in diameter. The bark of the trunk is brown, that of the branches rough and whitish. The leaves are oblong ovate, acuminate, nearly equal at the base, unequally serrate, pubescent, and very rough on both sides, four or five inches in length by two or three in breadth, and supported on short footstalks. The buds, a fortnight before their development, are covered with a dense russet down. The flowers, which appear before the leaves, are sessile, and in clusters at the extremity of the young shoots. The bunches of flowers are surrounded by scales, which are downy like the buds. The calyx also is downy. There is no corolla. The stamens are five, short, and of a pale rose color. The fruit is a membranaceous capsule or samara, enclosing in the middle one round seed, destitute of fringe.†

This species of elm is indigenous, growing in all parts of the United States north of the Carolinas, but most abundantly west of the Alleghany Mountains. It flourishes in open, elevated situations, and requires a firm, dry soil. From the *white elm* (*U. Americana*) it is distinguished by its rough branches, its larger, thicker, and rougher leaves, its downy buds, and the character of its flowers and seeds. Its period of flowering is in April. The inner bark is the part used, and is brought to the shops separated from the epidermis. Large quantities are collected in the Lower Peninsula of Michigan.

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* *Trochisci Santonini.* U. S. *Troches of Santonin; Pastilles de Santonine,* Fr.; *Santoninpastillen,* G. "Take of Santonin, in fine powder, *half a troyounce;* Sugar, in fine powder, *eighteen troyounces;* Tragacanth, in fine powder, *half a troyounce;* Orange Flower Water, *a sufficient quantity.* Rub the powders together until they are thoroughly mixed; then with Orange Flower Water form a mass, to be divided into four hundred and eighty troches." *U. S.* Each of these troches contains half a grain (0·03 Gm.) of santonin. They afford an excellent means of administration.

† *Fremontia Californica,* Torr., or *California Slippery Elm,* is not botanically allied to the *Ulmus fulva;* its bark is said, however, to have the same properties as slippery elm, and to be used for a similar purpose.

It is in long, nearly flat pieces, from one to two lines thick, of a fibrous texture, a tawny color which is reddish on the inner surface, a peculiar sweetish, not unpleasant odor, and a highly mucilaginous taste when chewed. "The inner surface finely ridged; fracture fibrous and mealy; the transverse section delicately checkered." *U. S.* By grinding, it is reduced to a light, grayish fawn-colored powder. It abounds in mucilaginous matter, which it readily imparts to water. The mucilage is precipitated by solutions of acetate and subacetate of lead, but not by alcohol.

Much of the bark brought into the market is of inferior quality, imparting comparatively little mucilage to water. It has the characteristic odor of the genuine bark, but is much less fibrous and more brittle, breaking abruptly when bent, instead of being capable, like the better kind, of being folded lengthwise without breaking. To what this inferiority is owing, whether to difference in the species or the age, or to circumstances in the growth of the tree producing it, we are unable to state.

Dr. C. W. Wright, of Cincinnati, in a communication to the *Western Lancet*, states that slippery-elm bark has the property of preserving fatty substances from rancidity; a fact derived originally from the Indians, who prepared bears' fat by melting it with the bark, in the proportion of a drachm of the latter to a pound of the former, keeping them heated together for a few minutes, and then straining off the fat. Dr. Wright tried the same process with butter and lard, and found them to remain perfectly sweet for a long time. (*A. J. P.*, xxiv. 180.)

Medical Properties and Uses. Slippery-elm bark is an excellent demulcent, applicable to all cases in which this class of medicines is employed. It is especially recommended in dysentery, diarrhœa, and diseases of the urinary passages. Like the bark of the common European elm, it has been employed in cutaneous eruptions; but neither in these nor in any other complaints does it probably exert any greater powers than such as belong to the demulcents generally. Its mucilage is nutritious; and we are told that it has proved sufficient for the support of life in the absence of other food. The case of a lad of 15 is recorded, who, a day or two after eating a portion of this bark, became violently ill, and died. The stomach was examined, and found full of the bark twisted into balls. The death was no doubt owing to the large amount of indigestible matter in the stomach, and not to any poisonous property of the bark. (*Phila. Med. Times*, Feb. 7, 1874, p. 303.) Dr. J. R. Dowler, of Beardstown, Ill., reports two cases of tape-worm, one in a child, the other in an adult, in which the worm was discharged, as a consequence of chewing and swallowing the bark of the elm. (*Bost. Med. and Surg. Journ.*, March 16, 1865, p. 132.)

It is commonly used as a drink in the form of infusion. (See *Mucilago Ulmi.*) The powder may be used stirred in hot water, with which it forms a mucilage, more or less thick according to the proportion added. The bark also serves as an emollient application in cases of external inflammation. For this purpose the powder may be formed into a poultice with hot water, or the bark itself may be applied, previously softened by boiling. Dr. McDowell, of Virginia, recommended slippery-elm bark for the dilatation of fistulas and strictures (see *Med. Examiner*, i. 244); subsequently Dr. H. R. Storer, of Boston, used it advantageously for dilating the os uteri (*Bost. Med. and Surg. Journ.*, liii. 300); and Dr. A. Abbe, of the same place, succeeded in curing with it a case of stricture of the rectum. (*Ibid.*, liv. 349.)

Off. Prep. Mucilago Ulmi, *U. S.*

UNGUENTA. *Ointments.*

(ỤN-GUĔN'TẠ—ụn-gwĕn'tạ.)

Pommades, Onguentes, *Fr.;* Salben, *G.*

These are fatty substances, softer than cerates, of a consistence like that of butter, and such that they may be readily applied to the skin by inunction. When ointments are prepared by merely mixing medicinal substances with simple ointment, *lard*, or *petrolatum*, care should be taken, if the added substance be a powder, that it be brought to the finest possible state of division, before being incorporated with the unctuous matter. If soluble in water or alcohol, it may often be advantageously rubbed with a little of one of these liquids. Gritty matter should not be allowed to enter these preparations. When an extract is added, if not uniformly soft, it should be made so by trituration with a little water or alcohol according to its nature. Many of the ointments become rancid if long kept, and should, therefore, be prepared in small quantities at a time, or only when wanted for use. The tendency to rancidity may be in a considerable degree counteracted by imbuing the unctuous vehicle with benzoin, or with poplar buds, as recommended by M. Deschamps (*A. J. P.*, xv. 260); but care should be taken that there be no therapeutical objection to the admixture.* Elm bark is said to have the same effect. (See page 1488.) According to Dr. Geisler, ten drops of spirit of nitrous ether, incorporated with an ounce of ointment, overcomes the disagreeable fatty odor. *(Pharm. Centralb.*, 1847, p. 927.) Petrolatum and glycerite of starch are new officinal bases for ointments. (See *Petrolatum* and *Glyceritum Amyli.*) *Glycelæum* is a compound of finely powdered almond meal 1 part, glycerin 2 parts, and olive oil 6 parts. It was proposed by T. B. Groves, *Chem. and Drug.*, Sept. 14, 1867, as a substitute for plasma and other fatty bodies, and has no doubt advantages, one of which is the facility with which it can be removed from the skin by a wet sponge. It has been proposed to substitute glycerin for oils and fats in the preparation of ointments, either wholly or in part; but, when these are to be applied by inunction, they are altogether unfit for the purpose, as it remains upon the skin, producing a rough sensation of adhesiveness, very different from the softness caused by oleaginous matter under similar circumstances, and in some skin diseases the glycerin in the ointment would be positively injurious.

The Cerates having been abolished as a class in the British Pharmacopœia, a few of the individual articles have been transferred to the Ointments, making the definition of the latter class of preparations, as given above, not exactly applicable to all the individual substances at present included among them in that Pharmacopœia. We consider no substance as strictly entitled to the name of ointment which is not of such a consistence as to adapt it to application to the skin by friction or inunction. Ointments should be dispensed in glass, porcelain, or queensware pots or jars, or, if for temporary use, in tight wooden boxes. We have used a very convenient method, suggested by Dr. A. Van Harlingen, of dispensing soft ointments by introducing them into collapsible tubes. These tubes are similar to those used for holding artists' colors, and have the advantage of shielding the ointment from the oxidizing action of the air whilst permitting the use of the desired quantity. The following additions have been made to this class at the last revision: *Ung. Acidi Gallici*, *Ung. Chrysarobini*, *Ung. Diachylon*, *Ung. Iodoformi*, *Ung. Sulphuris Alkalinum*. The ointments formerly officinal, which have been omitted in the present U. S. and Br. Pharmacopœias, are *Ung. Antimonii*, *Ung. Cantharidis*, *Ung. Creasoti*, *Ung. Hydrargyri Iodidi Rubri*, *Ung. Iodinii Compositum*, *Ung. Sulphuris Iodidi*, *Ung. Tabaci*, *Adeps Suillus Præparatus*, Dub., *Unguentum Conii*, Lond., *Ung. Cupri Subacetatis*, Ed., Dub., *Ung. Hydrargyri Iodidi*, Lond., *Ung. Hydrarg. Nitratis Mitius*, Lond., *Ung. Opii*, Lond., *Ung. Picis*, Lond., and *Ung. Sulphuris Compositum*, Lond.

UNGUENTUM. *U.S.* *Ointment.*

(UN-GUĔN'TUM.)

Unguentum Simplex, *Br.*, also *U. S.* 1850; Simple Ointment; Unguentum Adipis, *U. S.* 1860; Pommade simple, *Fr.;* Wachssalbe, *G.*

"Lard, *eighty parts* [or four ounces av.]; Yellow Wax, *twenty parts* [or one ounce av.], To make *one hundred parts* [or five ounces av.]. Melt the Wax and add the Lard gradually; then stir the mixture constantly until cool." *U. S.*

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* *Populinated Lard.* M. Emile Mouchon gives the following method of applying to lard the preservative influence of poplar buds and benzoin. Having prepared, by percolation, a *tincture of poplar buds* from one part of the dried buds in powder and four of alcohol, he adds by degrees to 1000 parts of melted lard 60 parts of the tincture, so that all the alcohol may be driven off, then strains, and agitates the mixture till it concretes on cooling. The same method is pursued with the tincture of benzoin, in the same proportions; and the tincture of guaiac will answer the same purpose. Lard thus prepared keeps perfectly well for a very long time. (*Journ. de Pharm.*, xxv. 458.) Mr. T. B. Groves has shown that the oil of pimenta and balsam of Peru have, in a powerful degree, the same preservative influence on lard. (*P. J. Tr.*, Nov. 1864, p. 249.)

"Take of White Wax *two ounces* [avoirdupois]; Prepared Lard *three ounces* [avoird.]; Almond Oil *three fluidounces.* Melt the Wax and Lard in the Oil on a water-bath; then remove the mixture, and stir constantly while it cools." *Br.*

This is emollient, and is occasionally employed as a mild dressing to blistered or excoriated surfaces, but more frequently as a vehicle for more active substances. It is the basis of several officinal ointments.

Off. Prep. Unguentum Acidi Carbolici, *U. S.;* Ung. Antimonii Tartarati, *Br.;* Ung. Cadmii Iodidi, *Br.;* Ung. Creasoti, *Br.;* Ung. Elemi, *Br.;* Ung. Hydrargyri Ammoniati; Ung. Hydrarg. Iodidi Rubri, *Br.;* Ung. Hydrarg. Oxidi Flavi, *U. S.;* Ung. Hydrarg. Oxidi Rubri, *U. S.;* Ung. Plumbi Iodidi, *Br.;* Ung. Resinæ, *Br.*

UNGUENTUM ACIDI CARBOLICI. *U. S.* *Ointment of Carbolic Acid.*

(ỤN-GUĔN'TỤM ĂÇ'Ị-DĪ CẠR-BŎL'Ị-CĪ.)

Pommade d'Acide phénique, *Fr.;* Phenolsalbe, *G.*

"Carbolic Acid, *ten parts* [or forty-eight grains]; Ointment, *ninety parts* [or one ounce av.], To make *one hundred parts* [or about one ounce]. Mix them thoroughly." *U. S.*

The quantity of carbolic acid in this ointment has been decreased from 12 per cent. in the U. S. P. 1870 to 10 per cent. in the present revision. This is an improvement, for it is a very strong ointment, which for most purposes requires dilution.

UNGUENTUM ACIDI GALLICI. *U. S.* *Ointment of Gallic Acid.*

(ỤN-GUĔN'TỤM ĂÇ'Ị-DĪ GĂL'LỊ-CĪ.)

Pommade d'Acide gallique, *Fr.;* Gallussäuresalbe, *G.*

"Gallic Acid, *ten parts* [or forty-eight grains]; Benzoinated Lard, *ninety parts* [or one ounce av.], To make *one hundred parts* [or about one ounce]. Rub the Gallic Acid with the Benzoinated Lard, gradually added, until they are thoroughly mixed, avoiding the use of an iron spatula." *U. S.*

This is a new officinal ointment, which may be found useful as an astringent, but is much inferior to the ointment of tannic acid.

UNGUENTUM ACIDI TANNICI. *U. S.* *Ointment of Tannic Acid.*

(ỤN-GUĔN'TỤM ĂÇ'Ị-DĪ TĂN'NỊ-CĪ.)

Pommade d'Acide tannique, *Fr.;* Tanninsalbe, *G.*

"Tannic Acid, *ten parts* [or forty-eight grains]; Benzoinated Lard, *ninety parts* [or one ounce av.], To make *one hundred parts* [or about one ounce]. Rub the Tannic Acid with the Benzoinated Lard, gradually added, until they are thoroughly mixed, avoiding the use of an iron spatula." *U. S.*

Ointment of tannic acid is an excellent application in many cases of piles and prolapsus ani. It may be used also in flabby ulcers.

UNGUENTUM ACONITIÆ. *Br.* *Ointment of Aconitia.*

(ỤN-GUĔN'TỤM ĂC-Ọ-NĬ''TỊ-Æ—ăk-ọ-nĭsh'ẹ-ē.)

Pommade d'Aconitine, *Fr.;* Aconitinsalbe, *G.*

"Take of Aconitia *eight grains;* Rectified Spirit *half a fluidrachm;* Prepared Lard *one ounce* [avoirdupois]. Dissolve the Aconitia in the Spirit, add the Lard, and mix thoroughly." *Br.*

For the uses of this preparation, the reader is referred to the articles on *Aconitum* and *Aconitia.* Care must be taken not to apply it to an abraded or ulcerated surface, lest it might produce serious constitutional effects.

UNGUENTUM ANTIMONII TARTARATI. *Br.* *Ointment of Tartarated Antimony.*

(ỤN-GUĔN'TỤM ĂN-TỊ-MŌ'NỊ-Ī TĂR-TẠ-RĀ'TĪ.)

Antimonial Ointment, Tartar Emetic Ointment, Ointment of Tartarated Antimony; Unguentum Tartari Stibiati, *P. G.;* Ung. Stibiatum; Pommade stibiée, P. d'Autenrieth, *Fr.;* Pockensalbe, *G.*

"Take of Tartarated Antimony, in fine powder, *a quarter of an ounce;* Simple Ointment *one ounce.* Mix thoroughly." *Br.*

This ointment was omitted in the revision of U. S. P. 1880.* It may be most conveniently prepared, as in the Br. process, with *simple ointment*, as lard is too soft to be spread on linen, and simple ointment is sufficiently so to be applied by inunction.

The peculiar eruptive effects of tartar emetic may be procured by means of a strong solution, or of the powder sprinkled upon the surface or incorporated in the substance of some adhesive plaster, or of the ointment as above directed. The last method is, perhaps, the most convenient, and most generally resorted to. The proportion of tartar emetic may vary from one drachm to the ounce of lard to two drachms, or even to three drachms when a speedy effect is required, or when the skin is not very susceptible to its action. A small portion of the ointment may be rubbed twice a day, or more frequently, upon the surface to be affected, or it may be applied spread on a piece of linen. Care should be taken that the cuticle be entire, and that the application be not too long continued; as otherwise severe inflammation, and even gangrenous ulceration, may result.

UNGUENTUM AQUÆ ROSÆ. *U. S.* *Ointment of Rose Water. Cold Cream.*

(ỤN-GUĔN'TỤM Ā'QUÆ RŌ'ṢÆ—ā'kwē.)

Unguentum Leniens, *P. G.;* Cérat cosmétique, Crême froide, *Fr.*

"Expressed Oil of Almond, *fifty parts* [or five ounces av.]; Spermaceti, *ten parts* [or one ounce av.]; White Wax, *ten parts* [or one ounce av.]; Rose Water, *thirty parts* [or three fluidounces], To make *one hundred parts* [or ten ounces av.]. Melt together, at a moderate heat, the Oil, Spermaceti, and Wax; then gradually add the Rose Water, stir the mixture briskly and constantly until it is cool, and continue the stirring until it has become uniformly soft and creamy." *U. S.*

This preparation is a white, very soft, and elegant ointment, deriving a grateful odor from the rose water, which remains incorporated with the other constituents if kept enclosed in glazed vessels. The consistence of this ointment will not be quite so soft as that of the U. S. P. 1870, owing to the slight diminution in the quantity of oil and slight increase in the proportion of solids. We have found it an improvement to add oil of rose in the proportion of one drop to eight ounces, and to use an instrument known as the "Dover egg-beater" for giving it the desired creamy appearance. It is a pleasant, cooling application to irritated and excoriated surfaces, and may be used with great advantage for chapped lips and hands, so frequent in cold weather. As the ointment is liable to become rancid when long kept, and the water to separate upon exposure, Mr. Joseph Laidley has proposed the substitution for the rose water of oil of rose and glycerin, the former in the proportion of two drops, the latter in that of four fluidrachms, the quantity of spermaceti being increased by two drachms. (*A. J. P.*, xii. 119.) For some purposes the substitution is useful; but the officinal preparation is preferable for chapped hands, as the glycerin, not being absorbed, leaves an unpleasant sensation of stickiness on the skin.

UNGUENTUM ATROPIÆ. *Br.* *Ointment of Atropia.*

(ỤN-GUĔN'TỤM Ạ-TRŌ'PỊ-Æ.)

Pommade d'Atropine, *Fr.:* Atropinsalbe. *G.*

"Take of Atropia *eight grains;* Rectified Spirit *half a fluidrachm;* Prepared Lard *one ounce* [avoirdupois]. Dissolve the Atropia in the Spirit, add the Lard, and mix thoroughly." *Br.*

For the uses of this ointment, see *Belladonna* and *Atropina.* Caution must be observed that the ointment shall not come in contact with abraded, ulcerated, or wounded surfaces, and that it be not applied too freely to sound skin.

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* *Unguentum Antimonii.* "Take of Tartrate of Antimony and Potassium, in very fine powder, *one hundred grains;* Lard *four hundred grains.* Rub the Tartrate of Antimony and Potassium with the Lard, gradually added, until they are thoroughly mixed." *U. S.* 1870.

UNGUENTUM BELLADONNÆ. *U. S., Br.* *Belladonna Ointment.*

(ỤN-GUĔN′TỤM BĔL-LẠ-DŎN′NÆ.)

Pommade de Belladone, *Fr.;* Tollkirschensalbe, *G.*

"Alcoholic Extract of Belladonna, *ten parts* [or forty-eight grains]; Diluted Alcohol, *six parts* [or half a fluidrachm]; Benzoinated Lard, *eighty-four parts* [or four hundred grains], To make *one hundred parts* [or about one ounce]. Rub the Extract with the Diluted Alcohol, until uniformly soft, then gradually add the Lard, and mix thoroughly." *U. S.*

"Take of Extract of Belladonna *eighty grains;* Prepared Lard *one ounce* [avoirdupois]. Rub the Extract smooth with a few drops of distilled water, then add the Lard, and mix thoroughly." *Br.*

This is a convenient form for the external application of extract of belladonna. Care must be taken in preparing it that the extract employed have the due consistence; and, if dry and lumpy, it may be restored to the proper state by rubbing it with a little water in a heated mortar. The use of diluted alcohol as now officinally directed is still better.

UNGUENTUM CADMII IODIDI. *Br.* *Ointment of Iodide of Cadmium.*

(ỤN-GUĔN′TỤM CĂD′MỊ-Ī Ī-ŎD′Ị-DĪ.)

Pommade d'Iodure de Cadmium, *Fr.;* Jodkadmiumsalbe, *G.*

"Take of Iodide of Cadmium, in fine powder, *sixty-two grains;* Simple Ointment *one ounce* [avoirdupois]. Mix thoroughly." *Br.*

For its uses, see *Iodide of Cadmium,* page 306.

UNGUENTUM CANTHARIDIS. *Br.* *Ointment of Cantharides. Ointment of Spanish Flies.*

(ỤN-GUĔN′TỤM CẠN-THĂR′Ị-DĬS.)

Unguentum Cantharidum, *P.G.;* Unguentum Irritans, Unguentum ad Fenticulos; Onguent de Cantharides, *Fr.;* Spanischfliegensalbe, *G.*

"Take of Cantharides, Yellow Wax, each *one ounce* [avoirdupois]; Olive Oil *six fluidounces.* Infuse the Cantharides in the Oil, in a covered vessel, for twelve hours, then place the vessel in boiling water for fifteen minutes, strain through muslin with strong pressure, add the product to the Wax previously melted, and stir constantly while the mixture cools." *Br.*

The British process is a better one than that of the U. S. Pharmacopœia of 1870.* Olive oil is a good solvent of cantharidin. By its use the active matter of the flies is more uniformly diffused through the ointment than when they are directly incorporated in the state of powder, with the other ingredients. The preparation is thus better calculated to meet the end proposed of maintaining the discharge from blistered surfaces, without producing undue irritation. It has been said that the virtues of the flies are impaired by boiling; but the contrary has been proved to be the case, the cantharidin being neither altered nor volatilized at 100° C. (212° F.) (See *Cantharis.*) It should be recollected that this ointment is intended as a dressing for blisters, not to produce vesication, but the Committee of Revision wisely omitted the preparation from the U. S. P. 1880, as it was frequently prescribed under the impression that it was equal in strength to the cerate, in fact, identical with it, and disappointment resulted; such a preparation should be left to extemporaneous prescription. *Dupuytren's ointment,* employed as a local application to prevent the loss of hair, was made by macerating a drachm of flies in a fluidounce of alcohol, and incorporating one part of the tincture thus formed with nine parts of lard.

UNGUENTUM CETACEI. *Br.* *Spermaceti Ointment.*

(ỤN-GUĔN′TỤM CẸ-TĀ′CẸ-Ī.)

Onguent blanc, *Fr.;* Walrathsalbe, *G.*

"Take of Spermaceti *five ounces* [avoirdupois]; White Wax *two ounces* [avoird.];

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* "Take of Cantharides Cerate *one hundred and twenty grains;* Resin Cerate *three hundred and sixty grains.* Mix them thoroughly." *U. S.* 1870.

Almond Oil *one pint* [Imperial measure], or *a sufficiency.* Melt together with a gentle heat, remove the mixture, and stir constantly while it cools." *Br.*

This ointment is employed as a mild dressing for blisters, wounds, and excoriated surfaces. It should be made in small quantities at a time, as it is apt to become rancid when long kept.

UNGUENTUM CHRYSAROBINI. *U.S.* *Chrysarobin Ointment.*

(ỤN-GUĔN'TỤM ÇHRȲS-Ạ-RỌ-BĪ'NĪ.)

Pommade de Poudre de Goa, *Fr.;* Goapulversalbe, *G.*

"Chrysarobin, *ten parts* [or forty-eight grains]; Benzoinated Lard, *ninety parts* [or one ounce av.], To make *one hundred parts* [or about one ounce]. Rub the Chrysarobin with the Benzoinated Lard, gradually added, until they are thoroughly mixed." *U. S.*

This is a new officinal ointment, which has been used in psoriasis, ringworm, and other diseases of the skin, but has been to a great extent abandoned on account of the permanent stain that it leaves upon the linen; it has been to some extent supplanted by pyrogallic acid ointment.* The ointment is usually preferred when made by dissolving the chrysarobin in a little hot benzol, mixing this rapidly with a portion of the melted lard, and subsequently stirring before adding the rest of the lard.

UNGUENTUM CREASOTI. *U. S., Br.* *Ointment of Creasote.*

(ỤN-GUĔN'TỤM CRĒ-Ạ-SŌ'TĪ.)

Pommade de Créosote, *Fr.;* Kreosotsalbe, *G.*

"Take of Creasote *one fluidrachm;* Simple Ointment *one ounce* [avoirdupois]. Mix thoroughly." *Br.*

The British ointment is more than twice as strong as that officinal in the U. S. P. 1870, which was made by mixing half a fluidrachm of creasote with a troyounce of lard. For the use of this ointment, see *Creasotum.* It may sometimes be advantageously diluted with lard when found to irritate.

UNGUENTUM DIACHYLON. *U.S.* *Diachylon Ointment.*

(ỤN-GUĔN'TỤM DĪ-ĂÇH'Ỵ-LŎN—dī-ăk'ȩ-lŏn.)

Pommade de Diachylon, *Fr.;* Diachylonsalbe, *G.*

"Lead Plaster, *sixty parts* [or two hundred and sixty-four grains]; Olive Oil, *thirty-nine parts* [or one hundred and seventy grains]; Oil of Lavender, *one part* [or five minims], To make *one hundred parts* [or about one ounce]. Melt together the Lead Plaster and Olive Oil, at a moderate heat; then, having permitted the mass to become partly cool, incorporate with it the Oil of Lavender, and stir constantly until cold." *U. S.*

This new officinal ointment has been largely used by dermatologists in eczema and other skin diseases. It is frequently called "*Unguentum Diachylon Hebræ*" on account of its extensive use by Prof. Hebra, of Vienna. Vulpius states that the ointment used at Hebra's clinic, made according to the following formula, is very superior and will keep for weeks. 20 parts of litharge are heated with sufficient water and 80 parts of olive oil until the reaction is completed, when 1 part of oil of lavender is added to the strained and cooling mass.

Our experience with the ointment made by the latter formula is that the tendency to rancidity constitutes its greatest objection, and in warm weather it is impossible to keep it longer than a few days. If even slightly rancid, it is unfit for use in most cases. A. Deringer (*Pharm. Zeitschr. für Russland*, 1880, p. 103; *A. J. P.*, Sept. 1880) recommends the following modification. Dissolve 200 grammes of lead acetate in 1 litre of distilled water and 300 grammes of white Marseilles soap in 1½ litres of distilled warm water, filter both solutions, mix, wash the resulting precipitate frequently with distilled water, and, after removing the moisture from it as much as possible, melt 1 part of it together with 1½ parts best olive oil on a steam evaporating apparatus and triturate into a white, smooth ointment in a mortar, which then possesses all the excellent, mild and healing properties of Hebra's ointment.

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* The *ointment of pyrogallic acid* of the strength of from ten to forty grains to the ounce has been used as a substitute for chrysarobin ointment (*Unguentum Chrysarobini*). It is slower in its action than the ointment of chrysarobin, and also stains the hair, skin, etc. It is said when used too freely to cause constitutional disturbance, with fever, greenish urine, etc.

M. Eisner's modification, approved by Prof. L. A. Duhring, is as follows. One part of freshly-precipitated (from acetate of lead) pure white hydro-oxide of lead is rubbed with two parts of water, and mixed well with six parts of the best Lucca olive oil. It should be stirred for about two hours over a hot-water bath near the boiling point, and cooled with constant stirring until the proper consistence is obtained. While cooling, a drachm of oil of lavender to each half pound of ointment is to be added. (*Med. Times*, May 7, 1881.)

UNGUENTUM ELEMI. *Br.* *Ointment of Elemi.*

(ỤN-GUĔN'TỤM ĔL'Ẹ-MĪ.)

Unguentum (Balsamum) Arcæi; Onguent (Baume) d'Arcæus, *Fr.;* Elemisalbe, *G.*

"Take of Elemi *a quarter of an ounce;* Simple Ointment *one ounce.* Melt, strain through flannel, and stir constantly until the Ointment solidifies." *Br.*

This ointment is applied as a gentle stimulant to weak ulcers, and may be used for maintaining the discharge of issues and setons. It is the *linimentum arcæi* of the older pharmacy.

UNGUENTUM GALLÆ. *U. S., Br.* *Nutgall Ointment. Ointment of Galls.*

(ỤN-GUĔN'TỤM GĂL'LÆ.)

Pommade de Noix de Galle, *Fr.;* Galläpfelsalbe, *G.*

"Nutgall, in No. 80 powder, *ten parts* [or forty-eight grains]; Benzoinated Lard, *ninety parts* [or one ounce av.], To make *one hundred parts* [or about one ounce]. Rub the Nutgall with the Benzoinated Lard, gradually added, until they are thoroughly mixed." *U. S.*

"Take of Galls, in fine powder, *eighty grains;* Benzoated Lard *one ounce* [avoirdupois]. Mix thoroughly." *Br.*

Care should be taken to have the nutgall in very fine powder and thoroughly sifted. This is used chiefly in piles and prolapsus ani, though it may also be advantageously applied to flabby and indolent ulcers.

UNGUENTUM GALLÆ CUM OPIO. *Br.* *Ointment of Galls and Opium.*

(ỤN-GUĔN'TỤM GĂL'LÆ CŬM Ō'PỊ-Ō.)

"Take of Ointment of Galls *one ounce* [avoirdupois]; Opium, in powder, *thirty-two grains.* Mix thoroughly." *Br.*

This combination of galls and opium is sometimes employed for irritable piles. From half a drachm to a drachm of camphor is sometimes added.

UNGUENTUM HYDRARGYRI. *U. S., Br.* *Mercurial Ointment.* [*Blue Ointment.*]

(ỤN-GUĔN'TỤM HȲ-DRĂR'GỴ-RĪ.)

Unguentum Hydrargyri Cinereum, *P.G.;* Unguentum Mercuriale, s. Neapolitanicum; Pommade (Onguent) mercurielle, P. napolitaine, *Fr.;* Graue Quecksilbersalbe, *G.*

"Mercury, *four hundred and fifty parts* [or one ounce av.]; Lard, *two hundred and twenty-five parts* [or a half ounce av.]; Suet, *two hundred and twenty-five parts* [or a half ounce av.]; Compound Tincture of Benzoin, *forty parts* [or forty minims]; Mercurial Ointment, *one hundred parts* [or one hundred grains], To make *one thousand parts* [or about two ounces av.]. Mix the Mercury with the Tincture of Benzoin in a mortar, add the Mercurial Ointment, which should contain 50 per cent. of mercury, and triturate the mixture until globules of Mercury cease to be visible; then add the Lard and Suet, previously melted together and partially cooled, and continue the trituration until globules of Mercury cease to be visible under a magnifying power of ten diameters." *U. S.*

"Take of Mercury, Prepared Lard, each, *one pound* [avoirdupois]; Prepared Suet *one ounce* [avoird.]. Rub them together until metallic globules cease to be visible." *Br.*

The Pharmacopœias unite at present in recognizing but one mercurial ointment, which contains equal weights of mercury and fatty matter. When the physician wishes a weaker preparation, he may direct the ointment to be diluted with such a proportion of lard as may answer his purpose.

The officinal formula is particularly adapted to the extemporaneous preparation of this ointment, the process being that recommended by Prof. Joseph P. Remington (*A. J. P.*, 1881, p. 192); the mercurial ointment used in the process should not be old or rancid, as is usually recommended. The trituration should not be accompanied with pressure, but a light, rapid motion to the pestle is most effective. Compound tincture of benzoin was found by experiment to possess the adhesive properties necessary to extinguish the mercury rapidly, in the presence of a portion of mercurial ointment, whilst the alcohol is almost entirely dissipated by the time the ointment is finished, leaving less than one per cent. of the non-volatile constituents of the tincture.

In the preparation of mercurial ointment, care is requisite that the mercury should be completely extinguished. The trituration is usually performed upon the large scale in a marble mortar; as it is difficult to keep iron so clean as not to impart more or less oxide to the ointment. The mercury is known to be extinguished when a portion of the mass, rubbed upon paper or the back of the hand, exhibits no metallic globules under a magnifying glass of ten diameters. The operation cannot be considered as satisfactorily accomplished when the globules are invisible merely to the naked eye. To facilitate the process, which is very tedious, the addition of various substances has been proposed, calculated to hasten the disappearance of the metal. Turpentine and sulphur have been employed, but are inadmissible; the former because it renders the ointment too irritating, the latter because it forms with the mercury an active sulphide. Their presence in the ointment may be detected by the peculiar odor which they respectively emit when exposed to heat. Sulphur, moreover, gives the ointment a darker color than it has when pure. Rancidity in the lard employed facilitates the extinguishment of the mercury, but is liable to the same objection as turpentine, only to a greater degree. M. Guibourt recommends the addition of one-sixteenth of old mercurial ointment.* M. Simonin proposes the use of lard which has been exposed in thin layers to a damp air for fifteen days. This facilitates the extinguishment of the metal, but probably renders the preparation more irritant by the chemical alteration of the lard. The following plan of preparing the ointment was proposed by M. Chevallier. A pound of mercury, and half a pound of fresh lard, previously melted, are introduced into a stone or glass bottle, shaken till the mixture acquires the consistency of very thick syrup, then poured into a mortar, and incorporated by constant stirring, with an additional half pound of lard. In this manner, according to Chevallier, a perfect ointment may be made in half an hour. Dr. E. R. Squibb prepares this ointment by succussion in an apparatus which agitates the mixture of fats and mercury until the metal is extinguished. When prepared with lard alone, the ointment is apt, in hot weather, to become so soft as to allow the metal to separate. Hence the officinal use of suet; and even a larger proportion might be employed, during the summer season.

Dr. Christison states that the better plan is not to complete the process by a continuous trituration, but to operate for a short time every day, and allow the ointment in the mean time to be exposed to the air. But so much time and labor is required in this process, that the ointment is preferably made by machinery on the large scale. The fatty matters, kept in the fluid state by a heat of about 37·7° C. (100°F.), are triturated with the metal by means of two iron balls, which are driven rapidly round in a circular trough by steam power. The extinguishment of the mercury is thus effected in about twelve hours. In buying from the manufacturer, great care should be exercised by the pharmacist, as much of the commercial ointment contains less than the officinal percentage of mercury. Indeed, it is sometimes found in the market without a trace of mercury, having been made by mixing up lampblack with rancid lard and suet, until the proper tint is obtained.

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* It appears that Mr. J. Higginbottom made known, so long ago as the year 1814, this mode of extinguishing mercury. He recommends that equal weights of the old ointment and of mercury should be rubbed together, till the globules quite disappear, and the requisite proportion of lard then added. It is not necessary that the mercurial ointment should be rancid. (*P. J. Tr.*, xvi. 215.) For a process recommended by Mr. J. M. Maisch, of which the peculiarity is the use of mercury passed through chamois leather, so as to be sprinkled in minute division over the fat, see *A. J. P.* (xxviii. 107); and for another by Mr. E. H. Hance, in which melted spermaceti is employed as the extinguishing material, and which is said to answer well for small quantities, see the same journal (xxix. 15). M. E. Mouchon uses wax or stearin to facilitate extinguishment, and recommends benzoinated lard as the vehicle. (*Journ. de Chim. Méd.*, Nov. 1856, p. 652.) Geo. Boyle uses a portion of old mercurial ointment and ether. (*A. J. P.*, xlvi. 561.) M. Melseur affirms that the addition of glycerin very materially hastens the process. (*P. J. Tr.*, 1871, p. 339.)

A method of preparing mercurial ointment, proposed by Orosi, is to precipitate metallic mercury, in the pulverulent form, from a solution of corrosive sublimate, by an excess of stannous chloride, with the addition of hydrochloric acid; and, having poured off the supernatant fluid, washed the precipitate with warm water, and dried it between bibulous paper, to incorporate it with the prescribed proportion of lard. To prevent the precipitated mercury from running into globules, it is recommended to cover with fat the interior of the vessel in which the precipitation takes place. For an account of many expedients that have been proposed to facilitate the extinguishment of the metal, see a paper by Dieterich (*A. J. P.*, 1880, p. 138).

Mercurial ointment has when newly prepared a bluish color, which becomes darker by age. It has been thought to contain the mercury in the state of mercurous oxide; but most of the metal can be separated by methods not calculated to reduce the oxide; and it is now generally admitted that by far the greater part of it exists in a state of minute division, and not of chemical combination. It has been shown, however, that the metal is slightly oxidized; and the change of color which the ointment undergoes with age is attributable to further oxidation. If the ointment be kept long melted in a narrow vessel, metallic mercury subsides, and an oily liquid floats upon the surface. After this has been filtered so as to separate everything undissolved, it is blackened by sulphuretted hydrogen, and yields a trace of oxide of mercury to acetic acid. Dr. Christison states that he has examined various samples of the ointment, and never failed to detect oxide of mercury; and he has inferred from his observations that the oxide amounts to rather more than 1 per cent. (*Christison's Dispensatory.*) But the proportion is variable, according to the age and mode of preparation of the ointment. It scarcely admits of a doubt that the oxide of mercury formed enters into chemical combination with the lard, or one of its fatty acids. Mr. Donovan advanced the idea that the medicinal activity of the ointment depended exclusively on this compound of the lard with the mercurial oxide. But an ointment made by merely mixing lard and black oxide of mercury has not the same effect, because there is no chemical union between the ingredients. But, upon exposing such a mixture to a temperature of 176·6° C. (350° F.), and continually agitating it for two hours, he found that every ounce of lard dissolved and combined with twenty-one grains of oxide, and the resulting compound was proved to be equally effectual with the common ointment, and capable of being introduced into the system in one-third of the time. It has been proposed to substitute an ointment thus prepared for that made according to the officinal directions, as being more manageable and of more uniform strength. Care, however, would be required in preparing it to avoid a temperature either too high or too low; as the former might decompose the oxide, and the latter would be insufficient to effect its union with the lard. There would be danger, also, that the lard might be rendered irritant by the influence of the heat. From experiments by a committee of the College of Pharmacy of New York, it appears that the ointment, contained in jars, becomes somewhat unequal in consequence of the settling of the metallic ingredient. The inference is that, after long standing, the contents of the jar should be triturated so as to restore an equable strength before being dispensed. (*A. J. P.*, xvi. 2.)

Medical Uses. Mercurial ointment, when rubbed upon the surface of the body, produces, in consequence of its absorption, the general effects of mercury upon the system. It is resorted to either alone, when circumstances prevent or discourage the internal use of mercury, or conjointly with the internal use of the medicine, to produce a more speedy or powerful effect in urgent cases. It may also be advantageously employed as a resolvent in local affections; as in the case of venereal buboes, and of chronic glandular swellings, upon which it may be made to operate directly by being applied in the course of the absorbents passing through the enlarged glands. The proper quantity to be employed at one time, with a view to salivation, is about a drachm, which should be applied night and morning, by means of friction, to the inner surface of the thighs, legs, or arms, and continued till the system is affected. (See *Oleatum Hydrargyri*, page 989.)

In urgent cases, or in local affections, it may also be rubbed on other parts of the body, or applied to blistered surfaces. The friction should on each occasion be continued till the whole of the ointment is absorbed. When frequently rubbed upon the same part, it is apt to produce a disagreeable eruption, which interferes with its continued application. Camphor is sometimes added, in order to render it more easy of absorption; but, without producing this effect, it increases the liability of the ointment to irritate the skin, and is of no other advantage than to soften its consistence when too firm from a large proportion of suet. Mercurial ointment has been employed, with some success, to prevent the maturation of the smallpox pustule, and the consequent pitting. For this purpose it may be applied to the face or other part, thickly spread on patent lint or muslin, care being taken to prevent the access of the air to the covered part. To be successful it must be applied before the third or fourth day of the eruption. The ointment has been recommended also in erysipelas and chilblains. Iodide of potassium, rubbed with mercurial ointment, is said to promote the separation of the mercury in the form of globules (*Journ. de Pharm.*, 3e sér., x. 356); but the effect does not take place if the iodide is thoroughly dried and well powdered, and the ointment added to it by small portions at a time. (*Ibid.*, x. 421.) The ointment, diluted with twice or three times its weight of lard, is sometimes applied to ulcers, and to certain cutaneous eruptions.

Off. Prep. Linimentum Hydrargyri, *Br.;* Suppositoria Hydrargyri, *Br.;* Unguentum Hydrargyri Compositum, *Br.*

UNGUENTUM HYDRARGYRI AMMONIATI. *U. S., Br.* *Ointment of Ammoniated Mercury.*

(ỤN-GUĔN'TỤM HȲ-DRÄR'ÇỴ-RĪ ẠM-MŌ-NỊ-Ā'TĪ.)

Unguentum Præcipitati Albi; Ointment of White Precipitate; Unguentum Hydrargyri Præcipitati Albi, *P.G.;* Pommade de Précipité blanc, *Fr.;* Weisse Quecksilbersalbe, *G.*

"Ammoniated Mercury, in very fine powder, *ten parts* [or forty-eight grains]; Benzoinated Lard, *ninety parts* [or one ounce av.], To make *one hundred parts* [or about one ounce]. Rub the Ammoniated Mercury with the Benzoinated Lard, gradually added, until they are thoroughly mixed." *U. S.*

"Take of Ammoniated Mercury *sixty-two grains;* Simple Ointment *one ounce* [avoirdupois]. Mix thoroughly." *Br.*

Used chiefly in cutaneous eruptions, such as psora, porrigo, and herpes.

UNGUENTUM HYDRARGYRI COMPOSITUM. *Br.* *Compound Ointment of Mercury.*

(ỤN-GUĔN'TỤM HȲ-DRÄR'ÇỴ-RĪ CỌM-PŎṢ'Ị-TŬM.)

Pommade mercurielle composée, *Fr.;* Kampfer Quecksilbersalbe, *G.*

"Take of Ointment of Mercury *six ounces;* Yellow Wax, Olive Oil, of each, *three ounces;* Camphor *one ounce and a half.* Melt the wax with a gentle heat and add the Oil, then, when the mixture is nearly cold, add the Camphor in powder, and the Ointment of Mercury, and mix the whole thoroughly together." *Br.*

The addition of camphor to mercurial ointment tends to soften it, and is thought by some to promote the absorption of the mercury.

UNGUENTUM HYDRARGYRI IODIDI RUBRI. *Br.* *Ointment of Red Iodide of Mercury.*

(ỤN-GUĔN'TỤM HȲ-DRÄR'ÇỴ-RĪ Ī-ŎD'Ị-DĪ RÛ'BRĪ.)

Pommade de Dentoiodure de Mercure, *Fr.;* Jodquecksilbersalbe, *G.*

"Take of Red Iodide of Mercury, in fine powder, *sixteen grains;* Simple Ointment *one ounce* [avoirdupois]. Mix thoroughly." *Br.*

This ointment, which is identical with that officinal in the U. S. P. 1870, with the exception that the troyounce instead of the avoirdupois ounce was used in the U. S. P. formula, is employed as a dressing to scrofulous and syphilitic ulcers, especially when they are very indolent.

UNGUENTUM HYDRARGYRI NITRATIS. *U. S., Br.* *Ointment of Nitrate of Mercury.* [*Citrine Ointment.*]

(ỤN-GUĔN'TỤM HȲ-DRĂR'ǤỴ-RĪ NĪ-TRĀ'TĬS.)

Unguentum Citrinum; Unguentum Hydrargyri Citrinum; Pommade de Nitrate de Mercure, *Fr.;* Gelbe Quecksilbersalbe, *G.*

"Mercury, *seven parts* [or four hundred and forty-four grains]; Nitric Acid, *seventeen parts* [or one fluidounce and five fluidrachms]; Lard Oil, *seventy-six parts* [or eleven ounces av.]. Heat the Lard Oil, in a glass or porcelain vessel, to a temperature of 70° C. (158° F.); then add, without stirring, *seven parts* [or five fluidrachms] of Nitric Acid, continue the heat so long as a moderate effervescence continues, and allow the mixture to cool. Dissolve the Mercury in the remainder of the Nitric Acid, with the aid of sufficient heat to prevent the solution from crystallizing, add this solution to the mixture before it has become entirely cold, and mix them thoroughly, avoiding the use of an iron spatula." *U. S.*

"Take of Mercury, by weight, *four ounces* [avoirdupois]; Nitric Acid *twelve fluidounces;* Prepared Lard *fifteen ounces* [avoird.]; Olive Oil *thirty-two fluidounces.* Dissolve the Mercury in the Nitric Acid with the aid of a gentle heat; melt the Lard in the Oil, by a steam or water-bath, in a porcelain vessel capable of holding six times the quantity; and, while the mixture is hot, add the Solution of Mercury, also hot, mixing them thoroughly. If the mixture do not froth up, increase the heat till this occurs. Keep it stirred until it is cold." *Br.*

The chemical changes which take place in the preparation of this ointment are not precisely known. They differ somewhat according to the circumstances under which the operation is performed; for example, according to the proportion and strength of the acid, the nature of the fatty matter, and the degree of heat employed. In the British process and that of the U. S. P. 1870 the mercury, in the first step of the process, is converted into a mixture of mercuric and mercurous nitrate by the addition of nitric acid in excess, with the loss of some of the free nitric acid through deoxidation. When the acid mercurial solution is added to the fatty matter, a reaction takes place, which results in the fat being oxidized at the expense of the free nitric acid, nitrogen dioxide and nitrogen tetroxide being at the same time liberated, the olein of the fat is converted into elaïdin, which change is recognized by the beautiful orange color of the fat. But the degree to which these changes take place is influenced greatly by the temperature to which the mixture is exposed. If this be low, there is little or no escape of gas; if elevated, there is a copious evolution of nitrous fumes. In the former case the changes are obviously less considerable than in the latter.

As formerly prepared, this ointment, though at first beautifully yellow and of the proper consistence, soon began to change, acquiring in time a dirty greenish and mottled color, and becoming so hard and friable as to be unfit for use unless mixed with lard. These results were ascribed to various causes, and many different modifications of the process were proposed in order to obviate them. The U. S. process of 1860 was based upon the fact that the olive oil of the former British process is hardened by nitrous acid or the nitrate of mercury, while the same effect is not produced upon neat's-foot oil. As at first published, the process was defective in the direction to add the mercurial solution to the mixed oleaginous fluid when it begins to stiffen on cooling. When this direction was complied with, at least with the acid of the ordinary strength, the preparation had a brown color and semi-liquid consistence; but, with some modifications such as were introduced into the revised formula of the Pharmacopœia of 1850, the process yielded an excellent ointment, which, though it sometimes assumed a greenish color on exposure, retained permanently a soft unctuous consistence. We have had specimens of the ointment in our possession for several years, which have retained a uniform yellowish color, and a perfectly good unctuous consistence. R. Rother, however, affirmed that the fault is not in the components, but in the processes of the officinal formula of 1870 (*A. J. P.*, xlii. 420), especially in the use of too high a heat;* and these views have been confirmed by ample experience. The present officinal process is, as will be seen, based on Rother's formula, the principal modification being the substitution of lard oil, which obviates a tendency of the ointment to become too hard and of a granular consistence. The value of Rother's process lies principally in the fact that the olein of the oil is first converted into elaïdin by the addition of nitric acid alone, and the application of heat, and when the reaction has ceased and the basis of citrine ointment, as it might be called, is prepared, and nearly cold, the mercurial solution is added. In this way decomposition of the mercuric nitrate is avoided, as it is not subjected to heat, and the result is an ointment which will retain its color and consistence a long time. The drying vegetable oils do not appear, like olive oil, to be converted by nitrous acid or the nitrate of mercury into elaïdin; and it was a fair inference that they might be employed advantageously in the preparation of citrine ointment. Accordingly, Dr. Fessenden, of North Carolina, states, in an inaugural essay, that he substituted linseed oil for the neat's-foot oil of the U. S. process, and succeeded in obtaining a perfectly good and durable ointment. M. Falieres has found the oil of the ground-nut (*Arachis hypogæa*) to answer very well. (*P. J. Tr.*, 1873, p. 1031.) Washed butter is frequently used as the fat.

In the British process, when the fatty matter and mercurial solution are mixed, care must be taken that the heat applied be not too great. Gas is extricated at 82·2° C. (180° F.), and at 100° C. (212° F.) escapes so abundantly that the mixture boils over unless the vessel is very large. (*Alsop.*) Besides, if the heat is too great, a portion of the mercury is reduced, and the color of the ointment impaired. When large quantities of materials are operated upon, the reaction which occurs produces of itself a sufficient heat; but in ordinary cases the temperature should be kept at about 87·7° C. (190° F.) by means of a water-bath, and if it exceed 96·1° C. (205° F.) should be reduced. It should always be sufficient to produce a copious extrication of gas. The ointment should be prepared in a glass, porcelain, or well-glazed earthen vessel; and a glass rod or wooden spatula should be employed for stirring the mixture.

Medical Uses. This ointment is much and very advantageously employed, as a stimulant and alterative application, in porrigo or tinea capitis, impetigo larvalis or crusta lactea, psoriasis and pityriasis, certain forms of chronic eczema, psorophthalmia and inflammation of the eye and eyelids connected with porrigo of the face or scalp, and various other ulcerative and eruptive affections. It should be diluted with lard, unless in cases which require a very stimulant application. Some care is requisite in its use, to avoid the risk of salivation. When hard and friable, it must be rubbed up with fresh lard before it can be applied.

An ointment prepared with lard and nitric acid, called *Alyon's ointment*, after the person who first prepared it, was formerly much used in cases similar to those in which the citrine ointment is now employed. The *ointment of nitric acid* of the former Edinburgh and Dublin Pharmacopœias was of this character.

UNGUENTUM HYDRARGYRI OXIDI FLAVI. *U.S.* *Ointment of Yellow Oxide of Mercury.*

(ỤN-GUĔN'TỤM HȲ-DRĂR'ĢỴ-RĪ ŎX'Ị-DĪ FLĀ'VĪ.)

Pommade d'Oxyde jaune de Mercure, *Fr.;* Gelbe Quecksilberoxydsalbe, *G.*

"Yellow Oxide of Mercury, in very fine powder, *ten parts* [or forty-eight grains];

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* R. Rother's formula is as follows. "Take of Mercury 1½ troyounces; Nitric Acid, sp. gr. 1·42, 3½ troyounces; Lard, pure, 16½ troyounces. Dissolve the Mercury in 900 grains of the Nitric Acid, with the aid of heat, and keep the solution gently warm to prevent crystallization before it is used. Melt the Lard in a suitable vessel, with a moderate heat; then add the remainder of the Nitric Acid, and continue the heat, *without* stirring the mixture, as long as moderate effervescence continues; but if this becomes too violent, remove the mixture from the fire, and only replace it when the action slackens too much. Finally, when effervescence ceases, and the liquid only boils even under an increased heat. remove the mixture from the fire altogether; and when it begins to stiffen, add the mercurial solution and mix thoroughly." (*A. J. P.*, xlii. 420.) (For a formula in which neat's-foot oil is used, claimed by Mr. Thos. J. Covell to be superior to the officinal, and for a bibliography of the subject, see *A. J. P.*, xlii. 211.)

Ointment, *ninety parts* [or one ounce av.], To make *one hundred parts* [or about one ounce]. Rub the Oxide of Mercury with the Ointment, gradually added, until they are thoroughly mixed." *U. S.*

The unctuous vehicle of this ointment, without being so liquid as to allow the powder to subside, must yet melt at the heat of the body, and thus, when introduced into the eye, spread equably over the surface. It should, moreover, be as far as possible chemically indifferent to the oxide, and, while perfectly bland in its proper state, should not be liable to become irritating by rancidity. Simple ointment has been adopted by the revisers of the Pharmacopœia; but petrolatum, or a mixture of butter of cacao and almond oil, or of spermaceti, wax, and almond oil, without the rose-water, would be more elegant. (*P. J. Tr.*, 2d ser., vii. 324.)

UNGUENTUM HYDRARGYRI OXIDI RUBRI. *U.S.*, *Br.*

Ointment of Red Oxide of Mercury.

(ỤN-GUĔN′TỤM HȲ-DRÄR′ÇỴ-RĪ ŎX-Ị-DĪ RŪ′BRĪ.)

Unguentum Hydrargyri Rubrum, *P.G.;* Unguentum Præcipitatum Rubrum; Pommade de Précipité rouge; Baume ophthalmique rouge, *Fr.;* Rothe Quecksilbersalbe, *G.*

"Red Oxide of Mercury, in very fine powder, *ten parts* [or forty-eight grains]; Ointment, *ninety parts* [or one ounce av.], To make *one hundred parts* [or about one ounce]. Rub the Oxide of Mercury with a small quantity of the Ointment, until a perfectly smooth mixture is obtained; then gradually add the remainder of the Ointment, and mix thoroughly." *U. S.*

"Take of Red Oxide of Mercury, in very fine powder, *sixty-two grains;* Yellow Wax *one-quarter of an ounce* [avoirdupois]; Oil of Almonds *three-quarters of an ounce* [avoird.]. Melt the Wax at a gentle heat, mix the Oil with it, and when the mixture is nearly cold, add the Oxide of Mercury, and mix the whole thoroughly together." *Br.*

The red oxide of mercury here referred to is that prepared from the nitrate, and usually called *red precipitate.* It is important that the oxide should be thoroughly pulverized before being mixed with the lard; as otherwise it might prove injurious in cases of ophthalmia, in which it is sometimes used. When great care is taken to have the red oxide very finely pulverized, the color is more yellowish than is usual. This ointment loses its fine red color when long kept, probably in consequence of the conversion of the red oxide into the black, or its reduction to the metallic state. It is best to prepare it only in small quantities at a time. We have been informed that, if the preparation be made by mixing the red oxide with poplar-bud ointment, it will keep a long time without change. According to R. H. Stabler, of Alexandria, Va., an equally effectual method is to mix two drops of Liquor Potassæ with each ounce of the ointment when prepared (*A. J. P.*, xxiii. 123); but Mr. Kalish states that this is not effectual. According to Mr. Emil Martin, if a mixture of six parts of castor oil to two of wax be used as the basis of the ointment, the red color will remain unchanged for years. (*A. J. P.*, xliv. 202.) Mr. Julius Kalish substitutes oil of sweet almonds for the castor oil, on account of the unpleasant odor of the latter. (*A. J. P.*, xlv. 69.) Ointment of red oxide of mercury is a highly useful stimulating ointment, much employed in indolent and foul ulcers, in porrigo of the scalp, psorophthalmia and chronic conjunctival ophthalmia, especially when attended with thickening of the inner membrane of the eyelids, or with specks upon the cornea, but it is rapidly being supplanted by the ointment of yellow oxide of mercury. It may be diluted with lard if found too stimulating.

UNGUENTUM HYDRARGYRI SUBCHLORIDI. *Br.* *Ointment of Subchloride of Mercury.*

(ỤN-GUĔN′TỤM HȲ-DRÄR′ÇỴ-RĪ SŬB-ÇHLŌ′RỊ-DĪ.)

Unguentum Calomelanos, *Br.* 1864; Ointment of Calomel; Pommade de Calomélas, *Fr.;* Quecksilberchlorürsalbe, *G.*

"Take of Subchloride of Mercury *eighty grains;* Prepared Lard *one ounce* [avoirdupois]. Mix thoroughly." *Br.*

There is little occasion for such a preparation as this. Calomel is much inferior for affecting the system by inunction to the mercurial ointment; and as an application to ulcerated surfaces the form of cerate would be better. It may, however, be useful in certain cutaneous eruptions by being rubbed upon the part.

UNGUENTUM IODI. *U.S., Br.* *Iodine Ointment.*

(ỤN-GUĔN'TỤM Ī-Ō̆'DĪ.)

Unguentum Iodinii, *U. S.* 1870; Pommade d'Iode, *Fr.;* Jodsalbe, *G.*

"Iodine, *four parts* [or eighteen grains]; Iodide of Potassium, *one part* [or four grains]; Water, *two parts* [or eight minims]; Benzoinated Lard, *ninety-three parts* [or four hundred and twenty grains], To make *one hundred parts* [or about one ounce]. Rub the Iodine and Iodide of Potassium, first with the Water and then with the Benzoinated Lard, gradually added, until they are thoroughly mixed, avoiding the use of an iron spatula." *U. S.*

"Take of Iodine, Iodide of Potassium, of each, *thirty-two grains;* Proof Spirit *one fluidrachm;* Prepared Lard *two ounces* [avoirdupois]. Rub the Iodine and Iodide of Potassium well together, with the Spirit, in a glass or porcelain mortar, add the Lard gradually, and mix thoroughly." *Br.**

The object of the iodide of potassium and water is simply to bring the iodine into a state in which it may be thoroughly and equably incorporated with the lard. They have been found to answer better in practice than the alcohol formerly used.

Owing to the evaporation of the water, this ointment is said at times to contain sharp crystals of iodine. The use of glycerin instead of water would obviate this. When rubbed upon the skin it imparts to it an orange color, which, however, slowly disappears with the evaporation of the iodine. It is useful as a local application in goitre, scrofulous swellings of the glands and other chronic tumefactions, internal or external, operating probably through the medium of absorption. When continued for some time it occasionally produces a pustular eruption upon the portion of skin to which it is applied. Dr. Cerchiari strongly recommends it in cases of enlarged tonsils, after the disappearance of inflammation. It should be applied to the tonsils morning and evening by means of a camel's-hair pencil. In two months, according to the author, the enlargement disappears. (*A. J. P.*, viii. 83.) It has also been recommended in chilblains. The ointment should be prepared only when wanted for use; for it undergoes change if kept, losing its deep orange-brown color, and becoming pale upon its surface.

UNGUENTUM IODOFORMI. *U.S.* *Iodoform Ointment.*

(ỤN-GUĔN'TỤM Ī-Ọ-DỌ-FÖR'MĪ.)

"Iodoform, in very fine powder, *ten parts* [or forty-eight grains]; Benzoinated Lard, *ninety parts* [or one ounce av.], To make *one hundred parts* [or about one ounce]. Rub the Iodoform with the Benzoinated Lard, gradually added, until they are thoroughly mixed." *U. S.*

This is a new officinal ointment. It is important to have the iodoform in a very fine powder, as officinally directed, and, owing to the powerful odor of iodoform, it is usual to add oil of bitter almond or one of the other volatile oils, balsam of Peru, or a similar substance, to render the odor more bearable.

UNGUENTUM MEZEREI. *U.S.* *Mezereum Ointment.*

(ỤN-GUĔN'TỤM MẸ-ZĒ'RẸ-Ī.)

Pommade épispastique au Garou, Pommade de Mézéréon, *Fr.;* Seidelbastsalbe, *G.*

"Fluid Extract of Mezereum, *twenty-five ports* [or two fluidrachms]; Lard, *eighty parts* [or three hundred and sixty grains]; Yellow Wax, *twelve parts* [or fifty-four grains] [To make about one ounce av.]. Melt together the Lard and Wax with a moderate heat, add the Fluid Extract, and stir the mixture constantly until the alcohol has evaporated; then continue to stir until cool." *U. S.*

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* *Unguentum Iodinii Compositum.* U. S. 1870. "Take of Iodine *fifteen grains;* Iodide of Potassium *thirty grains;* Water *thirty minims;* Lard *a troyounce.* Rub the Iodine and Iodide of Potassium first with the Water, and then with the Lard, until they are thoroughly mixed." *U. S.* 1870.

This ointment is equivalent to the *pommade épispastique au garou* of the French Codex, which is prepared from the bark of *Daphne Gnidium.* It may also be made, as proposed by Guibourt, by mixing two drachms of the alcoholic extract of mezereum with nine ounces of lard and one ounce of wax. It is used as a stimulating application to blistered surfaces and to obstinate, ill-conditioned and indolent ulcers.

UNGUENTUM PICIS LIQUIDÆ. *U.S., Br.* *Tar Ointment.*

(ỤN-GUĔN'TỤM PĪ'CĬS LĬQ'UỊ-DÆ—lik'wẹ-dẹ.)

Pommade de Goudron, *Fr.;* Theersalbe, *G.*

"Tar, *fifty parts*, Suet, *fifty parts*, To make *one hundred parts.* Mix the Tar with the Suet, previously melted with a moderate heat, and, having strained the mixture through muslin, stir it constantly until cool." *U. S.*

"Take of Tar *five ounces;* Yellow Wax *two ounces.* Melt the Wax with a gentle heat, add the Tar, and stir the mixture briskly while it cools." *Br.*

This ointment is highly useful as a stimulant application in various scaly and scabby eruptions, particularly in psoriasis and lepra, and in that form of porrigo usually called tinea capitis, or scald-head. In the last-mentioned affection, it should be applied night and morning; and in bad cases the patient should constantly wear a cap thickly coated internally with the ointment. As it is often applied to the surface with friction, the suet of the U. S. process is, we think, better suited to give a proper consistence than is the wax of the British formula.

UNGUENTUM PLUMBI ACETATIS. *Br.* *Ointment of Acetate of Lead.*

(ỤN-GUĔN'TỤM PLŬM'BĪ ĂÇ-Ẹ-TĀ'TĬS.)

"Take of Acetate of Lead, in fine powder, *twelve grains;* Benzoated Lard *one ounce* [avoirdupois]. Mix thoroughly." *Br.*

A new officinal of the Br. Pharmacopœia, used as a dressing for inflamed and excoriated surfaces, though inferior, we think, to the cerate of the subacetate.

UNGUENTUM PLUMBI CARBONATIS. *U.S., Br.* *Ointment of Carbonate of Lead.*

(ỤN-GUĔN'TỤM PLŬM'BĪ CÄR-BỌ-NĀ'TĬS.)

Unguentum Cerussæ, s. Ung. Album Simplex, *P.G.;* Pommade de Carbonate de Plomb, Onguent blanc de Rhazis, *Fr.;* Bleiweisssalbe, *G.*

"Carbonate of Lead, in very fine powder, *ten parts* [or forty-eight grains]; Benzoinated Lard, *ninety parts* [or one ounce av.], To make *one hundred parts* [or about one ounce]. Rub the Carbonate of Lead with the Benzoinated Lard, gradually added, until they are thoroughly mixed." *U. S.*

"Take of Carbonate of Lead, in fine powder, *sixty-two grains;* Simple Ointment *one ounce* [avoirdupois]. Mix thoroughly." *Br.*

This ointment is used as a dressing to blistered or excoriated surfaces, burns, etc.

UNGUENTUM PLUMBI IODIDI. *U.S., Br.* *Ointment of Iodide of Lead.*

(ỤN-GUĔN'TỤM PLŬM'BĪ Ī-ŎD'Ị-DĪ.)

Pommade d'Iodure de Plomb, *Fr.;* Jodbleisalbe, *G.*

"Iodide of Lead, in very fine powder, *ten parts* [or forty-eight grains]; Benzoinated Lard, *ninety parts* [or one ounce av.], To make *one hundred parts* [or about one ounce]. Rub the Iodide of Lead with the Benzoinated Lard, gradually added, until they are thoroughly mixed." *U. S.*

"Take of Iodide of Lead, in fine powder, *sixty-two grains;* Simple Ointment *one ounce* [avoirdupois]. Mix thoroughly." *Br.*

For the uses of this ointment, see *Plumbi Iodidum.*

UNGUENTUM PLUMBI SUBACETATIS COMPOSITUM. *Br.* *Compound Ointment of Subacetate of Lead.*

(ỤN-GUĔN′TỤM PLŬM′BĪ SŬB-ĂÇ-Ẹ-TĀ′TĬS CỌM-PŎŞ′Ị-TŬM.)

See *Ceratum Plumbi Subacetatis.*

UNGUENTUM POTASSÆ SULPHURATÆ. *Br.* *Ointment of Sulphurated Potash.*

(ỤN-GUĔN′TỤM PỌ-TĂS′SÆ SŬL-PHŪ-RĀ′TÆ.)

Pommade de Foie de Soufre, *Fr.;* Schwefellebersalbe, *G.*

"Take of Sulphurated Potash *thirty grains;* Prepared Lard *one ounce* [avoirdupois]. Triturate the Sulphurated Potash in a porcelain mortar and gradually add the Lard, rubbing them together until the ointment is perfectly smooth and free from grittiness. The ointment when used should be recently prepared." *Br.*

This is another officinal novelty of the Br. Pharmacopœia, which, considering its extreme simplicity of preparation, and the expediency of making it only when wanted, might well have been left to extemporanous prescription. It may be used as a local remedy in scabies, the advanced stages of favous and eczematous affections, and all other cutaneous diseases which may have their origin in microscopic organisms. Its offensive odor may be corrected by incorporation with a little oil of anise.

UNGUENTUM POTASSII IODIDI. *U.S., Br.* *Ointment of Iodide of Potassium.*

(ỤN-GUĔN′TỤM PỌ-TĂS′SỊ-Ī Ī-ŎD′Ị-DĪ.)

Unguentum Kalii Iodati, *P.G.;* Pommade iodurè, *Fr.;* Jodkaliumsalbe, *G.*

"Iodide of Potassium, in fine powder, *twelve parts* [or sixty grains]; Hyposulphite of Sodium, *one part* [or five grains]; Boiling Water, *six parts* [or half a fluidrachm]; Benzoinated Lard, *eighty-one parts* [or four hundred grains], To make *one hundred parts* [or about one ounce]. Dissolve the Iodide of Potassium and the Hyposulphite of Sodium in the Boiling Water, in a warm mortar; then gradually add the Benzoinated Lard, and mix thoroughly." *U. S.*

"Take of Iodide of Potassium *sixty-four grains;* Carbonate of Potash *four grains;* Distilled Water *one fluidrachm;* Prepared Lard *one ounce* [avoirdupois]. Dissolve the Iodide of Potassium and Carbonate of Potash in the Water, and mix thoroughly with the Lard." *Br.*

The U. S. preparation of 1870 was apt to become discolored by time in consequence of the liberation of iodine. This is prevented in the U. S. P. 1880 by the hyposulphite of sodium, which also produces traces of iodide of sodium and sulphur. It is said that the same object may be obtained by mixing two drops of *Liquor Potassæ* with each ounce of the freshly-prepared ointment. (*A. J. P.*, xxiii. 123.) The addition of carbonate of potash by the present Br. Pharmacopœia is no doubt made with this object. This ointment is employed for the discussion of goitres, scrofulous tumors, and other indolent swellings, and is sometimes preferred to the ointment of iodine, as it does not, like that, discolor the skin.

UNGUENTUM RESINÆ. *Br.* *Ointment of Resin.*

(ỤN-GUĔN′TỤM RẸ-ŞĪ′NÆ.)

See *Ceratum Resinæ.*

UNGUENTUM SABINÆ. *Br.* *Ointment of Savin.*

(ỤN-GUĔN′TỤM SẠ-BĪ′NÆ.)

See *Ceratum Sabinæ.*

UNGUENTUM STRAMONII. *U.S.* *Stramonium Ointment.*

(ỤN-GUĔN′TỤM STRẠ-MŌ′NỊ-Ī.)

Pommade de Stramoine, *Fr.;* Stechapfelsalbe, *G.*

"Extract of Stramonium, *ten parts* [or forty-eight grains]; Water, *five parts* [or half a fluidrachm]; Benzoinated Lard, *eighty-five parts* [or four hundred grains], To make *one hundred parts* [or about one ounce]. Rub the Extract with the Water until uniformly soft; then gradually add the Benzoinated Lard, and mix thoroughly." *U. S.*

This is a more certain preparation than that of the former editions of the U. S. Pharmacopœia, which was made by boiling the fresh leaves in lard. For remarks by Mr. A. P. Sharp, of Baltimore, on the preparation of this ointment, see *A. J. P.* (xxvii. 391). A useful anodyne application in irritable ulcers, painful hemorrhoids, and certain cutaneous eruptions.

UNGUENTUM SULPHURIS. *U. S., Br.* *Sulphur Ointment.*

(ỤN-GUĔN'TỤM SŬL'PHU̇-RĬS.)

Unguentum Sulfuratum Simplex, *P.G.;* Pommade soufrié, *Fr.;* Schwefelsalbe, *G.*

"Sublimed Sulphur, *thirty parts* [or one hundred and thirty grains]; Benzoinated Lard, *seventy parts* [or three hundred grains], To make *one hundred parts* [or about one ounce]. Rub the Sulphur with the Benzoinated Lard, gradually added, until they are thoroughly mixed." *U. S.*

"Take of Sublimed Sulphur *one ounce;* Benzoated Lard, *four ounces.* Mix thoroughly." *Br.*

The U. S. ointment is nearly twice as strong as the British. Sulphur ointment is a specific for the itch. It should be applied every night over the whole surface till the complaint is cured. Four applications are generally sufficient to effect a cure. Sulphur ointment, applied freely over the variolous eruption, in its early stage, is said to prevent the maturation of the pustules and consequent pitting. Its disagreeable odor may be partially concealed by oil of lemons or of bergamot.

UNGUENTUM SULPHURIS ALKALINUM. *U. S.* *Alkaline Sulphur Ointment.*

(ỤN-GUĔN'TỤM SŬL'PHU̇-RĬS ĂL-KẠ-LĪ'NŬM.)

"Washed Sulphur, *twenty parts* [or ninety-six grains]; Carbonate of Potassium, *ten parts* [or forty-eight grains]; Water, *five parts* [or half a fluidrachm]; Benzoinated Lard, *sixty-five parts* [or three hundred and twelve grains], To make *one hundred parts* [or about one ounce]. Rub the Sulphur with the Carbonate of Potassium and the Water, gradually add the Benzoinated Lard, and mix thoroughly." *U. S.*

This is a new officinal ointment, useful in scabies and other skin affections.

UNGUENTUM SULPHURIS IODIDI. *Br.* *Ointment of Iodide of Sulphur.*

(ỤN-GUĔN'TỤM SŬL'PHU̇-RĬS Ī-ŎD'Ị-DĪ.)

Pommade d'Iodure de Soufre, *Fr.;* Jodschwefelsalbe, *G.*

"Take of Iodide of Sulphur *thirty grains;* Prepared Lard *one ounce* [avoirdupois]. Triturate the Iodide of Sulphur in a porcelain mortar, and gradually add the Lard, rubbing them together until the ointment is perfectly smooth and free from grittiness." *Br.*

This ointment is no longer officinal: the formula of U. S. P. 1870 was identical with the British.

This is admirably adapted, as a local remedy, to the treatment of chronic cutaneous eruptions unattended with inflammation, and is especially useful in psoriasis, lepra, porrigo, and the very advanced dry stages of eczema and impetigo.

UNGUENTUM TEREBINTHINÆ. *Br.* *Ointment of Turpentine.*

(ỤN-GUĔN'TỤM TĔR-Ẹ-BĬN'THỊ-NÆ.)

Pommade terébenthinée, *Fr.;* Terpenthinsalbe, *G.*

"Take of Oil of Turpentine *one fluidounce;* Resin, in coarse powder, *sixty grains;* Yellow Wax, Prepared Lard, of each, *half an ounce* [avoirdupois]. Melt the ingredients together by the heat of a steam or water-bath. Remove the vessel, and stir the mixture constantly while it cools." *Br.*

This is a somewhat stronger preparation than the British *Linimentum Terebinthinæ*, but is probably intended for the same purpose; as a dressing, namely, for burns, for which it is more convenient on account of its firmer consistence.

UNGUENTUM VERATRINÆ. *U. S. Veratrine Ointment.*

(ỤN-GUĔN'TỤM VĔR-Ạ-TRĪ'NÆ.)

Unguentum Veratriæ, *U. S.* 1870 and *Br.;* Pommade de Vératrine, *Fr.;* Veratrinsalbe, *G.*

"Veratrine, *four parts* [or twenty grains]; Alcohol, *six parts* [or half a fluidrachm]; Benzoinated Lard, *ninety-six parts* [or four hundred and eighty grains]. Rub the Veratrine with the Alcohol, in a warm mortar, until dissolved; then gradually add the Benzoinated Lard, and mix thoroughly." *U. S.*

"Take of Veratria *eight grains;* Prepared Lard *one ounce* [avoirdupois]; Olive Oil *half a fluidrachm.* Rub the Veratria and the Oil together; then mix them thoroughly with the Lard." *Br.*

For the uses of veratrine ointment, see *Veratrina* and *Oleatum Veratrinæ.* It should be noticed that the U. S. ointment is more than twice as strong as the British. It should be employed with caution, especially in the case of children.

UNGUENTUM ZINCI OXIDI. *U. S. Ointment of Oxide of Zinc.*

(ỤN-GUĔN'TỤM ZĬN'CĪ ŎX'Ị-DĪ—zĭn'sī.)

Unguentum Zinci, *Br.;* Ointment of Zinc; Unguentum Zinci, *P.G.;* Unguentum de Nihilo Albo; Pommade d'Oxyde de Zinc, Cérat épulotique, *Fr.;* Zinksalbe, *G.*

"Oxide of Zinc, *twenty parts* [or ninety grains]; Benzoinated Lard, *eighty parts* [or three hundred and sixty grains], To make *one hundred parts* [or about one ounce]. Rub the Oxide of Zinc with *twenty parts* [or ninety grains] of Benzoinated Lard, previously melted, until the mixture is perfectly smooth; then add the remainder of the Benzoinated Lard, and mix thoroughly." *U. S.*

"Take of Oxide of Zinc *eighty grains;* Benzoated Lard *one ounce* [avoirdupois]. Add the Oxide of Zinc to the Benzoated Lard, previously melted with a gentle heat, and stir the mixture constantly while it cools." *Br.*

The proportion of oxide of zinc has been increased from 16 per cent. to 20 per cent. in the present formula, and it is believed that the officinal formula is now free from objection. *Commercial* oxide of zinc should not be used, as it is usually gritty, and it is difficult to make a smooth ointment with it; the many expedients that have been suggested by various writers, such as the use of a paint-mill, flatiron, trituration with oil, or glycerin, are unnecessary if officinal or Hubbuck's oxide of zinc is used and the officinal formula followed. Cerate of Carbonate of Zinc is no longer officinal.[*]

This is employed as a mild astringent application in chronic ophthalmia with a relaxed state of the vessels, in cutaneous eruptions, and in sore nipples and other instances of excoriation or ulceration. It has taken the place of the discarded *unguentum tutiæ*, or *tutty ointment*, prepared from tutty or the impure oxide of zinc, by mixing it with five parts of simple ointment.

USTILAGO. *U. S. Ustilago.* [*Corn Smut.*]

(ŬS-TỊ-LĀ'GŌ.)

"Ustilago Maydis, Leveillé (*Nat. Ord.* Fungi), grown upon Zea Mays,[†] Linné.

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[*] *Ceratum Zinci Carbonatis.* U. S. 1870. *Cerate of Carbonate of Zinc.* "Take of Precipitated Carbonate of Zinc *two troyounces;* Ointment of Lard *ten troyounces.* Mix them." *U. S.* 1870. This preparation is an imitation of the cerate recommended by Turner, and is intended as a substitute for the former Ceratum Zinci Carbonatis and more ancient Ceratum Calaminæ of the U. S. Pharmacopœia, as more reliable, in consequence of the frequent falsification of calamine. It is mildly astringent, and is used in excoriations and superficial ulcerations, produced by the chafing of the skin, irritating secretions, burns, or other causes.

Ceratum Calaminæ. U. S. 1850. *Turner's Cerate.* The following is the old officinal process. "Take of Prepared Calamine, Yellow Wax, each, *three ounces;* Lard *a pound.* Melt the Lard and Wax together, and when on cooling they begin to thicken, add the Calamine, and stir the mixture constantly until cool." The uses of this cerate are the same as those mentioned above.

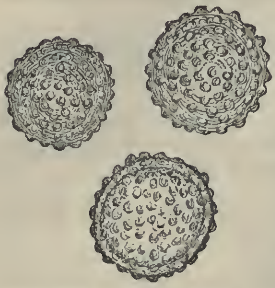
[†] There are several products of the Indian corn besides the smut which need notice here. According to the researches of Th. Husemann, during the fermentation which sometimes occurs in damp Indian meal two highly poisonous principles are developed, one a powerful depressant to the brain and medulla, the other a spinal stimulant. (*Arch. Exper. Path. Ex. Therap.*, ix. 226.) At-

(*Nat. Ord.* Graminaceæ.) Ustilago should be preserved in a dry place, and should not be kept longer than a year." *U. S.*

The genus Ustilago belongs to the fungal order of *Cæomacei*, all the members of which are parasitic on living plants, and have no peridieum, but produce simple spores of one or two kinds.

Gen. Ch. Plant deeply seated. *Spores* simple, springing from delicate threads or in closely-packed cells, ultimately breaking up into a powdery mass.

Ustilago Maydis Corda. Tulasne, *Ann. Sc. Nat.*, 1847. This smut is produced on the stems, the pistils (corn grains), and the male inflorescence (tassel) of the Indian corn. It is specifically characterized by its minute spherical spores, having their surface covered with echinulate warts. It is abundant in the United States wherever the Indian corn flourishes.


Spores of Ustilago Maydis.

Properties. Upon the corn the smut appears in masses, varying in size from a cherry to a child's head. These masses are smooth, irregularly globose, or sometimes lobulated, at first a sort of a livid, bluish tint, but finally becoming blackish, and finally bursting and emitting the black contents, consisting of innumerable globose very minute spores, each of which is covered with beautiful little pointed processes. In a dried state the masses are blackish and covered with a black powder.

In the smut Mr. C. H. Cressler found an alkaloid, which he considered to be identical with *secaline*, a supposed alkaloid of ergot. This has since been shown to be trimethylamine, and to be, moreover, a decomposition product, and not to exist originally in the ergot. Whether the alkaloids since discovered in ergot by Tanret and Dragendorff exist in ustilago has not been ascertained. Besides the alkaloid, there were obtained a thick, viscid, fixed oil, a resin soluble in ether but not in alcohol, pectin, gluten, and a species of sugar. (*A. J. P.*, 1861, p. 306.) Prof. H. B. Parsons analyzed ustilago, and found in it fixed oil, an amine-like volatile substance extracted by ether, which he states is not an alkaloid nor is it trimethylamine, and an acid which he has provisionally named sclerotic acid, because of its apparent similarity to the acid discovered by Dragendorff in ergot. (*N. R.*, March, 1882.) Corn smut is said to produce abortion in cows, when the diseased grain is eaten by them; and six drachms of this ergot produced the same effect on two pregnant bitches to which it was given to test its abortifacient property. (*A. J. P.*, Sept. 1861, p. 413.) It has also been used with asserted success in uterine inertia both in this country and in France. We are still without definite knowledge of the way in which it affects the system, but its properties probably resemble those of ergot, and certainly should be investigated.

UVÆ. *Br.* *Raisins.*

(Ū'VÆ—yū'vē.)

"The ripe fruit of Vitis vinifera, Linn., the Grape vine. Woodv. *Med. Bot.* plate 195. Dried in the sun or with artificial heat; imported from Spain." *Br.* *Nat. Ord.* Vitaceæ.

Uva Passa, *U. S.* 1870; Passulæ; Raisins, E.; Raisins secs, *Fr.;* Rosinen, *G.;* Uve passe, *It.;* Pasas, *Sp.*

Gen. Ch. Petals cohering at the apex, withering. *Berry* five-seeded, superior. *Willd.*

Vitis vinifera. Willd. *Sp. Plant.* i. 1180; *B. & T.* 66. The vine is too well known to require description. This particular species is distinguished by the char-

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tention has been called by Prof. Castan, of Montpellier, to the diuretic properties of the *stigmata of maize.* Although testimony to the contrary has been given, the evidence is so strong as to demand further trial. The stigmata, or "*silk,*" should be taken when the tassel has well shed its pollen. It is said to yield 20 to 30 per cent. of watery extract, of which a half drachm or more may be given daily in dropsy. Dr. Vauthier affirms that the active principle is *maizenic acid,* and that the remedy is especially valuable in uric or phosphatic gravel. (*Arch.* *Méd. Belges,* Aug. 1880.)

acter of its leaf, which is lobed, sinuated, and naked or downy. The leaves and tendrils are somewhat astringent, and were formerly used in diarrhœa, hemorrhages, and other morbid discharges. The juice which flows from the stem was also thought to be possessed of medicinal virtues, and the prejudice still lingers among the vulgar in some countries. The unripe fruit has a harsh sour taste, and yields by expression a very acid liquor, called *verjuice*, which was much esteemed by the ancients as a refreshing drink when diluted with water. It contains malic and tartaric acids, and another called *racemic acid*, a compound isomeric with tartaric acid, but differing in optical properties. M. A. Petit has ascertained that grape leaves contain 2 or 3 per cent. of glucose, and a quantity of acid varying from 1·3 to 1·6 per cent. Of the acid, tartaric acid constituted one-third, and most of this was in the form of cream of tartar. In a subsequent investigation, M. Petit found that, besides glucose or sugar of grapes, the leaves contained also a notable portion of common or cane sugar. In one instance he got 0·97 per cent. of cane sugar and 2·655 of glucose; in another in which he operated so that the common sugar in the leaves had less opportunity to be converted into glucose, he got 1·58 per cent. of the former and 1·749 of the latter. (*Journ. de Pharm.*, Janv. 1874, p. 41.) The seeds afford 15 to 18 per cent. of a bland fixed oil, which is occasionally extracted. Fitz (*Ber. Chem. Ges.*, 1871, p. 442) has shown that it consists of the glycerides of *erucic* acid, $C_{22}H_{42}O_2$, stearic and palmitic acids, the first-named acid largely prevailing. The seeds further contained 5 to 6 per cent. of tannic acid, which also exists in the skin of the fruit. The grape, when quite ripe, is among the most pleasant and grateful fruits brought upon the table, and is admirably adapted, by its refreshing properties, to febrile complaints. If largely taken, it proves diuretic and gently laxative. The ripe fruit differs from the unripe in containing more sugar and less acid, though never entirely destitute of the latter. The plant is supposed to have been derived originally from Asia; but it has been cultivated in Europe and Northern Africa from the remotest antiquity, and is now spread over all the temperate civilized regions of the globe. The fruit is exceedingly influenced by soil and climate, and the varieties which have resulted from culture or situation are innumerable. Those which yield the raisins of commerce are confined to the basin of the Mediterranean.

Raisins are prepared either by partially cutting the stalks of the bunches before the grapes are perfectly ripe, and allowing them to dry upon the vine, or by picking them in their mature state, and steeping them for a short time previously to desiccation in an alkaline ley. Those cured by the first method are most highly esteemed.*

Several varieties of raisins are known in commerce. The best of those brought to this country are the *Malaga raisins*, imported from Spain. They are large and fleshy, of a purplish brown color, and sweet agreeable taste. Those produced in Calabria are similar. The *Smyrna raisins* are also large, but of a yellowish brown color, slightly musky odor, and less agreeable flavor. They are originally brought from the coast of Syria. The *Corinthian raisins*, or *currants* as they are commonly called in this country, are small, bluish black, of a fatty appearance, with a vinous odor, and a sweet, slightly tartish taste. Their name was derived from the city in the vicinity of which they were formerly cultivated. At present they are procured chiefly from Zante, Cephalonia, and the other Ionian Islands. In the older Pharmacopœias they are distinguished by the title of *uvæ passæ minores*.

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* *Culture of Raisins.* The statement in the text in relation to the mode of drying grapes is allowed to remain, because made on what was deemed competent authority; but, in a journey through the raisin districts in the southeast of Spain, in the spring of 1861, Dr. George B. Wood made frequent inquiries at Malaga and Valencia, and found no one who had heard of the plan of partially cutting the stalks of the bunches and then allowing them to dry on the plant. The following is a brief account of the raisin culture near Malaga. The grape cultivated for drying is exclusively the Muscatel. The district appropriated to this purpose consists of red-earth lands, along the coast of the Mediterranean, extending for about 30 miles on each side of Malaga. The grounds planted with the vine are the shore plains and valleys, the smaller hills, and the lower declivities of the mountains. The vines are kept trimmed very low, and the earth between them loosened by the spade; the plough not being used. The grapes are ripe in August, when the bunches are cut off, and carefully dried in the sun, upon a hard level earthen floor, prepared for the purpose, which is protected by a shed when it rains After one side of the bunch has become dry, the other is carefully turned to the sun. When dried, they are generally packed in wooden boxes, each containing about 25 lbs. The most valuable, called the *bloom raisins* from the preservation of the bloom unbroken on the surface, are packed in paper boxes, and sent exclusively to the London market, where they are especially esteemed. About a million of boxes are sent annually to the United States, valued at two millions of dollars. The *Valencia raisin* is a different variety from the Malaga. The grape is thicker-skinned, and does not dry well unless with previous preparation. Hence, as soon as picked, they are dipped into a ley made from wood ashes, immediately removed, and then dried. The alkali causes the skin to crack in minute fissures, and thus facilitates drying. Dr. George B. Wood was assured that the Valencia raisins are not sent to the United States, but exclusively to England, where they are used in puddings. The Malaga grape, imported in the fresh state into this country, is a different variety from the raisin grape, and cultivated higher on the mountains.

Raisins contain a larger proportion of sugar than recent grapes. This principle, indeed, is often so abundant that it effloresces on the surface, or concretes in separate masses within the substance of the raisin. The *sugar of grapes* (*glucose*) differs from that of the cane, being less sweet, less soluble in cold water, and much less so in alcohol, and forming a syrup of less consistence.

Medical Properties and Uses. The chief medical use of raisins is to flavor demulcent beverages. Taken in substance they are gently laxative, but are also flatulent and difficult of digestion, and, when largely eaten, sometimes produce unpleasant effects, especially in children.

Off. Prep. Tinctura Cardamomi Composita, *Br.;* Tinctura Sennæ, *Br.*

UVA URSI. *U. S.* *Uva Ursi.* [*Bearberry.*]

(Ū'VA̧ ŬR'SĪ.)

"The leaves of Arctostaphylos Uva Ursi. Sprengel. (*Nat. Ord.* Ericaceæ.)" *U. S.* "The dried leaves of Arctostaphylos Uva Ursi. Spreng. *Syst.*, Woodv. *Med. Bot.* plate 70 (*Arbutus Uva Ursi*). From indigenous plants." *Br.*

Uvæ Ursi Folia, *Br.;* Feuilles de Busserole, Busserole, Raisin d'Ours, *Fr.;* Bärentraube, Bärentraubenblätter, *G.;* Corbezzolo, Uva Ursina, *It.;* Gayuba, *Sp.*

Gen. Ch. Drupe with five distinct, one-seeded stones. *Corolla* urceolate, with a revolute limb. *Stamens* included. *Anthers* with two spurs at the back. (Lindley, *Med. and Œcon. Bot.* 106.)

Arctosaphylos Uva Ursi. Sprengel, *Syst.* ii. 287; Carson, *Illust. of Med. Bot.* i. 61, pl. 52; *B. & T.* 163.—*Arbutus Uva Ursi.* Willd. *Sp. Plant.* ii. 618; Bigelow, *Am. Med. Bot.* i. 66. The *uva ursi*, or *bearberry*, is a low evergreen shrub, with trailing stems, the young branches of which rise obliquely upwards for a few inches. The leaves are scattered, upon short petioles, from half an inch to an inch long, obovate, or oblong spatulate, acute at the base, obtuse at the apex, entire, with a rounded margin, thick, coriaceous, smooth, shining, deep green on their upper surface, paler and covered with a net-work of veins beneath. The flowers, which stand on short reflexed peduncles, are in small clusters at the ends of the branches. The calyx is small, five-parted, reddish, and persistent. The corolla is ovate or urceolate, reddish white, or white with a red lip, transparent at the base, contracted at the mouth, and divided at the margin into five short reflexed segments. The stamens are ten, with short filaments and bifid anthers; the germ round, with a style longer than the stamens, and a simple stigma. The fruit is a small, round, depressed, smooth, glossy, red berry, with an insipid mealy pulp, and five cohering seeds.

This humble but hardy shrub inhabits the northern latitudes and high mountains of Europe, Asia, and America. On the American continent it extends from Hudson's Bay as far southward as New Jersey, in some parts of which it grows in abundance. It prefers a barren soil, flourishing on gravelly hills and elevated sandy plains. The leaves are the only part used in medicine. They are imported from Europe, but are also collected within our own limits; and the market of Philadelphia is supplied to a considerable extent from New Jersey. They should be gathered in autumn, and the green leaves only selected. In Europe the uva ursi is adulterated with the inert leaves of *Vaccinium Vitis Idæa;* these may be distinguished by their rounder shape, their revolute edges which are sometimes slightly toothed, and their dotted under surface. Leaves of the *Chimaphila umbellata*, sometimes found among the uva ursi, may be readily detected by their greater length, their cuneiform-lanceolate shape, and their serrate edges.

Properties. Uva ursi is inodorous when fresh, but acquires a smell not unlike that of hay when dried and powdered. Its taste is bitterish, strongly astringent, and ultimately sweetish. It affords a light brown, greenish yellow powder. Water extracts its active principles, which are also soluble in officinal alcohol. Among its ingredients are tannic and gallic acids, bitter extractive, resin, gum, fatty matter, a volatile oil, and salts of potassa and lime. The tannic acid is so abundant that the leaves are used for tanning in Russia. Neither this principle nor gallic acid exists in the leaves of the *Vaccinium Vitis Idæa*.

A crystallizable principle was extracted from uvi ursi by Mr. J. C. C. Hughes, to which he gave the name *ursin*, but Jungmann (*A. J. P.*, May, 1871, p. 205) afterwards showed it to be only impure arbutin. Kawalier (*Chem. Gaz.*, 1853, p. 61) obtained *arbutin*, $C_{24}H_{32}O_{14}.H_2O$, by precipitating the decoction with acetate of lead, filtering, treating the liquid with sulphuretted hydrogen, again filtering, evaporating to the consistence of syrup, and allowing the product to stand for several days. This gradually assumed the form of a crystalline jelly, which, being placed upon linen so as to allow the mother-liquor to drain off, and then pressed, yielded nearly colorless crystals, which were purified by solution in boiling water, and treatment with animal charcoal. Arbutin thus obtained is in long acicular, colorless crystals, united in tufts, and of a bitter taste. It is soluble in water, alcohol, and ether, unchanged apparently by a heat of 212° F., but fusible at a high temperature, without action on vegetable colors, and not precipitated by ferric salts, or by acetate or subacetate of lead. It is a glucoside, being resolvable by boiling with sulphuric acid into glucose and a peculiar substance named *arctuvine*, or *hydroquinone*. $C_6H_6O_2$. A test for arbutin, discovered by Julius Jungmann, is as follows. When phosphomolybdic acid is added to a solution of arbutin previously rendered alkaline by ammonia, or other alkali, a blue color is produced, which is deep when the solutions are strong, but observable even when they are very dilute. (*A. J. P.*, May, 1871, p. 204.)* After the extraction of arbutin, there is obtained from the mother-liquor *ericolin*, $C_{34}H_{56}O_{21}$.

Another crystallizable principle has been discovered by Trommsdorff, who calls it *ursone*, $C_{20}H_{34}O_2$. It appears to be of a resinous character, although it can be obtained in silky needles, being tasteless and inodorous, insoluble in water, difficultly soluble in alcohol and ether, fusible, at a higher temperature volatilizable, and inflammable in the air. It is obtained by treating uva ursi with a very small quantity of ether by percolation, allowing the ether to evaporate, washing the crystalline extract with ether, and re-crystallizing from alcohol. (*A. J. P.*, xxvii. 334.)

Medical Properties and Uses. Uva ursi is astringent and tonic, and is thought by some to have a specific direction to the urinary organs, for the complaints of which it is chiefly used. Others deny that it possesses a peculiar tendency of this kind, and ascribe its effects to its astringent and tonic action. It alters the color of the urine, and its astringent principle has been detected in that secretion. It probably, therefore, exerts a direct influence on the kidneys and urinary passages. Though known to the ancients, it had passed into almost entire neglect, till its use was revived by De Haen about the middle of the last century. It has acquired some reputation as an antilithic, and has undoubtedly been serviceable in gravel, partly, perhaps, by a direct action on the kidneys, partly by giving tone to the digestive organs, and preventing the accumulation of principles calculated to produce a secretion or precipitation of calculous matter. In chronic nephritis it is also a popular remedy, and is particularly recommended when there is reason to conjecture the existence of ulceration in the kidneys, bladder, or urinary passages. Diabetes, catarrh of the bladder, incontinence of urine, gleet, leucorrhœa, and menorrhagia are also among the diseases in which it has occasionally proved serviceable; and testimony is not wanting to its beneficial effects in phthisis pulmonalis. Dr. E. G. Harris, of Fayette, Alabama, believes it to have the property of promoting uterine contraction, and has employed it with supposed advantage as a substitute for ergot in tedious labors. (See *Med. Exam.*, N. S., ix. 727.) The dose of the powder is from a scruple to a drachm (1·3–3·9 Gm.), to be repeated three or four times a day; but the fluid extract is always preferred. Arbutin has been tried as medicine, in the hope that it might have the virtues of the uva ursi, of which it is a constituent, but hitherto with no great success. (*A. J. P.*, 1871, p. 205.)

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* *Sources of Arbutin.* Besides being a constituent of the two species of Arctostaphylos above mentioned, this principle is somewhat widely diffused in other plants. It is especially found in those belonging to the natural order Ericaceæ; as, *Chimaphila umbellata*, *Chimaphila maculata*, *Epigæa repens*, and *Gaultheria procumbens*. In some others it has been supposed to exist because, among the products of the dry distillation of their extract, a principle has been found denominated *hydroquinone*, which is one of the products of the destructive distillation of arbutin; but, as kinic acid yields the same substance in the same way, the inference in relation to the existence of arbutin in the plants is somewhat uncertain. Nevertheless, as kinic acid yields *pyrocatechin* along with hydroquinone, while arbutin gives only the latter, a method of distinguishing the two is afforded; the plants from which only hydroquinone is obtained probably contain arbutin; while, if both principles are obtained, kinic acid is probably in the plant. (Prof. Maisch, *A. J. P.*, 1874, p. 314.)

Analysis of Vaccinium vitis idæa, or *Red whortleberry*, by Dr. Gräger. The berries contain 10·185 of soluble matter, 4·204 of insoluble matter (cellulose, pectin, etc.), and 85·611 of water. The expressed juice yielded 1·975 of free organic acid (citric and malic), 5·185 sugar, 0·476 tannin, 2·333 albuminous and pectinaceous substances, suspended fat, etc., 0·216 inorganic bases (potassa, lime, magnesia, iron), and 89·815 water. The insoluble residue yielded 0·102 per cent. of ashes containing sulphate and phosphate of calcium, silicic acid, and oxide of iron. (*A. J. P.*, 1871, p. 543.)

Another species of Arctostaphylos is *A. glauca*, a small tree or shrub indigenous in California, where it generally grows in dry and rocky places on the west of the mountain ranges. The leaves are highly esteemed as a remedy in diarrhœa and gonorrhœa, being used in the form of decoction. Chemically examined by Mr. John Henry Flint, they were found to contain 9·8 per cent. of tannin; and the ashes of the incinerated leaves, amounting to 0 6 per cent., contained potassium, calcium, magnesium, and iron. A crystalline principle has been discovered in the leaves, which Mr. Flint found to be arbutin. (*A. J. P.*, May, 1873, p. 197.)

Off. Prep. Extractum Uvæ Ursi Fluidum, *U. S.;* Infusum Uvæ Ursi, *Br.*

VALERIANA. *U. S.* *Valerian.*

(VẠ-LĒ-RỊ-Ā′NẠ.)

"The rhizome and rootlets of Valeriana officinalis. Linné. (*Nat. Ord.* Valerianaceæ.)" *U. S.* "The dried root of Valeriana officinalis. Linn. Woodv. *Med. Bot.*, plate 96. From plants indigenous to and also cultivated in Britain, collected in autumn; wild plants being preferred." *Br.*

Valerianæ Radix, *Br.;* Valerian Root; Radix Valerianæ Minoris; Racine de Valériane, Valériane, *Fr.;* Wilde Baldrianwurzel, Baldrianwurzel, *G.;* Valeriana silvestre, *It.;* Valerian silvestre, *Sp.*

Gen. Ch. Calyx very small, finally enlarged into a feathery pappus. *Corolla* monopetalous, five-lobed, regular, gibbous at the base. *Capsule* one-celled. (*Loudon's Enc. of Pl.*) *Stamens* exserted, one, two, three, and four. (*Nuttall.*)

Valeriana officinalis. Willd. *Sp. Plant.* i. 177; *B. & T.* 146. The *officinal* or *great wild valerian* is a large handsome herbaceous plant, with a perennial root, and an erect, round, channelled stem, from two to four feet high, furnished with opposite pinnate leaves, and terminating in flowering branches. The leaves of the stem are attached by short, broad sheaths; the radical leaves are larger and stand on long footstalks. In the former the leaflets are lanceolate and partially dentate, in the latter elliptical and deeply serrate. The flowers are small, white, or rose-colored, agreeably odorous, and disposed in terminal corymbs, interspersed with pear-shaped pointed bracts. The number of stamens is three. The fruit is a capsule containing one oblong-ovate, compressed seed. The plant is a native of Europe, where it grows either in damp woods and meadows, or on dry elevated grounds. As found in these different situations, it presents characters so distinct as to have induced some botanists to make two varieties. Dufresne makes four, of which three prefer marshy situations. The variety which affects a dry soil (*sylvestris*, L. Ph.) is not more than two feet high, and is distinguished by its narrow leaves. It has been generally believed to be superior to the others in medicinal virtue; but, from experiments of A. Buchner, it appears that the dried roots of the variety which grows in low moist grounds are in no respect inferior, and that the general opinion to the contrary is a prejudice. (*Pharm. Centralblatt*, June, 1852, p. 429.)*

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* *Valeriana Mexicana.* D. C. According to the *Nueva Farmac. Mexicana*, the roots of this plant contain a large percentage of valerianic acid, which they yield readily and economically. In Mexican commerce they are said to occur in slices or fleshy disks about four centimetres or more in diameter, or in voluminous tubercles. Externally the color is grayish yellow, internally yellow: the odor is strong and disagreeable, the taste bitter.

The root should be collected in spring before the stem begins to shoot, or in the autumn when the leaves decay. It should be dried quickly, and kept in a dry place. It consists of numerous long, slender, brittle, cylindrical, thick-barked rootlets, issuing from a tuberculated head or rhizome, which is from "four-fifths of an inch to an inch and a half (2 to 4 cm.) long, upright, subglobular or obconical, truncate at both ends, brown or yellowish brown, internally whitish or pale brownish, with a narrow circle of white wood under the thin bark." *U. S.* As brought to this country, it frequently has portions of the stem attached. The English is superior to that from the continent of Europe. Valerian of good quality has been produced by the Shakers at Enfield, New Hampshire, also in Northern Vermont and New York. Mr. Thos. Doliber obtained from the American root 28·97 per cent. of alcoholic extract, and from the English 17·59 per cent., and states that the native drug has, in our market, almost superseded the European. (*A. J. P.*, 1867, p. 70.)

Properties. The color of the root is externally yellowish or brown, internally white. The powder is yellowish gray. The odor, which in the fresh root is slight, in the dried is strong and highly characteristic, and, though rather pleasant to many persons, is very disagreeable to others. Cats are strongly attracted by it. The taste is at first sweetish, afterwards bitter and aromatic. Valerian yields its active properties to water and alcohol. Trommsdorff found it to consist of 1·2 parts of volatile oil; 12·5 of a peculiar extractive matter, soluble in water, insoluble in ether and alcohol, and precipitated by metallic solutions; 18·75 of gum; 6·25 of a soft odorous resin; and 63 of lignin. Runge found in it a peculiar fixed acid, which produced with bases white salts, becoming green on exposure to the air. (*Chem. Gaz.*, No. 170, p. 452.) Of these constituents the most important is the *volatile oil.* It is of a pale greenish color, of the sp. gr. 0·934, with the pungent odor of valerian, and an aromatic taste. It becomes yellow and viscid by exposure.

Bruylants (*Berichte Chem. Ges.*, 1878, p. 449) has obtained from oil of valerian, 1st, a hydrocarbon or terpene, $C_{10}H_{16}$, boiling at 157° C.; 2d, a liquid compound, $C_{10}H_{18}O$, which by means of chromic acid affords common camphor and formic, acetic, and valerianic acids, which are met with in old valerian root, owing no doubt to the slow oxidation of the compound $C_{10}H_{18}O$; 3d, a crystalline compound of the same composition, which in the root is probably combined with the three organic acids mentioned, constituting with them compound ethers; 4th, at from 285° C. to 290° C. a greenish, syrupy oil, which, when rectified, is colorless, and seems to have the composition of a *borneol-oxide*, $(C_{10}H_{17})_2O$.

Trommsdorff ascertained the existence in the oil of a peculiar volatile acid, upon which the name of *valerianic acid* has been conferred. This, when separated from the oil, is a colorless liquid, of an oleaginous consistence, having an odor analogous to that of valerian, and a very strong, sour, disagreeable taste. It is soluble in thirty parts of water, and in all proportions in ether and alcohol. It combines with salifiable bases, forming soluble salts, which retain, in a diminished degree, the odor of the acid. (*Journ. de Pharm.*, xx. 316.) The results of Bruylants just given show that the acid does not exist free in the oil, but is produced by the decomposition of its borneol-ether. Valerianic acid is obtained by distilling the impure oil from carbonate of magnesium, decomposing by sulphuric acid the valerianate of magnesium which remains, and again distilling. M. Rabourdin, of Orleans, believing that a large proportion of the valerianic acid remains fixed in the root by union with a base, and does not come over by distillation alone, procures it by adding sulphuric acid to the root with a sufficient quantity of water, distilling, separating the oil, saturating the liquor with carbonate of sodium, evaporating, adding a slight excess of sulphuric acid, and again distilling. (*Ibid.*, vi. 310.) The following process by Messrs. T. and H. Smith, of Edinburgh, avoids the inconvenience of distilling so bulky a root as valerian, while it answers the same purpose as that of M. Rabourdin. Boil the root for three or four hours with rather more than its bulk of water, in which an ounce of carbonate of sodium is dissolved for every pound of the root, replacing the water as it evaporates. Express strongly, and boil the residuum twice with the same quantity of water, expressing each time as before. Mix the liquids, add two fluidrachms of strong sulphuric acid for every pound of the root, and distil till three-fourths of the liquid have passed over. Neutralize this with carbonate of sodium, concentrate the liquid, decompose the valerianate of sodium contained in it by sulphuric acid, and separate the valerianic acid set free by a separatory funnel, or by distillation. (*A. J. P.*, xvii. 253.) M. Lefort obtains the acid by the rapid oxidation of the volatile oil. He distils 100 parts of the root with 500 of water, 10 of sulphuric acid, and 6 of bichromate of potassium, and has thus procured a larger proportion of acid than by any other process. (*Journ. de Pharm.*, 3e sér., x. 194.)

The roots of *Valeriana Phu* and *V. dioica* are said to be sometimes mingled with those of the officinal plant; but the adulteration is attended with no serious consequences; as, though much weaker than the genuine valerian, they possess similar properties. The same cannot be said of the roots of several of the *Ranunculaceæ*, which, according to Ebermayer, are sometimes fraudulently substituted in Germany. They may be readily detected by their want of the peculiar odor of the officinal root. According to M. O. Raveil, the valerian in the markets of Paris is largely adulterated with the roots of *scabious* (*Scabiosa succisa* and *S. arvensis*, Linn.). They are shorter than the genuine root, with larger radicles, less rough, little or not at all striated, very brittle, with a white amylaceous fracture. The roots are inodorous in themselves, but acquire smell from contact with the valerian. (*Journ. de Pharm.*, xxvi. 209.)

Medical Properties and Uses. Valerian is gently stimulant, with an especial direction to the nervous system, but without narcotic effects. In large doses it produces a sense of heaviness and dull pain in the head, with various other effects indicating nervous disturbance. The oil, largely taken, is said by M. Barailer, from his own observation, to produce dulness of intellect, drowsiness ending in deep sleep, reduced frequency of pulse, and increased flow of urine. (See *A. J. P.*, 1861, p. 239.) It is useful in cases of irregular nervous action, when not connected with inflammation, or an excited condition of the system. Among the complaints in which it has been particularly recommended are hysteria, hypochondriasis, epilepsy, hemicrania, and low forms of fever, attended with restlessness, morbid vigilance, or other nervous disorder. It has also been used in intermittents, combined with Peruvian bark, and in acute rheumatism. As the virtues of valerian reside chiefly in the volatile oil, the medicine should not be given in decoction or extract. The distilled water is used on the continent of Europe; and the volatile oil is occasionally substituted with advantage for the root. The dose of the oil is four or five drops (0·24–0·3 C.c.). Valerianic acid also has been used internally. (See *Acidum Valerianicum.*) Landerer says that, in his experience, the acid prepared from the root is preferable therapeutically to the artificial acid.

Off. Prep. Abstractum Valerianæ, *U. S.;* Extractum Valerianæ Fluidum, *U. S.;* Tinctura Valerianæ; Tinctura Valerianæ Ammoniata.

VANILLA. *U. S.* *Vanilla.*

(VA̤-NĬL′LA̤.)

"The fruit of Vanilla planifolia. Andrews. (*Nat. Ord.* Orchidaceæ.)" *U. S.*

Fructus (s. Silique) Vanillæ, *P. G.;* Vanille, *Fr., G.*

Gen. Ch. *Sepals* spreading or erect, distinct. *Petals* of a similar form and texture. *Labellum* connate with the columna, crested, membranous, convolute, undivided. *Anther* terminal, opercular; pollen granular. *Fruit* a fleshy *pod;* seeds round, destitute of loose tunic. *Lindley.*

Vanilla planifolia. Andrews, *Bot. Repository*, t. 538 (1808); *B. & T.* 272.—*V. claviculata*, Swartz. This is a fleshy, dark green, perennial climbing plant, with a very long, smooth, dark green stem, much branched, and furnished at the nodes with aerial roots, which cling to and obtain nourishment from the tree supporting the plant. The dark green, tough leaves are alternate, oval, sessile, attenuate at the apex, fleshy, and veinless. The pale greenish yellow, sessile flowers are about two inches in diameter, and occur in loose, axillary racemes of eight or ten. The fruit is a slender pod, seven or eight inches long, filled with an oily mass containing numerous small, black, shining seeds. The plant is a native of the West

Indies, Mexico, and South America, and is cultivated in Java and the Isles of France and Bourbon. It is stated to be grown under glass in England and France, and at Liège, with commercial success. (*A. J. P.*, xlvi. 419.) Doubts, however, exist whether commercial vanilla is entirely derived from this species, and the United States Pharmacopœia formerly ascribed it to *V. aromatica*, Schwartz, which is specifically characterized by its ovate, oblong, nerved, opposite leaves, its wavy sepals, its acute lip, and its very long cylindrical capsules. *V. Guaynensis* and *V. palmarum* are said to yield an aromatic fruit. (See also below.)

In Mexico the vanilla plant flourishes on the eastern coast, in the States of Vera Cruz and Oaxaca. It begins to bear fruit in three years, and continues to bear thirty or forty years. Though most of the vanilla of commerce is derived from plants growing wild in the forests, yet much is the product of a species of cultivation which is very simple. All that is necessary is to cut a slip of the stem from the lower part, and plant it near the trunk of a tree, attaching it by cords. The plant immediately takes root in the bark of the tree, and sends out air roots, which, reaching the ground, fix themselves in the soil. The fruit is ready for collection about the end of March, and the harvest continues three months. (*A. J. P.*, 1866, p. 38.)

The pods are collected before they are quite ripe, dried in the shade, covered with a coating of fixed oil, and then tied in bundles, which are surrounded with sheet lead, or enclosed in small metallic boxes, and sent into the market. Several varieties of vanilla exist in commerce.* The most valuable, called *ley*, or *vainilla mansa*, by the Spaniards, consists of cylindrical, somewhat flattened pods, six or eight inches long, three or four lines thick, nearly straight, narrowing towards the extremities, bent at the base, shining and dark brown externally, wrinkled longitudinally, soft and flexible, and containing within their tough shell a soft black pulp, in which numerous minute, black, glossy seeds are embedded. It has a peculiar, strong, agreeable odor, and a warm, aromatic, sweetish taste. The interior pulpy portion is most aromatic. In it are more or less numerous, minute crystals. Another variety, called *vainilla simarona* by the Spaniards, is smaller, of a lighter color, and less aromatic. The pods are said to be very dry and to contain no vanillin. (*Nueva Farmacop. Mexicana.*) According to Schiede, it is yielded by a distinct species, the *Vanilla sylvestris* (Schiede). A third variety is the *vainilla pompona* of the Spaniards (*boba vainilla*, or *plátano vainilla*). In this, the pods are from five to seven inches long, from six to nine lines broad, shaped somewhat like a plantain, almost always open, very dark brown or nearly black, soft, viscid, and of a strong, not very pleasant, anise-like odor. Schiede states that it is the product of the *Vanilla pompona* (Schiede). The variety *vainilla vezacate* is said to be derived from pods gathered long before maturity. (*N. Farm. Mexic.*) According to Bucholz, vanilla does not yield volatile oil when distilled with water; and the aroma appears to depend on chemical changes which take place during and after the curing of the fruit.

Many years since, vanilla was analyzed by Bucholz and Vogel, the former of whom found in it a disagreeably smelling fixed oil, a soft resin smelling feebly of vanilla when heated, a bitterish extractive resembling tannin, sugar, starch, and benzoic acid. But the characteristic odorous principle was not isolated. This object was accomplished by M. Gobley, who, by exhausting vanilla with alcohol of 85°, evaporating the resulting tincture to an extract, softening this with water, and agitating in a flask with ether so long as it gave color to that fluid, then evaporating the ethereal liquid and treating the residue with boiling water, obtained on the evaporation of the water a crop of crystals having the odor of vanilla. Purified by treatment with animal charcoal, and recrystallization, the new principle appeared in the form of colorless, long, four-sided needles, terminated by two faces. It has a strong odor of vanilla, with a hot, biting taste, and is frequently seen in acicular crystals upon the external surface of the bean. This compound, for which M. Gobley proposed the name *vanillin*, is now recognized as the methyl-ether of protocatechuic aldehyd, $C_6H_3\left\{\begin{matrix}OCH_3\\OH\\COH\end{matrix}\right.$, or $C_8H_8O_3$. It forms crystalline needles, fusing at 80°–81° C. Difficultly soluble in cold water, readily in hot water, easily soluble in alcohol and ether, chloroform and carbon disulphide. It oxidizes slowly in damp air to *vanillic acid*, $C_8H_8O_4$; when heated with dilute hydrochloric acid to 200° C., it breaks up into methyl chloride and protocatechuic acid.

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* For further details, see *A. J. P.*, xlvi. 417.

Tiemann and Haarmann (*Ber. Chem. Ges.*, 1874, p. 613), who first ascertained the true character of vanillin, also found that it could be made synthetically from *coniferin*, a glucoside contained in the cambium layer of the pine. This coniferin, $C_{16}H_{22}O_8 + 2H_2O$, or the compound $C_{10}H_{12}O_3$, which with glucose results from its decomposition, is oxidized by sulphuric acid and potassium bichromate with the production of vanillin. Artificial vanillin was made in this way from coniferin under Tiemann and Haarmann's patents, but it is now made from *eugenol*, $C_{10}H_{12}O_2$, which is oxidized with alkaline solution of potassium permanganate. Eugenol can also be changed into *aceteugenol*, which with weak acid solution of potassium permanganate is oxidized to *acetvanillic* acid, and this by boiling with weak caustic potash is changed into vanillin. Oil of cloves is therefore used as a basis for the manufacture of artificial vanillin. Although the latter substance has been largely manufactured, it does not take the place of the preparations of vanilla, the flavor and odor of the latter being greatly preferred. It passes with water in distillation. If vanilla finely divided be distilled with water, a turbid liquid passes, which becomes clear by agitation with ether; and the ether on evaporation yields crystals of vanillin. Messrs. Tiemann and Haarmann obtained from Mexican vanilla 1·69, Reunion vanilla 2·48, Java vanilla 2·75 per cent. of vanillin. Mr. Stokeby found in vanilla resin, wax, a fixed oil, a brown resinous matter, tannic acid changing the salts of iron to green, gum, sugar, phosphates, and sulphates; and hydrochloric acid separated from it oxalic acid, and potassa humic acid. (*Journ. de Pharm. et de Chim.*, 4e sér., iii. 76, 1866.)

Medical Properties and Uses. Vanilla has the properties of the aromatics generally, but is probably more diffusibly stimulant, with some influence on the nervous system. It is employed more as a perfume, and to flavor chocolate, ice-cream, etc., than as a medicine.* It has, however, been recommended as a remedy in hysteria and low fevers, in the form of an infusion made in the proportion of about half an ounce to a pint of boiling water, and given in tablespoonful (15 C.c.) doses. A fluid extract would be a convenient form for exhibition.

Off. Prep. Tinctura Vanillæ, *U. S.;* Trochisci Ferri, *U. S.*

VAPORES. *Vapors. Inhalations.*

(VA̤-PŌ'RĒṢ.)

This is a class of preparations introduced into the British Pharmacopœia, the expediency of which, in a pharmaceutical code, is, to say the least, doubtful. There is no such complexity in the preparations as to require peculiar skill, and the whole process, in each case, is more appropriate to the duties of a nurse in the sick chamber, than to those of the pharmacist.

VAPOR ACIDI HYDROCYANICI. *Br.* *Inhalation of Hydrocyanic Acid.*

(VĀ'PO̤R ĂÇ'Ị-DĪ HȲ-DRO̤-CȲ-ĂN'Ị-CĪ.)

"Take of Diluted Hydrocyanic Acid *ten to fifteen minims;* Water (cold) *one fluidrachm.* Mix in a suitable apparatus, and let the vapor that arises be inhaled." *Br.*

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* *Vanilla Poisoning.* Twenty years ago, Orfila recorded cases of poisoning by the eating of vanilla ices, and recently many cases have occurred both in Europe and in this country. The symptoms are those of intense gastro-intestinal irritation, and closely resemble those of cholerine. That the attacks have not simply been cholera morbus induced by the ingestion of cold ices, is shown by the facts that many of the flavored dishes were pies and even simple farinaceous puddings. Elaborate chemical investigations have proven the absence of metallic poisons in the ingesta. It seems to be clearly made out that the vanilla bean was the vehicle of the poison; but the nature of the latter has not been determined. Schroff believes it to be cardol derived from the oil of cashew nut, placed upon the vanilla pod to preserve it, but there does not seem to be any proof of this; and it is stated that cardol could not be found in the vanilla pods obtained from the Vienna café at Berlin, where poisoning had occurred. For further particulars, consult *P. J. T.*, 1874, p. 853.

VAPOR CHLORI. *Br.* *Inhalation of Chlorine.*

(VĀ'PỌR ÇHLŌ'RĪ.)

"Take of Chlorinated Lime *two ounces;* Water (cold) *a sufficiency.* Put the powder into a suitable apparatus, moisten it with the Water, and let the vapor that arises be inhaled." *Br.*

VAPOR CONIÆ. *Br.* *Inhalation of Conia.*

(VĀ'PỌR CỌ-NĪ'Æ.)

"Take of Extract of Hemlock *sixty grains;* Solution of Potash *one fluidrachm;* Distilled Water *ten fluidrachms.* Mix. Put 20 minims of the mixture on a sponge, in a suitable apparatus, so that the vapor of hot water passing over it may be inhaled." *Br.*

The object of the potassa is to decompose the salt of conine in the extract, by taking the acid, and liberating the volatile alkaloid. The genuineness of the vapor may be known by the strong mouse-like odor which is perceived.

VAPOR CREASOTI. *Br.* *Inhalation of Creasote.*

(VĀ'PỌR CRĒ-Ạ-SŌ'TĪ.)

"Take of Creasote *twelve minims;* Boiling Water *eight fluidounces.* Mix the Creasote and Water in an apparatus so arranged that air may be made to pass through the solution, and may afterwards be inhaled." *Br.*

VAPOR IODI. *Br.* *Inhalation of Iodine.*

(VĀ'PỌR Ī-Ō'DĪ.)

"Take of Tincture of Iodine *one fluidrachm;* Water *one fluidounce.* Mix in a suitable apparatus, and, having applied a gentle heat, let the vapor that arises be inhaled." *Br.*

VERATRINA. *U. S.* *Veratrine.*

(VĔR-Ạ-TRĪ'NẠ.)

"An alkaloid or mixture of alkaloids, prepared from the seeds of Asagræa officinalis. Lindley. (*Nat. Ord.* Melanthaceæ.)" *U. S.*

Veratria, *U. S.* 1870; Veratria, *Br.;* Veratrium, *P.G.;* Veratrine, *Fr.;* Veratrin, *G.*

"Take of Cevadilla *two pounds* [avoirdupois]; Distilled Water, Rectified Spirit, Solution of Ammonia, Hydrochloric Acid, of each, *a sufficiency;* Purified Animal Charcoal, *sixty grains.* Macerate the Cevadilla with half its weight of boiling Distilled Water, in a covered vessel, for twenty-four hours. Remove the Cevadilla, squeeze it, and dry it thoroughly with a gentle heat. Beat it now in a mortar, and separate the seeds from the capsules by brisk agitation in a deep narrow vessel, or by winnowing it gently on a table with a sheet of paper. Grind the seeds in a coffee mill, and form them into a thick paste with Rectified Spirit. Pack this firmly in a percolator, and pass Rectified Spirit through it till the Spirit ceases to be colored. Concentrate the spirituous solution by distillation, so long as no deposit forms; and pour the residue, while hot, into twelve times its volume of cold Distilled Water. Filter through calico, and wash the residue on the filter with Distilled Water, till the fluid ceases to precipitate with Ammonia. To the united filtered liquids add the Ammonia in slight excess, let the precipitate completely subside, pour off the supernatant fluid, collect the precipitate on a filter, and wash it with Distilled Water till the fluid passes colorless. Diffuse the moist precipitate through twelve fluidounces of Distilled Water, and add gradually with diligent stirring sufficient Hydrochloric Acid to make the fluid feebly but persistently acid. Then add the Animal Charcoal; digest at a gentle heat for twenty minutes, filter, and allow the liquid to cool. Add Ammonia in slight excess, and, when the precipitate has completely subsided, pour off the supernatant liquid, collect the precipitate on a filter, and wash it with cold Distilled Water till the washings cease to be affected by nitrate of silver acidulated with nitric acid. Lastly, dry the precipitate first by imbibition with filtering paper, and then by the application of a gentle heat." *Br.*

The U. S. P. 1880 very properly does not give a process for this alkaloid, as it cannot be made profitably by the pharmacist.

In the U. S. process of 1870 the first step is to obtain a tincture of cevadilla. In the British process, which is mainly that of the late Edinburgh Pharmacopœia, the use of alcohol is preceded by measures calculated to bring the seeds into a proper state for its action. This is not satisfactorily effected by mere bruising. The seeds are not thus separated from the capsules; and, on account of their elasticity, they cannot be conveniently comminuted in a mortar. The mode of proceeding given in the British Pharmacopœia was suggested by Christison, and is said by him to answer the purpose. In the U. S. process of 1870 the tincture, when made, is evaporated to the consistence of an extract. This contains the veratrine combined with a vegetable acid, probably gallic, as it exists in the seeds. From the extract the alkaloid is dissolved by the acidulated water, which at the same time converts it in great measure into a sulphate, a small portion possibly remaining in the solution combined with an excess of the native acid. The magnesia combines with the acids and throws down the veratrine, which is then taken up by alcohol, and again yielded in a purer state by evaporation. To purify it still further, it is redissolved in water by the agency of sulphuric acid, is submitted to the action of animal charcoal, and is finally precipitated by ammonia. In the British process, the tincture is concentrated until it begins to let fall a precipitate, and is then poured into water, which throws down the resin and oil with a portion of the coloring matter, and retains the salt of veratrine. This is then decomposed by ammonia, and the precipitated veratrine is slightly washed with cold water to free it from adhering impurities. If much water is employed in the washing, a considerable portion of the veratrine is lost, in consequence of being in some degree soluble in that menstruum in its ordinary impure state. The remaining steps of the British process consist in the purification of the veratrine by forming a hydrochlorate in solution, decolorizing this by animal charcoal, and again precipitating by ammonia.*

The U. S. process of 1870† is essentially that of M. Courbe. The veratrine obtained by it, though not pure, is sufficiently so for medical use. A drachm of it, in this state, may be procured from a pound of cevadilla. Meissner, in 1819, applied the term *sabadilline* to an alkaloid extracted by him. Pelletier and Caventou had probably produced the same preparation when they announced the discovery of veratrine in the same year. This substance is the veratrine described as prepared by Couerbe's process. Couerbe, in 1834, announced the discovery of an additional alkaloid, to which he gave Meissner's old name of sabadilline, and Weigelin, in 1871, announced the discovery of a third alkaloid, which he called *sabatrine*. G. Merck, in 1855, obtained veratrine in a crystallized state by solution and separation from strong alcohol.

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* Mr. James Beatson, manufacturing chemist of the U. S. Naval Laboratory at New York, recommends the following method of preparing veratrine as less complicated and troublesome than the officinal, and quite satisfactory in its results. Take 73 pounds (avoirdupois) of cevadilla, rub it upon a coarse wire sieve so as to separate the seeds from the capsules, and reduce the former to a coarse powder by a Swift's drug mill. Pass the capsules also through the mill, separate the finer portion, and mix it with the ground seeds. Moisten the mixture with alcohol, and allow it to stand 12 hours; then introduce it into a displacement apparatus, and pour upon it 30 gallons of alcohol. When a convenient quantity of the liquid has passed, submit it to distillation, and return the distilled alcohol to the displacement apparatus; and proceed in the same way until the cevadilla is thoroughly exhausted. Collect all the alcoholic liquor from the exhausted seeds, and continue the distillation until the tincture has a syrupy consistence. Pour this while hot into eight times its volume of cold water, throw the whole on a calico filter, and wash until the washings cease to indicate the presence of the veratrine. Mix the washings with what first passed through the filter, and add aqua ammoniæ in excess (about 4 pounds). Wash the precipitated veratrine with cold water, and dry it with a very gentle heat. Mr. Beatson obtained by this process eleven and a quarter ounces of veratrine, but faintly tinged with coloring matter. (*A. J. P.*, xxvi. 5.)

† *Veratria*, U. S. 1870. "Take of Cevadilla, in moderately fine powder, *twenty-four troyounces;* Alcohol, Sulphuric Acid, Magnesia, Water of Ammonia, Purified Animal Charcoal, Water, each, *a sufficient quantity*. Digest the Cevadilla with eight pints of Alcohol, for four hours, in a distillatory apparatus, with a heat approaching to boiling, and pour off the liquid. To the residue add eight pints more of Alcohol mixed with the portion distilled, and, having digested for an hour, pour off the liquid as before. Digest for a third time with the same quantity of Alcohol, together with the portion last distilled, and again pour off. Press the remains of the Cevadilla, mix and strain the liquids, and, by means of a water-bath, distil off the Alcohol. Boil the residue three or four times in Water acidulated with Sulphuric Acid, mix and strain the liquids, and evaporate to the consistence of syrup. Add Magnesia in slight excess, shake the mixture frequently, then express, and wash what remains. Repeat the expression and washing two or three times, and, having dried the residue, digest it with a gentle heat several times in Alcohol, and strain after each digestion. Distil off the Alcohol from the mixed liquids, boil the residue for fifteen minutes in water mixed with a little Sulphuric Acid and Purified Animal Charcoal, and strain. Having thoroughly washed what remains, mix the washings with the strained liquid, evaporate with a moderate heat to the consistence of thin syrup, and drop in sufficient Water of Ammonia to precipitate the Veratria. Lastly, wash the alkaloid with Water, and dry it with a gentle heat."

Wright and Luff (*Journ. Chem. Soc.*, 33, p. 338) have brought order from this confusion by a careful study of the whole subject. They find three alkaloids in sabadilla seeds: *cevadine*, $C_{32}H_{49}NO_9$ (the alkaloid hitherto known as the veratrine of Merck); *veratrine*, $C_{37}H_{53}NO_{11}$; and *cevadilline*, $C_{34}H_{53}NO_8$. Of these, the cevadine (formerly veratrine) forms, when crystallized from alcohol, needles or compact crystals, which fuse at 205° C. (401° F.), effloresce rapidly in the air, and become opaque. It is insoluble in water, easily soluble in alcohol and ether. It dissolves in warm concentrated hydrochloric acid with dark violet color, which on boiling becomes intensely red. When heated with alcoholic potash they are decomposed into methyl-crotonic (tiglinic) acid and cevine, $C_{27}H_{43}NO_8$. The veratrine of Wright and Luff is obtained from the mother-liquor of the cevadine by extraction with ether. It forms an uncrystallizable resinous mass, fusing at 180° C., but yields crystallized salts. Boiled with caustic soda it is decomposed into dimethyl-protocatechuic (veratric) acid and verine $C_{28}H_{45}NO_8$. Cevadilline remains after the extraction of the veratrine, insoluble in ether. It is also uncrystallizable, nearly insoluble in ether and boiling benzol, but easily soluble in fusel oil.

Two acids have also been found in sabadilla: the *sabadillic* or *cevadic acid* of Pelletier and Caventou, forming needle-like crystals fusing at 20° C., and the *veratric acid* of Merck, which Koerner showed to be dimethyl-protocatechuic acid.

Properties. Veratrine is officinally described as "a white, or grayish white, amorphous, rarely crystalline powder, permanent in the air, odorless, of a distinctive, acrid taste, leaving a sensation of tingling and numbness on the tongue, producing constriction of the fauces, and highly irritant to the nostrils. Veratrine is very slightly soluble in cold or hot water, but imparts to it an acrid taste and a feebly alkaline reaction. In boiling water it strongly cakes together without melting. It is soluble in 3 parts of alcohol at 15° C. (59° F.), and very soluble in boiling alcohol; also soluble in 6 parts of ether, in 2 parts of chloroform, in 96 parts of glycerin, and in 56 parts of olive oil. When heated, it melts; at higher temperatures it chars and is wholly dissipated. "With nitric acid, Veratrine forms a yellow solution, and, by contact with sulphuric acid, it first assumes a yellow color, which soon passes to reddish yellow, then to an intense scarlet, and, after a while, to violet-red. On triturating Veratrine with sulphuric acid in a glass mortar, the yellow or yellowish red solution exhibits, by reflected light, a strong, greenish yellow fluorescence, which becomes more intense on adding more sulphuric acid. Heated with concentrated hydrochloric acid, it dissolves with a blood-red color." *U. S.*

Medical Properties and Uses. Veratrine is locally irritant, and exercises a peculiar influence on the nervous system. Rubbed upon the skin it excites a sensation of warmth and a peculiar tingling. Sometimes an evanescent blush is produced, and still more rarely an eruption upon the skin; but, in general, no decided signs of inflammation are evinced. Upon the denuded cutis, however, veratrine and its salts are powerfully irritating; in the mouth and fauces they produce an almost insupportable sense of acrimony, and snuffed up the nostrils excite violent sneezing. Magendie states that, when taken internally in the dose of a quarter of a grain, they promptly produce abundant alvine evacuations, and in larger doses provoke more or less violent vomiting. Other experimenters have observed similar effects. Dr. Turnbull, on the contrary, says that he has very seldom found them to purge, even when largely administered. According to this author, their first effect, when given in moderate doses, is a feeling of warmth in the stomach, gradually extending itself over the abdomen and lower part of the chest, and ultimately to the head and extremities. If the medicine is continued, this feeling of warmth is followed by a sense of tingling, similar to that produced by the external use of the medicine, which manifests itself in different parts of the body, and sometimes over the whole surface, and is frequently accompanied by perspiration and some feelings of oppression. Occasionally also diuresis is produced. When taken in toxic doses it causes violent vomiting, serous purging, often with intense burning in the mouth and throat, and general muscular weakness. No fatal case of poisoning is on record; but in the experiments of Esche on himself a half-grain of the acetate produced collapse, with a pale, cold, wet skin, pinched features, a rapid, thready, irregular pulse, violent vomiting, and marked muscular tremblings. The phenomena of veratria-poisoning in dogs, rabbits, etc., are failure of muscular power, along with violent muscular twitchings and convulsions, which are often plainly excited by external irritants, severe vomiting, generally but not always accompanied by purging, and disturbance of motion, respiration, and circulation. The pulse is at first, if the dose be not too large, quickened and strengthened, but in a very short time it becomes slower and weaker, and finally very frequent, thready, and irregular. When very large doses are given, the animal often dies at once of a universal paralysis. After death from a very large dose, the muscles are found to have lost more or less completely their irritability. This loss of irritability is preceded by a stage of excessive irritability, and there can be no doubt that the alkaloid acts directly and powerfully upon the muscle. The poison appears also to affect the motor peripheral nerves. The centre of respiration is profoundly depressed by the alkaloid, which is also a direct paralyzant to the heart muscle.

The diseases in which veratrine has been employed are chiefly gout, rheumatism, and neuralgia. M. Piedagnel has used it with great supposed advantage in acute articular rheumatism, which he has found generally to get well under its use in seven or eight days. (See *Am. Journ. of Med. Sci.*, N. S., xxvi. 496.) Dr. Turnbull has found it useful also in dropsy, and in diseases of the heart, particularly those of a functional character. He thinks he has also seen it do good in structural diseases of that organ, but chiefly by acting as a diuretic, and thus removing effusion in the pericardium. Prof. Vogt, of Berne, has employed it in pneumonia, giving 5 milligrammes (about the thirteenth of a grain) every two hours, and five or six times that amount during the day, increased in insusceptible persons to ten or twelve times the quantity; the dose being continued or increased till vomiting and reduction of the pulse are produced. (See *A. J. P.*, May, 1860, p. 222.) Dr. D. Martin, of the French army, has experienced great advantage from it in choroido-iritis. (*Ann. de Thérap.*, 1867, p. 16.) Veratrine has also been employed in dysmenorrhœa, and in various nervous affections, as paralysis, hooping-cough, epilepsy, hysteria, and disorders dependent upon spinal irritation. One-twelfth of a grain (0·005 Gm.) may be given in the form of pill, and repeated every three or four hours till the effects of the medicine are experienced. Some prefer the salts for internal use. Dr. Turnbull states that the tartrate is least disposed to irritate the stomach. The sulphate or acetate, however, may be used. Any one of these salts may be prepared by treating veratrine with water acidulated with the acid to perfect neutralization, and then carefully evaporating to dryness. For internal administration, however, it is a remedy of doubtful value. It is much more employed externally, and is applicable in this way to many of the complaints already mentioned. It has been highly praised as a local application in chronic swellings, stiffening, and induration of the joints, whether from rheumatism, scrofula, or simply from local injuries, as sprains. It may be used either dissolved in alcohol, or rubbed up with lard or other unctuous substance, in the proportion of from five to twenty grains to the ounce. It is advisable that the alkaloid should be dissolved in a little alcohol before being mixed with the lard. Of the ointment thus prepared, a portion of the size of a filbert may be rubbed upon the skin over the part affected, night and morning, from five to fifteen minutes, or until the more urgent symptoms are relieved. Veratrine may be used in this way to the amount of from four to eight grains in the day. Care must be taken that the cuticle is sound over the parts to which it is applied. When the skin is irritable, smaller quantities than those above mentioned must be used.

Off. Prep. Oleatum Veratrinæ; Unguentum Veratrinæ, *U. S.*

VERATRUM VIRIDE. *U. S.* *Veratrum Viride.* [*American Hellebore.*]

(VẸ-RĀ'TRỤM VĬR'Ị-DĒ.)

"The rhizome and rootlets of Veratrum viride. Aiton. (*Nat. Ord.* Melanhaceæ.)" *U. S.* "The dried rhizome of Veratrum viride. Collected in autumn in the United States and Canada." *Br.*

Veratri Viridis Radix, *Br.;* Green Hellebore Root; Veratre vert, *Fr.;* Grüner Germer, *G.*

Gen. Ch. Flowers monœciously polygamous. *Perianth* of six spreading and separate obovate, oblong (greenish or brownish) sepals, more or less contracted at base, entirely free from the ovary, not gland-bearing. *Filaments* free from the sepals, and shorter than they, recurving. *Gray.*

Veratrum viride. Willd. *Sp. Plant.* iv. 896; Bigelow, *Am. Med. Bot.* ii. 121; *B. & T.* 286. The American hellebore,* known also by the names of *Indian poke, poke root,* and *swamp hellebore,* has a perennial, thick, fleshy root or rhizome, the upper portion of which is tunicated, the lower solid, and beset with numerous whitish fibres or radicles. The stem is annual, round, striated, pubescent, and solid, from three to six feet in height, furnished with bright green leaves, and terminating in a panicle of greenish yellow flowers. The leaves gradually decrease in size as they ascend. The lower are from six inches to a foot long, oval, acuminate, plaited, nerved, and pubescent, and embrace the stem at their base, thus affording it a sheath for a considerable portion of its length. Those on the upper part of the stem, at the origin of the flowering branches, are oblong lanceolate. The panicle consists of numerous flowers, distributed in racemes with downy peduncles. Each flower is accompanied with a downy, pointed bract, much longer than its pedicel. There is no calyx, and the corolla is divided into six oval acute segments, thickened on the inside at their base, with the three alternate segments longer than the others. The six stamens have recurved filaments, and roundish two-lobed anthers. The germs are three, with recurved styles as long as the stamens. Some of the flowers have only the rudiments of pistils. Those on the upper end of the branchlets are barren, those below fruitful. The fruit consists of three cohering capsules, separating at top, opening on the inner side, and containing flat imbricated seeds.

This indigenous species of Veratrum inhabits swamps, wet meadows, and the banks of mountain streamlets. It is more abundant northward, but reaches as far south as the Carolinas. From May to July is the season for flowering. It is doubtful whether the root should be collected in autumn, or just before flowering. It should not be kept longer than one year, as it deteriorates by time.

Properties. As found in the shops, it is usually in small pieces or fragments; but sometimes it comes whole or merely sliced, so that its characteristic form may be observed. In this condition it is seen to consist of a rhizome one to three inches in length by somewhat less than an inch in thickness where broadest, tapering to a very obtuse or truncated extremity, simple or divided, compact but light, of a dark brown color externally, and either closely invested with numerous yellowish rootlets often several inches long, or exhibiting marks on the surface whence they have been removed. When sliced, the cut surface is of a dingy white color. The rootlets are three to six inches long, about as thick as a large knitting-needle, or somewhat thicker, obviously much shrunk in drying, and marked by numerous close-set indentations, which give them a characteristic appearance. Not unfrequently portions of the dried stem or leafstalks remain attached to the rhizome, which should always be rejected, as they were ascertained by Prof. Procter to be inert. (*A. J. P.*, 1864, p. 99.) The root has a bitter, acrid taste, leaving a permanent impression in the mouth and fauces; it is inodorous, but its powder produces sneezing when snuffed. In sensible properties it bears a close resemblance to white hellebore.

The chemical composition of *Veratrum viride* is closely analogous to that of *Veratrum album,* so that a brief review of the chemical history of the two will be given.

Pelletier and Caventou, in 1819, found in the rhizome of *Veratrum album* a substance which they regarded as identical with the veratrine just announced by Meissner as contained in sabadilla seeds. Simon (*Ann. Ch. und Ph.*, 24, p. 214), in 1837, found the alkaloid *jervine* also in *Veratrum album.* Worthington (*A. J. P.*, 1839, p. 89) found an alkaloid in *Veratrum viride* which he considered to be the veratrine then known from other sources. Richardson, in 1857, and Percy, in 1864, confirmed his results. Bullock (*A. J. P.*, 1865, p. 321) shortly after found, on examination of *Veratrum viride,* that while it contained at least two characteristic alkaloids, neither of these was veratrine. The alkaloids noted by Bullock were named in a former edition of this work *viridine* and *veratroidine.* Peugnet (*N. Y. Med. Record*, 1872, p. 120), in 1872, showed the identity of the first of these with jervine, and this was confirmed by Mitchell (*A. J. P.*, 1874), who also made out a distinct alkaloid in *Veratrum album*, to which he applied the name of *veratralbine.* Meanwhile, the veratroidine discovered by Bullock in *Veratrum viride* was also found in *Veratrum album* by Tobien in 1877. In a paper published in 1876 (*A. J. P.*, April, 1876), Bullock expresses his doubt as to the existence of veratroidine as a distinct alkaloid, considering that it may have been only jervine admixed with resin. Here the matter rested until the elaborate researches of Wright and Luff (*Journ. Chem. Soc.*, 35, pp. 405, 421), who find in *Veratrum album, jervine,* $C_{26}H_{43}NO_2 + 2H_2O$, *rubijervine*, $C_{26}H_{43}NO_2$, *pseudojervine*, $C_{29}H_{43}NO_7$, and *veratralbine*, $C_{28}H_{43}NO_5$ (?), and also traces of an alkaloid having sternutatory power (possibly *cevadine*). In *Veratrum viride* they found jervine, pseudojervine, cevadine, very little rubijervine, and traces of veratrine and veratralbine. Of these, rubijervine probably agrees with Bullock's veratroidine, although as prepared by Bullock in his earlier experiments it was undoubtedly mixed with resin, as the fusing point given (270° F.–275° F.) is much lower than that given by Wright and Luff for their pure crystals, which fused at 236° C. (456·8° F.). Pseudojervine forms crystals very similar to those of jervine, but it fuses at 299° C. (570·2° F.), instead of 231°–237° C. (447·8° F.–458·6° F.). Worthington has pointed out the presence of gallic acid and sugar in *Veratrum viride.*

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* The specific distinctness of the American plant from the European is very doubtful. Certain Alpine forms of *V. album* are said to resemble exactly the *V. viride.*

Medical Properties and Uses. When taken in small doses by man, veratrum viride first reduces the force without much lessening the frequency of the pulse, but after a time the pulse-rate falls very much.

If any exertion be made during this stage of depression, the slow pulse will be suddenly converted into an exceedingly rapid one. The slow pulse is sometimes moderately full, but is always very soft and compressible; the rapid pulse is exceedingly feeble and small, often thready, and may become imperceptible. Severe nausea and vomiting accompany or follow the reduction of the pulse-rate. That the latter is not due to gastric disturbance is, however, shown by the fact that it often precedes the stomachic symptoms, and may exist without them. During the stage of depression there is always decided muscular weakness and relaxation. After a poisonous dose the symptoms above noted are increased in intensity and become very alarming. A running, almost imperceptible pulse, a cold, clammy skin, intense nausea and incessant attempts at vomiting, or retching, or hiccough, absolute muscular prostration, faintness, vertigo, loss of vision, and semi-unconsciousness, make up the group of extreme symptoms. For full details as to the method in which these symptoms are produced, the reader is referred to H. C. Wood's Treatise on Therapeutics; the allotted space here will allow us only to state that veratrum viride is a powerful spinal and arterial depressant, exerting little or no direct influence upon the cerebral centres; it lowers the pulse-rate by a direct action on the muscle (jervine) and by stimulating the inhibitory nerves (veratroidine); it diminishes the force of the heart-beat by a direct influence on the cardiac muscle (jervine), and produces a general vaso-motor paralysis (jervine) more or less complete according to the size of the dose. By the action especially of the jervine the spinal motor centres are directly depressed. Neither the sensory centres nor the motor or sensory nerves are distinctly affected.

Veratrum viride is used in practical medicine to reduce arterial excitement and to quiet spinal spasms. In adynamic fevers it should never be administered; but in the first stage of frank pneumonia, or in any disease, when true sthenic arterial excitement is to be combated, except it be in gastritis or peritonitis, it may be employed as a prompt, thoroughly efficient, and at the same time very safe remedy,—very safe, since it is almost incapable of producing death in the robust adult, unless used with great recklessness and in repeated doses. In chronic *cardiac diseases* it may be employed in precisely those cases in which digitalis is contra-indicated,—*i.e.*, where there is excessive hypertrophy.

In poisoning, vomiting should be encouraged by large draughts of warm water until the stomach is well washed out. Then the patient should be forced to lie flat upon the back, with the head lower than the feet, and the efforts at vomiting should be restrained. If they cannot be checked, and if the prostration be severe, on no account should the patient be allowed to rise up, but must be made to vomit into a towel. A full dose of laudanum should be given by the rectum, and brandy or whisky administered by the mouth. Spirits will sometimes be retained only when given undiluted, and in such form they will often quiet the stomach at once. If the stomach refuse alcohol in any shape, the rectum should be made use of. Ammonia may be employed as an adjuvant to alcohol, and in extreme cases should be injected hypodermically, or even into a vein. The use of external heat is important, and mild flagellations, rubbing with coarse towels, sinapisms, etc., may be used to keep up the external capillary circulation. The drug should always be administered in the form of the *fluid extract*, dose, one to three drops (0·05–0·15 C.c.); or of the *tincture*, dose, three to six drops (0·15–0·30 C.c.), to be given every hour or two, and closely watched. The occurrence of nausea should be the signal for the suspension of the remedy.

VIBURNUM. *U.S. Viburnum. Black Haw.*

(VĪ-BÜR′NỤM.)

"The bark of Viburnum prunifolium. Linné. (*Nat. Ord.* Caprifoliaceæ.)" *U.S.*

Gen. Ch. Calyx five-toothed. *Corolla* spreading, deeply five-lobed. *Stamens* five. *Stigmas* one to three. *Fruit* a one-celled, one-seeded drupe, with thin pulp and a crustaceous, flattened stone. *Gray's Manual.*

Besides the officinal species, other of the shrubs which constitute this genus have been said to possess medical properties. It is claimed that *V. opulus*, or *cranberry tree*, common in the Northern United States and Europe, is an antispasmodic, and in some localities it is known as *cramp bark*. The berries are acid, and sometimes used as food, under the name of the *upland* or *bush cranberry*. *V. obovatum* is used in the Southern States as an antiperiodic. (*A. J. P.*, 1878, p. 4.)

V. prunifolium. L. This is a tall, very handsome shrub, which is quite common in the Middle and Southern United States, east of the Mississippi, flowering in May and ripening in the early autumn its ovoid or oblong blackish fruit. It is specifically distinguished by all of its flowers being perfect; its opposite leaves being broadly oval, obtuse at each end, finely and sharply serrate, smooth, shiny above, situated on naked petioles; and its cymes being sessile.

Properties. The bark is officinally described as "in thin pieces or quills, glossy purplish brown, with scattered warts, and minute black dots; when collected from old wood, grayish brown; the thin, corky layer easily removed from the green layer; inner surface whitish, smooth; fracture short; inodorous, somewhat astringent and bitter." *U. S.* Mr. Herman Van Allen found the following constituents in viburnum: 1, a brown resinous body, of a very bitter taste, from which it was found impossible to separate the sugar; 2, a greenish yellow resin or neutral principle of a bitter taste, slightly soluble in water, freely so in alcohol, called by Krämer *viburnin;* 3, valerianic acid; 4, a tannic acid giving greenish black color with ferric salts; 5, oxalic acid; 6, citric acid; 7, malic acid; 8, sulphates; 9, chlorides of calcium, magnesium, potassium, and iron. (*A. J. P.*, 1880, p. 443.)

Medical Properties and Uses. Dr. D. L. Phares, who first called the attention of the profession to this drug, affirms that it is nervine, antispasmodic, astringent, diuretic, and tonic, and is especially useful in the nervous diseases of pregnancy and in the prevention of miscarriage. Some confirmation of his statements has been given (see *Bost. Med. and Surg. Journ.*, Oct. 1867, p. 212), but we have no exact knowledge of the action of the remedy, and its value must be considered at present apocryphal. The dose of the fluid extract, the only eligible form of administration, may be set down as one to two fluidrachms (3·75–7·5 C.c.).

Off. Prep. Extractum Viburni Fluidum, *U. S.*

VINUM ALBUM. *U. S.* *White Wine.*

(VĪ′NỤM ĂL′BỤM.)

"A pale amber-colored or straw-colored, alcoholic liquid, made by fermenting the unmodified juice of the grape, freed from seeds, stems, and skins." *U. S.*

VINUM RUBRUM. *U. S.* *Red Wine.*

(VĪ′NŬM RŪ′BRỤM.)

"A deep red, alcoholic liquid, made by fermenting the juice of colored grapes in presence of their skins." *U. S.*

Wine is the fermented juice of the grape, the fruit of *Vitis vinifera* of botanists. The juice of sweet grapes consists of a considerable quantity of grape sugar, certain nitrogenized principles which act as ferments when the proper conditions are developed, and a small portion of extractive, tannic acid, bitartrate of potassium, tartrate of calcium, common salt, and sulphate of potassium; the whole dissolved or suspended in a large quantity of water. Sour grapes contain, in addition, a peculiar acid isomeric with the tartaric, called *racemic acid.* (See page 121.) Grape juice, therefore, embraces all the ingredients essential to the production of the vinous fermentation, and requires only the influence of the atmosphere and a proper temperature to convert it into wine.

Owing to the growing excellence in quality of American wines, the Committee of Revision of the U. S. P. 1880 decided to abandon the former titles, *Vinum Xericum* and *Vinum Portense*, to adopt the old titles, *Vinum Album* and *Vinum Rubrum*, and to permit any wine to be used, whether American or foreign, provided it complies with the requirements of alcoholic strength and purity.

Preparation. The juice expressed from the ripe grapes by various methods runs into vats and constitutes the "*must.*" The temperature of the air being about 15·5° C. (60° F.), fermentation gradually takes place in the must, and becomes fully established after a longer or shorter period. In the mean time, the must becomes sensibly warmer, and emits a large quantity of carbonic acid, which causes the more solid parts to be thrown to the surface in a mass of froth, having a hemispherical shape called the *head.* The liquor from being sweet becomes vinous, owing to the conversion of the grape sugar into alcohol. After a while the fermentation slackens, when it becomes necessary to accelerate it by thoroughly mixing the contents of the vat. When the liquor has acquired a strong vinous taste and become perfectly clear, the wine is considered formed, and is racked off into casks. But even at this stage of the process the fermentation continues for several months longer. During the whole of this period, a frothy matter is formed, which for the first few days collects round the bung, but afterwards precipitates along with coloring matter and tartar, forming a deposit which constitutes the wine-lees.*

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*In certain parts of France, the wine-makers are in the habit, during the fermentation of the wines upon the marc, of adding plaster of Paris, under the impression that it improves the color and insures the stability of the wines. The process is called by the French *plâtrage.* The chemistry of the process has recently been investigated by M. Chancel and MM. Bussy and Buignet, who coincide in the conclusion that, through the agency of the sulphate of calcium, a portion of the bitartrate of potassium in the grape, which is but partially dissolved by the wine, in consequence of its limited solvent power, is introduced into the wine, increasing its acidity, and contributing to its stability. But these chemists differ as to the precise nature of the change. Thus, while M. Chancel thinks that the reaction between the sulphate of calcium and bitartrate of potassium results in the production of free tartaric acid and sulphate of potassium which dissolve, and tartrate of calcium which remains in the marc, MM. Bussy and Buignet, agreeing with the former that tartaric acid, sulphuric acid, and potassa are imparted to the wine, each in the proportion of a single molecule, yet believe them to be so combined as to form bitartrate of potassium and bisulphate of potassium, the increased acidity being ascribable to the bisulphate; and, considering the peculiar affinities

Division and Nomenclature. Wines, according to their color, are divided into the red and the white; and according to their taste and other qualities, are either spirituous, sweet, dry, light, sparkling, still, rough, or acidulous. *Red wines* are derived from the must of black grapes, fermented with their skins and seeds, or what is collectively called the *marc; white wines*, from white grapes, or from the juice of black grapes, fermented apart from the marc. The coloring matter of the grape is almost insoluble in water, and hence the juice of the red grape is nearly colorless, and will produce a white wine if fermented alone; but, when fermented with the presence of the grape, the alcohol generated dissolves the coloring matter, which is soluble in that liquid; and thus the wine becomes red. The other qualities of wines depend on the relative proportions of the constituents of the must, and on the mode in which the fermentation is conducted. The essential ingredients of the must, as a fermentable liquid, are water, sugar, and a ferment. The exact composition of the must is shown by the following analysis of must from different sources and years:

	Sp. Gr.	Water. Per Cent.	Nitrogenous Material.	Sugar.	Acid.	Other Non-nitrogenous Material.	Ash.
Minimum........	1·0690	51·53	0·11	12·89	0·20	1·68	0·20
Maximum........	1·2075	82·10	0·57	35·45	1·18	11·62	0·63
Mean........	1·1024	74·49	0·28	19·71	0·64	4·48	0·40

(König's *Nahrungs- und Genussmittel,* vol. ii. p. 436.)

If the juice be very saccharine, and contain sufficient ferment to sustain the fermentation, the conversion of the sugar into alcohol will proceed until checked by the production of a certain amount of the latter, and there will be formed a *spirituous* or *generous* wine. If, while the juice is highly saccharine, the ferment be deficient in quantity, the production of alcohol will be less, and the redundancy of sugar proportionately greater, and a sweet wine will be formed. It is stated by M. G. Fleury that lævulose undergoes the vinous fermentation much more readily than glucose, and that the sugar of sweet wines is chiefly lævulose. Whether a grape yields a sweet or a dry wine seems then to depend, to some extent, upon the character of its sugar. (*Journ. de Pharm.*, 4e sér., viii. p. 323.) When the sugar and ferment are in considerable amount, and in the proper relative proportions for mutual decomposition, the wine will be strong-bodied and sound, without marked sweetness or acidity, and of the kind called *dry.* A small proportion of sugar can give rise only to a small proportion of alcohol, and consequently the less saccharine grapes will generate a comparatively weak or *light wine*, which will be sound and stable in its constitution in case the ferment is not in excess, but otherwise liable to pass into the acetous fermentation and become sharp. In case the wine is bottled before the fermentation is fully completed, the process will go on slowly in the bottles, and the carbonic acid generated, not having vent, will impregnate the wine and render it effervescing and *sparkling.* The *rough* or *astringent* wines owe their flavor to a portion of tannic acid derived from the marc of the grape; and the *acidulous* wines to the presence of carbonic acid, or of an unusual proportion of tartar. Several of the above qualities often coexist. Thus, a wine may be spirituous and sweet, spirituous and rough, sweet and rough, light and sparkling, etc. Wines are made in many countries, and are known in commerce by various names, according to their source. Thus, *Portugal* produces Port and Lisbon; *Spain*, Sherry, Saint Lucar, Malaga, and Tent; *France*, Champagne, Burgundy, Hermitage, Vin de Grave, Sauterne, and Claret; *Germany*, Hock and Moselle; *Hungary*, Tokay; *Sicily*, Marsala or Sicily Madeira, and Lisa; the *Cape of Good Hope*, Constantia; *Madeira* and *the Canaries*, Madeira and Teneriffe.

In the United States the first attempt to manufacture wine, on an extended scale, was made towards the close of the last century, at Spring Mill, near Philadelphia, by

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brought into play, this is, we think, the correct view. Whether the introduction of this new component into wines is beneficial or otherwise, they do not pretend to determine. (*Journ. de Pharm. et de Chim.*, 4e sér., i. pp. 347 and 351.) For means of detecting plastered wine, see *Journ. de Pharm.*, Sept. 1875.

Peter Legaux, agent of the Pennsylvania Vine Company, and proved unsuccessful. The native grape found most suitable by the Company, after the foreign had failed on account of the climate, was the *Schuylkill muscatel grape.* The next attempt was made by the Swiss at Vevay, Indiana, with the Schuylkill grape, and was partially successful; a rough red wine being manufactured which met with a ready sale in the neighboring States. In a few years the manufacture of this wine languished; foreign wines superseding it. The foreign grape, after numerous trials, not succeeding as a wine grape, investigations were undertaken to determine the adaptation of our various native grapes for making wine. Among these the *Catawba grape*, a native of North Carolina, introduced to public notice by Major Adlum, of Washington City, about the year 1825, has been largely cultivated in Southern Ohio as a wine grape. The chief objection to it is its liability to the rot. *Catawba wine* is of three kinds,—the still, the sparkling, and the sweet. *Still Catawba*, the result of a completed fermentation, is a light, dry, acidulous wine, in these particulars like hock, but entirely different in flavor. It has a pinkish or straw color. *Sparkling Catawba* is made by letting the wine undergo the secondary fermentation in the bottle. It looks like champagne, but has a different and peculiar taste. *Sweet Catawba* resembles the lighter sweet wines of Europe, and is prepared by adding sugar to the grape juice before fermentation. Within a few years various other varieties of grape have come into vogue, and native wines are rapidly coming into use, and constantly improving in quality. They are largely manufactured in various sections of our country, particularly upon the Pacific coast. The climate of Texas is peculiarly favorable to the growth of the grape vine. The *El Paso grape* is found in the vicinity of the falls of the Rio Grande; and the *great mustang* grows luxuriantly in every part of the State, and yields a superior red wine. California is rich in native grapes, and produces an immense amount of wine, which is now coming into general use. Considering its advantages of soil and climate, there is good reason to believe that it may, at no very distant time, rank among the most productive wine regions of the globe. At present the grape, for wine-making, is successfully cultivated in eighteen States of the Union. We learn from the official statistician of the Department of Agriculture at Washington, that the estimate of the wine crop of the United States for the year 1881 was from 20,000,000 to 25,000,000 gallons. A misfortune in reference to our domestic wines is that they are too often sold before they have had the opportunity of ripening with age.

Properties. Wine, considered as the name of a class, may be characterized as a spirituous liquid, resulting from the fermentation of a fruit juice, or, in its more restricted use, of a grape juice, and containing coloring matter, and other substances, either combined or intimately blended with the spirit. It always contains a small proportion of aldehyd. All its other qualities vary with the nature of each particular wine. The principal varieties of foreign wines are briefly characterized below. *American* wines are classed as Sherries, Ports, Dry Red, Dry White, Champagnes, Sweet Catawbas, and special brands.

Sherry (VINUM XERICUM, Br., U. S. 1870) is of a deep amber color, and when good possesses a dry aromatic flavor and fragrancy, with very little acidity. It ranks among the stronger white wines, and contains from 17 to 19 per cent. by volume of alcohol. It is prepared in the vicinity of Xeres, in Spain, and hence its English name *sherry.* This wine is supposed to have been the *sack* of Shakspeare, so called from the word *sec* (dry). Mr. Henry Long has found about a grain of sulphuric acid in an ounce and a half of sherry wine, and supposes it to be free; but in the light of the experiments of MM. Bussy and Buignet (see note, page 1522), it is, we think, more likely to be in the state of bisulphate of potassium, resulting from the reaction between bitartrate of potassium and sulphate of calcium used in preparing the wine. (*P. J. Tr.*, 1867, p. 732.)

Port (VINUM PORTENSE, U. S. P. 1870) is of a deep purple color, and in its new state is a rough, strong, and moderately sweet wine. When kept a certain time in bottles, it deposits a considerable portion of its astringent matter, loses the greater part of its sweetness, acquires more flavor, and retains its strength. If too long kept, it deposits the whole of its astringent and coloring matter, and becomes deteriorated. Considerable quantities of brandy are usually added to it, which causes its heating quality on the palate. It is one of the strongest wines in common use. According to Dr. Muspratt, of Liverpool, the alcohol in genuine port never exceeds 19 per cent. (*Med. Times and Gaz.*, 1856, p. 355.)

Madeira is the strongest of the white wines in use. It is somewhat acid, and, when of proper age and in good condition, has a rich, nutty, aromatic flavor. As it occurs in the market, however, it is of very variable quality, on account of the adulterations and mixtures to which it is subjected after importation.

Teneriffe is a white wine, of a somewhat acid taste, and, when of good quality, of a fine aromatic flavor. Its average strength is about the same as that of sherry. It is made from the same grape as madeira, to which it bears a close resemblance.

Claret, called in France *vin de Bordeaux*, from its being produced near that city, in the district of Médoc, is a red wine, and from its moderate strength is ranked as a light wine. It has a deep purple color, and, when good, a delicate taste, in which the vinous flavor is blended with some acidity and astringency. The most esteemed kinds are the clarets called *Château-Margaux*, *Château-Lafite*, and *Château-Latour*. Another celebrated variety is the *Château-Haut-Brion* of the Pays de Grave. Claret is the French wine most extensively consumed in the United States.

Pharmacopœial Requirements. The U. S. Pharmacopœia 1880 does not recognize any special variety of wine; only the general classes of white and red. (See page 1522.) In selecting wines for pharmaceutical purposes the apothecary should see that it conforms to the following description and tests of the Pharmacopœia. "*White Wine* should have a full, fruity, agreeable taste, without excessive sweetness or acidity; and it should have a pleasant odor, free from yeastiness. Its sp. gr. at 15·6° C. (60° F.) should not be less than 0·990, nor more than 1·010. If 10 C.c. of White Wine be diluted with an equal volume of distilled water and treated with 5 drops of test-solution of ferric chloride, only a faint, greenish brown color should make its appearance (abs. of tannic acid). Upon evaporation and twelve hours' drying on the water-bath, it should leave a residue of not less than 1·5 per cent., nor more than 3·0 per cent. Using litmus paper as an indicator, 250 C.c. of White Wine should require, for complete neutralization, not less than 15, nor more than 26 C.c. of the volumetric solution of soda. Tested by the following method, White Wine should contain not less than *ten per cent.*, nor more than *twelve per cent.*, by weight of absolute alcohol. Weigh a definite volume of the Wine at the temperature of 15·6° C. (60° F.); evaporate it in a porcelain capsule to one-third of its original volume, cool, and add distilled water until the mixture measures its original volume at the temperature of 15·6° C. (60° F.); then weigh again. The first weight divided by the second will afford a quotient (to be carried out to four decimal places) which corresponds to the percentage of absolute alcohol, by weight, in the Wine (which may be ascertained by consulting the alcoholometrical table in Part III.).* *Red Wine* should have a full, fruity, moderately astringent, pleasant taste, without decided sweetness or excessive acidity. It should have a pleasant odor, free from yeastiness. Its sp. gr. at 15·6° C. (60° F.) should not be less than 0·989, nor more than 1·010. If 10 C.c. of Red Wine be diluted with an equal volume of distilled water, and treated with 5 drops of test-solution of ferric chloride, the liquid should acquire a brownish green color, due to tannic acid. Upon evaporation and twelve hours' drying on the water-bath, it should leave a residue of not less than 1·6 per cent., nor more than 3·5 per cent. Using litmus paper as an indicator, 250 C.c. of Red Wine should require, for complete neutralization, not less than 15, nor more than 26 C.c. of the volumetric solution of soda. If 50 C.c. of Red Wine be treated with a slight excess of water of ammonia, the liquid should acquire a green or brownish green color; if it be then well shaken with 25 C.c. of ether, the greater portion of the ethereal layer removed and evaporated in a porcelain capsule with excess of acetic acid and a few fibres of uncolored silk, the latter should not acquire a crimson or violet color (abs. of aniline colors). With test-solution of acetate of lead, Red Wine should form a heavy precipitate, which may vary in color from bluish green to green. Tested by the method given above under White Wine, Red Wine should contain not less than *ten per cent.*, nor more than *twelve per cent.*, by weight, of absolute alcohol."

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* This method of ascertaining the amount of alcohol in wine was devised by Mr. H. B. Parsons, and, though subject to a trifling deviation from strict accuracy where the wine contains acetic acid or other volatile constituents, it is far preferable for pharmacists' use to the method of distillation, which requires special apparatus and great care in condensation. The error from the presence of acetic acid could be prevented by neutralizing the wine with a few drops of solution of soda before testing.

The officinal method of ascertaining the alcoholic strength is based upon the following plan of Horsley's. Note the specific gravity of the wine. Then take 5 fluidounces of it, boil it down in a flask to 2 fluidounces, and allow it to cool. All the alcohol is thus driven off. Add to the residuary liquid sufficient distilled water to bring it to the original measure of 5 fluidounces, and ascertain the specific gravity of the mixture. Deduct the excess of its specific gravity over 1·000, which is the specific gravity of distilled water, from the specific gravity of the wine as at first noted, and the difference will be the specific gravity of the alcohol and water in the wine. Then by consulting the tables giving the percentage in alcohol of liquids containing alcohol and water, the percentage of alcohol in the wine will be obtained. Thus, suppose the specific gravity of the wine to be 0·997, and that of the liquid, after treatment as directed, 1·020. Then 0·020, the excess of the latter specific gravity over that of water or 1·000, deducted from 0·997, gives 0·977 as the specific gravity of the mixed alcohol and water in the wine, which, by referring to the table in Part III., will be found to indicate a percentage by weight of 15·67 of absolute alcohol. (*Chem. News*, Oct. 19, 1861.)

The intoxicating ingredient in all wines is the alcohol which they contain; and hence their relative strength depends upon the quantity of that substance entering into their composition. The alcohol, however, naturally in wine, is so blended with its other constituents as to be in a modified state, which renders it less intoxicating and injurious than the same quantity of alcohol, separated by distillation and diluted with water. This is hardly true of the alcohol which is usually added to wines by manufacturers. The following table, taken in part from Girardin's *Chimie appliquée aux Arts industriels*, 5th ed., and in part from König's *Nahrungs- und Genussmittel*, 1880, shows the percentage of alcohol in the best-known European wines.

European Wines.	Per Cent. Alcohol by Vol.	Per Cent. by Weight.	Per Cent. of Sugar.
Lisa (G.)	23·47	......	......
Madeira, 1870 (K.)	19·11	15·54	......
" 1868 (K.)	18·81	15·34	......
Sherry, 1870 (K.)	22·90	18·66	......
" Amontillado, 1870 (K.)	20·06	16·34	......
Port, white, 1860 (K.)	20·03	16·28	......
" red, 1863 (K.)	19·46	15·82	......
" red, 1865 (K.)	21·91	17·93	......
Marsala (Ingham) (K.)	20·44	16·73	......
" (Woodhouse) (K.)	19·09	15·52	......
Malaga, 1872 (K.)	16·14	13·23	16·57
Muscat wine, 1872 (K.)	12·35	10·02	15·52
Tokay, 1868 (K.)	12·13	9·80	22·11
" (Ausbruch), 1866 (K.)	12·74	10·29	14·99
Ruster (Ausbruch), 1872 (K.)	11·08	8·96	21·74
Samos wine, 1872 (K.)	13·55	10·97	11·82
Champagne (Carte Blanche) (K.)	11·75	9·51	11·53
" (not effervescing) (G.)	12·69	......	......
Hock (effervescing) (K.)	12·14	9·80	8·49
Sherry (Lachryma Christi) (G.)	17·00	......	......
Moselle wine (K.)	12·06	......	......
Rhine wine (Hesse), red (K.)	9·55	......	......
" " white (K.)	11·07	......	......
German wine (Reisling) (K.)	11·30	......	......
" (Traminer) (K.)	11·80	......	......
" (Gutedel) (K.)	10·30	......	......
Claret (Saint Estèphe) (G.)	9·70	......	......
" (Château-Latour) (G.)	9·30	......	......
" (Château-Lafite) (G.)	8·77	......	......
" (Château-Margaux) (G.)	8·07	......	......
Chablis, white (G.)	7·33	......	......

In view of the important position accorded to American wines at present, the following valuable table will be interesting.

Analysis of American Wines. (H. B. Parsons, *Report of Department of Agriculture*, 1880.)

WINES.	Specific Gravity.	Per Cent. Alcohol by Weight.	Per Cent. Alcohol by Vol.	Per Cent. Total Residue.	Per Cent. Total Ash.	Per Cent. Glucose.	Per Cent. Total Acid as Tartaric.	Per Cent. Fixed Acid as Tartaric.	Per Cent. Vol. Acid as Acetic.
I. Dry Red Wines.									
Norton's Virginia, 1879	·9937	10·21	12·77	2·88	·298	trace.	·680	·498	·146
" " 1880	·9941	8·99	11·26	2·38	·222	0·12	·662	·308	·283
Concord, 1880	·9933	8·72	10·91	2·38	·185	0·45	·619	·332	·230
Ives, 1880	·9925	8·65	10·82	2·17	·152	0·20	·680	·363	·254
Ives and Clinton, 1880	·9920	9·62	12·05	2·17	·183	trace.	·635	·372	·210
Clinton, 1880	·9920	10·90	13·62	2·49	·165	0·30	·620	·302	·254
Cynthiana, 1880	·9952	9·26	11·61	2·66	·343	trace.	·561	·289	·218
Sonora Red Mission, 1879	·9968	7·99	10·03	2·42	·428	none.	·722	·301	·337
Zierfandell, 1878	·9957	8·21	10·30	2·45	·213	trace.	·825	·437	·310
California Claret	·9964	8·41	10·56	2·43	·326	"	·903	·331	·458
Prince William	·9945	10·20	12·77	3·16	·297	"	·699	·317	·306
II. Dry White Wines.									
California Muscatel	·9913	10·67	13·34	1·41	·190	0·12	·767	·272	·396
California Sonoma Hock	·9845	9·66	12·05	1·18	·190	0·13	·422	·213	·167
Pleasant Valley Catawba	·9903	10·99	13·71	2·10	·135	trace.	·833	·480	·282
Brocton Catawba	·9890	12·28	15·30	2·09	·121	0.26	·789	·385	·323
Missouri Catawba	·9911	8·88	11·08	1·67	·129	trace.	·772	·387	·308
Sonoma Riesling, 1879	·9906	10·54	13·15	1·70	·194	"	·575	·257	·254
Sonoma Mission, 1879	·9935	8·30	10·38	1·67	·193	"	·619	·317	·242
Sonoma Gutedel, 1879	·9921	9·50	11·87	1·71	·197	"	·589	·287	·242
White Zierfandell, 1878	·9928	9·56	11·96	1·96	·211	"	·761	·393	·324
Iona, 1870	·9892	12·05	15·02	1·62	·090	"	·810	·561	·199
White Concord, 1880	1·0105	8·02	10·21	1·34	·183	"	·481	·252	·183
III. Sweet Wines.									
Port Wines:									
Brocton Port, N. Y.	1·0508	10·00	13·24	17·04	·139	11·80	·828	·600	·182
California Port	1·0297	16·10	20·89	12·37	·285	5·78	·510	·320	·152
Speer's Port, N. J.	1·0213	13·67	17·59	10·69	·309	7·44	·705	·347	·286
Los Angeles, California	1·0339	12·68	16·52	14·18	·345	11·39	·508	·348	·128
Sherry Wines:									
California Sherry	·9873	14·42	17·92	1·95	·197	0·61	·532	·231	·241
New York Sherry	·9944	20·09	25·17	5·17	·479	2·97	·694	·332	·290
Marsala	1·0052	16·06	20·33	6·42	·428	3·53	·626	·418	·166
Speer's Sherry	·9949	17·62	22·09	4·89	·219	3·33	·476	·271	·164
Champagnes:									
"Dry Sillery"	1·0293	9·22	11·96	10·70	·104	7·34	·685	·438	·198
"Grand Prize," medium dry.	1·0228	9·75	12·49	9·15	·134	8·21	·821	·323	·398
"Eclipse," extra dry	1·0174	9·26	11·87	7·78	·149	6·51	·885	·295	·472
"Gold Seal"	1·0402	8·26	10·82	13·31	·110	12·02	·880	·447	·346
Cook's Imperial	1·0207	8·41	10·82	8·47	·130	7·23	·779	·470	·247
Sweet Catawbas:									
Bass Island	1·0338	11·68	15·21	14·49	·152	11·00	·595	·296	·239
Iowa, 1871	1·0101	9·89	12·58	7·23	·211	4·01	·668	·318	·280
Brocton, N. Y.	1·0512	10·71	14·18	16·71	·113	15·22	·714	·471	·194
Miscellaneous:									
Sweet Muscatel	1·1022	13·51	18·58	31·34	·371	25·37	·753	·421	·266
Los Angeles Muscatel	1·0418	12·81	17·08	15·61	·173	13·44	·533	·360	·138
Los Angeles Angelica	1·0493	14·77	18·78	18·04	·177	16·20	·466	·314	·122
Brocton Sweet Regina	1·0515	9·71	12·87	16·52	·101	15·31	·628	·465	·130
Scuppernong, 1880	1·0100	8·50	10·82	5·71	·111	1·78	·653	·252	·321
Sweet Scuppernong, 1878	1·0404	9·06	11·87	14·13	·132	11·56	·758	·323	·348
Dry Scuppernong, 1879	·9948	10·72	13·43	3·39	·108	1·31	·925	·346	·463
Brandies:									
Pure Grape, 1878	·9272	46·00	53·70	0·12	....	....	....	....	·111
Brandy, 1876	·9399	43·81	51·58	....	....	trace.	....	....	·075

Dr. H. Bence Jones has acertained the acidity of equal bulks of foreign wines, except Teneriffe, expressed in grains of caustic soda. The bulk taken was that of 1000 grs. of water at 60°; and the numbers express the extremes of acid; sherry, 1·95–2·85; port, 2·10–2·55; madeira, 2·70–3·60; claret, 2·55–3·45. The same authority has determined the proportion of sugar to the ounce in sherry, port, and madeira, expressed in grains: sherry, 4–18; port, 16–34; madeira, 6–20. Claret contains no sugar. Assuming that the sugar becomes acid in the system, the order of acidity of these wines, beginning with the least acid, is claret, sherry, madeira, port. (*Chem. Gaz.*, Jan. 16, 1854, p. 35.)

Dr. Christison considers it a mistake to suppose that wines become stronger by being kept a long time in casks. His experiments appear to prove the reverse. While wine is not rendered more alcoholic by age for some time, its flavor is improved, and its value thus increased. It becomes less acid partly by the deposition of tartar, and probably also by the reaction between the acids and alcohol resulting in the production of ether. Most light wines finally spoil even when well bottled.

Composition. Wines consist mainly of water and alcohol. They contain also volatile oil, œnanthic ether, grape sugar, sometimes glycerin in minute proportion (*Journ. de Pharm.*, Oct. 1859, p. 292), gum,* extractive, coloring matter, tannic, malic, phosphoric, carbonic, and acetic acids, bitartrate of potassium (tartar),† and tartrate of calcium. The volatile oil has never been isolated, but is supposed to be the cause of the delicate flavor and odor of wine, called the *bouquet.* According to Dr. F. L. Winckler, the bouquet depends upon the presence of a nitrogenous compound of a volatile organic acid with a volatile base, which has a different smell in different wines. *Œnanthic ether* (ethyl acetate, caproate, and pelargonate) was discovered in wine by Pelouze and Liebig. It is obtained towards the end of the distillation of wine, on the great scale, for making brandy. It forms only about one part in ten thousand of the wine. It is a colorless liquid, having a peculiar vinous odor, and a taste at first slight, but afterwards acrid. It is considered to be identical with *pelargonic ether*, under which head, in Part II., it is more fully described. Œnanthic ether must not be confounded with the substance which gives rise to the bouquet of wine. The other ingredients of wine, just enumerated, are sometimes present and sometimes absent. Thus, sugar is present in sweet wines, tannic acid in rough wines, and carbonic acid in those that effervesce. The different kinds of wine derive their various qualities from the mode of fermentation, the nature of the grape, and the soil and climate in which it may have grown. The alcohol in pure wine is that which results from the vinous fermentation, and is intimately united with the other ingredients of the liquid; but with almost all the wines of commerce a portion of brandy is mixed, the state of union of which is probably different from that of the natural alcohol of the wine. By the British custom-house regulations, 10 per cent. of brandy may be added to wines after importation; but to good wines not more than 4 or 5 per cent. is added.

Most wines on being kept form deposits, whether in the cask or in bottles. M. L. Pasteur divides these deposits into three kinds. 1. One consists of crystals of bitartrate of potassium, of neutral tartrate of calcium, or of a mixture of the two salts. This does not adhere to the sides of the vessel, but has sufficient weight to collect in a small bulk on repose. It is productive of little inconvenience physically, and has no injurious chemical effect on the wine. 2. A second deposit, often confounded with the first, but altogether distinct, is formed of the coloring substances which adhere to the sides of the bottles, especially the most dependent. It is owing to the oxidation, through the air, of the soluble coloring matters of the wine, which thus become insoluble. In consequence of its adhesion to the bottle, it allows the wine to be poured off quite clear. Its formation is generally coincident with improvement in the wine, which becomes at the same time lighter colored, so that, after many years, the red wines, like port, will be almost as light as madeira. 3. The third kind of deposit is the most troublesome and injurious. It consists of cryptogamic vegetations, which, in the opinion of M. Pasteur, are the exclusive cause of all the alterations in wines which are considered as maladies. These never adhere to the sides of the bottle, unless confined by the coloring matter, which is very rare. They are little bodies so light that the least movement of the bottle disturbs them, and the liquid becomes turbid to a considerable extent. In a mere physical point of view, therefore, they are very inconvenient, by interfering with the decanting of the wine; while, acting as ferments, they cause great mischief not only by the change of the principles of the wine, but by adding to it new products, the direct result of their own action. As most wines are under their influence, the injury they produce in destroying the better qualities of wine is incalculable. (*Journ. de Pharm. et de Chim.*, 4e sér., ii. 40, 1865.) The remedy for this disorder in wines, suggested by M. Pasteur, is to destroy the cryptogams by the aid of heat. All that is necessary is, by means of a water-bath, to expose the wine, in bottles, to a heat of 140° to 160° F. Experience has shown that in this way the wine soon clarifies itself, keeps well afterwards, and with an improved flavor. The process of heating their wines was to some extent employed by the ancients. Appert was the first in modern times to try it; and in fact it is nothing more nor less than his own peculiar process for preserving vegetable liquids. M. de Vergnette-Lamotte also experimented with wines with the same effect; but the theory of the change was first made known by Pasteur. (*Ibid.*, iii. 118, 1866.)

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* For a paper on the effect of gum upon the determination of the amount of glucose in wine, see *Journ. de Pharm.*, Oct. 1875, p. 274.

† M. Phipson has recognized in some wines, especially a red wine of Meudon, and in some clarets from Bordeaux, the *acid racemate* or *paratartrate of potassium*, which he distinguished by the shape of its crystals floating in the wine, and afterwards separated and examined chemically. The crystals are in octagonal tables, partially colored by the red matter of the wine. He considers its presence as an evidence of good quality in the wine. (*Journ. de Pharm. et de Chim.*, 4e sér., iii. 274, 1866.)

Adulterations. Wines are very frequently adulterated, and counterfeit mixtures are often palmed upon the public as genuine wine. Free sulphuric acid in red wines cannot be detected by barium salts; for all wines contain a small quantity of the soluble sulphates. It may be discovered, however, by dropping the suspected red wine on a piece of common glazed paper, containing starch. If the wine be pure, the spot, when dry, will be violet blue, and the paper unaltered in texture; but if the wine contain even a thousandth part of sulphuric acid, the paper will be spotted rose-red, and prove brittle and friable when slightly rubbed between the fingers. (*Lassaigne*, *O. Henri*, and *Bayard*.) Formerly the wine dealers were in the habit of putting litharge into wines that had become acescent. The oxide of lead formed with the acetic acid acetate of lead, which, being sweet, corrected the defect of the wine, but at the same time rendered it poisonous. At the present day, this criminal practice is wholly abandoned. The adulteration is readily detected by sulphuretted hydrogen, which causes a black and flocculent precipitate. Mr. Brande, among the numerous samples of wine of suspected purity which he examined, did not find one containing any poisonous ingredient fraudulently introduced. Lead, in minute quantity, may sometimes be detected; but it is derived invariably from shot in the bottle, or from some analogous source. Rhenish wines, when acid from the presence of free tartaric or acetic acid, may be restored by the addition of neutral tartrate of potassium, which gives rise to the formation of cream of tartar. (*Andrew Ure.*) Spurious mixtures, frequently containing very little of the fermented juice of the grape, and which are sold as particular wines, may not be poisonous; but they are, notwithstanding, highly pernicious in their effects upon the stomach, and always produce mischief and disappointment, when depended on as therapeutic agents. The wines most frequently imitated are port and madeira; cider is often the chief ingredient in the spurious mixtures. *English port* is sometimes made of a small portion of real port, mixed with cider, juice of elderberries, and brandy, and rendered astringent with logwood and alum. According to Stracke, genuine wines do not contain salts of potassa in quantity sufficient to yield a precipitate with platinic chloride. If, therefore, a suspected wine be evaporated to dryness, and the extract, after being washed with alcohol so long as this is colored by it, and then dissolved in water, give a precipitate with platinic chloride, the presence of cider may be suspected. (*Journ. de Pharm.*, Mai, 1862, p. 442.) By most dealers in wine, coloring is employed, made usually of elderberries and alum. The practice of coloring wines is very reprehensible. In France coloring is openly sold with impunity, and extensively employed; although the wine dealer who uses it is liable to fine and imprisonment.*

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* *The Detection of Coloring Matter in Wine.* Alum may be detected in red wine by boiling it for a few minutes. If alum be present, even in $\frac{1}{3000}$ part, the wine gradually becomes turbid, and furnishes a flocculent precipitate; while a pure red wine is not rendered turbid, even by long boiling. (*J. L. Lassaigne.*) M. Lapeyrére states (*Journ. de Pharm.*, 4e sér., xi. 291) that logwood may be detected by means of bibulous paper which has been saturated with a neutral acetate of copper; a strip of this, if dipped for a moment into natural wine, takes a gray or grayish rose color, but, if logwood be present, the tint is a violaceous blue. M. de Cherville dissolves a piece of potash in the wine; if no sediment appear, and the wine becomes greenish, it is uncolored; if a precipitate fall,

The weaker wines often spoil by keeping. In this case they are apt to dissolve any tartar that may have been deposited, and have been found to contain propionic acid. The result is ascribed by M. Nicklès to a fermentative decomposition of the tartar. Of course, in this state the wine contains potassa, and would not respond favorably to the test of platinic chloride before given. (*Journ. de Pharm.*, Août, 1862, p. 90.) Lactic acid is one of the products of the changes which take place in the spontaneous deterioration of wine; and M. Balard has succeeded in discovering the peculiar lactic acid ferment in spoiled wines. The appearance of this is preceded by that of globules similar to those of yeast; and, after the completion of the lactic acid fermentation, and the commencement of the putrefactive, a throng of vibriones is observable. After the cessation of the vinous fermentation, and during the progress of that of lactic acid, all disengagement of gas ceases. (*Ibid.*, Juillet, 1862, p. 9.)

Besides the grape, a number of other fruits yield a juice susceptible of the vinous fermentation.* The infusion of malt, also, is capable of undergoing this process, and becomes converted into the different kinds of porter and ale. The product in all these cases, though not commonly called a wine, is nevertheless a vinous liquor, and may be classed among the wines properly so called. The following is a list of these vinous liquors, together with the percentage of alcohol which they contain, as ascertained by Mr. Brande: currant wine, 20·55; gooseberry wine, 11·84; orange wine, 11·26; elder wine, 8·79; cider, from 5·21 to 9·87; perry, 7·26; mead, 7·32; Burton ale, 8·88; Edinburgh ale, 6·20; brown stout, 6·80; London porter, 4·20; small beer, 1·28. Dr. H. Bence Jones gives the following percentages of alcohol in the undernamed liquors: cider, from 5·4 to 7·5; bitter ale, from 6·6 to 12·3; porter, from 6·5 to 7·0; brown stout, from 6·5 to 7·9. According to L. Hoffmann, Burton ale consists, in the 100 parts, of carbonic acid 0·04, absolute alcohol 6·62, extract of malt 14·97, and water 78·37; and pale ale, of carbonic acid 0·07, absolute alcohol 5·57, extract of malt 4·62, and water 89·74. None of these liquors should be kept in leaden vessels, for fear of being rendered poisonous.

Medical Properties and Uses. Wine is consumed in most civilized countries; but in a state of health it is at least useless, if not absolutely pernicious. The degree of mischief which it produces depends on the character of the wine. Thus, the light wines of France are comparatively harmless; while the habitual use of the stronger wines, such as sherry, port, madeira, etc., even though taken in moderation, is always injurious, as having a tendency to induce gout, apoplexy, and other diseases dependent on plethora and over-stimulation. All wines, however, when used habitually in excess, are productive of bad consequences. They weaken the stomach, produce disease of the liver, and give rise to gout, dropsy, apoplexy, tremors, and not unfrequently mania. Nevertheless, wine is an important medicine, productive of the best effects in certain diseases. As an article of the materia medica, it ranks as a stimulant and antispasmodic. In the convalescence from protracted fever, it is frequently the best remedy that can be employed. In certain stages of fever, and in extensive ulceration and gangrene, this remedy, either alone, or conjoined with bark and opium, is often our main dependence. According to Dr. Stokes, of Dublin, the weakness or absence of the first sound of the heart is an indication for the use of wine in typhus fever. When given in low febrile affections, if it increase the fulness and lessen the frequency of the pulse, mitigate delirium, and produce a tendency to sleep, its further use may be deemed proper; but, if it render the pulse quicker, augment the heat and thirst, produce restlessness, or

it has been colored; a violet sediment indicating elder or mulberries; red, beet root or Pernambuco wood; violet red, logwood; yellow, "phytolac" berries; violet blue, privet berries; pale violet, sunflower. (*Phila. Med. Times*, iv. 639.) A. Dupré recommends that a small cube of jelly (prepared by dissolving 5 grammes of gelatin in 100 C.c. of warm water, and allowing to cool) be placed in the wine. After 24 to 48 hours the jelly is removed and washed. If the coloring matter be artificial, it will have penetrated the whole cube; if it be natural, only the surface. *Nessler's reagent* consists of 7 parts of alum, 10 parts of acetate of sodium, in 100 parts of water. Natural colored wines are not affected by this; artificial colors are altered to a more or less distinct blue. (*Proc. Amer. Pharm. Ass.*, xxvii. 213.)

* It is stated that fruit wines contain phosphate of calcium, whilst grape wines contain phosphate of magnesium, and that the two can thus be distinguished. It is, however, very doubtful whether this is universal, and it is most likely that it applies only to the products of certain neighborhoods. (*A. J. P.*, 1872, p. 105.)

increase delirium, it should be immediately laid aside as injurious. In some convulsive diseases, as, for example, tetanus, wine, liberally given, has often proved useful.

Wine, when used medicinally, should be good of its kind; for otherwise it will disagree with the stomach, and prove detrimental rather than useful. The individual wine selected for internal exhibition must be determined by the nature of the disease, and the particular object in view. Sherry, when in good condition, is a fine wine, and, as it contains very little acid, is to be preferred whenever the stomach is delicate or has a tendency to dyspeptic acidity. Port is generally used in cases of pure debility, especially when attended with a loose state of the bowels, unaccompanied with inflammation. In such cases it often acts as a powerful tonic as well as stimulant, giving increased activity to all the functions, especially digestion. Claret is much less heating, and is often useful on account of its aperient and diuretic qualities. Champagne is applicable to the sinking stage of low fevers with irritable stomach, and is often useful in the debility of the aged. All the acidulous wines are contra-indicated in the gouty and uric acid diathesis, as they are apt to convert the existing predisposition into disease.

The quantity of wine which may be given with advantage in disease is very variable. In low fevers it may be administered to the extent of a bottle or more in twenty-four hours, either pure, or in the form of *wine-whey.* This is made by adding to a pint of boiling milk, removed from the fire, from a gill to half a pint of white wine, straining without pressure to separate the curd, and sweetening the clear whey with loaf sugar.

Pharmaceutical Uses. White wine when fortified is employed as a menstruum to extract the virtues of several plants (see *Vinum Album Fortius*); and the preparations formed are called *vinous tinctures* or *medicated wines.* Tartar emetic and iron are the only mineral substances prepared in a similar manner. (See *Vinum Antimonii* and *Vinum Ferri.*) For the peculiar powers of wine as a menstruum, see *Vina Medicata.*

VINA MEDICATA. *Medicated Wines.*

(VĪ′NẠ MĔD-Ị-CĀ′TẠ.)

Vins médicinaux, *Fr.;* Medicinische Weine, *G.*

The advantages of wine as a pharmaceutic menstruum are that, in consequence of the alcohol it contains, it dissolves substances insoluble in water, and, to a certain extent, resists their tendency to spontaneous change; while, at the same time, it is less stimulant than rectified or proof spirit, both from its smaller proportion of alcohol, and from the modified state in which this fluid exists in its composition. The acid which it usually contains serves in some instances to increase its solvent power. But most wines, particularly the light varieties, are liable to undergo decomposition; and even the strongest acquire such a liability from the principles which they extract from vegetable substances; so that medicated wines, though they keep much better than infusions or decoctions, are inferior in this respect to the tinctures. The proportion of alcohol, moreover, is not constant; and the preparations, therefore, made with them, were formerly of unequal strength. From these causes, few medicated wines are at present retained. In the choice of wine, the purest and most generous should be selected. The medicated wines, in consequence of their liability to change, should be prepared in small quantities, from stronger white wine, and should be kept in a cool place. The following additions have been made to this class in the U. S. P. 1880. *Vinum Album Fortius, Vinum Aromaticum, Vinum Ferri Amarum,* and *Vinum Ferri Citratis.** The Wines, formerly officinal, which have been omitted in the present Pharmacopœias are *Vinum Tabaci, Vinum Gentianæ,* Ed., and *Vinum Veratri Albi,* U. S., Lond.

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* *Vinum Pepsini* was not introduced into the U. S. P. 1880. It is usually made by dissolving 256 grains of Saccharated Pepsin in a pint of Sherry Wine. If used at all, it should be dispensed soon after it is made, and the strength should be doubled. It is an uncertain preparation at best. (See *Liquor Pepsini.*)

VINUM ALBUM FORTIUS. *U. S.* *Stronger White Wine.*

(VĪ′NỤM ĂL′BỤM FŎR′TỊ-ŬS.)

"White Wine, *seven parts* [or fifty-five fluidounces]; Alcohol, *one part* [or nine and a half fluidounces]. Mix them." *U. S.* "When tested for alcohol, as described under White Wine (see page 1525), Stronger White Wine should contain not less than *twenty per cent.* nor more than *twenty-five per cent.* of absolute alcohol, by weight." *U. S.*

This preparation has been introduced into the Pharmacopœia of 1880 for the purpose of having a wine for pharmaceutical menstrua which will contain sufficient alcohol to render the medicated wines more permanent in their character and less variable in alcoholic strength. The Pharmacopœia of 1870 gave no direction regarding the amount of alcohol in sherry wine which was directed as a menstruum, and the medicated wines found in pharmacy were as variable in this respect as the wine itself was in commerce, and they frequently contained too little alcohol to keep them from becoming sour. By introducing tests and a method of assay (see *Vinum Album*, page 1525), and then directing a reasonable limit, which will allow the use of any pure wine whether native or foreign, the objects sought for are accomplished. The addition of alcohol frequently causes a slight precipitation of flocculent matter, which may be removed after standing by filtration.

VINUM ALOES. *U. S., Br.* *Wine of Aloes.*

(VĪ′NỤM ĂL′Ọ-ĒṢ.)

Vinum aloeticum; Vin aloétique, *Fr.;* Aloewein, *G.*

"Purified Aloes, *six parts* [or two ounces av.]; Cardamom, *one part* [or one hundred and forty-six grains]; Ginger, *one part* [or one hundred and forty-six grains]; Stronger White Wine, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Mix the Aloes, Cardamom, and Ginger, and reduce them to a moderately coarse (No. 40) powder. Macerate the powder with *ninety parts* [or twenty-six fluidounces] of Stronger White Wine for seven days, with occasional agitation, and filter through paper, adding, through the filter, enough Stronger White Wine to make the filtered liquid weigh *one hundred parts* [or measure two pints]." *U. S.*

"Take of Socotrine Aloes *one ounce and a half* [avoirdupois]; Cardamom Seeds, freed from the pericarps and bruised, Ginger, in coarse powder, of each, *eighty grains;* Sherry *two pints* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation; filter the liquor, and add sufficient Sherry to make two pints [Imp. meas.]." *Br.*

The wine of aloes is a warm stomachic purgative, useful in constipation, dependent on a want of due irritability of the alimentary canal, and in complaints connected with this state of the bowels, and long used in chlorosis, amenorrhœa, dyspepsia, gout, paralysis, etc. It is said to leave behind it a more lax condition of the bowels than most other cathartics. The dose as a stomachic is one or two fluidrachms (3·75–7·5 C.c.), as a purgative from half a fluidounce to a fluidounce (15–30 C.c.).

VINUM ANTIMONII. *U. S.* *Wine of Antimony.*

(VĪ′NỤM ĂN-TỊ-MŌ′NỊ-Ī.)

Vinum Antimoniale, *Br.;* Antimonial Wine; Vinum Stibiatum, s. Emeticum, *P.G.;* Vin antimonié, Vin stibié, *Fr.;* Brechwein, *G.*

"Tartrate of Antimony and Potassium, *four parts* [or fifty-eight grains]; Boiling Distilled Water, *sixty parts* [or two fluidounces]; Stronger White Wine, *a sufficient quantity*, To make *one thousand parts* [or two pints]. Dissolve the Tartrate of Antimony and Potassium in the Water, and, while the solution is hot, add *six hundred parts* [or twenty fluidounces] of Stronger White Wine, and filter through paper, adding, through the filter, enough Stronger White Wine to make the filtered liquid weigh *one thousand parts* [or measure two pints]." *U. S.*

"Take of Tartarated Antimony *forty grains;* Sherry *one pint* [Imperial measure]. Dissolve." *Br.*

In the first edition of the United States Pharmacopœia, the proportion of tartar emetic was four grains to the fluidounce of wine. In the revision of 1830, the quantity was reduced to two grains, and, as this was very nearly the proportion directed by the British Colleges, the highly important object was accomplished, of uniformity in the strength of this very popular preparation. The seeming discrepancy between the British formula and that of the U. S. Pharmacopœia of 1870 disappeared when it was considered that the Imperial pint, employed in the former, contains twenty fluidounces, each very nearly equal to the fluidounce of the ordinary apothecaries' measure. The U. S. officinal name was adopted as most convenient, sufficiently expressive, and in accordance with the nomenclature of several other metallic preparations, such as *Emplastrum Ferri*, *Mistura Ferri Composita*, etc. The proportion of tartar emetic has been slightly decreased in the formula of the U. S. P. 1880. It is now about 1·8 gr. in a fluidounce. It was 2 gr. in a fluidounce in U. S. P. 1870.

Difficulty is often experienced in effecting a solution of tartar emetic in wine; and precipitation is apt to occur after the solution has been effected. These results are attributable either to impurity in the antimonial salt, which frequently contains bitartrate of potassium and various insoluble substances, or to inferiority in the character of the wine, which holds in solution vegetable principles that form insoluble compounds with the antimony. Dr. Paris stated that he had seen the decomposition of the tartar emetic so complete that no traces of the salt could be detected in the supernatant liquid. The difficulty is not avoided by the plan adopted in the U. S. Pharmacopœia, of first dissolving the antimonial in water, and then adding the wine; for, even allowing that the solution may be accomplished, the same ingredients are present, and their mutual reaction must ultimately result in the same effects. The proper course is to select perfectly pure crystallized tartar emetic, and sound wine, which make a permanent solution. To obviate the risk of decomposition, the Dublin College directed water and rectified spirit in about the proportion in which these exist in the wines just mentioned. The only objection to this menstruum is the want of color, which renders the preparation liable to be confounded with less active liquids.

The advantages of antimonial wine are, that it affords the means of administering minute doses of tartar emetic, and is more permanent than an aqueous solution of that salt, which is liable to spontaneous decomposition. It is usually administered in small doses as a diaphoretic or expectorant, or as an emetic in infantile cases. When a considerable quantity of tartar emetic is requisite, it should always be given in extemporaneous aqueous solution: The dose of the wine, as an expectorant or diaphoretic, is from ten to thirty drops (0·6–1·9 C.c.), given frequently; as an emetic for children, from thirty drops to a fluidrachm (1·9–3·75 C.c.), repeated every fifteen minutes till it operates.

Off. Prep. Mistura Glycyrrhizæ Composita, *U. S.*

VINUM AROMATICUM. *U. S.* *Aromatic Wine.*

(VĪ'NỤM ĂR-Ọ-MĂT'Ị-CŬM.)

Vin aromatique, *Fr.:* Aromatischewein, *G.*

"Lavender, *one part* [or seventy-two grains]; Origanum, *one part* [or seventy-two grains]; Peppermint, *one part* [or seventy-two grains]; Rosemary, *one part* [or seventy-two grains]; Sage, *one part* [or seventy-two grains]; Wormwood, *one part* [or seventy-two grains]; Stronger White Wine, *a sufficient quantity*, To make *one hundred parts* [or one pint]. Mix the solid ingredients, and reduce them to a coarse (No. 20) powder. Moisten the powder with *four parts* [or six fluidrachms] of Stronger White Wine, pack it moderately in a conical glass percolator, and gradually pour enough Stronger White Wine upon it to make the filtered liquid weigh *one hundred parts* [or measure one pint]." *U. S.*

This is a new officinal, although by no means a new preparation. It is practically identical with the *Vin aromatique* of the French Codex, which is made by macerating one hundred parts of aromatic species (a mixture of equal parts of the herbs used in our officinal aromatic wine, and in addition wild thyme and hyssop) with one hundred parts of *Teinture vulnéraire* (a tincture containing the same herbs, and ten more of similar properties) and one thousand parts of red wine.

This wine is principally used as an astringent and stimulating lotion to chancres, open buboes, and other indolent ulcers. In many cases it should be diluted, but on occasion it may be employed of full strength. It is never given internally.

VINUM COLCHICI RADICIS. *U. S.* *Wine of Colchicum Root.*

(VĪ′NỤM CŎL′ȻHỊ-CĪ RẠ-DĪ′CĬS—kŏl′kẹ-sī.)

Vinum Colchici, *Br.;* Vin de Bulbes de Colchique, *Fr.;* Zeitlosenknollenwein, *G.*

"Colchicum Root, in No. 30 powder, *forty parts* [or thirteen ounces av.]; Stronger White Wine, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *ten parts* [or four fluidounces] of Stronger White Wine, pack it moderately in a conical percolator, and gradually pour enough Stronger White Wine upon it to make the filtered liquid weigh *one hundred parts* [or measure two pints]." *U. S.*

"Take of Colchicum Corm, sliced, dried, and bruised, *four ounces* [avoirdupois]; Sherry *one pint* [Imperial measure]. Macerate the Colchicum in the Wine for seven days in a closed vessel, with occasional agitation, press and strain through calico; then add sufficient Sherry to make up one pint [Imp. meas.]." *Br.*

This is intended to be a saturated vinous tincture of colchicum. As the colchicum bulb imported into the United States is of variable strength, the only method by which an active preparation can be insured, is to employ a large quantity of it in proportion to that of the menstruum. If the former should happen to be in excess, no other injury could result than a slight pecuniary loss; while a deficiency in the strength of the preparation would frequently be of serious detriment in urgent cases of disease. A wine made from the fresh bulb is occasionally imported from England, and is thought by some to be more efficacious than our officinal preparation; but we have seldom been disappointed in obtaining the effects of colchicum from the wine prepared according to the directions of the U. S. Pharmacopœia. The dose of the officinal wine is from ten minims to a fluidrachm (0·6–3·75 C.c.), repeated three or four times a day, or more frequently in severe cases, till its effects are experienced. In gout it is frequently given in connection with magnesia and its sulphate; and in neuralgic cases we have found much advantage from combining it with the solution of sulphate of morphine, especially when we have desired to give it a direction rather to the skin than to the bowels. It has been employed externally with asserted advantage in rheumatism. In overdoses it may produce fatal effects. Death is said to have occurred in one instance from two drachms and a half (5·6 C.c.) of the wine; but much more would probably in general be requisite to produce this result.

VINUM COLCHICI SEMINIS. *U. S.* *Wine of Colchicum Seed.*

(VĪ′NỤM CŎL′ȻHỊ-CĪ SĔM′Ị-NĬS—kŏl′kẹ-sī.)

Vinum Colchici, *P.G.;* Vin de Semences de Colchique, *Fr.;* Zeitlosensamenwein, *G.*

"Colchicum Seed, in No. 20 powder, *fifteen parts* [or five ounces av.]; Stronger White Wine, *a sufficient quantity*, To make *one hundred parts* [or two pints]. To the powder add *ninety parts* [or twenty-eight fluidounces] of Stronger White Wine, and macerate for seven days, with occasional agitation; then filter through paper, adding, through the filter, enough Stronger White Wine to make the filtered liquid weigh *one hundred parts* [or measure two pints]." *U. S.*

As the seeds of colchicum are less liable to injury than the bulb, and are, therefore, of more uniform strength, there is not the same necessity for preparing a saturated tincture. Dr. Williams, who introduced the seeds into use, supposed that their active properties resided in their coating, and that it was, therefore, not advisable to bruise them in preparing the wine or tincture. But this has been shown to be an error by the experiments of Mr. Bonnewyn, who found a larger portion of colchicine in a tincture of the bruised than in one of the unbruised seeds. (See *A. J. P.*, xxvi. 120.) Mr. L. I. Morris has shown, however, that by *digesting* instead of macerating the whole seeds the colchicine can be all extracted. (See *Tinctura Colchici.*) In order that the seeds may be properly comminuted, Prof. Maisch recommends that they should be macerated for two or three days in a portion of the wine, before being bruised. (*Ibid.*, xxviii. 514.) It is stated that sometimes this tincture becomes turbid from the development of the yeast fungus in it. (Vulpius, *A. J. P.*, xliv. 212.) The dose is from thirty minims to two fluidrachms (1·9–7·5 C.c.). Two fluidounces (60 C.c.) have proved fatal.

VINUM ERGOTÆ. *U. S.* *Wine of Ergot.*

(VĪ'NỤM ẸR-GŌ'TÆ.)

Vin de Seigle, *Fr.;* Mutterkornwein, *G.*

"Ergot, recently ground and in No. 30 powder, *fifteen parts* [or five ounces av.]; Stronger White Wine, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the powder with *four parts* [or ten fluidrachms] of Stronger White Wine, pack it moderately in a cylindrical percolator, and gradually pour enough Stronger White Wine upon it to make the filtered liquid weigh *one hundred parts* [or measure two pints]." *U. S.*

The large proportion of fixed oil in ergot interferes with the solvent action of the menstruum, unless the grains are properly comminuted. They should not be bruised so as to "raise" the oil, but ground in a mill, which cuts them in minute pieces. The use of such ground ergot, and fortified white wine, will insure a more reliable preparation than that formerly directed, which was a diluted fluid extract. The strength has also been increased from twelve and a half per cent. to fifteen per cent. of active ingredient. The dose of this wine is for a woman in labor two or three fluidrachms (7·5–11·25 C.c.); for other purposes, one to four fluidrachms (3·75–15 C.c.), to be repeated several times a day, and gradually increased if necessary.

VINUM FERRI AMARUM. *U. S.* *Bitter Wine of Iron.*

(VĪ'NỤM FĔR'RĪ Ạ-MĀ'RỤM.)

Vin Quinquina ferrugineux. *Fr.;* Bitter Eisenwein. *G.*

"Solution of Citrate of Iron and Quinine, *eight parts* [or seventeen fluidrachms*]; Tincture of Sweet Orange Peel, *twelve parts* [or four fluidounces]; Syrup, *thirty-six parts* [or ten fluidounces]; Stronger White Wine, *forty-four parts* [or one pint], To make *one hundred parts* [or two pints]. Mix and filter through paper." *U. S.*

This new officinal wine has been very largely used in this country, although the same objections to the introduction of elixirs into the Pharmacopœia might be made with equal force to the acceptance of bitter wine of iron. It is a mild ferruginous tonic, a fluidounce representing eighteen grains of citrate of iron and quinine of officinal strength, equivalent to about sixteen grains of citrate of iron and two grains of quinine.† The dose is from a dessertspoonful to a tablespoonful (7·5–15 C.c.).

VINUM FERRI. *Br.* *Wine of Iron.*

(VĪ'NỤM FĔR'RĪ.)

Vinum Chalybeatum, s. Martiatum: Vin chalybé, *Fr.;* Eisenwein, Stahlwein, *G.*

"Take of Fine Iron Wire (about No. 35) *one ounce* [avoirdupois]; Sherry *one pint* [Imperial measure]. Macerate for thirty days in a closed vessel, the Iron being almost but not quite wholly immersed in the Wine, and the vessel frequently shaken, and the stopper removed; then filter." *Br.* (See *Vinum Ferri Citratis.*)

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* Five hundred and eighty grains of soluble citrate of iron and quinine of officinal strength may be substituted for this quantity if more convenient.

† *Bitter Wine of Iron.* The following formula, in which Calisaya bark and gentian are used, is said by Dr. Chas. L. Mitchell to yield an elegant preparation.

Take of ground Calisaya Bark 192 grains; ground Gentian Root 128 grains; Soluble Citrate of Iron 192 grains; Sherry Wine 13 fluidounces: Brandy 1 fluidounce; Alcohol 1 fluidounce: Oil of Orange 12 minims: Sugar 2 ounces; Solution of Tersulphate of Iron 2 fluidounces; Water of Ammonia q. s. Dissolve the Oil in the Alcohol and mix with the Sherry Wine and Brandy. Percolate with this the ground drugs, recover 15 fluidounces of tincture by pouring on water. Dilute the iron solution with twice its bulk of water and add Ammonia in slight excess. Wash and drain the precipitate thoroughly. Mix this with the tincture, and agitate occasionally until a filtered portion has a light yellow color and does not precipitate with tincture of the Chloride of Iron. Filter, dissolve the Citrate of Iron and Sugar, and bring up the measure with a little water to 16 fluidounces; a fluidounce represents 12 grains of Calisaya Bark, 8 grains of Gentian Root, and 12 grains of Citrate of Iron. Dose, one to three fluidrachms.

When wine is made to react on metallic iron with presence of air, the metal is oxidized, and then unites with the excess of acid of the bitartrate of potassium, which is the characteristic salt of wines. The ferruginous salt, therefore, formed is the tartrate of iron and potassium, or tartarated iron of the Br. Pharmacopœia; and this was the old method of preparing the Wine of Iron. But it is obvious that the strength in iron cannot be entirely uniform, as the quantity dissolved must depend on the proportion of the bitartrate in the wine, which is variable, and on various circumstances of the manipulation. In consideration of these objections, it was thought best, in the Br. formula of 1864, to substitute a simple solution in the wine of the tartrate of iron and potassium already formed, and to abandon the old tedious formula. But it is obvious that a solution of the ferruginous salt in wine is not exactly the same as the wine of iron prepared with the metal, as it contains the bitartrate of potassium unaltered. For this or other reasons, the Br. Pharmacopœia has returned to the old method. The dose of the wine of iron is from one to four fluidrachms (3·75–15 C.c.).

VINUM FERRI CITRATIS. *U. S., Br.* *Wine of Citrate of Iron.*

(VĪ'NỤM FĔR'RĪ CĪ-TRĀ'TĬS.)

Vin ferrugineux, *Fr.;* Eisenwein, *G.*

"Citrate of Iron and Ammonium, *four parts* [or five hundred and eighty grains]; Tincture of Sweet Orange Peel, *twelve parts* [or five fluidounces]; Syrup *twelve parts* [or three fluidounces]; Stronger White Wine, *seventy-two parts* [or twenty-three fluidounces], To make *one hundred parts* [or about two pints]. Mix and filter through paper." *U. S.*

"Take of Citrate of Iron and Ammonia *one hundred and sixty grains;* Orange Wine *one pint* [Imperial measure]. Dissolve, and let the solution remain for three days in a closed vessel, shaking it occasionally; afterwards filter. Dose one to four *fluidrachms* (3·75–15 C.c.)." *Br.*

This is a new officinal wine: it has been much used in this country as a mild chalybeate, although heretofore it varied much in composition from the need of an authoritative formula. A fluidrachm (3·75 C.c.), which is the average dose, contains about two and a quarter grains of the iron salt.

VINUM IPECACUANHÆ. *U. S., Br.* *Wine of Ipecac.*

(VĪ'NỤM ĬP-Ẹ-CĂC-U̇-ĂN'HÆ—ĭp-ẹ-kăk-u̇-ăn'ē.)

Vin d'Ipecacuanha, *Fr.;* Brechwurzelwein, *G.*

"Fluid Extract of Ipecac, *seven parts* [or twenty fluidrachms]; Stronger White Wine, *ninety-three parts* [or thirty fluidounces], To make *one hundred parts* [or about two pints]. Mix and filter through paper." *U. S.*

"Take of Ipecacuanha, bruised, *one ounce* [avoird.]; Sherry, *one pint* [Imp. meas.]. Macerate for seven days in a closed vessel, with occasional agitation, strain, press and filter; then add sufficient Sherry to make one pint [Imp. meas.]." *Br.*

The preparations of the two Pharmacopœias are not of the same strength; the U. S. wine containing the virtue of about 37 grains, the British of only somewhat more than 20 grains, in a fluidounce. In the preparation of the British Pharmacopœia, the strength of this wine was reduced almost one-third. Wine of Ipecac possesses all the medical properties of the root, and may be used as a substitute when it is desirable to administer the medicine in a liquid form. As it is milder, without being less efficacious, than antimonial wine, it is in some instances preferable as an emetic for infants, especially when the antimonial, as not unfrequently happens, is disposed to irritate the bowels. It is much used as an expectorant and diaphoretic; and the effects of the Dover's powder may be obtained by combining it with laudanum, or other liquid preparation of opium. The dose as an emetic for an adult is a fluidounce (30 C.c.); as an expectorant and diaphoretic, from ten to thirty minims (0·6–1·9 C.c.). A fluidrachm (3·75 C.c.) may be given as an emetic to a child one or two years old, and repeated every fifteen minutes till it operates.

VINUM OPII. *U. S., Br. Wine of Opium. Sydenham's Laudanum.*

(VĪ'NỤM Ō'PỊ-Ī.)

Tinctura Opii Crocata, *P.G.;* Vin d'Opium composé, *Fr.;* Safranhaltige Opiumtinktur, *G.*

"Powdered Opium, *ten parts* [or four hundred and fifty-six grains]; Cinnamon, in No. 60 powder, *one part* [or forty-five grains]; Cloves, in No. 30 powder, *one part* [or forty-five grains]; Stronger White Wine, *a sufficient quantity*, To make *one hundred parts* [or ten fluidounces]. To the mixed powders add *ninety parts* [or nine fluidounces] of Stronger White Wine, and macerate the mixture for seven days, with occasional agitation; then transfer it to a filter, and gradually pour enough Stronger White Wine upon it to make the filtered liquid weigh *one hundred parts* [or measure ten fluidounces]." *U. S.*

"Take of Extract of Opium *one ounce* [avoirdupois]; Cinnamon Bark, bruised, Cloves, bruised, of each, *seventy-five grains;* Sherry *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation, and filter." *Br.*

The strength of Wine of Opium has been materially decreased in the revision of the U. S. P. 1880. It now contains the virtues of one grain of powdered opium in 10·5 minims, where it formerly was of the strength of one grain in 8 minims.

The wine made according to the directions of the U. S. Pharmacopœia 1870 was a vinous tincture of opium. It contained about the same proportions of the ingredients as the *laudanum of Sydenham*, from which it differed only in wanting a drachm of saffron. The aromatic additions are thought to adapt it to certain states of the stomach or system, in which laudanum is found to produce unpleasant effects. On being long kept it deposits insoluble matter, a sample of which M. Bihot, of Malines, has shown to consist mainly of narcotine, with possibly a little codeine, without any discoverable trace of morphine. (*Journ. de Pharm.*, xxx. 200.) Mr. Ware recommended it as a local application to the eye, in the latter stages of ophthalmia, when the vessels of the conjunctiva still remain turgid with blood. Two or three drops are introduced into the eye every morning till the redness disappears. The dose of the wine of opium is fifteen to twenty drops (0·9–1·25 C.c.).*

VINUM QUINIÆ. *Br. Wine of Quinia.*

(VĪ'NỤM QUĪ'NỊ-Æ.)

Vin de Quinine, *Fr.;* Chininwein, *G.*

"Take of Sulphate of Quinia *twenty grains;* Citric Acid *thirty grains;* Orange Wine *one pint* [Imperial measure]. Dissolve first the Citric Acid. and then the Sulphate of Quinia in the Wine; allow the solution to remain for three days in a closed vessel, shaking it occasionally; and afterwards filter. The dose is from half a fluidounce to a fluidounce (15–30 C.c.)." *Br.*

VINUM RHEI. *U. S., Br. Wine of Rhubarb.*

(VĪ'NỤM RHĒ'Ī.)

Tinctura Rhei Vinosa, Tinctura Rhei Darelii, *P.G.;* Vin de Rhubarbe, *Fr.;* Weinige Rhabarbertinktur, *G.*

"Rhubarb. in No. 30 powder, *ten parts* [or three and a quarter ounces av.]; Calamus, in No. 30 powder, *one part* [or one hundred and forty grains]; Stronger White Wine, *a sufficient quantity*, To make *one hundred parts* [or two pints]. Moisten the mixed powders with *five parts* [or one and a half fluidounces] of Stronger White Wine, pack the mixture in a conical glass percolator, and gradually pour enough Stronger White Wine upon it to make the filtered liquid weigh *one hundred parts* [or measure two pints]." *U. S.*

"Take of Rhubarb Root, in coarse powder, *one ounce and a half* [avoirdupois];

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* *Rousseau's laudanum* is a tincture of opium made with very weak alcohol, according to the following formula. "Take of White Honey *twelve ounces;* Warm Water *three pounds.* Having dissolved the honey, set the solution aside in a warm place; and, as soon as fermentation begins, add of selected opium *four ounces*, previously dissolved in *twelve ounces* of water. Allow the mixture to stand for a month at the temperature of 24° Réaumur (86° F.); then strain, filter. and evaporate to *ten ounces;* finally strain, and add *four ounces and a half* of alcohol of 20° B. Seven drops contain about a grain of opium." (*Pharmacop. Univers.*, ii. 265.)

Canella Alba Bark, in coarse powder, *sixty grains;* Sherry *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation, then strain, press, filter, and add sufficient Sherry to make one pint [Imp. meas.]." *Br.*

Calamus has been substituted for canella, with possibly no other object than to use an indigenous aromatic instead of a foreign one, which is falling into neglect and is no longer officinal. This is a warm cordial laxative applicable to debilitated conditions of the system or alimentary canal requiring evacuation of the bowels. This wine is about one-third weaker than that of U. S. P. 1870. The dose is from one to four fluidrachms (3·75–15 C.c.) or more.

VIOLA TRICOLOR. *U. S.* *Viola Tricolor.* [*Pansy.*]

(VĪ-Ō′LA̦ TRĬC′O̦-LŎR.)

"The wild-grown, flowering herb of Viola tricolor. Linné. (*Nat. Ord.* Violaceæ.)" *U. S.*

Violette, Violette odorante, *Fr.;* Wohlriechendes Veilchen, Veilchen, *G.;* Violetta, *It.;* Violeta, *Sp.*

Gen. Ch. *Calyx* five-leaved. *Corolla* five-petalled, irregular, horned at the back. *Anthers* cohering. *Capsule* superior, three-valved, one-celled.

This genus includes numerous species, of which, though perhaps all or nearly all are possessed of analogous properties, one only, the *V. tricolor,* is now officinal; *V. pedata* and *V. odorata* having been respectively dropped at the late revisions of the U. S. and Br. Pharmacopœias. As *V. odorata* has long held the most conspicuous place in the genus medically considered, and *V. pedata* was so recently officinal, we shall treat of them together with the officinal species.

Viola tricolor. Linn. The *Heart's-Ease Pansy* or *Johnny Jump-up* of the gardens has an erect or ascending angular-branched stem. The leaves are alternate, oval or roundish, and the lower ones cordate, crenate, or entire, provided with large lyrately pinnatifid stipules. The flowers are large, on long peduncles, variously colored, mostly in purple, blue, and yellow, with an obtuse spur, and the variegated petals shorter or longer than the calyx; inodorous. It is a native of Europe, cultivated in very numerous varieties, and naturalized in certain portions of the United States (Kentucky and southward).

Viola pedata. Willd. *Sp. Plant.* i. 1160; Curtis, *Bot. Mag.* 89. This is an indigenous species, without stems, glabrous, with three to five divided, often pedate leaves. The flowers are large and blue, often more or less variegated, and without beard on the petals. The stigma is large, compressed at the sides, and nearly beakless. The plant grows in dry sandy hills and fields and rocky woods, from New England to Carolina, and flowers in May and June.

Viola odorata, Willd. *Sp. Plant.* i. 1163, resembles very closely the common wild blue violet of America, *V. cucullata,* from which it is at once distinguished by its delicious fragrance. It is stemless, with blue flowers, having the lateral petals bearded, and reniform or heart-shaped, obtuse and crenate leaves, supported on long quadrangular channelled peduncles. It is a native of Europe, growing in woods, hedges, and other shady places, and has been introduced into this country.

The flowers yield their odor and slightly bitter taste to boiling water; and their infusion affords a very delicate test for acids and alkalies, being reddened by the former, and rendered green by the latter. Their odor is destroyed by desiccation; and the degree to which they retain their fine color depends upon the care used in collecting and drying them. They should be gathered before being fully blown, deprived of their calyx, and rapidly dried, either in a heated room, or by exposing them to a current of very dry air. The flowers of other species are often mingled with them, and, if of the same color, are equally useful as a chemical test.

In the root, leaves, flowers, and seeds of *Viola odorata,* M. Boullay discovered an alkaloid, *violine,* allied to *emetine,* but possessing distinct properties. It is white, soluble in alcohol, scarcely soluble in water, and forms salts with the acids. It exists in the plant combined with malic acid, and may be obtained by treating with distilled water the alcoholic extract of the dried root, decomposing by means of magnesia the malate of violine contained in the solution, and extracting the alkaloid from the precipitated matters by alcohol, which yields it on evaporation. To obtain it entirely pure, a more complicated process is necessary. Orfila has ascertained that it is exceedingly active and even poisonous. It is probably contained in most of the other species of Viola.

Medical Properties, etc., of the Violets. The herbaceous parts of different species of violet are mucilaginous, emollient, and slightly laxative, and have been used in pectoral, nephritic, and cutaneous affections. Much was formerly thought of the *Viola tricolor*, or *pansy*, as a remedy in crusta lactea. A decoction in milk of a handful of the fresh herb was taken morning and evening, and a poultice made with the same decoction was applied to the affected part. Cures in numerous instances are said to have been effected by this treatment, persevered in for some time. Our own *Viola pedata* is considered a useful expectorant and demulcent in pectoral complaints. (*Bigelow.*) In Europe, a syrup prepared from the fresh flowers of *Viola odorata* is employed as an addition to demulcent drinks, and as a laxative for infants. The seeds were formerly considered beneficial in gravel, but are not now used. The root, which has a bitter, nauseous, slightly acrid taste, acts in the dose of from thirty grains to a drachm (1·95–3·9 Gm.) as an emetic and cathartic. It is probable that the same property is possessed by the roots of all the violets; as it is known to be by several species of *Ionidium*, which belongs to the same natural family. The existence in small proportion of the emetic principle, upon which the powers of the root probably depend, in the leaves and flowers, accounts for the expectorant properties attributed to these parts of the plant.

VITELLUS. *U. S.* *Yolk of Egg.*

(VỊ-TĔL'LỤS.)

"The yolk of the egg of Gallus Bankiva, *var.* domesticus. Temminck. (*Class*, Aves; *Order*, Gallinæ.)" *U. S.*

The yolk of egg has been made officinal because of its use in the glycerite of yolk of egg. (See *Glyceritum Vitelli*, page 717.)

XANTHOXYLUM. *U. S.* *Xanthoxylum.* [*Prickly Ash.*]

(XẠN-THŎX'Ỵ-LŬM.)

"The bark of Xanthoxylum fraxineum, Willdenow, and of Xanthoxylum carolinianum. Lambert. (*Nat. Ord.* Rutaceæ, Xanthoxyleæ.)" *U. S.*

Toothache Tree, Angelica Tree, Suterberry; Clavalier, Frêue épineux, *Fr.;* Zahnwehholz, *G.*

Gen. Ch. MALE. *Calyx* five-parted. *Corolla* none. FEMALE. *Calyx* five-parted. *Corolla* none. *Pistils* five. *Capsules* five, one-seeded. *Willd.**

Xanthoxylum fraxineum. Willd. *Sp. Plant.* iv. 757; Bigelow, *Am. Med. Bot.* iii. 156.—*X. Americanum*, Miller; Torrey and Gray, *Fl. of N. Am.* i. 214. The prickly ash is a shrub from five to ten feet in height, with alternate branches, which are covered with strong, sharp, scattered prickles. The leaves are alternate and pinnate, consisting of four or five pairs of leaflets, and an odd terminal one, with a common footstalk, which is sometimes prickly on the back, and sometimes unarmed. The leaflets are nearly sessile, ovate, acute, slightly serrate, and somewhat downy on their under surface. The flowers, which are small and greenish, are disposed in sessile umbels near the origin of the young shoots. The plant is polygamous; some shrubs bearing both male and perfect flowers, others only female. The number of stamens is five, of the pistils three or four in the perfect flowers, about five in the pistillate. Each fruitful flower is followed by as many capsules as it had germs. These capsules are stipitate, oval, punctate, of a greenish red color, with two valves, and one oval blackish seed. This species of Xanthoxylum is indigenous, growing in woods and in moist shady places throughout the Northern, Middle, and Western States. The flowers appear in April and May, before the foliage. The leaves and capsules have an aromatic odor, recalling that of the oil of lemons. The bark is the officinal portion.

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* The fruit of *Xanthoxylum alatum*, growing in Northern India and China, is used, under the name of *Japanese pepper*, as a condiment in Japan and China. It is in small roundish capsules, of which one or more stand upon a peduncle, of a reddish brown color, and beset externally with numerous little prominences, which appear to enclose the oil to which the fruit owes its pungency. The flavor of the capsule is aromatic, pungent, and agreeable. The seeds are black, shining, and destitute of pungency. Dr. Stenhouse has obtained from the fruit by distillation a liquid volatile oil, isomeric with oil of turpentine, which he calls *xanthoxylene*, colorless, and of an extremely agreeable odor; and a crystalline stearoptene, which separates from the liquid on cooling. This he calls *xanthoxylin*, and gives it the formula $C_{20}H_{24}O_8$. It is slightly aromatic, insoluble in water, soluble in alcohol and ether, fusible and volatilizable unchanged. (*P. J. Tr.*, xvii. 19, and N. S. ii. 554.)

Properties. The bark of *Xanthoxylum fraxineum* is in quills, from one or two lines to nearly an inch in diameter, thin, externally of a darkish gray color diversified by whitish patches and minute black dots, with the epidermis in many pieces marked by closely set transverse cracks, internally finely striated longitudinally and somewhat shining, and, when derived from the smaller branches, exhibiting "whitish straight, two-edged spines, linear at the base, and about a quarter of an inch (6 mm.) long; inner surface whitish, smooth; fracture short, non-fibrous, green in the outer, and yellowish in the inner layer." *U. S.* The bark is very light, brittle, nearly or quite inodorous, and of a taste which is at first sweetish and slightly aromatic, then bitterish, and ultimately acrid. The acrimony is imparted to boiling water and alcohol, which extract the virtues of the bark. Its constituents, according to Dr. Staples, besides fibrous substance, are volatile oil, a greenish fixed oil, resin, gum, coloring matter, and a peculiar crystallizable principle which he calls *xanthoxylin*, but of which the properties are not designated. (*Journ. of the Phila. Coll. Pharm.*, i. 165.) It is probably identical with the bitter crystalline principle found by MM. Chevallier and Pelletan in the bark of *Xanthoxylum Clava Herculis*, and named by them *xanthopicrite;* and this has been found by Mr. Perrins to be identical with berberine; so that the prickly ash is to be added to the list of medical substances, already large, in which this widely diffused alkaloid is contained. (*P. J. Tr.*, March, 1863, p. 403.)*

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* *Berberine.* This alkaloid appears to have been first discovered, in 1826, in a species of Xanthoxylum, by Chevallier and Pelletan, who, from its color and taste, named it *xanthopicrite.* Buchner and Herberger, in 1835, found it in *Berberis vulgaris*, and named it berberine: but none of these chemists were aware of its alkaline properties. Indeed, the substance obtained by them, at least the berberine of Buchner, must have been a native salt of the proper alkaloid, which was not, therefore, procured in a pure state. Subsequently Fleitmann demonstrated its basic character, and published an account of several of its salts. It is not confined to the barberry, but has been found, by various chemists, in several other plants, particularly those combining bitterness and a yellow color, as in various products of *Cocculus palmatus, Hydrastis Canadensis, Xanthorriza apiifolia, Coptis Teeta, Xanthoxylum Clava Herculis, Coscinium fenestratum*, and others belonging to the natural families of Berberaceæ, Menispermaceæ, and Ranunculaceæ. Indeed, few if any of the known alkaloids are so widely diffused as this appears to be in the vegetable kingdom. A list of all the plants from which it has been obtained is contained in *A. J. P.* (Sept. 1863, p. 456).

Berberine may be obtained most readily from its sulphate. Prof. Procter has given the following process for preparing it, based upon a suggestion of Mr. Merrill, of Cincinnati. The coarsely powdered root is to be exhausted by repeated decoction with boiling water, and the mixed liquids, after filtration, are to be evaporated to a soft extract. This is to be digested several times with stronger alcohol, in the proportion of a pint to half a pound of the root, until exhausted, one-fourth of its bulk of water is to be added to the tincture, and five-sixths of the alcohol to be distilled off. To the residue, while still hot, sulphuric acid is to be added in excess, and the liquid allowed to cool. The sulphate of berberine is deposited in crystals, and, having been purified by recrystallization, is to be decomposed by the addition, in excess, to its solution in boiling water, of freshly precipitated protoxide of lead, the solution being kept hot until the decomposition is completed. This may be known by the absence of a precipitate when acetate of lead is added to a drop of the clear liquid. The liquid is then to be filtered, and set aside to crystallize. Thus obtained, berberine is in the form of a yellow powder, which, under the microscope, appears to consist of groups of minute, acicular crystals. It has a bitter taste, is soluble in about 100 parts of cold water, still less soluble in cold alcohol, freely soluble in both these liquids when hot, and insoluble in ether. It forms salts of difficult solubility with hydrochloric and sulphuric acids, and is distinguished by being copiously precipitated by the former acid from its cold watery solution in the form of crystals of the hydrochlorate. It is freely dissolved by acetic acid, which forms with it a readily soluble salt. (*A. J. P.*, Jan. 1864, p. 10.) Its formula is, according to Fleitmann, $C_{42}H_{40}N_2O_{11}$, but, on the more recent authority of Perrins, $C_{20}H_{17}NO_4$. (*P. J. Tr.*, April, 1863, p. 464.) Hlasiwetz (*Ann. Ch. Pharm.*, 115, p. 45) also confirms this formula, which may therefore be assumed as correct. The *hydrochlorate of berberine*, which is the salt that has attracted most notice, may be readily obtained by using hydrochloric instead of sulphuric acid in the above process, and purifying the precipitate by solution in hot alcohol, and subsequent refrigeration. It is in fine acicular crystals, of a bright yellow color, and intensely bitter taste, very slightly soluble in cold water, to which, however, it imparts a deep yellow color, slightly soluble also in cold alcohol, but dissolved in large proportion by both liquids when hot. By concentrated nitric acid both this salt and its base are decomposed, with the production of a dark red color, and the escape of nitrous fumes. A process for *Hypophosphite of Berberine*, by Prof. J. U. Lloyd, may be found in *A. J. P.*, July, 1877. Parsons (*N. R.*, 1879, p. 109) analyzed *Phosphate of Berberine*, and believes the formula to be $C_{20}H_{17}NO_4,2H_3PO_4$.

"The bark of *Xanthoxylum Carolinianum* resembles the preceding, but is about one-twelfth of an inch (2 mm.) thick, and is marked by many conical, corky projections, sometimes four-fifths of an inch (2 cm.) high, and by stout, brown spines, rising from a corky base." *U. S.*

Aralia spinosa, or angelica tree, which grows in the Southern States, is occasionally confounded with *X. fraxineum*, in consequence partly of being sometimes called, like the latter, *prickly ash.* Its bark is nearly smooth externally, is beset with slender prickles in transverse rows, and has a taste different from that of *X. fraxineum.*

Medical Properties and Uses. Xanthoxylum is stimulant, producing, when swallowed, a sense of heat in the stomach, with more or less general arterial excitement, and a tendency to diaphoresis. It is thought to resemble mezereum and guaiac in its remedial action, and is given in the same complaints. As a remedy in chronic rheumatism, it enjoys some reputation in this country. The dose of the powder is from ten grains to half a drachm (0·65–1·95 Gm.), to be repeated three or four times a day. A decoction, prepared by boiling an ounce in three pints of water down to a quart, may be given in the quantity of a pint (472 C.c.), in divided doses, during the twenty-four hours. The powder has sometimes been employed as a topical irritant; and the bark, used as a masticatory, is a popular remedy for toothache, and has been recommended in palsy of the tongue.

Off. Prep. Extractum Xanthoxyli Fluidum, *U. S.*

ZINCUM. *U. S., Br.* *Zinc.*

Zn; 64·9. (ZĬN′CŲM.) Zn; 32·45.

"Metallic Zinc, in the form of thin sheets, or irregular, granulated pieces." *U. S.* "Zinc of commerce." *Br.*

Speltrum: Speltre; Zinc, *Fr.;* Zink, *G.;* Zinco, *It., Sp.*

Zinc occurs native in two principal states; as a sulphide, called *blende*, and as a carbonate and silicate, to which the name of *calamine* is applied indiscriminately. In this country there are two additional ores that are worked for zinc. They both occur at Franklin and Mine Hill, New Jersey, and are characteristic of those localities. They are the native oxide, called *red oxide* or *zincite*, and a mixture of zinc oxide with oxide of manganese and iron, known as *franklinite.* Zinc has been detected, in the vegetable kingdom, in a peculiar violet, *Viola calamina*, growing on the calamine hills of Rhenish Prussia. It is largely produced in Germany and this country, the chief American localities being the New Jersey localities before mentioned, Lehigh Co., Pennsylvania, Virginia, and Wisconsin. The metal is extracted generally from calamine. This is roasted and mixed with charcoal powder, and the mixture heated in iron cylinders placed horizontally over a furnace. When the reduction of the zinc commences, iron receivers are adapted to the opening of the cylinder to condense the volatilized metal. The metal is then melted and run into moulds, and forms *speltre*, or the zinc of commerce. In this state it contains iron, and traces of lead, cadmium, arsenic, copper, sulphur, and charcoal. To purify it from these substances, it must be subjected to a second distillation in a crucible, furnished with a tube passing through its bottom, and open at both ends; its upper extremity reaching a little more than half-way up the interior of the crucible, and its lower end terminating above a vessel of water. The impure zinc being placed in the crucible, the cover luted on, and the fire applied, the pure zinc is volatilized, and, passing down the tube by a descending distillation, condenses in the water below. In the arts, zinc is purified sufficiently for commercial purposes without volatilization.

The Lehigh Zinc Company, at Bethlehem, Pa., furnishes at the present time about one-half of the annual consumption of the country. The capacity of these works in 1880 was as follows: For oxide of zinc, 3000 tons per year; for metallic zinc, 3600 tons per year; for sheet zinc, 3000 casks, or 1800 tons.

Properties. Zinc has a bluish white color, a peculiar taste, and a perceptible smell when rubbed. Its texture is laminated, and its fracture crystalline. Its malleability and ductility are not very great. When perfectly pure, it may be reduced to thin leaves at ordinary temperatures; but the zinc of commerce requires to be heated to a temperature between 100° C. and 148·8° C. (212° F. and 300° F.)

to render it sufficiently malleable to be rolled into sheets. The softness of zinc is peculiar, as is shown by the circumstance that it clogs the file when the attempt is made to reduce it to filings; and hence to have it in the divided form it is necessary to melt it, and triturate it at the moment of solidification. Subjected to heat it fuses at 398° C. (773° F.). According to Dr. A. von Riemsdyk, it volatilizes to some extent before fusion at a temperature of 268·3° C. (515° F.). (*A. J. P.*, 1869, p. 424.) At full redness it boils, and in close vessels may be distilled over; but in open vessels it takes fire, and burns with a dazzling white flame, giving off dense white fumes. It dissolves in most of the acids with disengagement of hydrogen, and precipitates all the metals either in the metallic state, or in that of oxide. It forms but one oxide (a monoxide) and but one sulphide. The monoxide is officinal, and will be described under another head. (See *Zinci Oxidum.*)

The officinal zinc is described as "a bluish white metal, having the sp. gr. 6 9. When treated with warm, diluted sulphuric acid, it is almost completely dissolved to a colorless liquid which yields a white precipitate with test-solution of ferrocyanide of potassium or of sulphide of ammonium. If the gas which is given off during the solution be made to come in contact with paper wet with test-solution of nitrate of silver, no brown or black stain should be produced on the paper (absence of arsenic). On adding water of ammonia to a colorless solution of the metal in diluted sulphuric acid, a white precipitate is produced which should be soluble in an excess of water of ammonia, yielding a colorless liquid (absence of more than traces of lead, iron, and copper)." *U. S.*

Zinc of good quality dissolves in dilute sulphuric acid, with the exception of a scanty grayish black residue. If absolutely pure, it would be wholly dissolved. The solution is colorless, and yields white precipitates with ferrocyanide of potassium and ammonium sulphydrate. Ammonia throws down from this solution a white precipitate, which is wholly dissolved when the alkali is added in excess.

Zinc is extensively employed in the arts. It is the best metal that can be used, in conjunction with copper or carbon, for galvanic combinations. Its solution in dilute sulphuric acid furnishes the readiest method for obtaining hydrogen. With copper it forms *brass*, and, in the form of *sheet zinc*, it is employed to cover the roofs of houses, and for other purposes. It is also applied to the covering of iron, to protect it from oxidation, in the same manner as tin, forming what is known commercially as *galvanized iron.* It should, however, never be used for culinary vessels, as it is soluble in the weakest acids. Zinc and its oxide are dissolved to a certain extent by water containing common salt; a double chloride of zinc and sodium being produced in solution. (*Journ. de Pharm.*, Nov. 1867, p. 397.)

The compounds of zinc are poisonous, but not to the same extent as those of lead. The oxide of zinc, used in painting as a substitute for white lead, is said to be capable of producing a colic, resembling that caused by lead, and called *zinc colic.* It attacks workmen exposed to the dust of the oxide while engaged in packing it in barrels, and yields to the remedies appropriate to the treatment of lead colic. (See *Chem. Gaz.*, Sept. 16, 1850.) This statement, however, is, to say the least, very questionable.

Pharmaceutical Uses. Zinc is never used as a medicine in the metallic state, but is employed in this state to prepare Sulphate and Chloride of Zinc, and the Reduced Iron of the Br. Pharmacopœia. In combination it forms a number of important preparations, a list of which, with their synonymes, is subjoined.*

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* *Nitrate of Zinc* is sometimes used as a caustic either in the form of *paste* or in *pencils.* M. Lefort prepares it by dissolving commercial zinc with heat in equal volumes of nitric acid and water, maintaining an excess of zinc, and concentrating until a slight basic precipitate is formed, which carries down any iron present. Boiling water is then added, and, when cool, the solution is filtered, and evaporated at a gentle heat until slight ebullition takes place; if then left to cool, it forms a cake, which should be broken up and drained in a glass funnel. Of the nitrate of zinc so prepared, 100 grammes are dissolved in 50 grammes of water, and afterwards incorporated with 50 grammes of wheaten flour. This forms a homogeneous paste, which remains soft, spreads easily over surfaces without afterwards contracting, and does not spread at the edges through absorption of moisture. When made into cylinders, it should not be dried by heat, as it slightly decomposes and becomes yellow and friable; it may be kept dry by placing it in a tin box with some pieces of quicklime, but not in contact with them. (*London Medical Record*, June 18, 1873; *A. J. P.*, Dec. 1873.) Dr. Chas. Rice prepares pencils by pouring fused nitrate of zinc into paper cylinders, which are made by rolling paper around a lead-pencil and sealing with wax. (See *N. R.*, 1876, p. 44.)

Zinc is employed medicinally,

I. IN THE METALLIC STATE.
- Zincum Granulatum, *Br.—Granulated Zinc.*

II. OXIDIZED.
- Zinci Oxidum, *U. S., Br.—Oxide of Zinc.*
  - Unguentum Zinci Oxidi, *U. S.;* Unguentum Zinci, *Br.—Ointment of Oxide of Zinc.*

III. COMBINED WITH CHLORINE.
- Zinci Chloridum, *U. S., Br.—Chloride of Zinc.*
- Liquor Zinci Chloridi, *Br.—Solution of Chloride of Zinc.*

IV. COMBINED WITH PHOSPHORUS.
- Zinci Phosphidum, *U. S.—Phosphide of Zinc.*

V. OXIDIZED AND COMBINED WITH ACIDS.
- Zinci Acetas, *U. S., Br.—Acetate of Zinc.*
- Zinci Carbonas Præcipitatus, *U. S.;* Zinci Carbonas, *Br.—Precipitated Carbonate of Zinc.*
- Zinci Sulphas, *U. S., Br.—Sulphate of Zinc. White Vitriol.*
- Zinci Valerianas, *U. S., Br.—Valerianate of Zinc.*

ZINCUM GRANULATUM. *Br.* *Granulated Zinc.*

(ZĬN′CỤM GRĂN-U-LĀ′TỤM.)

"Take of Zinc of commerce *one pound.* Fuse it in an earthen crucible, heated to a sufficient but not excessive degree in a suitable fire, and pour the fluid metal in a thin stream into a vessel containing two gallons of cold water. Remove the Granulated Zinc from the water and dry it." *Br.*

Off. Prep. Liquor Zinci Chloridi, *Br.;* Zinci Chloridum, *Br.;* Zinci Sulphas, *Br.*

ZINCI ACETAS. *U. S., Br.* *Acetate of Zinc.*

$Zn(C_2H_3O_2)_2 . 3H_2O$; 236·9. (ZĬN′CĪ Ạ-CĒ′TĂS.) $ZnO, C_4H_3O_3 . 3HO$; 118·45.

"Acetate of Zinc should be kept in well-stopped bottles." *U. S.*

Zinci Aceticum, *P.G.;* Acetas Zincicus; Acétate de Zinc, *Fr.;* Essigsaures Zinkoxyd, *G.*

"Take of Carbonate of Zinc *two ounces* [avoirdupois]; Acetic Acid *five fluidounces* or *a sufficiency;* Distilled Water *six fluidounces.* Add the Carbonate of Zinc in successive portions to three [fluid]ounces of the Acetic Acid, previously mixed with the Water in a flask; heat gently, add by degrees the remainder of the Acid till the carbonate is dissolved; boil for a few minutes, filter while hot, and set it aside for two days to crystallize. Decant the mother-liquor; evaporate to one-half, and again set it aside for two days to crystallize. Place the crystals in a funnel to drain, then spread them on filtering paper on a porous tile, and dry them by exposure to the air at ordinary temperatures." *Br.*

In the U. S. process of 1870* the oxide of zinc is acted upon directly by the acetic acid. Formerly the salt was prepared by precipitating acetate of lead with zinc. The crystals of acetate of zinc, as thus obtained, were apt to be colored with iron. Should this be the case, a boiling solution of them in distilled water is to be treated by the addition of successive portions of precipitated carbonate of zinc, until a small quantity of the liquid, being filtered, passes colorless. The zinc of the carbonate of zinc precipitates the iron, and takes its place in the solution; and the iron is known to be all removed, when a portion of the solution is found, upon trial, to filter colorless. This mode of purifying the acetate of zinc from iron was suggested by Professor Procter, and was adopted in the U. S. Pharmacopœia of 1850, in place of the mode by means of a solution of chlorinated lime, which he found to separate the iron imperfectly. The necessary carbonate of zinc may be obtained extemporaneously, by converting one-thirtieth of the colored solution of the acetate into carbonate by precipitating it with carbonate of potassium in slight excess, as originally proposed by Prof. Procter. The precipitated carbonate, first washed from acetate of potassium, is added in the state of magma to the colored solution, boiling hot. During the evaporation of the solution of the acetate of zinc, a small portion of the acetic acid is lost; and hence the necessity of acidulating with a few drops of acetic acid before crystallizing. In the *British* process, there is simply a decomposition of the carbonate of zinc by acetic acid, with the formation of acetate of zinc in solution, and the escape of carbonic acid. Though not economical, these processes have the recommendation of being easily performed, and of yielding a pure product. In relation to the acetate of zinc, see a paper by Mr. Ambrose Smith, *A. J. P.* (vii. 14).

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* Take of Commercial Oxide of Zinc *two troyounces;* Acetic Acid *eight fluidounces and a half;* Distilled Water *five fluidounces.* Mix the Acid and Water, and digest the Oxide of Zinc in the mixture for half an hour, then heat to the boiling point, filter while hot, and set aside to crystallize. Drain the crystals in a funnel, and dry them upon bibulous paper. An additional quantity of crystals may be obtained by evaporating the mother-liquor to one-half, slightly acidulating with acetic acid, and crystallizing." *U. S.* 1870.

Properties. Acetate of zinc is in "soft, white, micaceous or pearly, six-sided tablets or scales, somewhat efflorescent in dry air, having a faintly acetous odor, a sharp, metallic taste, and a slightly acid reaction. Soluble in 3 parts of water, and in 30 parts of alcohol at 15° C. (59° F.); in 1·5 part of boiling water, and in 3 parts of boiling alcohol. When strongly heated, the salt melts, and at a higher temperature, it is decomposed with evolution of acetous vapors, a residue of oxide of zinc being finally left. The aqueous solution of the salt yields a white precipitate with test-solution of ferrocyanide of potassium or of sulphide of ammonium. On heating the salt with sulphuric acid, acetous vapors are evolved. The aqueous solution, acidulated with hydrochloric acid, should yield no dark-colored precipitate with hydrosulphuric acid (abs. of lead, copper). On adding test-solution of carbonate of ammonium to the aqueous solution, a white precipitate is produced which should be wholly soluble in an excess of the reagent (abs. of iron, aluminium, and most of the alkaline earths). On completely precipitating the zinc from this alkaline solution by sulphide of ammonium, the filtrate should leave no fixed residue on evaporation and gentle ignition (salts of alkalies or of alkaline earths)." *U. S.*

Although the Pharmacopœia has adopted the formula giving to acetate of zinc three molecules of water, Dibbit states that it contains but two molecules. Franchimont has confirmed this, and proved that both of these two molecules are lost at the temperature of 100° C. (212° F.). (*Ber. d. Deutsch. Chem. Ges.*, 1879, p. 11; *A. J. P.*, May, 1879.) The precipitate thrown down by ammonia from the pure salt is entirely redissolved by an excess of the precipitant; but, if ferric oxide be present, it will be left undissolved. Acetate of zinc is decomposed by the mineral acids, with the escape of acetous vapors.

Medical Properties. Acetate of zinc is used almost exclusively as a local remedy. It is employed principally as an astringent collyrium in ophthalmia, and as an injection in gonorrhœa, after the acute stage in these affections has passed. The strength of the solution, usually prescribed, is one or two grains to a fluidounce (0·065–0·13 Gm. to 30 C.c.) of distilled water.

ZINCI BROMIDUM. *U. S.* *Bromide of Zinc.*

$ZnBr_2$; 224·5. (ZĬN'CĪ BRŌ'MĮ-DŬM.) ZnBr; 112·25.

Bromure de Zinc, *Fr.;* Bromzink, *G.*

"Bromide of Zinc should be kept in small, glass-stoppered vials." *U. S.*

This is a new officinal salt of zinc. It may be made either by the direct combination of zinc and bromine, or by dissolving zinc in a solution of hydrobromic acid. Mr. L. Lyons proposes to make this salt by dissolving 100 grains of potassium bromide and 240 grains of crystallized sulphate of zinc, each, in the smallest quantity of hot water, and mixing while hot. When the mixture has cooled, twice its bulk of alcohol is added, and the whole filtered through asbestos to separate the sulphate of potassium. The filtrate is then evaporated to dryness.

Properties. It is officinally described as "a white, or nearly white, granular powder, very deliquescent, odorless, having a sharp, saline and metallic taste, and a neutral reaction. Very soluble in water and in alcohol. When strongly heated, it fuses, and, at a higher temperature, it is volatilized with partial decomposition. The aqueous solution of the salt yields a white precipitate with test-solution of ferrocyanide of potassium or of sulphide of ammonium. On adding some disulphide of carbon to the aqueous solution, then chlorine water, drop by drop, and agitating, the disulphide will separate with a yellow to brownish red color, free from violet tint. When acidulated with hydrochloric acid, the aqueous solution should yield no dark-colored precipitate with hydrosulphuric acid (abs. of lead, copper). On adding test-solution of carbonate of ammonium to the aqueous solution, a white precipitate is produced which should be wholly soluble in an excess of the reagent (abs. of iron, aluminium, and most of the alkaline earths). On completely precipitating the zinc from this alkaline solution by sulphide of ammonium, the filtrate should leave no fixed residue on evaporation and gentle ignition (salts of alkalies or of alkaline earths). 1 Gm. of the dry salt, when completely precipitated by nitrate of silver, yields 1·67 Gm. of dry bromide of silver." *U. S.*

Medical Properties. The medical properties of the bromide of zinc are not certainly known. It is capable in excessive doses of acting as an irritant poison. It has been commended in epilepsy, but its value is very problematical. Dr. William A. Hammond uses a *Syrup of Bromide of Zinc*, made by dissolving 480 grains of bromide of zinc in 4 fluidounces of syrup, giving ten drops three times a day, and increasing the dose to forty drops.

ZINCI CARBONAS PRÆCIPITATUS. *U. S.* *Precipitated Carbonate of Zinc.*

(ZĬN'CĪ CĂR-BŌ'NĂS PRÆ-CĬP-Ị-TĀ'TỤS.)

$(ZnCO_3)_2 . 3Zn(HO)_2$; 546·5. $2ZnO, CO_2 . 3ZnO, HO$; 273·25.

Zinci Carbonas, *Br.;* Zinci Carbonas Precipitata, *U. S.* 1870; Carbonate of Zinc; Zincum Carbonicum, Carbonas Zincicus; Carbonate de Zinc, *Fr.;* Kohlensaures Zinkoxyd, *G.*

"Take of Sulphate of Zinc *ten ounces* [avoirdupois]; Carbonate of Soda *ten ounces and a half* [avoird.]; Boiling Distilled Water *a sufficiency*. Dissolve the Carbonate of Soda with a pint [Imperial measure] of the Water in a capacious porcelain vessel, and pour into it the Sulphate of Zinc also dissolved in a pint [Imp. meas.] of the Water, stirring diligently. Boil for fifteen minutes after effervescence has ceased; and let the precipitate subside. Decant the supernatant liquor, pour on the precipitate three pints of boiling Distilled Water, agitating briskly; let the precipitate again subside; and repeat the process of effusion of hot Distilled Water and subsidence, till the washings are no longer precipitated by chloride of barium. Collect the precipitate on calico, let it drain, and dry it with a gentle heat." *Br.*

Calamina, U. S. 1850, was dropped from the U. S. Pharmacopœia in 1860 on account of its impurities, and in the last revision the formula for its substitute was also omitted. In the U. S. formula of 1870* a double decomposition takes place between the salts employed, resulting in the formation of sulphate of sodium in solution, and basic carbonate of zinc which precipitated. Carbonate of sodium is preferable to carbonate of potassium for decomposing the sulphate; since the former gives rise to sulphate of sodium, which is more easily washed away than sulphate of potassium derived from the latter. Boiling water is properly used in the process, in order to obtain a pulverulent precipitate, which is readily washed. If cold solutions are used, a gelatinous precipitate is formed, which is washed with difficulty. When a solution of zinc sulphate is precipitated by an excess of acid potassium carbonate, a normal carbonate of zinc is obtained. With normal sodium carbonate, on the other hand, taken as a precipitant, a basic salt results. The present British formula is essentially that of the U. S. P. 1870, having superseded the Dublin process, in which the reacting salts were chloride of zinc and carbonate of sodium.

Properties. It is officinally described as "a white, impalpable powder, permanent in the air, odorless and tasteless, insoluble in water or alcohol, but soluble in acids with copious effervescence. When strongly heated, the salt loses water and carbonic acid gas, and leaves a residue of oxide of zinc. On dissolving the salt to saturation in diluted sulphuric acid, a portion of the filtrate, when mixed with test-solution of ferrocyanide of potassium or of sulphide of ammonium, yields a white precipitate. Another portion of this filtrate, acidulated with hydrochloric acid, should not yield a dark-colored precipitate with hydrosulphuric acid (abs. of lead, copper). Another portion, mixed with test-solution of carbonate of ammonium, yields a white precipitate which should be wholly soluble in an excess of the reagent (abs. of iron, aluminium, and most of the alkaline earths). On completely precipitating the zinc from this alkaline solution by sulphide of ammonium, the filtrate should not leave more than a trifling, fixed residue on evaporation and gentle ignition (limit of salts of alkalies or of alkaline earths)." *U. S.* If adulterated with chalk it will be only partly soluble in this acid. Precipitated carbonate of zinc is often sold under the incorrect name of flowers of zinc, a name which properly belongs only to the oxide, as obtained by combustion. When obtained from solutions of sulphate of zinc and carbonate of sodium, it has a variable composition, as different hydrated basic carbonates are formed, according to the temperature used, etc.; the higher the temperature and the larger the quantity of water used, the more basic the carbonate becomes. According to the Br. Pharmacopœia, it consists, as thus prepared, of one mol. of carbonate and two mols. of oxide of zinc, with three mols. of water ($ZnCO_3 + 2ZnO + 3H_2O$). The basic character of the salt officinal in U. S. P. 1870 is explained by the fact that effervescence of carbonic acid takes place on mixing the solutions. It is employed for the same purposes as prepared calamine, and is gradually superseding the spurious article usually sold under that name. The U. S. P. 1870 ordered a cerate made from it as a substitute for calamine cerate.

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* "Take of Sulphate of Zinc, Carbonate of Sodium, each, *twelve troyounces;* Water *eight pints.* Dissolve the salts separately, with the aid of heat, each in four pints of the Water. Then mix the solutions, and, having stirred the mixture, set it by that the powder may subside. Lastly, having poured off the supernatant liquid, wash the precipitate with hot water until the washings are nearly tasteless, and dry it with a gentle heat." *U. S.* 1870.

Off. Prep. Zinci Acetas, *Br.*

ZINCI CHLORIDUM. *U. S., Br.* *Chloride of Zinc.* *Butter of Zinc.*

$ZnCl_2$; 135·7. (ZĬN′CĪ CHLŌ′RI-DŬM.) $ZnCl$; 67·85.

"Chloride of Zinc should be kept in small, glass-stoppered vials." *U. S.*

Zinc Butter; Zincum Chloratum, *P.G.;* Chloruretum Zincicum; Chlorure de Zinc, *Fr.;* Chlorzink, *G.*

"Take of Granulated Zinc *sixteen ounces* [avoirdupois]; Hydrochloric Acid *forty-four fluidounces* [Imperial measure]; Solution of Chlorine *a sufficiency;* Carbonate of Zinc *half an ounce* [avoird.], or *a sufficiency;* Distilled Water *one pint* [Imp. meas.]. Put the Zinc into a porcelain basin, add by degrees the Hydrochloric Acid previously mixed with the water, and aid the action by gently warming it on a sand-bath until gas is no longer evolved. Boil for half an hour, supplying the water lost by evaporation, and allow it to stand on a cool part of a sand-bath for twenty-four hours, stirring frequently. Filter the product into a gallon bottle, and pour in the Solution of Chlorine by degrees, with frequent agitation, until the fluid acquires a permanent odor of chlorine. Add the Carbonate of Zinc, in small quantities at a time, and with renewed agitation, until a brown sediment appears. Filter through paper into a porcelain basin, and evaporate until a portion of the liquid, withdrawn on the end of a glass rod and cooled, forms an opaque white solid. Pour it out now into proper moulds, and when the salt has solidified, but before it has cooled, place it in closely stoppered bottles." *Br.*

In the U. S. process of 1870* the chloride of zinc is obtained by evaporating the previously formed solution. The British first prepares the chloride of zinc in solution, and in order to get rid of the iron uses chlorine, which combines with the iron to form ferric chloride; and, the carbonate of zinc being added, the zinc combines with the chlorine to increase the product of chloride of zinc, whilst ferric oxide is deposited, and carbonic acid is set free. As this preparation is used chiefly as a caustic, it is melted and cast into moulds as the last step in the Br. process.

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* "Take of Solution of Chloride of Zinc *a convenient quantity.* Evaporate the Solution to dryness in an evaporating dish, fuse the dry mass, pour the liquid on a flat stone, and when it has congealed, break the mass in pieces, and keep the fragments in a well-stopped bottle." *U. S.* 1870.

In relation to this chloride, the reader is referred to a paper by Mr. B. J. Crew in *A. J. P.*, 1853, p. 203.

M. Rhighini prepares this chloride by double decomposition between solutions of chloride of barium and sulphate of zinc. Sulphate of barium is precipitated, and chloride of zinc remains in solution, from which it is obtained in white flaky crystals by due evaporation.

Properties. It is officinally described as "a white, crystalline powder, or white, opaque pieces, very deliquescent, odorless, having a very caustic, saline and metallic taste, and an acid reaction. The salt is very soluble in water, and in alcohol, forming a clear or only faintly opalescent liquid. This opalescence is removed by the addition of a few drops of hydrochloric acid. When heated to about 115° C. (239° F.), the salt melts, yielding a clear liquid, which, on cooling, congeals to a white or grayish white solid. At a higher temperature it is partially volatilized and decomposed. The aqueous solution yields a white precipitate with test-solution of ferrocyanide of potassium, or of sulphide of ammonium, or of nitrate of silver. The aqueous solution of the salt should be miscible with alcohol without precipitation (abs. of basic salt). When acidulated with hydrochloric acid, it should yield no dark-colored precipitate with hydrosulphuric acid (abs. of lead, copper). On adding test-solution of carbonate of ammonium to the aqueous solution, a white precipitate is produced which should be wholly soluble in an excess of the reagent (abs. of iron, aluminium, and most of the alkaline earths). On completely precipitating the zinc from this alkaline solution by sulphide of ammonium, the filtrate should leave no fixed residue on evaporation and gentle ignition (salts of alkalies or of alkaline earths)." *U. S.*

When pure, it is wholly soluble in water, alcohol, and ether; but, as prepared by the U. S. formula, it contains some oxychloride, which is left undissolved by water. According to M. Lassaigne, commercial chloride of zinc sometimes contains as much as 12 per cent. of arseniate of zinc, which, being insoluble in solution of chloride of zinc, will be left undissolved when the chloride is treated with water. (*Phillips's Trans. of the Lond. Pharm.*, 1851, p. 375.) It yields with ammonia and potassa a white precipitate, soluble in those reagents when added in excess. The carbonates of potassium and sodium also throw down white precipitates, which are not dissolved by an excess of the precipitants. Chloride of zinc has a strong tendency to combine with organic bases, forming crystallizable compounds, as with strychnine, morphine, quinine, cinchonine, etc.; in this respect resembling certain other metallic chlorides, as of platinum, palladium, gold, and mercury. (*Journ. de Pharm.*, 4e sér., iii. 56.) When exposed to heat, chloride of zinc first melts and then sublimes. It has been obtained in small deliquescent octahedrons of the formula $ZnCl_2 + H_2O$, by evaporating its hydrochloric acid solution to a syrup, and then adding a little concentrated hydrochloric acid to this. It consists of one atom of zinc 64·9, and two of chlorine 70·8 = 135·7.[*]

Medical Properties and Uses. This chloride was introduced into medicine by Dr. Papenguth, of St. Petersburg, and subsequently recommended by Prof. Hancke, of Breslau, and Dr. Canquoin, of Paris. Internally it has been given as an alterative and antispasmodic in scrofula, epilepsy, chorea, and, combined with hydrocyanic acid, in facial neuralgia. Its chief use, however, has been as an escharotic, applied to cancerous affections, and to ulcers of an anomalous and intractable character. When thus used, it not only destroys the diseased structure, but excites a new action in the surrounding parts. As a caustic it has the advantage of not causing constitutional disorder from absorption.

Dr. Canquoin prepares the chloride of zinc, as an escharotic, by thoroughly and quickly mixing it with wheat flour and water into a paste of four different strengths, containing severally an ounce of the chloride, incorporated with two, three, four, and five ounces of flour; fifteen drops of water being added for every ounce of flour, or sufficient to form the paste. According to the French Codex, *Pâte de Canquoin*[†] is prepared by triturating an equal weight of flour with the chloride dissolved in a very little water. It is applied in cakes from a twelfth to a third of an inch in thickness, and produces an eschar more or less deep (from a line to an inch and a half), according to the thickness and strength of the paste, the length of the application, and the nature of the part acted on. The strongest paste is applied to lardaceous and fibro-cartilaginous structures; the second, to carcinomatous tumors, and very painful cancers which have not much thickness; and the third, to cancerous affections in persons who have a dread of the use of the knife. These preparations, applied to the skin denuded of its cuticle by means of a blister, excite in a few minutes a sensation of heat, and afterwards violent burning pain. The eschar, which is white, thick, and very hard, falls off, with the aid of an emollient poultice, between the eighth and twelfth days. To destroy thick cancerous tumors having an uneven surface and situated in fleshy parts, Dr. Canquoin uses a caustic formed of one part of chloride of zinc, half a part of chloride of antimony, and two and a half parts of flour, made into a paste with water. In all cases the caustic is to be reapplied, after the falling off of the eschar, until the whole morbid structure is destroyed. When the skin is unbroken, it is now usual to destroy not merely the cuticle, but the true skin also, by means of the acid nitrate of mercury, to the extent desired for the chloride to operate. This is applied, spread on lint, and the dressing is covered with a portion of cotton wadding, to absorb any discharge, and to preserve a uniform temperature. The surrounding skin should be protected from the caustic by a thickly-spread dressing of simple cerate, containing as much chloroform as it will take up, as recommended by Dr. E. S. Haviland, of London. M. Bonnet has applied the paste of chloride of zinc to the treatment of aneurism. He has reported the complete cure of one case of subclavian aneurism from a penetrating wound by a continued series of applications of the paste. Every two or three days, the superficial layers of the slough were removed by a bistoury. At the end of the second month, the eschar began to detach itself without any hemorrhage, and the clot came away with the eschar. Chloride of zinc has also been used successfully by MM. Bonnet and Gensoul in the treatment of aneurism by anastomosis. (*Med. Times and Gaz.*, July 23, 1853.) Instead of flour, Dr. Alex. Ure, of Glasgow, mixes the chloride with pure anhydrous sulphate of calcium in impalpable powder. He states that this has the advantages of furnishing a porous medium from which the escharotic gradually exudes into the morbid structure, and of forming afterwards, by acquiring a firmer consistence, an impervious case for the eschar. Mr. Cock, of Guy's Hospital, has imitated this mode of preparing the chloride, so as to form a caustic which may be limited in its action, and does not run. It may be prepared as a caustic seton, by thickly covering a waxed cotton wick with Dr. Canquoin's caustic paste, and then rolling it out in the form of a cylinder, according to the plan of M. Ancrénis, of Lyons. A thread is wound spirally round the cylinder to give it firmness. Mr. Calloway, of Guy's Hospital, has employed the chloride of zinc with considerable success in the treatment of nævi materni. He rubs it, at intervals, on the part until the skin becomes slightly discolored. The late Mr. Guthrie used it with advantage for penetrating the hard case of new bone which forms over a sequestrum in order to expose the latter and permit its convenient extraction.

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[*] For the chemistry of its influence on camphor, see *Chem. News*, xx., 1869, p. 229.

[†] P. Carles states that the officinal paste is too hygroscopic; he triturates in a mortar 10 grammes of fused chloride of zinc with 2 grammes of 60 per cent. alcohol, and incorporates, with constant

Chloride of zinc, with a view to its escharotic effect, may be formed extemporaneously by means of *galvanism*, on the plan recommended by an English physician, Dr. Thomas Smith. A simple galvanic circle is formed by riveting a disk of zinc, of the size of the eschar desired, to a disk of silver of equal size; the pair being excited by a piece of spongio-piline, placed on the silver, and moistened with a solution of common salt. The little battery is then fixed upon the skin by means of strips of adhesive plaster. Once in twelve hours it must be removed, and washed in salt and water, and then reapplied. By the electrolysis of the common salt chlorine is liberated, which, combining with the zinc, converts it to a certain extent into the chloride. This, acting on the skin, exercises its caustic effect; and at the end of twelve days a white eschar is formed. This mode of forming an issue has, according to Dr.

trituration, 15 grammes of wheat flour. This mass may be formed into cylinders of suitable size, and when once dry is but little affected by atmospheric humidity. (*L'Union Pharm.*, April, p. 100.)

Smith, the advantage of being less painful than those usually employed. According to M. E. Robiquet, chloride of zinc may be made into a very pliable caustic, susceptible of taking any desired shape, by melting it with an equal weight of gutta-percha.

For internal exhibition, the most convenient form is a solution in the spirit of ether, in the proportion of half an ounce to three fluidounces. Of this from four to eight drops (0·24–0·5 C.c.) may be given twice a day. Dr. Lloyd, of London, has found chloride of zinc useful as an injection in the acute stage of gonorrhœa, made of the strength of about two grains to three fluidounces of distilled water, and employed once in five or six hours. A solution of one grain to the fluidounce is used by Mr. Critchett, of the Royal Ophthalmic Hospital, London, as a collyrium in vascular and thickened conjunctiva, forming a sort of gleet of the eye.

In overdoses chloride of zinc acts as a corrosive poison, producing burning pain in the gullet and stomach, nausea and vomiting, cold sweats, depression of the pulse, and cramps of the legs. The antidotes are alkalies, or their carbonates, and, if these be not immediately at hand, soap. Dr. Letheby reports a fatal case of poisoning by this chloride occurring in a child. The form of chloride swallowed was Burnett's disinfecting fluid. (See *Liquor Zinci Chloridi.*) Its local effect was that of a corrosive on the lips, mouth, and fauces. Among the constitutional effects were paralysis of the voluntary muscles, coldness of the surface, dilated pupil, and coma.*

Off. Prep. Liquor Zinci Chloridi, *Br.*

ZINCI IODIDUM. *U. S.* *Iodide of Zinc.*

ZnI_2; 318·1. (ZĬN'CĪ Ī-ŎD'Ĭ-DŬM.) ZnI; 159·05.

Iodure de Zinc, *Fr.;* Jodzink, *G.*

This iodide may be formed by digesting an excess of zinc, in small pieces, with iodine diffused in water. Combination takes place, and, by evaporation, a deliquescent, very soluble saline mass is obtained, having a metallic styptic taste, resembling that of sulphate of zinc. It may also be obtained by heating in a flask a mixture of 20 parts of zinc and 170 of iodine, and subliming into a vial. Thus prepared, it is in the form of white needles. This salt is very liable to spontaneous decomposition. "Iodide of Zinc should be kept in small, glass-stoppered vials." *U. S.*

Properties. The U. S. Pharmacopœia of 1880, in which it is officinal for the first time, describes it as "a white, or nearly white, granular powder, very deliquescent, odorless, having a sharp, saline and metallic taste, and an acid reaction. Very soluble in water and in alcohol. When strongly heated, it melts, and, at a higher temperature, it is volatilized with partial decomposition. The aqueous solution yields a white precipitate with test-solution of ferrocyanide of potassium or of sulphide of ammonium, a yellow precipitate with test-solution of acetate of lead, and a red one with test-solution of mercuric chloride. The aqueous solution of the salt, when acidulated with hydrochloric acid, should yield no dark-colored precipitate with hydrosulphuric acid (abs. of lead, copper). On adding test-solution of carbonate of ammonium to the aqueous solution, a white precipitate is produced which should be wholly soluble in an excess of the reagent (abs. of iron, aluminium, and most of the alkaline earths). On completely precipitating the zinc from this alkaline solution by sulphide of ammonium, the filtrate should leave no fixed residue on evaporation and gentle ignition (salts of alkalies or of alkaline earths). 1 Gm. of the dry salt, when completely precipitated with nitrate of silver, yields 1·47 Gm. of dry iodide of silver." *U. S.*

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* *Solution of Hypochlorite of Zinc.* This may be prepared by the process of R. F. Fairthorne, as follows. "Take of Chlorinated Lime, 12 troyounces; Sulphate of Zinc, 24 troyounces; Water, 12 pints. Dissolve the sulphate of zinc in three pints of water. Triturate the chlorinated lime, a little at a time, with portions of the water added slowly, and mix thoroughly with the remainder of the water. Allow it to stand until the lime has subsided. Pour off the clear liquid. Transfer the sediment to a muslin strainer, and allow it to drain until sufficient liquid has passed to measure 8 pints with the decanted portion of the solution. Mix this with the solution of sulphate of zinc, and, having set it aside for twelve hours, pour off the clear portion of the liquid and place the remaining portion on a piece of muslin to drain. Mix these liquids, and pour more water on the precipitate, if necessary, so as to make 11 pints and a half of the finished product." (*A. J. P.*, March, 1881.) This solution is recommended as having advantages over solution of chlorinated soda, in not being alkaline, and as combining astringent and antiseptic properties, and thus useful as an ingredient in gargles, injections, or lotions.

Medical Properties. Iodide of zinc was proposed as long ago as 1853, by Dr. Barlow, of Guy's Hospital, as an alterative remedy in chorea, scrofula, and some forms of hysteria (*Med. Times and Gaz.*, Nov. 1853, p. 501), but it has failed to come into general use as an internal remedy. The best form of administration is in *syrup*, to protect it from change. The dose is from a half to two grains (0·03 to 0·13 Gm.).* Iodide of zinc has been used for many years as an external application. Dr. J. J. Ross, of Scotland, employed a solution, containing from 10 to 30 grains to the fluidounce of water, with great advantage in enlarged tonsils, applied by means of a piece of sponge tied to a quill. After the use of the solution for some time, he applied the iodide, rendered liquid by deliquescence, by means of a camel's-hair brush. A solution containing one or two grains (0·065 to 0·13 Gm.) to the fluidounce (30 C.c.) of water has been used as an astringent injection in gonorrhœa. An ointment, made with a drachm (3·9 Gm.) of the iodide to an ounce (31·1 Gm.) of lard, has been substituted by Dr. Ure for the ointment of iodide of potassium in the treatment of tumors, applied in the quantity of a drachm twice a day.

ZINCI OXIDUM. *U. S., Br.* *Oxide of Zinc.*

ZnO ; 80·9. (ZĬN′CĪ ŎX′Ị-DŬM.) ZnO; 40·45.

Zincum Oxydatum Purum, *P.G.;* Oxydum Zincicum; Oxyde de Zinc, *Fr.;* Philosophenwolle Zinkblumen, Zinkoxyd, *G.*

"Take of Carbonate of Zinc *six ounces.* Place the Carbonate of Zinc in a loosely covered Hessian crucible, and expose it to a dull red heat until a portion, taken from the centre of the contents of the crucible and cooled, no longer effervesces when dropped into diluted sulphuric acid. Let the crucible cool, and transfer the product to stoppered bottles." *Br.*

The British Pharmacopœia and the U. S. P. 1870† prepared the oxide of zinc from the carbonate already formed. By referring to the article on Precipitated Carbonate of Zinc, it will be found that it is obtained in the process from sulphate of zinc, by the decomposing influence of carbonate of sodium. Other methods of obtaining the carbonate of zinc are by the mutual decomposition of the chloride and carbonate of sodium and the sulphate and carbonate of ammonium; but the officinal plan is to be preferred. M. Lefort found it to furnish a carbonate which is washed with facility, and is convertible by calcination into a pure oxide, readily reduced to an impalpable and very light powder. (*Journ. de Pharm.*, 3e sér., xi. 329.) It is, besides, more economical. The carbonate of zinc, in whatever way obtained, is exposed to heat to drive off the carbonic acid and water, in order to obtain the oxide. According to Mohr, a full red heat is not necessary; a temperature between 280° C. and 300° C. (536° F. and 572° F.) being sufficient. It is probable that an unnecessarily high heat injures the oxide as a therapeutic agent.

Oxide of zinc may be obtained by the combustion of the metal; and in this way it was formerly prepared by the Dublin College. Zinc melts at 433° C. (801·4° F.), and immediately becomes covered with a film of gray oxide. When the temperature reaches nearly to redness, it takes fire and burns with an intense white light, generating the oxide in the form of very light and white flocculi, resembling carded wool, which quickly fill the crucible, and are in part driven into the atmosphere by the current of air. The late Mr. G. D. Midgely, of London, several years ago, called attention to the production of oxide of zinc by combustion, and gave a description of the apparatus by which he was enabled to prepare from one to two hundred weight of the oxide at one operation. It consisted of a large muffle, heated to redness in a suitable furnace, and supplied with zinc from time to time as the combustion proceeded. The necessary draught of air was conveyed from the muffle by a tube, passing through the top of the furnace, and terminating in a vessel of water, in which the portion of oxide carried up by the current was retained. The resulting oxide was freed from particles of metallic zinc by being passed through a sieve. At the present time oxide of zinc is very largely produced from calamine by the so-called "furnace and bag" process, at Bethlehem, Pa., by the Lehigh Zinc Company. The process is as follows. The ore is first ground fine by a stone crusher, and then carefully mixed with coal known as "buckwheat," next in grade to "pea." It is then transferred to the furnaces, of which there are fifty-four, with 1390 feet of grate-surface. Within these the mixed coal and ore are reduced by the direct action of heat and the cold blast upon a furnace-bed having a multiplicity of small holes, each producing the reducing flame of the blow-pipe. The zinc oxide rises, and passes through a huge combustion-flue to a large circular tower, 50 feet high, in which the oxide and ashes separate. The ashes being heavier than the oxide, the velocity of the fans which impel the product forward lifts the oxide to the top, and the ashes drop to the bottom. The oxide is forced onward through a cooling-room, size 80 by 40 feet, and heated to from 400° to 700° F. Thence the oxide is blown through large flues into the "bag" room. This is a large building, devoid of furniture, excepting long bags of muslin, 45 feet long, in which the oxide is deposited. It is now very white, and, after being kiln-dried and bolted, it is placed in bags, and by heavy pressure reduced in bulk, barrelled, and is ready for shipment.

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* Mr. A. B. Taylor, of Philadelphia, prepares a syrup of iodide of zinc by gently heating, in an evaporating dish, *twelve drachms and two scruples* of iodine, and *an ounce* of finely granulated zinc, with *nine fluidounces* of water, until they unite, filtering the solution, while hot, on *a pound* (avoird.) of sugar, contained in a wide-mouthed bottle holding a little more than a pint, and adding, through the filter, sufficient water to make the whole measure a pint. This syrup is perfectly clear and colorless, is styptic to the taste, and contains a drachm of iodide of zinc in each fluidounce. (*A. J. P.*, Jan. 1852, p. 33.) The dose of this syrup is from 20 to 50 drops (1·25–3·12 C.c.), sufficiently diluted with water, three times a day.

† "Take of Precipitated Carbonate of Zinc *twelve troyounces.* Expose it, in a shallow vessel, to a low red heat until the water and carbonic acid are wholly expelled." *U. S.* 1870.

Properties. The officinal oxide of zinc is a "soft, pale yellowish, nearly white powder, permanent in the air, odorless and tasteless, insoluble in water or alcohol, but soluble in acids without effervescence (abs. of carbonate). When strongly heated, the Oxide assumes a deep lemon-yellow color, but turns nearly white again on cooling. On dissolving the Oxide, to saturation, in diluted sulphuric acid and filtering, a portion of the filtrate, when mixed with test-solution of ferrocyanide of potassium or sulphide of ammonium, yields a white precipitate. Another portion of this filtrate, acidulated with hydrochloric acid, should yield no dark-colored precipitate with hydrosulphuric acid (abs. of lead, copper). Another portion, mixed with test-solution of carbonate of ammonium, yields a white precipitate which should be wholly soluble in an excess of the reagent (abs. of iron, aluminium, and most of the alkaline earths). On completely precipitating the zinc from this alkaline solution by sulphide of ammonium, the filtrate should not leave more than a trifling, fixed residue on evaporation (limit of salts of alkalies or of alkaline earths)." *U. S.* As obtained by combustion it is perfectly white. It dissolves in potassa and soda, but not in their carbonates. Being anhydrous, it is insoluble in ammonia; but the impure oxide found in commerce, being generally hydrated, is soluble in that alkali. At a low white heat it fuses, and at full whiteness sublimes. When prepared by combustion it was formerly called *pompholix*, *nihil album*, *lana philosophica*, and *flowers of zinc.* If the precipitate with the former test is bluish white, iron is indicated; if black with the latter, lead is shown. Prepared by the old officinal process, namely, by precipitating sulphate of zinc with ammonia, it contains the subsulphate, the acid of which may be detected by dissolving the oxide in nitric acid and precipitating by barium nitrate. Sometimes it is obtained by precipitating chloride of zinc with ammonia, in which case the oxide contains subchloride, easily detected by nitrate of silver. If it contain white lead or chalk, it will not be entirely soluble in dilute sulphuric acid, but an insoluble sulphate of lead or of lime will be left. If iron be present, brownish red flocks of ferric oxide will remain undissolved, when the hydrochloric acid solution of the oxide is treated with ammonia in excess. Oxide of zinc consists of one atom of zinc 64·9, and one of oxygen 16 = 80·9.

The powder sold in the shops as oxide of zinc is often very impure. Sometimes the carbonate is substituted for it, showing that the exposure to a red heat has been omitted. In this case the preparation will effervesce with acids. Some samples contain a large proportion of subsulphate, showing that the discarded but productive process of precipitating the sulphate of zinc solution by ammonia has been employed. Again, other samples contain oxychloride. These impure oxides are pointed out by

Mr. Redwood, of London, as occurring in the English market, and, no doubt, are sold in the United States. (See *P. J. Tr.*, 1855, p. 301.) A sample of commercial zinc oxide is noticed in *N. R.*, Aug. 1878, which proved to be powdered gypsum. Unfortunately, a white oxide is preferred by purchasers, though whiteness is generally a sign of impurity; the officinal oxide being yellowish white.

Medical Properties and Uses. This oxide is tonic, antispasmodic, and astringent. It has been given in chorea, epilepsy, hooping-cough, spasm of the stomach dependent on dyspepsia, and other similar affections, and the diarrhœa of infants. Externally it is employed as an exsiccant to excoriated surfaces, sometimes by sprinkling it on the affected part, but generally in the form of ointment. (See *Unguentum Zinci Oxidi.*) It has also been used in gonorrhœa. (*N. R.*, July, 1874.) The dòse is from two to eight grains (0·13–0·52 Gm.) or more, repeated several times a day, and given in the form of pill. As a cosmetic it has the great advantage over the preparations of lead of not being poisonous.

Oxide of zinc, prepared by combustion, called commercial oxide of zinc, is extensively used in painting as a substitute for white lead, over which it has the advantage of not being discolored by sulphuretted hydrogen. It is stated that it has greater covering power as a color than white lead, 10 parts being equal to 13 of white lead. It is, however, dearer, so that the pure oxide has not replaced white lead. There is an English preparation known as Griffith's zinc-white, or *zincolith*, made by precipitating zinc sulphate by barium sulphide. It is therefore a mixture of zinc sulphide and barium sulphate. If this is roasted in a current of superheated steam the zinc sulphide is converted into zinc oxide. This process has been patented in Germany by Meissner. (Wagner's *Chem. Technol.*, 11th ed., p. 159.) It has, moreover, the merit of not producing injurious effects on the workmen at all comparable to those caused by white lead. It is, indeed, usually considered innocuous, but a case of chronic poisoning by it has been reported by Prof. Botkin. (*Brit. and For. Med.-Chir. Rev.*, ii., 1873, p. 254.) The oxide thus prepared, even though pure, should not be substituted for the officinal, as its state of aggregation is probably different, and it has not the smoothness and freedom from gritty particles possessed by the latter.

Off. Prep. Unguentum Zinci, *Br.;* Unguentum Zinci Oxidi, *U. S.*

ZINCI PHOSPHIDUM. *U. S.* *Phosphide of Zinc.*

Zn_3P_2; 256·7. (ZĬN'CĪ PHŎS'PHỊ-DŬM.) Zn_3P; 128·35.

Phosphure de Zinc, *Fr.;* Phosphorzink, *G.*

This is a new officinal, which has been used extensively of late years in certain nervous affections. According to Hager it was first prepared by Marggraf in 1740. It was formerly made by fusing, in a bath of iron filings, 74 parts of pure zinc, and adding gradually in small pieces 26 parts of dry phosphorus. This process gives good results only in small quantities (10 to 20 Gm.). A more recent process is to pass vapors of phosphorus in a current of dry hydrogen over fused zinc. The product is a spongy, gray mass, of metallic appearance, containing rhomboidal crystals, and resembling somewhat reduced iron when powdered. The metallic particles of zinc should be separated. Its sp. gr. is 4·72. " Phosphide of Zinc should be kept in small, glass-stoppered vials." *U. S.*

Properties. It is thus described in the U. S. Pharmacopœia of 1880. "Minutely crystalline, friable fragments, having a metallic lustre on the fractured surfaces, or a grayish black powder, permanent in the air, having a faint odor and taste of phosphorus, insoluble in water or alcohol, but completely soluble in hydrochloric or sulphuric acids with evolution of phosphoretted hydrogen. When strongly heated, with exclusion of air, the salt melts and is completely volatilized. If heated for some time in the air, it is partially converted into phosphate of zinc. On dissolving the salt, to saturation, in diluted sulphuric acid, and driving off the phosphoretted hydrogen by heat, a portion of the cold filtrate, when mixed with test-solution of ferrocyanide of potassium or of sulphide of ammonium, yields a white precipitate. Another portion of the filtrate, acidulated with hydrochloric acid, should not yield a dark-colored precipitate with hydrosulphuric acid (abs. of lead, copper)." *U. S.* For a method of assay of phosphide of zinc, see *N. R.*, June, 1879.

Medical Properties. It has been proved by direct experiment upon animals, as well as by clinical experience, that the phosphide of zinc affects the system physiologically and therapeutically in exactly the same manner as does phosphorus, and it is now very frequently employed in medicine as a substitute for that element. Theoretically, each grain of the phosphide contains nearly a quarter of a grain of phosphorus. It is asserted in the journals to have been administered in doses of one or even two grains; but of the pure salt such amounts are excessive and extremely dangerous; the maximum commencing dose is one-twentieth of a grain (0·003 Gm.).

ZINCI SULPHAS. *U. S., Br.* *Sulphate of Zinc.*

$ZnSO_4.7H_2O$; 286·9. (ZĬN'CĪ SŬL'PHĂS.) $ZnO, SO_3.7HO$; 143·45.

"Sulphate of Zinc should be kept in well-stopped bottles." *U. S.*

Zincum Sulfuricum, *P.G.;* Sulfas Zincicus, Vitriolum Album; Sulfate de Zinc, Vitriol blanc, *Fr.;* Schwefelsaures Zinkoxyd, Weisser Vitriol, Galitzenstein, *G.*

"Take of Granulated Zinc *sixteen ounces* [avoirdupois]; Sulphuric Acid *twelve fluidounces* [Imperial measure]; Distilled Water *four pints* [Imp. meas.]; Solution of Chlorine *a sufficiency;* Carbonate of Zinc *half an ounce* [avoird.], or *a sufficiency.* Pour the Acid previously mixed with the Water on the Zinc contained in a porcelain basin, and, when effervescence has nearly ceased, aid the action by a gentle heat. Filter the fluid into a gallon bottle, and add gradually with constant agitation the Solution of Chlorine until the fluid acquires a permanent odor of chlorine. Add now with continued agitation the Carbonate of Zinc until a brown precipitate appears; let it settle, filter the solution, evaporate till a pellicle forms on the surface, and set aside to crystallize. Dry the crystals by exposure to the air on filtering paper, placed on porous tiles. More crystals may be obtained by again evaporating the mother-liquor." *Br.*

Strong sulphuric acid is very little acted upon by zinc, some hydrogen sulphide being evolved by the reduction of the acid; but, when it is *diluted*, water is instantly decomposed, and while hydrogen escapes with rapid effervescence, oxygen combines with the zinc and the acid, generating the sulphate of zinc. Thus it is perceived that *hydrogen* is a collateral product of the process. The proportion of the zinc to the strong acid in the process is as 4 to 5·53. The molecular weights give the ratio of 4 to 6 almost exactly; which indicates that the metal is somewhat in excess. If the materials are mixed at once, without any precaution, the effervescence of hydrogen is apt to be excessive, and to cause the overflowing of the liquid. This may be avoided by commencing the solution of zinc with a very dilute acid, which, as the action slackens, is made by degrees stronger and stronger, by the addition, at intervals, of small portions of fresh acid. As the zinc of commerce generally contains iron, this would contaminate the product, unless precautions were taken to prevent it. Hence the addition of chlorine, which reacts with the sulphate of iron to form ferric sulphate and ferric chloride, which, upon the addition of the carbonate of zinc, yield the sulphuric acid and chlorine to the zinc; the ferric oxide being deposited, and the carbonic acid set free. The former is separated by filtration, the latter escapes during the evaporation, the additional sulphate of zinc crystallizes with that first formed, and the chloride of zinc remains in the mother-waters.

Preparation on the Large Scale. Impure sulphate of zinc, as it occurs in commerce, is called *white vitriol.* It is manufactured by roasting *blende* (native sulphide of zinc) in a reverberatory furnace. This mineral, besides sulphide of zinc, contains small quantities of the sulphides of iron, copper, and lead; and by roasting is converted, in consequence of the oxidation of its constituents, into sulphate of zinc, mixed with the sulphates of iron, copper, and lead. The roasted matter is then lixiviated; and the solution obtained, after having been allowed to settle, is concentrated by evaporation; so that, on cooling, it may concrete into a white crystalline mass, resembling lump sugar. In this state it always contains sulphate of iron, and sometimes a small proportion of sulphate of copper. It may be purified from these metals by dissolving it in water, and boiling the solution with oxide of zinc, which converts the sulphates of iron and copper, by precipitating their bases, into sulphate of zinc. The purified solution is then decanted or filtered, and, after due evaporation, allowed to crystallize. It has generally been proposed to purify the white vitriol of commerce by digesting its solution with metallic zinc, under the impression that this is capable of precipitating all the foreign metals; but, according to Berzelius, though it will precipitate copper readily, it has no action on iron. Prof. F. Stolba recommends a process which has been used successfully for the purification of sulphate of zinc by the use of carbonate of zinc and permanganate of zinc. (See *A. J. P.*, 1877, p. 72.)

Properties. Sulphate of zinc is in "small, colorless, right rhombic prisms, or acicular needles, slowly efflorescing in dry air, odorless, having a sharp, saline, nauseous and metallic taste, and an acid reaction. Soluble in 0·6 part of water at 15 C. (59° F.), and in 0·3 part of boiling water; insoluble in alcohol. When strongly heated, the salt melts, gradually loses water, and, at a higher temperature, it is decomposed with evolution of sulphurous vapors. The aqueous solution of the salt yields a white precipitate with test-solution of ferrocyanide of potassium, or of sulphide of ammonium, or of chloride of barium. A one per cent. aqueous solution of the salt, acidulated with nitric acid, should not be rendered turbid by test-solution of nitrate of silver (abs. of chloride). The aqueous solution, acidulated with hydrochloric acid, should yield no dark-colored precipitate with hydrosulphuric acid (abs. of lead, copper). On adding test-solution of carbonate of ammonium to an aqueous solution of the salt, a white precipitate is produced, which should be wholly soluble in an excess of the reagent (abs. of iron, aluminium, and most of the alkaline earths). On completely precipitating the zinc from this alkaline solution by sulphide of ammonium, the filtrate should leave no fixed residue on evaporation and gentle ignition (salts of alkalies or of alkaline earths)." *U. S.* Its crystals have considerable resemblance to those of sulphate of magnesium. It effloresces slightly in dry air, and, though neutral in composition, reddens vegetable blues. When heated it dissolves in its water of crystallization, which gradually evaporates; and by a prolonged ignition the whole of the acid is expelled, and the oxide of zinc left. The alkaline carbonates precipitate the metal in the state of white carbonate. Pure sulphate of zinc is precipitated white by ferrocyanide of potassium and ammonium sulphydrate. What is thrown down by chloride of barium or acetate of lead (sulphate of barium or sulphate of lead) is not dissolved by nitric acid. If copper be present, ammonia will produce a blue tinge; if iron, the ferrocyanide of potassium will cause a bluish white precipitate instead of a white one, and tincture of galls a purple color. Cadmium and arsenic may be detected by acidulating the solution with sulphuric acid, and passing a stream of sulphuretted hydrogen through it; when, if either of these metals be present, it will be thrown down as a yellow sulphide. Sulphate of zinc is incompatible with alkalies and alkaline carbonates, hydrosulphates, lime-water, the soluble salts of lead, and astringent infusions.

The impure commercial variety of sulphate of zinc, called white vitriol, is in the form of irregular white masses, having some resemblance to lump sugar. The lumps usually exhibit, here and there on the surface, yellow stains, produced by ferric oxide. It is less soluble than the pure salt, on account of its containing less water of crystallization.

Composition. Crystallized sulphate of zinc consists of one sulphuric acid group SO_4, 96, one atom of zinc 64·9, and seven mols. of water 126 = 286·9. The white vitriol of commerce contains but three mols. of water.

Medical Properties and Uses. This salt is tonic, astringent, and, in large doses, a prompt emetic, producing very little depression, and much used when it is desired simply to evacuate the stomach. In dyspepsia it has been used with advantage in small doses, from a quarter of a grain to a grain (0·016–0·065 Gm.), repeated several times a day; but, if good effects are not soon apparent, it should be laid aside. In the night-sweats of consumption it is sometimes employed, especially in combination with extract of belladonna or of hyoscyamus. Formerly it was much used in epilepsy and other spasmodic diseases; it is still occasionally administered in chorea. As an astringent it is chiefly employed externally. Its solution constitutes a good styptic to bleeding surfaces, and is frequently resorted to as an injection in fluor albus and gonorrhœa, and as a collyrium in ophthalmia, also as a stimulant application to ulcers both of the mucous membrane and the skin. The dose, as a tonic, is from one to two grains (0·065 to 0·013 Gm.); as an emetic, from ten to thirty grains (0·65 to 1·95 Gm.). When used as a collyrium, injection, or gargle, or as a wash for indolent ulcers, from one to three grains (0·065 to 0·2 Gm.) or more may be dissolved in a fluidounce (30 C.c.) of water. For medicinal purposes the crystallized salt should only be used. Prof. Simpson, of Edinburgh, employed the dried sulphate of zinc, in the form of powder, paste, or ointment, as a powerful, rapid, manageable, safe caustic in indurated inflammatory ulcers of the cervix uteri; in lupus; in ulcerous forms of skin diseases; in removing the small red sensitive tumors which form at the orifice of the female urethra, and in destroying ulcerated condylomata and warty excrescences. The dried salt should be finely levigated. The caustic paste is made by incorporating an ounce of the powder with a drachm of glycerin; and the caustic ointment, by thoroughly mixing the same quantity of the powder with two drachms of lard. (See *Am. Journ. of Med. Sci.*, April, 1857, p. 485.)

Sulphate of zinc, in an overdose, acts as an irritant poison. Besides vomiting and incessant retching, it produces anxiety, distressing restlessness, and extreme prostration. Few cases are on record of fatal poisoning by this salt; the patient being generally relieved by its prompt expulsion in vomiting. Four cases, however, have been reported in an Italian journal, two of which proved fatal. In one of the fatal cases, an ounce and a half had been swallowed by mistake for Epsom salt. The treatment consists in the free administration of bland drinks, the use of opium to allay irritation, and the employment of the usual antiphlogistic remedies, should symptoms of inflammation arise.

Off. Prep. Zinci Carbonas, *Br.;* Zinci Carbonas Præcipitatus, *U. S.;* Zinci Valerianas, *Br.*

ZINCI VALERIANAS. *U. S., Br.* *Valerianate of Zinc.*

$Zn (C_5 H_9 O_2)_2 . H_2 O$; 284·9. $ZnO, C_{10} H_9 O_3 . HO$; 142·45.

(ZĬN′CĪ VẠ-LĒ-RỊ-Ā′NĂS.)

Zincum Valerianicum, *P.G.;* Valerianas Zincicus; Valerianate de Zinc, *Fr.;* Baldriansaures Zinkoxyd, *G.*

Valerianate of Zinc was formerly included among the preparations of the U. S. Pharmacopœia, but at the revision of 1880 no process was inserted. The British Pharmacopœia still gives a formula for its preparation; this, with the old U. S. formula and remarks upon them contained in the 14th edition of the U. S. Dispensatory, may be found in the foot-note.*

"Valerianate of Zinc should be kept in small, well-stopped vials." *U. S.*

* "Take of Valerianate of Soda *two troyounces and a half;* Sulphate of Zinc *two troyounces* and *four hundred and twenty grains;* Distilled Water, *a sufficient quantity.* Dissolve the salts separately, each in twenty fluidounces of Distilled Water, and, having heated the solutions to 212°, mix them, and set the mixture aside to crystallize. Decant the mother-water from the crystals, and put them upon a filter in a funnel to drain. Mix the mother-water and the drainings, evaporate at a heat not exceeding 200° to four fluidounces, and again set aside to crystallize. Add the crystals, thus obtained, to those in the funnel, wash the whole with a little Distilled Water, and, having removed them with the filter, spread them on bibulous paper, and dry them with a heat not exceeding 200°." *U. S.* 1870.

"Take of Sulphate of Zinc *five ounces and three-quarters* [avoirdupois]; Valerianate of Soda *five ounces* [avoird.]; Distilled Water *a sufficiency.* Dissolve the Sulphate of Zinc and the Valerianate of Soda, each in two pints [Imperial measure] of the Water; raise both solutions to near the boiling point, mix them, cool, and skim off the crystals which are produced. Evaporate the mother-liquor at a heat not exceeding 200°, till it is reduced to four [fluid]ounces; cool again, remove the crystals which have formed, and add them to those which have been already obtained. Drain the crystals on a paper filter, and wash them with a small quantity of cold Distilled Water, till the washings give but a very feeble precipitate with chloride of barium. Let them now be again drained, and dried on filtering paper at ordinary temperatures." *Br.*

These formulas are essentially the same as that of the late Dublin Pharmacopœia. In the formation of the salt a double decomposition takes place between the reacting salts, resulting in the production of valerianate of zinc and sulphate of sodium. Upon mixing the hot solutions, crystals of the sparingly soluble valerianate of zinc form on the surface of the liquid; and during the progress of its concentration to one-tenth, more of them are successively produced. These are then washed with cold distilled water to separate adhering sulphate of sodium, drained on a filter, and dried.

Properties. This salt is in "soft, white, pearly scales, permanent in the air, having a faint odor of valerianic acid, a sweet, afterwards styptic and metallic taste, and an acid reaction. Soluble in 100 parts of water, and in 40 parts of alcohol at 15° C. (59° F.), both solutions becoming turbid on boiling. When heated the salt melts; at a higher temperature it gives off white, inflammable vapors, and finally leaves a residue of oxide of zinc. The salt is completely dissolved by an excess of water of ammonia, and, on adding test-solution of sulphide of ammonium to this solution, a white precipitate is produced. The filtrate should leave no residue on evaporation (abs. of salts of alkalies and alkaline earths). On mixing a cold, concentrated solution of the salt and a similar one of acetate of copper, no turbidity or precipitate should be produced in the mixture (abs. of butyrate). On moistening 1 Gm. of the salt with nitric acid, evaporating to dryness, again moistening with nitric acid, drying and igniting, a residue will be left which should weigh 0·283 Gm." *U. S.* The salt, as obtained by the British and U. S. P. 1870 formulas, contained one mol. of water; but when formed by saturating carbonate of zinc, made into a paste with water, with valerianic acid, it contains six mols. of water, and, when dried at 50° C. (122° F.), perfectly resembles the officinal salt. (*Wittstein.*) Other authorities (Flückiger, *Pharmac. Chem.*, and Roscoe and Schorlemmer's *Chem.*, vol. iii. part i.) give the formula of the stable crystallized salt as $Zn(C_5H_9O_2)_2+2H_2O$. Acetate of zinc, impregnated with oil of valerian, has been substituted for this salt; but at present, from the relative costliness of the oil, there is no inducement to this fraud. The butyrate of zinc has been sold in Paris for the valerianate, and is so like it as not to be distinguished by its physical properties. The two salts, however, may be discriminated by adding a concentrated solution of the acid of the suspected salt, obtained by distillation with sulphuric acid, to a concentrated solution of acetate of copper. If the acid is the butyric, its addition to the solution of the acetate disturbs the transparency of the latter, by the formation of a bluish white precipitate; while, if the valerianic, no change is produced. (Larocque and Huraut, *Journ. de Pharm.*, 3e sér., ix. 430.)

Medical Properties. Valerianate of zinc was proposed as a remedy, on theoretical grounds, by Prince Louis-Lucien Bonaparte. Upon trial it was found to possess antispasmodic properties. By some of the Italian physicians it has been extolled as a remedy in neuralgic affections. Dr. Namias, of Venice, employed it with advantage in anomalous nervous affections, attended with palpitation of the heart, constriction of the throat, and pain in the head. Dr. Francis Devay, of Lyons, found it useful in epilepsy, and in the nervous affections which accompany chlorosis. The dose is one or two grains (0·065–0·13 Gm.), repeated several times a day, and given in the form of pill. (See a paper by Prof. Procter, *A. J. P.*, April, 1845.)

ZINGIBER. *U. S., Br.* *Ginger.*

(ZĬN′ÇḬ-BẸR.)

"The rhizome of Zingiber officinale. Roscoe. (*Nat. Ord.* Zingiberaceæ.)" *U. S.* "The scraped and dried rhizome." *Br.*

Rhizoma Zingiberis, *P.G.;* Gingembre, *Fr.;* Ingwer, *G.;* Zenzero, *It.;* Gengibre, *Sp.*

Gen. Ch. Flowers spathaceous. Inner limb of the *corolla* with one lip. *Anther* double, with a simple recurved horn at the end. *Germen* inferior. *Style* enclosed in the furrow formed by the anther. *Loudon's Encyc. of Plants.*

Zingiber officinale. Roscoe, *Trans. Linn. Soc.* viii. 348; Carson, *Illust. of Med. Bot.* ii. 55, pl. 98.—*Amomum Zingiber.* Willd. *Sp. Plant.* i. 6; *B. & T.* 270. The ginger plant has a biennial or perennial, creeping, tuberous root or rhizome, and an annual stem, which rises two or three feet in height, is solid, round, erect, and enclosed in an imbricated membranous sheathing. The leaves are lanceolate, acute, smooth, five or six inches long by about an inch in breadth, and stand alternately on the sheaths of the stem. The flower-stalk rises by the side of the stem from six inches to a foot, and like it is clothed with oval, acuminate sheaths; but it is without leaves, and terminates in an oval, obtuse, bracteal, imbricated spike. The flowers are of a dingy yellow color, and appear two or three at a time between the bracteal scales.

The plant is a native of Hindostan, and is cultivated in all parts of India. It is also cultivated in the West Indies, whither it was transplanted from the East, and at Sierra Leone in Africa. The flowers have an aromatic smell, and the stems, when bruised, are slightly fragrant; but the root is the portion in which the virtues of the plant reside. This is fit to be dug up when a year old. In the West Indies, the ginger crop is gathered in January and February, after the stems have withered. After having been properly cleansed, the root is scalded in boiling water, in order to prevent germination, and is then rapidly dried. Thus prepared, it constitutes the ordinary ginger of commerce, or *black ginger*, as it is sometimes called from the darkish color acquired in the process. It is imported chiefly from Calcutta, and is known to the druggists by the name of East India ginger; but recently considerable quantities have been brought from Africa, and some probably reaches us from the West Indies. In Jamaica another variety is prepared by selecting the best roots, depriving them of their epidermis, and drying them separately and carefully in the sun. This is called in the books *white ginger*, and is most highly valued. It reaches us from England, where it is said to undergo some further preparation, by which its appearance is improved. It is usually called in our markets *Jamaica ginger*. The root is also at present imported from the East Indies deprived of the epidermis. Considerable quantities are brought immediately from the West Indies in a recent state, and sold by the confectioners. A preserve is made from ginger by selecting the roots while young and tender, depriving them of their cortical covering, and boiling them in syrup. This is occasionally imported from the East and West Indies. When good it is translucent and tender.

The *recent root* is from one to four inches long, somewhat flattened on its upper and under surface, knotty, obtusely and irregularly branched or lobed, externally of a light ash color with circular rugæ, internally yellowish white and fleshy. It sometimes germinates when kept in the shops.

The *common* or *black ginger* is of the same general shape, but has a dark ash-colored wrinkled epidermis, which, being removed in some places, exhibits patches of an almost black color, apparently the result of exposure. Beneath the epidermis is a brownish, resinous, almost horny cortical portion. The interior parenchyma is whitish and somewhat farinaceous. The powder is of a light yellowish brown color. This variety is most extensively used.

The *Jamaica* or *white ginger* differs in being entirely deprived of epidermis, and white or yellowish white on the outside. The pieces are rounder and thinner, in consequence of the loss of substance in their preparation. They afford when pulverized a beautiful yellowish white powder, which is brought from Liverpool in jars. This variety is firm and resinous, and has more of the sensible qualities of ginger than the black. The uncoated ginger of the East Indies resembles the Jamaica, but is darker, being gray rather than white. As the Jamaica commands a much higher price than even the uncoated East India production, the latter is occasionally altered to simulate the former. This is sometimes done by coating the exterior with sulphate or carbonate of calcium, sometimes by bleaching, by which not only the exterior but also the internal parts are rendered whiter than in the unprepared root. Trommsdorff found, in a specimen which he examined, evidences of the presence of chlorides, sulphates, and calcium, and concluded that the bleaching was effected by chlorine, or by chloride of lime and sulphuric acid. Having macerated some black ginger in water, deprived it of the cortical portion, treated it for twenty-four hours with sulphuric acid diluted with nine times its weight of water, and finally placed it in a mixture of chloride of lime and water, in which it was allowed to remain for two days, he found it, upon being washed and dried, to present an appearance closely resembling that of the finest white ginger, both on the surface and internally. (*Ann. der Pharm.*, xvii. 98.) According to Brande, ginger is often washed in whiting and water; and Pereira states that it is sometimes bleached by exposure to the fumes of burning sulphur.

General Properties. The U. S. Pharmacopœia describes ginger as " about three-fifths of an inch (15 mm.) broad, flattish, on one side lobed or clavately branched; deprived of the corky layer; pale buff-colored, striate, breaking with a mealy, rather fibrous fracture, showing numerous, small, scattered resin-cells and fibro-vascular bundles, the latter enclosed by a nucleus sheath." The odor of ginger is aromatic and penetrating, the taste spicy, pungent, hot, and biting. These properties gradually diminish, and are ultimately lost, by exposure. The virtues of ginger are extracted by water and alcohol. Its constituents, according to M. Morin, are a volatile oil; a resinous matter, soft, acrid, aromatic, and soluble in ether and alcohol; a sub-resin insoluble in ether; gum; starch; sulphur; acetic acid; acetate of potassium; and lignin. The peculiar flavor of the root appears to depend on the volatile oil, its pungency partly on the resinous or resino-extractive principle. A considerable quantity of pure white starch may be obtained from it. The volatile oil, examined by A. Papousek, was yellow, of the odor of ginger, and of a hot aromatic taste. Its sp. gr. was 0·893, and boiling point 246 1° C. (475° F.). Deprived of water by distillation over phosphoric oxide, it consisted of carbon and hydrogen, with the formula $C_{10}H_{16}$, and therefore belongs to the terpenes. (See *Chem. Gaz.*, 1853, p. 12.) According to Zeller, one pound of the dried root yields one drachm and seventeen grains of volatile oil. (*Centralb.*, 1855, p. 207.) Flückiger obtained from one hundred and twelve pounds of Jamaica ginger four and a half ounces of the oil, or about one-quarter of one per cent. He states, however, that Messrs. Schimmel & Co., of Leipsic, informed him that they obtained as much as 2·2 per cent. from good ginger. (*Pharmacographia*, 2d ed., p. 637.) Those pieces of ginger which are very fibrous, light and friable, or worm-eaten, should be rejected. The commercial powder of ginger is very frequently adulterated, rice starch, flour ginger which has been exhausted in making preparations, and even brick-dust and chalk, being used for the purpose, and the loss of pungency atoned by the addition of capsicum or mustard.

Medical Properties and Uses. Ginger is a grateful stimulant and carminative, and is often given in dyspepsia, flatulent colic, and the feeble state of the alimentary canal attendant upon atonic gout. It is an excellent addition to bitter infusions and tonic powders, imparting to them an agreeable, warming, and cordial operation upon the stomach. When chewed it produces much irritation of the mouth, and a copious flow of saliva; and, when snuffed up the nostrils in powder, excites violent sneezing. It is sometimes used as a local remedy in relaxation of the uvula and palsy of the tongue and fauces. Externally it is rubefacient. It may be given in powder or infusion. The dose of the former is from ten grains to a scruple (0·65–1·3 Gm.) or more. The infusion may be prepared by adding half an ounce of the powdered or bruised root to a pint of boiling water, and may be given in the dose of one or two fluidounces (30–60 C.c.) A fluid extract and oleoresin of ginger are now officinal, and are very convenient preparations. (See *Extractum Zingiberis Fluidum* and *Oleoresina Zingiberis.*) The dose of the former may be from ten to thirty minims (0·6–1·9 C.c.), of the latter from two to five minims (0·12–0·3 C.c.). There is also an officinal tincture, the dose of which is about a fluidrachm (3·75 C.c.).

Off. Prep. Confectio Scammonii, *Br.;* Extractum Zingiberis Fluidum, *U. S.;* Infusum Sennæ, *Br.;* Oleoresina Zingiberis, *U. S.;* Pilulæ Scillæ Compositæ; Pulvis Aromaticus, *U. S.;* Pulvis Cinnamomi Compositus, *Br.;* Pulvis Jalapæ Compositus, *Br.;* Pulvis Opii Compositus, *Br.;* Pulvis Rhei Compositus; Pulvis Scammonii Compositus, *Br.;* Syrupus Rhamni, *Br.;* Tinctura Zingiberis; Tinctura Zingiberis Fortior, *Br.;* Vinum Aloës.

PART II.

DRUGS AND MEDICINES NOT OFFICINAL.*

In the progress of the medical art, numerous remedies have at different times risen into notice and employment, which, by the revolutions of opinion incident to our science, or by the discovery of more efficient substitutes, have so far fallen into disrepute as to have been discarded from general practice, and to no longer hold a place in the officinal catalogues. Of these, however, some are still occasionally employed by practitioners and referred to by writers, and many retain a popularity as domestic remedies, or among empirics, which they have lost with the medical profession generally. The attention of physicians must, therefore, frequently be called to them in the course of practice; and it is highly desirable to possess some knowledge of their properties and effects, in order to be enabled to judge of their agency in any particular case, and at the same time to avoid the suspicion of incompetence which might attach to the exhibition of entire ignorance in relation to them. The remark is true also of other substances, which, though at no time ranked among regular medicines, are yet habitually employed in families, and the influence of which, either remedial or otherwise, must often enter into our estimate of the causes which produce or modify disease. New medicines, moreover, are frequently brought forward, which, without having obtained the sanction of the medical authorities, are occasionally prescribed, and therefore merit notice. To supply, to a certain extent, the requisite means of information in regard to these extra-officinal remedies, is the object of the following brief notices, among which are also included accounts of substances not employed as medicines, but usually kept in the drug stores for various purposes connected with the arts, or with domestic convenience. In a work intended for the use as well of the apothecary and druggist as of the physician and medical student, the introduction of such accounts is obviously proper, if kept in due subordination to the more important object of teaching the properties of medicines, and the modes of preparing them. The authors regret that the limits, which practical convenience appears to require in a Dispensatory, do not admit of a more complete description of the various drugs and medicines of the kind above alluded to, but the attempt is made to give at least the information where to look for an account of almost everything used in medicine. In relation to the nomenclature employed, it may be proper to observe that all those vegetable remedies, which, not being generally kept in the shops, have no current commercial name, are described under the scientific title of the plant producing them; while other substances are designated by the names which ordinary usage has assigned them.

ABROMA AGUSTUM. A viscid white fluid found in the fleshy bark of the root of this plant, which is a native of India, is stated by B. B. Mohun Sircor to be of great service in dysmenorrhœa. A half drachm of the fresh root is given at a dose. (*Am. Jour. Med. Sci.*, July, 1873, p. 276.)

ACERATES DECUMBENS. This plant, which grows in New Mexico, is stated by Dr. Wm. J. Wilson, U.S.A., to be used by the Mexicans as a specific in snake-bite. (*Phila. Med. Times*, v. 183.)

ACETATE OF ALUMINIUM. This salt may be obtained by the direct combination of hydrated alumina with acetic acid, or by reaction between sulphate of aluminium and acetate of lead, $Al_2(SO_4)_3 + 3Pb(C_2H_3O_2) = 3PbSO_4 + Al_2(C_2H_3O_2)_3$. It is deliquescent. Acetate of aluminium is valuable only as a disinfectant, operating in this way like the sulphate of aluminium, and employed in the same manner. (See *Aluminii Sulphas.*) *Subacetate of aluminium* has been used in solution as a local astringent in various skin affections. (For a formula, see *A. J. P.*, 1872, p. 104.)

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* By the term officinal medicines, here as well as elsewhere in this work, are meant such as are embraced in the United States and British Pharmacopœias.

ACETATE OF MAGNESIUM. *Magnesii Acetas.* $Mg(C_2H_3,O_2)_2$. This salt, proposed as a purgative by M. Renault, of Paris, is deliquescent, and cannot be crystallized without difficulty. (*Carl von Hauer.*) It has the merit of extreme solubility both in water and alcohol. Though without much taste, it is inferior in that respect to citrate of magnesium, for which it is proposed as a substitute. It is prepared for therapeutic use by saturating 120 parts of carbonate of magnesium with acetic acid, and evaporating the resulting liquid, after filtration, to 300 parts. The product is a syrupy acetate of magnesium, which is to be mixed with three times its weight of syrup of oranges, to form the preparation of M. Renault. Of this about four ounces is the dose. An objection to the liquid acetate is, that, owing to its attraction for moisture, it cannot be preserved of uniform strength for mixing with the syrup of oranges. (*Jour. de Pharm.*, 3e sér., xiii. 260.)

ACHILLEA. *U.S.* 1870 (*Herbe aux Charpentiers, Millefeuille*, Fr.; *Schafgarbe, Schafrippe*, G.; *Millefoglie*, It.; *Cientoenrama, Yerba de San Juan*, Sp.). *Achillea Millefolium. Milfoil* or *yarrow* is a perennial herb, common to the old and new continents, though supposed to have been introduced into this country from Europe. It abounds in old fields, along fences, and on the borders of woods and of cultivated grounds, throughout the United States. It is from a foot to eighteen inches high, and is specifically distinguished by its doubly pinnate, downy, minutely divided leaves, with linear, dentate, mucronate divisions, from which it derived the name of milfoil, by its furrowed stem and calyx, and by its dense corymb of whitish flowers, which appear throughout the summer, from June to September. The whole herb is medicinal. *Achillea Moschata* or *Iva* of Europe is sometimes used as a substitute for *A. Millefolium.* Von Planta found in it a bitter, aromatic, bluish-green volatile oil, *Ivaol* ($C_{12}H_{20}O$), and a peculiar nitrogenous principle, *Moschatin* ($C_{21}H_{27}NO_7$). (*Ann. Chem. Pharm.*, clv. 145, 1870.) For further particulars see *P. J. Tr.*, March, 1871.

Both the flowers and leaves of *A. Millefolium* have an agreeable, though feeble aromatic odor, which continues after drying, and a bitterish, astringent, pungent taste. The aromatic properties are strongest in the flowers, the astringency in the leaves. The plant contains besides a volatile oil and tannin a peculiar principle, *Achillein*, which was discovered by Zanon. (*Ann. Chem. Pharm.*, lviii. 21.) As analyzed by Von Planta (*Ann. Chem. Pharm.*, clv., 1870) its formula is $C_{20}H_{38}N_2O_{15}$. It occurs in a brownish-red mass of a strongly bitter taste, soluble in water, more feebly in alcohol, not at all in ether. It has been surmised to be an alkaloid, but this is very doubtful. *Achilleic acid*, also discovered by Zanon, is affirmed by Hlasiwetz to be identical with aconitic acid. The oil, which may be obtained separate by distillation with water, has a beautiful azure-blue color, and the peculiar flavor of milfoil. The active principles are extracted both by water and alcohol. *A. Millefolium* is a mild aromatic tonic and astringent. In former times it was much used as a vulnerary, and was given internally for the suppression of hemorrhages, and of profuse mucous discharges. It was employed also in intermittents, and as an antispasmodic in flatulent colic and nervous affections. Its hot infusion is used as an emmenagogue in France, and also in suppression of the lochia; it is sometimes employed in low exanthematous fevers with difficult eruption. In these cases it probably acts as a stimulant sudorific, as do most aromatic herbs. In some parts of Sweden it is said to be employed as a substitute for hops in the preparation of beer, which it is thought to render more intoxicating. It is best administered in infusion (ounce to the pint), made without boiling, or the volatile oil may be given in doses of twenty or thirty drops. Puppi found that thirty to seventy-five grains of achillein in divided doses produced marked irregularity of the pulse with increase of the appetite.

ACTÆA SPICATA. *Baneberry. Herb Christopher.* This is a perennial, herbaceous, European plant, growing in the woods of mountainous regions, and attaining a height of two feet or more. The root is of a dark-brown color, and bears some resemblance to that of *Helleborus niger*, for which it is said to be occasionally substituted. Its odor, in the recent state, is sweetish and rather nauseous, but is in great measure dissipated by drying. The taste is bitterish and somewhat acrid. In its operation on the system, the root is purgative and sometimes emetic, and is capable, in overdoses, of producing dangerous effects. It is unknown in this country. We have, however, a native species of Actæa, *A. Americana* of Pursh, of which there are two varieties—*alba* and *rubra*—distinguished by the color of their berries, which in the former are white, and in the latter red. They are sometimes called *white* and *red cohosh*, a name derived from the language of the aborigines. By some botanists they are treated of as distinct species, under the names of *Actæa alba* and *Actæa rubra.* They grow in the rich deep mould of rocky woods, from Canada to Virginia. They are said to have been much esteemed by the Indians. Their medical properties are probably similar to those of *A. spicata.* The name *baneberry*, given to different species of Actæa, was derived from the reputed poisonous properties of their berries. Mr. Frederick Stearns, in his account of the medical plants of Michigan, speaks of the rhizome of *Actæa alba* as being violently purgative. (*Proc. of the Am. Pharm. Assoc.*, 1858, p. 240.)

ADANSONIA DIGITATA. *Baobab.* A tree of enormous magnitude, belonging to the Sterculiaceæ (*Lindley*). It is a native of Africa, extending quite through that continent from Senegal to Abyssinia, and has been introduced into the West Indies. The leaves and bark of this tree abound in mucilage, and have little smell or taste. By the Africans the leaves are used as a diaphoretic, and the subacid pulp of the fruit in dysentery. Dr. Duchassaing, of Guadaloupe, West Indies, and M. Pierre, of France, commend the bark highly as an antiperiodic. (*Arch. Gén.*, 3e sér., xxiii. 535.) It is said to be acceptable to the stomach, and to produce no other observable physiological effect than increase of appetite, increased perspiration, and perhaps diminished frequency of pulse. An ounce may be boiled in a pint and a half of water to a pint, and the whole taken in a day. (*Journ. de Pharm.*, 3e sér., xiii. 412 and 421.)

ADD ADD. The leaves of *Celastrus obscurus*, used in Abyssinia as an antiperiodic. Prof. Dragendorff found in them tannic acid, volatile oil, and a bitter principle *celastine*, chemically identical with menyanthin. (*A. P. A.*, xxvi. 299.)

ADENIA VENENATA. This is a climbing passion-flower of Africa, said by the traveller Schweinfurth to be used as a vesicant. (*P. J. Tr.*, March, 1874.)

ADIANTUM PEDATUM. *Maidenhair.* An indigenous fern, the leaves of which are bitterish and aromatic, and have been supposed to be useful in chronic catarrhs and other pectoral affections. A European species, known by the same vulgar name, is the *A. Capillus Veneris*, which has similar properties, though feebler, and has been much used as a pectoral, on the continent of Europe, from very early times. It is given in the form of infusion, sweetened with sugar or honey; and a syrup prepared from it is popular in France, under the name of *sirop de capillaire.* The name of maidenhair has also been given to *Asplenium Trichomanes*, the leaves of which have a mucilaginous, sweetish, somewhat astringent taste, and have been used for the same purposes with those of the plants above mentioned. Another species of Asplenium, *A. Adiantum nigrum*, has been substituted for the genuine maidenhair; but neither of them has the aromatic flavor of that fern.

ADONIS VERNALIS. The leaves of this plant, which grows wild in Southern Europe, are sometimes used in medicine, whilst the rhizome has been discovered in commercial black hellebore, as an adulteration. Linderos examined the leaves and found in them 10 per cent. of *aconitic acid.* (Liebig's *Annalen d. Chem.*, *N. R.*, 1876, p. 340.) The leaves are reputed to possess drastic properties.

ÆSCULUS HIPPOCASTANUM. *Horsechestnut.* The horsechestnut is a native of Asia, and was introduced about the middle of the sixteenth century into Europe, where, as well as in this country, it is now extensively cultivated as an ornamental tree. Quercitrin has been found by Rochleder in very small proportion in the leaves. (*Journ. de Pharm.*, Mai, 1859, p. 393.) *Fraxin*, a peculiar principle of the bark of Fraxinus excelsior, has been detected also, by Mr. Stokes, in the bark of the horsechestnut; and Rochleder has discovered in the capsules of the fruit a peculiar acid, which he names *capsulæscic acid.* (*Ibid.*, Août, 1860, p. 151.) The fruit and bark have been used in medicine. The *fruit* abounds in starch, but has a rough, disagreeable, bitter taste, of which it may in great measure be deprived by maceration in an alkaline solution. The starch has been prepared in France for use; the nut being reduced to a pulp, washed, and treated like the potato. (*Am. Journ. of Sci. and Arts*, Sept. 1856, p. 264.) The bitter principle is denominated *esculin*, and, according to Rochleder, may be obtained by precipitating with acetate of lead a decoction of the rind, filtering, treating the filtered liquor with sulphuretted hydrogen, again filtering, evaporating to the consistence of syrup, and setting the residue aside in a cool place. In a few days, the liquid is converted into a mass of crystals, which are to be expressed, and purified by repeated crystallization from alcohol, and afterwards from boiling water. If now washed on a filter with cold water till they have lost one-third of their weight, they are rendered as pure as it is possible to obtain them. (For another process of preparing it, see *A. J. P.*, xliv. 400.) Esculin is in shining white, prismatic crystals, inodorous, bitter, but slightly soluble in cold water, more soluble in boiling water, and very readily so in boiling alcohol, and in alkaline solutions. Its solution is precipitated by subacetate of lead. Its formula, according to Schiff, is $C_{15}H_{16}O_9$. When treated with dilute sulphuric acid, it is converted into grape sugar, and a peculiar substance called *esculetin.* (*Chem. Gaz.*, Jan. 15, 1857, p. 27.) Tannin is found in all parts of the tree, including the *leaves* as well as the bark and fruit. According to Rochleder, when pure, it is white and soluble in water, alcohol, and ether; becomes red by the absorption of oxygen; colors *green* the persalts of iron, but *violet* on the addition of a little alkali; precipitates gelatin but not tartar emetic; in concentrated solution is precipitated, at least partially, by sulphuric, hydrochloric, and metaphosphoric acids, while acetic acid is opposed to this result; and forms also, with the sulphites of potassium and sodium and the hydrosulphate of ammonium, precipitates which are dissolved by dilute acetic acid. (*Journ. de Pharm.*, Janv. 1868, p. 72.) The powdered kernel of the nut is a sternutatory. The extract of the wood is said to be used in dyeing silk black. The fixed oil, extracted from the kernels by ether, has been employed in France as a topical remedy in rheumatism; and the bark as an antiperiodic in doses of half an ounce in the 24 hours, given in the form of decoction. Esculin has also been successfully administered in malarial disorders, in 15 grain doses repeated once during the intermissions. (*Ann. de Thérap.*, 1859, p. 160; 1860, p. 198.)

The fruit of the *Æsculus Pavia*, or the *Red Buckeye* of the Southern United States, is said to be actively poisonous, producing symptoms analogous to those caused by strychnia. Mr. E. C. Batchelor (*A. J. P.*, xlv. 144) found in the cotyledons of the seeds about 2½ per cent. of a peculiar glucoside. *Æsculus glabra*, the *Ohio Buckeye*, is asserted to be very useful in congestions of the portal circulation. (*New Preparations*, ii. 21.)

AGARIC. *Touchwood. Spunk. Tinder.* This is the product of different species of a genus of mushrooms denominated *Boletus.* Several species are used as food, several are poisonous, and two at least have been ranked among officinal medicines in Europe. *Boletus laricis*, *Polyporus officinalis*, Fries, which grows upon the larch of the old world, is the *white agaric* or *purging agaric* of medical writers. It is of various sizes, from that of the fist to that of a child's head, or even larger, hard and spongy, externally brownish or reddish; but, as found in commerce, it is deprived of its exterior coat, and consists of a light, white, spongy, somewhat farinaceous, friable mass, which, though capable of being rubbed into powder upon a sieve, is not easily pulverized in the ordinary mode, as it flattens under the pestle. It has a sweetish very bitter taste, and Braconnot believed it consisted of 72 parts of resinous matter, 2 of bitter extractive, and 26 of *fungin*, a nutritious animalized principle, constituting the base of the fleshy substance of mushrooms. The fungin has since been shown to be merely *metacellulose*, and may be obtained by treating the agaric with water, weak soda solution, hydrochloric acid, and alcohol. Masing (*Archiv d. Pharm.*, 1875, 111) obtained from agaric two distinct resins; one insoluble in chloroform, being a white, crystalline powder, without odor or taste; the other soluble in chloroform and alcohol, and of an intensely bitter taste.

Medical Properties.—In the dose of four or six grains, it is said to act powerfully as a cathartic; but Lieutaud asserts that it may be given in the quantity of thirty grains or a drachm without sensibly purging. M. Andral has found it useful in checking the night-sweats of phthisis. He uses it in doses of eight grains, and gradually increases to a drachm during the day, without any observable inconvenience to the digestive functions. In this country it is scarcely employed. That which is most esteemed is said to be brought from Siberia; but it is probably produced wherever the European larch grows. Dr. Wm. M. McPheeters (*St. Louis Med. and Surg. Journ.*, x. 421) found a specimen brought from the Rocky Mountains decidedly cathartic in doses of 25 grains. A tincture of the agaric of the Canadian larch has been used successfully in rheumatism by Dr. J. A. Grant. (*British-Am. Journ.*, April, 1862.)

Thoerner obtained from *Agaricus atromentosus* crystalline, dark-brown scales, which he believed to be *dioxykinon.* (*Ber. Deutsch Chem. Ges.*, 1878, p. 533.)

Boletus igniarius, or *agaric of the oak*, like the species just described, is compared in shape to the horse's hoof. Its diameter is from six to ten inches. It is soft like velvet when young, but afterwards becomes hard and ligneous. It usually rests immediately upon the bark of the tree, without any supporting footstalk. On the upper surface it is smooth, but marked with circular ridges of different colors, more or less brown or blackish; on the under, it is whitish or yellowish, and full of small pores; internally it is fibrous, tough, and of a tawny-brown color. It is composed of short tubular fibres compactly arranged in layers, one of which is added every year. The best is that which grows on the oak, and the season for collecting it is August or September. It has neither taste nor smell. Among its constituents, according to Bouillon-Lagrange, are extractive, resin in very small proportion, azotized matter also in small quantity, chloride of potassium, and sulphate of calcium; and in its ashes are found iron, and phosphate of calcium and magnesium. It is prepared for use by removing the exterior rind or bark, cutting the inner part into thin slices, and beating these with a hammer until they become soft, pliable, and easily torn by the fingers. In this state it was formerly much used by surgeons for arresting hemorrhage, being applied immediately, with pressure, to the bleeding vessel. It probably acts mechanically, like any other soft porous substance, by absorbing the blood and causing it to coagulate, and is not relied on in severe cases. In the obstinate hemorrhage which occasionally takes place from leech-bites, especially those of the European leech, it may be used advantageously, though perhaps not more so than well-prepared lint. It has been sometimes applied to the purposes of moxa.

When prepared agaric is steeped in a solution of nitre, and afterwards dried, it becomes very readily inflammable, and is employed as tinder. Some recommend the substitution of chlorate of potassium for nitre. The preparation is usually known by the name of *spunk*, and is brought to us from Europe. Spunk or tinder, the *amadou* of the French, is in flat pieces, of a consistence somewhat like that of very soft, rotten buckskin leather, of a brownish-yellow color, capable of absorbing liquids, and inflammable by the slightest spark. It is said to be prepared also from various other species of Boletus, as *B. ungulatus*, *B. fomentarius*, *B. ribis*, etc.

AGARICUS MUSCARIUS. *Fly Fungus.* This fungus has been used from time immemorial by the Tartars as a means of producing intoxication. Various attempts have been made to isolate its active principle, but MM. Schmiedeberg and Koppe first obtained the alkaloid *muscarine*, $C_5H_{13}NO_2$, in a state of purity. The physiological as well as the chemical relations of the poison have been very fully investigated by its discoverers. (*Das Muscarin*, Leipzig, 1869.) The alkaloid may be produced artificially by gently heating choline platinochloride with strong nitric acid. Potassium chloride is used to decompose the muscarine platinochloride and produce muscarine hydrochloride; treatment with moist oxide of silver yields the muscarine as a hydrate ($C_5H_{13}NO_2H_2O$). We have only room for a few prominent facts concerning muscarine. It resembles Calabar bean somewhat in its action, and is antagonistic to atropia, producing free salivation and weeping, vomiting, diminution of the force and frequency of the pulse, dyspnœa, great muscular weakness, deepening into paralysis and finally death, usually by arrest of respiration. The pupil is intensely contracted, but dilates before death. The diastole of the heart is very much prolonged, and after very large doses diastolic arrest occurs. This is due to an action upon the inhibitory nerves, and if atropia be given so as to paralyze them the cardiac movements re-occur. The vaso-motor nerves are said to be paralyzed. The action on the abdominal viscera is very marked. The muscles of the intestines, bladder, and spleen are tetanically contracted. Thus the intestines are transformed into hard white cords, or afterwards, becoming somewhat relaxed, exhibit a tumultuous peristalsis. The abdominal secretions are greatly increased. Most of the physiological results obtained by Schmiedeberg and Koppe have been confirmed by M. J. L. Prevost. (*Jour. de Pharm.*, 4e sér., xx. 385; *Congrès Méd. Internat.*, *Comptes-Rendus*, Geneva, 1878.)

AGAVE AMERICANA. *American Agave. American Aloe. Maguey.* An evergreen succulent plant, indigenous in Florida, Mexico, and other parts of tropical America, and largely cultivated, chiefly for hedges, in the South of Europe, especially in Spain. This and other species of Agave bear a considerable resemblance, in appearance, to the plants of the genus Aloe, with which they are sometimes confounded. From the root and leaves of the American agave, when cut, a saccharine juice flows out, which may be converted by evaporation into syrup and even sugar, and by fermentation into a vinous liquor. According to M. Lenoble, this juice when fresh has an herbaceous somewhat nauseous odor and acrid taste, and reddens litmus paper. It is said to be laxative, diuretic, and emmenagogue, and in doses of two fluidounces, three times a day, has been found very useful in scurvy. (Dr. G. Perin, U.S.A., *N. Y. Jour. of Med.*, N. S., vii. 181.) According to M. Bazire, however, it is not the *A. Americana* which produces the sweet juice from which the intoxicating *pulque* of the Mexicans is obtained, but another species, bearing considerable resemblance to the Americana. The latter plant, he informs us, yields a very bitter, viscid, and astringent juice, while it is from the Agave *pulque* that the sweet fermentable juice is procured. (*Jour. de Pharm.*, 4e sér., iv. 103-4.) The expressed juice, evaporated to the consistence of a soft extract, forms a lather with water, and is employed as a substitute for soap. The fibres of the old leaves, separated by bruising and maceration in water, are used for thread. M. Lenoble found in the leaves an acrid volatile oil, a gum-resinous principle, lignin, salts of potassa and lime, and silica; and thinks that a vinegar or ointment of the leaves might be advantageously used as an epispastic. (*Jour. de Pharm. et de Chim.*, xv. 350.) It is said that a gum exudes and hardens on the leaves of the Maguey, which has been compared to gum arabic, but in fact differs from it in containing a much larger proportion of lime, and in being only partially soluble in water; the soluble portions resembling pure gum, but the larger insoluble portions having all the characteristics of bassorin. (*Ibid.*, 4e sér., iv. 104.) *Agave Virginica*, which grows in our Southern States, and is known in South Carolina by the name of *rattlesnake's master*, has a very bitter root, which is used, in the form of tincture, in flatulent colic. (Robert King Reid, *Inaug. Thes.*, 1849.)

AGERATUM CONYZOIDES, a Brazilian plant said to be used as an emmenagogue by Mr. Barker Smith, *Chemist and Druggist*, May 15, 1876.

AGRIMONIA EUPATORIA. *Common Agrimony.* This species of agrimony is a perennial herb, inhabiting Asia, Europe, and North America, and, in this country, found in fields and on the borders of woods, and flowering during the summer months. Its stem, which rises from one to three feet in height, is hairy, furnished with interruptedly pinnate leaves, and terminated by a long simple spike of yellow flowers. Both the herb and root have been employed. The former has a weak but agreeable aromatic odor, and a rough, bitterish, somewhat aromatic taste. The fragrance is strongest in the flowers. The root has similar properties; but its taste is more bitter and astringent. A volatile oil may be obtained from the plant by distillation. Agrimony is a mild corroborant and astringent. The herb has been employed in relaxed conditions of disease, as in passive hemorrhages, and chronic affections of the mucous membranes. It has been recommended, also, as a deobstruent in jaundice and visceral obstructions, and as an alterative in diseases of the skin. In Europe it is popularly used, in the form of a gargle, in affections of the throat. The Indians of North America and the Canadians are reported to have employed the root with advantage in fevers. The plant may be given in substance, infusion, or decoction. The dose of the powder is a drachm or more.

AILANTHUS GLANDULOSA. This well known shade-tree, belonging to the natural order of Rutaceæ, in its general aspect and the character of its foliage appears like a gigantic sumach, and it was at one time considered as a Rhus. In France it is cultivated for the sake of its leaves, upon which the Chinese silk-worm is fed, and is known by the name of *Japan varnish* (*vernis du Japon*), from its having been mistaken for the true Japan varnish tree, which is a species of Sumach. (*P. J. Tr.*, vii. 370.) According to Prof. Hetet, the bark is an active vermifuge. When in powder it is of a greenish-yellow color, a strong, narcotic, nauseating odor, in its recent state, and of a strongly bitter taste. When chewed, besides the bitterness, it appears, through its influence on the gustatory nerves, to produce in a few moments a general uneasiness, a sense of increasing weakness, dazzling, cold sweats, with shivering and nauseous sensations, which are very remarkable, but seem to be well atttested. The inference from these effects is that it has probably a powerful depressing agency on the nervous system, similar to that of tobacco. Examined chemically, the bark has been found to contain lignin, chlorophyll, a yellow coloring principle, a gelatinous substance (pectin), a bitter substance, an odorous resin, traces of a volatile oil, an azotized fatty matter, and several salts. An *oleoresin* is obtained from the bark by the action of alcohol, which has the consistence of tar, a very dark greenish-brown color, and in a high degree the smell and taste of the bark. M. Hetet experimented upon dogs with the powdered bark, powdered leaves, and various preparations of the bark. As a general result, they were found to produce a purgative effect, with copious stools and the discharge of worms. The resin purged, but rarely acted as an anthelmintic. The depressing effects on the nervous system in man were found to depend on the volatile oil, as the resin alone had no such influence. The oil is so powerful that persons exposed to the vapors, in preparing the extract, are liable to be seized with vertigo, cold sweats, and vomiting. The powdered bark has been given in several cases of tape-worm in the human subject, and proved remarkably successful in causing its expulsion, at the same time operating on the bowels. The oleoresin produced the same effect in a somewhat smaller dose, and has the advantage that it keeps better than the bark, which loses its powers with age. A fact worthy of remark is that neither the bark nor its preparation, taken internally, produce vomiting in man; while this effect is determined by the inhalation of its vapors, when it is boiled. The cathartic operation is not violent. The dose of the powder which was found sufficient for the expulsion of the tape-worm was from seven or eight to thirty grains. (*Journ. de Pharm.*, Mars, 1859, p. 163.) In China the bark is very popular as a remedy in dysenteric and other bowel complaints. (*A. J. P.*, 1874, p. 276; *P. J. Tr.*, vii. p. 372.)

In India the bark of the *Ailanthus Excelsa* is used as a bitter tonic. It is said to occur in rough, dirty green pieces, originally large, but of so friable a character that in handling they become very much broken up. Mr. Narayan Daji found in it a peculiar bitter uncrystallizable principle and a bitter nitrogenous acid, *Ailanthic Acid*, to which he attributes medical virtues. (*P. J. Tr.*, Aug. 1870, Oct. 1876, June, 1877.)

AJUGA CHAMÆPITYS. *Ground Pine. Chamæpitys.* A low, creeping, annual, labiate plant, a native of Europe, and found also in some parts of the United States. The leaves, which bear some resemblance to those of the pine in shape, have a strong, peculiar, resinous, not disagreeable odor, and a bitter, balsamic taste. They contain a small proportion of volatile oil, and are said to be stimulant, diuretic, and aperient. They have been given in rheumatism, gout, palsy, and amenorrhœa in doses of from one to two drachms, preferably in the form of a wine.

Ajuga reptans or *common bugle*, and *A. pyramidalis*, perennial plants of Europe, have also been used in medicine. They are nearly inodorous, have a somewhat astringent, bitterish, and saline taste. Their virtues are probably those of a mild astringent and tonic. They have been recommended in pulmonary consumption, hæmoptysis and other hemorrhages, and in hepatic obstructions, but are at present nearly obsolete.

AKAZGA. *Boundou. Quai.* These are the native names of an ordeal poison, used in a district on the West Coast of Africa, extending far into the interior, north and south of the equator, from the use of which in their trials thousands of persons are said to perish annually. It is referred to in the works of Du Chaillu and of Winwood Reade. It comes in bundles consisting of long, slender, crooked stems, with the root generally attached, sometimes of the branches, but seldom of the whole plant. This is about six feet high, with a yellowish-orange bark, in some parts light-red, and covered by a gray efflorescence. The leaves are opposite, oval-acuminate, with a linear prolongation at the end more than an inch long. The precise botanical character of the plant is not known, but it is thought to be a Loganiacea. The active principle of the plant has been extracted by Dr. Thos. R. Fraser, who found it to be an alkaloid and named it *akazgia.* It is colorless, crystallizable with difficulty, soluble in 60 parts of cold absolute alcohol, 16 parts of officinal alcohol, 130 parts of anhydrous ether, and in 13,000 parts of water at 15·5° C. (60° F.). It is freely soluble in chloroform, carbon disulphide, benzole, and ether of sp. gr. 0·735. The alcoholic extract or the alkaloid acts on the system similarly to nux vomica. (*Chem. News*, Oct. 18, 1867, p. 203.)

This is probably the poison referred to under the name of *boundou* or *icaja*, by MM.

Pecholier and Saint Pierre, who consider the plant producing it as belonging to the Apocyneæ, and state that it is used as an ordeal poison by the natives of Gaboon, in Africa. They extracted from it a poisonous principle, which reacted like strychnia upon the animal economy. (See *A. J. P.*, March, 1867, p. 124.)

ALBUMINATE OF IRON. *Ferri albuminas.* This preparation has come into some prominence, more particularly in Europe, on account of its asserted advantages over other compounds of iron; Démarquay, Chrisnard, and others, recommending its employment in chlorosis and anæmia as being more readily absorbed. Friese, Kobligk, Bernbeck, Biel, Holdermann, Nierck, Donitz, Hager, have proposed methods for preparing either the solution or dry salt. Prof. C. L. Diehl, however, after a careful review of the processes of these investigators, offers the following. 4 troyounces of white of eggs are diluted with 8 fluidounces of water; 50 minims of officinal solution of chloride of iron diluted with 4 fluidounces of water are added, and the solution filtered. The filtrate is now mixed with 10 fluidounces of a saturated solution of chloride of sodium, the precipitate collected on a wet muslin strainer, washed with a mixture of 1 volume of the saturated solution of chloride of sodium and 3 volumes of water until the washings give but a faint reaction for iron. The washed albuminate of iron is, after draining, powerfully pressed to get it as dry as possible, and then exposed to a dry atmosphere, and finally powdered. This salt contains the equivalent of 5 per cent. of ferric oxide, or 10 per cent. of ferric chloride. (For other processes, see *A. J. P.*, 1880, p. 177.) As thus obtained, albuminate of iron is a cinnamon-brown powder, having a slight taste of common salt (due to the presence of a small quantity), soluble in water, particularly if slightly acidulated with hydrochloric acid, and is best administered in doses of twenty to thirty grains in simple aqueous solution, which should be freshly prepared. It may also be given in the form of a pill, either alone or combined with strychnia, quinia, etc.

ALBUMINATE OF IRON AND POTASSIUM, SYRUP OF. This syrup, proposed by M. Lassaigne, is made as follows. Dissolve 100 parts of white of eggs in 100 of distilled water, and precipitate the filtered solution with 36 parts of a solution of ferric sulphate, marking 5° of the areometer. Then add 2 parts of alcoholic potassa, previously dissolved in 50 parts of water. This, by agitation, will gradually dissolve the precipitate caused by the ferruginous solution, forming a deep orange-yellow liquid. The liquid is then converted into a syrup by dissolving in it one and a half times its weight of coarsely powdered sugar, and filtering. The syrup has a slightly alkaline and sweetish taste, totally devoid of inky flavor. Each fluidounce contains about six grains of anhydrous sesquioxide of iron.

ALBUMINATE OF IRON AND SODIUM. Angelico Fabri, observing that simple contact of the white of eggs with a salt of iron and soda was sufficient to produce a soluble albuminate of iron and sodium, the composition of which is so stable that it is not disturbed by ferrocyanide of potassium unless with the presence of an acid, and inferring that this is the condition in which the several ingredients of the compound exist in the blood, proposes this salt as likely to meet better than any other those wants of the system which call for the use of chalybeates. He prepares the salt by pouring upon the whites of four eggs, previously beaten up, solutions separately made of 112 grains of caustic soda and 104 of sulphate of iron in sufficient distilled water; shaking the mixture and placing it on a filter to separate the excess of hydrated oxide of iron which has precipitated; adding lime-water to the filtrate to separate the sulphuric acid of the sulphate of sodium which exists in the solution; again filtering, and precipitating the lime held in the solution by passing through it a stream of carbonic acid; filtering a third time to separate the carbonate of calcium; and finally reducing the liquid with a moderate heat to the measure of a pint. A transparent orange-yellow solution is thus obtained, having a slightly saltish and chalybeate taste, and unaffected by ferrocyanide of potassium unless with the presence of an acid. Each fluidounce contains 4 grains of the albuminate, with an excess of albumen and soda, which gives it an alkaline reaction, and renders it conformable to the state in which the compound exists in the blood. The albuminate of iron and sodium may be obtained in radiated crystals by evaporating the salt to dryness. (*A. J. P.*, Jan. 1863, p. 69; from *Journal of Rational Medicine*, May, 1862.)

ALCHEMILLA VULGARIS. *Ladies' Mantle.* This perennial European herb has an astringent, bitterish taste, and was formerly employed in diarrhœa, and other complaints requiring the use of astringents. By the ancients it was highly esteemed; and extraordinary powers were ascribed to it by the alchemists, from whom, according to Linnæus, it derived its generic title.

ALCORNOQUE. Under this name a bark was introduced into Europe from South America, more than fifty years since, and for a short time attracted considerable attention. It has been conjecturally referred by different writers to different plants, but its precise origin is unknown. It is in large thick pieces, composed of two layers, of which the external is reddish, cracked, granular, spongy, and two or three lines in thickness, the internal lamellated, woody, and possessed of the quality of imparting a yellow color to the saliva when chewed. It is inodorous. The outer layer is of an astringent, somewhat bitter taste, and was thought to have febrifuge powers; the inner is much more bitter, and is decidedly emetic. The bark was brought into notice chiefly as a remedy in phthisis; but, having been found useless in that complaint, has fallen into entire neglect. It was given in the form of powder, in the dose of thirty grains; or half an ounce of it was boiled in a pint of water down to half a pint, and two or three tablespoonfuls of the decoction were administered every two hours. In these doses it acted as an emetic. The bark known in Spain by the name of *alcornoque* is obtained from the cork-tree (*Quercus Suber*), and has sometimes been confounded in European pharmacy with that derived from South America. It has the properties of the ordinary oak barks.

ALDEHYD. (C_2H_4O.) Aldehyd is a generic term understood by chemists to apply to a class of bodies holding an intermediate position between the alcohols and the acids derived from them by oxidation. And, as with alcohol, when the kind is not mentioned, ethylic alcohol is always understood, so acetic aldehyd is always meant when the term aldehyd is used. The word means alcohol deprived of hydrogen (*alcohol dehydrogenatum*). Aldehyd may be prepared in many ways: usually, however, by the oxidation of alcohol in some form. W. and R. Rodgers (*J. P. Chem.*, 40, 248) give the following. 1 part of alcohol sp. gr. 842, and 1 part of potassium bichromate, are introduced in a large tubulated retort, and 1⅓ parts of sulphuric acid dropped in through the tubulure. Sufficient heat is evolved to start the distillation, but heat must be applied towards the end. The distillate is slightly contaminated with acetic acid. If the aldehyd be desired pure, the distillate is to be mixed with twice its volume of ether, surrounded with cold water, and dry ammoniacal gas passed in to saturation. Aldehyd-ammonia crystallizes out. This is to be decomposed in a retort by a mixture of 3 parts sulphuric acid and 4 parts of water, and the distillate rectified and dried by contact with chloride of calcium. Aldehyd is a colorless, mobile, inflammable liquid, having a rather pungent, ethereal, and suffocating odor. Its sp. gr. is 0·790, and boiling point 22° C. (71·6° F.). It mixes in all proportions with water, alcohol, and ether, and is rapidly converted into acetic acid on exposure to the air, through absorption of oxygen. It possesses very marked antiputrescent properties, meat being preserved for months by its two per cent. aqueous solution. The intoxication caused by it in animals is characterized by a very great loss of sensibility. It appears to paralyze the vagi, although its cardiac action is comparatively feeble. Upon the respiration it exerts a most powerful influence, in small doses quickening it, in large doses depressing it. The temperature is very much diminished. Locally it is very irritating. (*Med. Times and Gaz.*, Sept. 1875, p. 340.)

ALETRIS. *Star Grass. Aletris Farinosa*, Wild. *Sp. Plant.*, ii. 183; Bigelow, *Am. Med. Bot.*, iii. 92, is an indigenous perennial plant, the leaves of which spring immediately from the root, and spread on the ground in the form of a star. Hence have originated the popular names of *star grass*, *blazing star*, *mealy starwort*, and *colic root*, by which it is known in different parts of the country. The leaves are sessile, lanceolate, entire, pointed, very smooth, longitudinally veined, and of unequal size, the largest being about four inches in length. From the midst of them a flower-stem rises, one or two feet in height, nearly naked, with remote scales, which sometimes become leaves. It terminates in a slender scattered spike, the flowers of which stand on very short pedicles, and have minute bractes at the base. The calyx is wanting. The corolla is tubular, oblong, divided at the summit into six spreading segments, of a white color, and when old, of a mealy or rugose appearance on the outside. The plant is found in almost all parts of the United States, growing in fields and about the borders of woods, and flowering in June and July. The root, which was formerly included in the U. S. secondary list, is small, crooked, branched, blackish externally, brown within, and intensely bitter. The bitterness is extracted by alcohol, and the tincture becomes turbid upon the addition of water. The decoction is moderately bitter; but much less so than the tincture. It affords no precipitate with the salts of iron. (*Bigelow.*) In small doses (10 grains) it appears to be a simple bitter tonic. In very large doses, it is said to be cathartic and emetic, and to produce some narcotic effect. It has been employed, with asserted benefit, in colic, dropsy, and chronic rheumatism.

ALEURITES TRILOBA, OIL OF. The *Aleurites triloba* is a small tree belonging to the Euphorbiaceæ. It is widely diffused through the tropics, being indigenous in the East Indies and Islands of the Pacific, and naturalized in the West Indies. The fruit is a nut nearly as large as a walnut, consisting of a thick shell enclosing a kernel containing much azotized matter and rich in oil, of which it is said to yield nearly one-half its weight by expression. The nuts, strung together on the fibres of the palm-leaf, are used in the South Pacific Islands as a substitute for candles. The oil has been long known in the various countries inhabited by the plant, being called in Jamaica *Spanish walnut oil*, in India *Belgaum walnut oil*, in Ceylon *kekune oil*, and in the Sandwich Islands *kukui oil*. It may be obtained by boiling with water the kernels previously beaten in a mortar, or by expression. Sixteen pints of kernels yield about three pints of oil. The yearly product of the Sandwich Islands is said to be 10,000 gallons. (M. C. Cooke, *P. J. Tr.*, Nov. 1860, p. 282.) The oil is very fluid, of an amber color, without smell, congealing at 32° F., insoluble in alcohol, readily saponifiable, "and very strongly drying.” It is said to be a mild cathartic, acting upon the intestines in the same manner as castor oil, but causing no nausea or griping, and having the further advantages of a nutty flavor, and of being more prompt in its effects. (*Journ. de Pharm.*, 3e sér., xxiv. p. 228.) The dose is from one-half to one ounce; the smaller quantity generally answering. The cake left after the expression of the oil, given to a dog in the dose of about half an ounce, produced no vomiting, but acted strongly as a purgative.

The oil of the *Tung Tree*, *Aleurites cordata*, is enormously used in the arts in China, under the name of *wood oil*.

ALGAROBILLA, the pod of *Balsamocarpum brevifolium* (nat. ord. Leguminosæ), a drug containing over 60 per cent. of tannin and a large quantity of ellagic acid, is obtained from Chili. (Gehe's Report, *N. R.*, 1878, p. 332.)

ALISMA PLANTAGO. *Water Plantain.* A perennial herbaceous plant, common to Europe and the United States, and growing in streams, pools, ditches, and other standing waters. The *root* has when fresh an odor like that of Florentine orris, but loses it when dried. Its taste is acrid and nauseous. It contains a pungent volatile oil and an acrid resin, to which all its virtues must be ascribed. It acquired at one time considerable credit as a preventive of hydrophobia, but is totally inefficient. The Calmucks in Russia are said to use it for food. The *leaves* are rubefacient, and will sometimes even blister. They have been recommended in gravel and complaints of the bladder, in the dose of a drachm. The powdered root has been commended in chorea and epilepsy. The dose, at first about 8 or 10 grains morning and evening, is rapidly increased to three or four teaspoonfuls in the course of the day. (*Ann. de Thérap.*, 1859, p. 62.)

ALKANET. This is the root of *Anchusa tinctoria*, or *dyers' alkanet*, an herbaceous perennial plant, growing in the Grecian Archipelago and the South of Europe. It is said in some medical works to be cultivated abundantly in the South of France; but another plant is probably referred to—*Lithospermum tinctorium* of Linnæus and De Candolle, *Anchusa tinctoria* of Lamarck—which is a native of that country, and the root of which is considered as the true alkanet by the French writers. Others regard *Lawsonia inermis* as the source of true alkanet. Alkanet, as found in the shops, is in pieces three or four inches long, from the thickness of a quill to that of the little finger, somewhat twisted, consisting of a dark-red, easily separable bark, and an internal ligneous portion, which is reddish externally, whitish near the centre, and composed of numerous distinct, slender, cohering fibres. As it comes to us it is usually much decayed internally, very light, and of a loose, almost spongy texture. The fresh root has a faint odor, and a bitterish, astringent taste; but when dried it is nearly inodorous and insipid. Its coloring principle, which abounds mostly in the cortical part, is soluble in alcohol, ether, and the oils, to which it imparts a fine deep red; but is insoluble in water. It may be obtained by first exhausting the root with water, and then treating it with a weak solution of the carbonate of potassium or sodium, from which the coloring principle may be precipitated by an acid. According to Pelletier, by whom it was discovered, it possesses acid properties, forming with the alkalies and earths neutral compounds, which are of a blue color, and soluble in alcohol and ether. It is not poisonous. He called it *anchusic acid*, and stated that it may be sublimed unchanged. (*Journ. de Pharm.*, xix. 105.) It has also received the names of *anchusin* and *alkannin*, and another process for it is to exhaust the alkanet root with petroleum benzin, and simply evaporate the percolate. The tincture of alkanet has its color deepened by acids, changed to blue by alkalies, and again restored by neutralizing the latter substances. It may, therefore, be used as a test. The extract obtained by evaporating the tincture is dark brown. Alkanet is somewhat astringent, and was formerly used in several diseases; but it is now employed exclusively for coloring oils, ointments, and plasters, which are beautifully reddened by one-fortieth of their weight of the root. The best way to use it with this object in view is to suspend the alkanet, after tying it in a piece of flannel, in the melted fat. It is said also to be used in the preparation of spurious port wine.

ALLIARIA OFFICINALIS. *Erysimum Alliaria.* Linn. *Hedge Garlic.* A perennial European herb, having an alliaceous odor when rubbed, and a bitterish, somewhat acrid taste. When eaten it communicates its smell to the breath. Mr. Wertheim obtained from the root a volatile oil, apparently identical with that of mustard. (*Ann. der Chem. und Pharm.*, liii. 52.) The herb and seeds are esteemed diuretic, diaphoretic, and expectorant, and have been given in humoral asthma, chronic catarrh, and other complaints in which garlic is useful. The herb has also been recommended as an external application in gangrenous affections, and to promote suppuration.

ALNUS GLUTINOSA. *Common European Alder.* A European tree twenty-five feet or more in height, growing in swamps, on the sides of streams, and in other damp places. The bark and leaves are very astringent, and somewhat bitter. The former has been used in intermittent fever, the latter as a topical remedy in wounds and ulcers. The bruised leaves are sometimes applied to the breast for the purpose of repelling the milk. The cones also are astringent, and form a useful gargle in complaints of the throat. All these parts of the tree are used in dyeing, and the leaves and bark in tanning. According to Eitner, the bark contains from 16 to 20 per cent. of tannic acid. (*Gerber*, 1878, pp. 85 and 124.) The tannic acid, however, appears to differ from that of galls and oak bark, as, according to Dr. Stenhouse, it does not yield glucose when acted on by sulphuric acid. (*P. J. Tr.*, Dec. 1861.) F. Dreykorn and E. Reichardt, however, state that it is resolved by sulphuric acid into alnine red and sugar. (*A. J. P.*, xlii. p. 403.) *Alnus serrulata*, or common *American alder*, and *Alnus urcana*, or *Tag alder*, appear to have analogous properties. The latter has been strongly commended as a hæmostatic. (*N. R.*, Jan. 1872.)

AMARANTHUS HYPOCHONDRIACUS. *Prince's Feather.* An annual plant, growing spontaneously though sparingly in the Middle States, but believed to have been derived from tropical America. It is cultivated in our gardens on account of its flowers, which are in densely crowded spikes, and of a deep red color. The leaves are said to be astringent, and to be used internally and topically in the complaints to which the astringents generally are applicable.

AMBERGRIS. *Amber Grisea.* This substance, which is found floating on the sea, or thrown by the waves upon the shores of various countries, particularly in the southern hemisphere, is now generally believed to be produced in the intestines of the *Physeter macrocephalus*, or spermaceti whale, and perhaps in those of some other fish. It is in roundish or amorphous pieces, usually small, but sometimes of considerable magnitude; and masses have been found weighing 50, 100, and even 200 pounds. These pieces are often composed of concentric layers. They are of various colors, usually gray, with brownish, yellow, and white streaks, often dark-brown or blackish on the external surface. They are opaque, lighter than water, and of a consistence like that of wax. Ambergris has a peculiar aromatic agreeable odor, is almost tasteless, softens with the warmth of the hand, melts under 100° C. (212° F.), is almost completely volatilizable by heat, and is inflammable. It is insoluble in water, but is readily dissolved, with the aid of heat, by alcohol, ether, and the volatile and fixed oils. It consists chiefly of a peculiar fatty matter analogous to cholesterin, and denominated by Pelletier and Caventou *ambrein*. This may be obtained by treating ambergris with heated alcohol, filtering the solution, and allowing it to stand. Crystals of ambrein are deposited. It is incapable of forming soaps with the alkalies. When pure it has little or no odor. Ambergris is often adulterated; but does not then exhibit its ordinary fusibility and volatility. It was long regarded as a cordial and antispasmodic, somewhat analogous to musk; and has been recommended in typhoid fevers, and various nervous diseases. It formerly entered into many officinal preparations, and is still retained in some European Pharmacopœias. The French Codex directs a tincture to be prepared by macerating, for ten days, 100 parts of powdered ambergris with 1000 parts of alcohol at sp. gr. 0·864, expressing and filtering. M. Stan. Martin assures us that the tincture will keep better, deposit nothing, and have a more agreeable odor, if the ambergris, instead of being merely powdered in a mortar, be subjected to porphyrization, especially with the addition of washed sand. Heat, he says, should never be used in its preparation. (*Journ. de Pharm.*, 4e sér., i. 448.) It is, however, feeble as a remedy, and is much more used in perfumery than in medicine. The dose is from five grains to a drachm.

AMBROSIA TRIFIDA. *Ragweed.* (*Gray's Manual*, p. 212.) This and another indigenous species, *A. artemisiæfolia*, both annual plants, and usually ranked among worthless weeds, have found a place in the Materia Medica of the eclectics, by whom they are deemed astringent and somewhat exciting, and are given in low forms of fever, and other conditions of the system in which the vital actions are enfeebled.

AMMONIATED IRON. FERRUM AMMONIATUM. *Ammoniated Iron. Ammonio-chloride of Iron.* This drug was formerly recognized both by the U. S. and London Pharmacopœias, which contained formulas for its preparation. The following was the U. S. process. "Take of Subcarbonate of Iron *three ounces;* Muriatic Acid *ten fluidounces;* Muriate of Ammonia *two pounds and a half;* Distilled Water *four pints.* Mix the Subcarbonate of Iron with the Muriatic Acid in a glass vessel, and digest for two hours; then add the Muriate of Ammonia, previously dissolved in the Distilled Water, and, having filtered the liquor, evaporate to dryness. Rub the residue to powder." (*U. S.*) The process of the *London College* was essentially the same as the above, of which, in fact, it was the original. There is no reason to believe that the chloride of iron and chloride of ammonium are chemically combined in the preparation. According to Mr. Phillips, they are in the proportion of 15 parts of the iron to 85 of the ammonium salt.

Ammoniated iron, thus prepared, is in crystalline grains, of a fine reddish-orange color, and a sharp, styptic, saline taste. It is entirely soluble in water and diluted alcohol, is deliquescent, and should be kept in well-stoppered bottles. By the alkalies and their carbonates, and by lime-water it is decomposed, with the precipitation of about 7 per cent. of ferric oxide, and potassa in excess occasions the evolution of ammonia. Like the other chalybeates, it is incompatible with vegetable astringents. As procured by sublimation (*flores martiales, ens martis*), it is of a yellow color and feeble odor. It unites aperient with chalybeate properties, and is said to have been used with advantage in amenorrhœa, epilepsy, scrofula, rickets, etc.; but it is at best uncertain, and is now very seldom prescribed. The dose is from four to twelve grains.

AMYLAMINE, HYDROCHLORATE OF. (*Chloride of amylium.*) $C_5H_{13}N,HCl$, crystallizes either in efflorescent scales or quadratic octohedrons. The physiological action of this salt has been investigated by M. Dujardin-Beaumetz. (*Comptes-Rendus*, lxxvii. 1247.) In small doses (1 to 5 centigrammes to a rabbit) it lowered the temperature and also the force and frequency of the pulse. In larger amounts it produced profound nervous disturbance, with tonic and clonic convulsions, ending often in death. In man he found it, in doses of from 7 to 15 grains, to diminish the pulse and temperature.

ANACAHUITE WOOD. Under this name, in the year 1860, considerable quantities of a peculiar wood were imported from Tampico, in Mexico, into Germany, where for a short time it attracted great attention as a supposed remedy in phthisis, but failed to sustain its first reputation. It is the product of *Cordia Boissieri* of Alphonse de Candolle. (See *P. J. Tr.*, Dec. 1862, p. 272, where the plant is figured.)

ANACARDIUM OCCIDENTALE. Linn. *Cassuvium pomiferum.* Lam. *Cashew-nut.* A small and elegant tree, growing in the West Indies, and other parts of tropical America. A gum exudes from the bark, which bears some resemblance to gum arabic, but is only in part soluble in water, and consists of true gum and bassorin. It is the *gomme d'acajou* of the French writers. The fruit is a fleshy, pear-shaped receptacle, supporting at its summit a hard, shining, ash-colored, kidney-shaped nut, an inch or more in length, and three-quarters of an inch broad, consisting of two shells, with a black juice between them, and of a sweet oily kernel. The receptacle is red or yellow, and of an agreeable subacid flavor with some astringency. It is edible, and affords a juice which has been recommended in uterine complaints and dropsy. This juice is converted by fermentation into a vinous liquor, which yields a spirit by distillation, used in making punch, and said to be powerfully diuretic. The nuts are well known under the name of *cashew-nuts.* The black juice, contained between their outer and inner shell, is extremely acrid and corrosive, producing, when applied to the skin, severe inflammation, followed by blisters or desquamation. It has been examined chemically by Staedeler, who found in it two peculiar principles, one having acid properties, which he calls *anacardic acid*, and the other a yellow, oleaginous liquid, named *cardol.* (See *Journ. de Pharm.*, 3e sér., xiii. 459.) The juice is used in the West Indies for the cure of corns, warts, ringworms, and obstinate ulcers, and even of elephantiasis. It is said to be sometimes applied to the face by females, in order to remove the cuticle, and produce a fresher and more youthful aspect. In a case of external poisoning which came under our notice, in a lady who was exposed to the fumes of the nut while roasting, the face was so much swollen that for some time not a feature was discernible. A similar case, occurring in a boy who had cut open one of the nuts, eaten a small portion raw, and by handling it had spread the juice over different parts of the body, is recorded by Dr. Monkur in the *N. J. Med. Reporter* (April, 1855, p. 187). The tongue, face, neck, hands, forearms, scrotum, etc., were red and enormously swollen, and very painful. The tincture of iodine was found useful as a local application. The kernel has a sweet, agreeable taste, and is eaten like chestnuts, either raw or roasted. It is also used as an ingredient of puddings, etc., and forms an excellent chocolate when ground with cocoa. By age it becomes rancid. The black juice of the nut, and a milky juice which flows from the tree after incision, are sometimes used for marking linen, which they stain almost indelibly.

ANAGALLIS ARVENSIS. *Scarlet Pimpernel.* An annual plant, growing in Europe and this country, with small, delicate, procumbent stems, furnished with opposite branches, opposite ovate leaves, and small scarlet flowers, which are supported upon axillary, solitary peduncles, and appear in June and July. It has little smell, but a bitterish, somewhat acrid taste. The ancients esteemed it a counter-poison, and in modern times it has been used as a preventive of hydrophobia. It is not wholly inactive; as Orfila found three drachms of an extract prepared from it sufficient to destroy a dog, with marks of inflammation of the bowels. It has been recommended as a local application to old and ill-conditioned ulcers, and has been given internally in visceral obstructions, consumption, dropsy, epilepsy, mania, etc. Mr. J. A. Heintzelman obtained a small quantity of volatile oil from the dried herb, and found it of a strong peculiar odor, a pungent and somewhat acrid taste, and the sp. gr. 0·987. Four drops of it produced intense headache and nausea, lasting for 24 hours, with pains throughout the body. Another species, considered by Linnæus as a variety of *A. arvensis*, is *A. cærulea*, distinguished by its blue flowers. The medical properties of the two are the same.

ANCHUSA OFFICINALIS. *Bugloss.* This species of Anchusa is a native of Europe, and unknown in the United States. It is a biennial plant, from one to three feet high, and was formerly much esteemed as a medicine. The root, leaves, and flowers were officinal. These are inodorous and nearly tasteless. The root is mucilaginous and slightly sweetish, and the flowers very feebly bitter. The plant has no claim whatever to the credit, formerly attached to it, of possessing cordial and exhilarating properties. It was used by the ancients in hypochondriacal affections; but, as it was given in wine, the elevation of spirits was probably due to the vehicle. In France, the *Anchusa Italica*, which is there known as *buglosse*, is substituted for *A. officinalis.*

ANDROMEDA ARBOREA. *Sorrel-tree.* A beautiful indigenous tree, growing in the valleys of the Alleghanies, from Pennsylvania to Florida. The leaves have a pleasant acid taste, and are used by hunters to allay thirst, and form in decoction a grateful refrigerant drink in fevers. Dr. Barton, in his "Collections," states that a decoction of *A. Mariana* is employed in the Southern States, as a wash in a disagreeable ulceration of the feet to which the negroes are liable. The powder upon the leaves and buds of *A. speciosa* is said to be a powerful errhine. The oil of *A. Leschenaultii*, a native of India, was found by Mr. J. Broughton to be methyl salicylate, almost identical with oil of wintergreen. (*P. J. Tr.*, Oct. 1871.)

ANGELICA. *Angelica atropurpurea*, sometimes called *masterwort*, has a perennial purplish root, and a smooth herbaceous stem, the dark color of which has given rise to its specific name. The leaves are ternate, and supported by very large inflated petioles. The partitions of the leaf are nearly quinate, with ovate, acute, deeply serrate, somewhat lobed leaflets, of which the three terminal are confluent. The flowers are greenish-white. The purple angelica extends throughout the United States from Canada to Carolina, growing in meadows and marshy woods, and flowering in June and July. It is smaller than *A. Archangelica*, with a less succulent stem. The whole plant was formerly officinal. It has a strong odor, and a warm aromatic taste. The juice of the recent root is acrid, and is said to be poisonous; but the acrimony is dissipated by drying. The medical virtues of the plant are similar to those of the garden angelica of Europe, for which it has been proposed as a substitute. It is, however, little employed. An infusion is occasionally used in flatulent colic, and we are told that the stems are sometimes candied by the country people.

Angelica Archangelica. Garden Angelica has a long, thick, fleshy, biennial root, furnished with many fibres, and sending up annually a hollow, jointed, round, channeled, smooth, purplish stem, which rises five feet or more in height, and divides into numerous branches. The leaves, which stand upon round fistulous footstalks, are very large, doubly pinnate, with ovate-lanceolate, pointed, acutely serrate leaflets, the terminal being three-lobed. The flowers are small, greenish-white, and disposed in very large, many-rayed terminal umbels, composed of numerous dense, hemispherical umbellets. This plant is a native of the north of Europe, and is found in the high mountainous regions in the southern section of that continent, as in Switzerland and among the Pyrenees. It is cultivated in various parts of Europe, and may be occasionally met with in the gardens of this country. It flowers during the summer. The whole plant has a fragrant odor and aromatic properties; but the root and fruit only were officinal. 1. The *root* should be dug up in the autumn of the first year, as it is then least liable to become mouldy and worm-eaten. It is spindle-shaped, an inch or more thick at top, and beset with long descending radicles. The fresh root has a yellowish-gray epidermis, a fleshy yellow parenchyma, and when wounded yields a honey-colored juice, having all the aromatic properties of the plant. The dried root is grayish-brown and much wrinkled externally, whitish and spongy within, and breaks with a starchy fracture, exhibiting shining resinous points. It is very apt to be attacked by worms, and is said to keep best, in the state of powder, in full and well-closed vessels. The smell is strong and fragrant, and the taste at first sweetish, afterwards warm, aromatic, bitterish, and somewhat musky. These properties are extracted by alcohol, and less perfectly by water. The constituents of the root, according to the younger Buchner, are volatile oil, a volatile acid which he calls *angelicic acid*, a wax-like substance, a crystallizable sub-resin, a brittle amorphous resin, a bitter principle, tannic acid, malic acid, sugar, starch, albumen, pectic acid, fibrin, and various salts. Five hundred parts yield nearly four parts of volatile oil. The angelicic acid of Buchner is now known as *angelic acid*, $C_5H_8O_2$, a monatomic acid of the acrylic acid series. Valerianic acid, $C_5H_{10}O_2$, has also been recognized as occurring in the root. 2. The *seeds*, as the fruit is commonly called, are two or three lines long, oval, obtuse or somewhat notched at the ends, flat, with a longitudinal furrow on one side, convex with three angular ridges on the other. They are ash-colored, and have the smell and taste of the root. They are said to keep well.

Garden angelica is an elegant aromatic tonic. The Laplanders, in whose country it flourishes, esteem it highly as a condiment and medicine. In Europe, the stems are frequently made into a preserve, and used in desserts in order to excite the stomach. The dose of the root or seeds is from thirty grains to a drachm.

ANGRÆCUM FRAGRANS. This is an orchidaceous plant, indigenous in the Isle of Bourbon and Mauritius, where the leaves have been long used, under the name of *faham*, for the same purposes as Chinese tea. According to Dr. H. Paschkis, the drug as it appears in the French market consists of well-preserved entire leaves and leafy stalks. The leaves are yellow to yellowish brown, softening like leather in water, and very tough. When freshly obtained they have an agreeable coumarin-like odor. They reach a length of about 7 cm. (3 inches) and a breadth of more than 1 cm. In form they are linear, rounded at the apex, and split up by a shallow indentation into two unequal roundish points; at the base they alternate only slightly, and surround the petiole like a sheath. The parallel veins are somewhat more prominent on the under side than on the upper. (*P. J. Tr.*, 1881, p. 913.) They have a somewhat pungent aromatic taste, and a strong and highly agreeable odor, scenting the whole apartment with a delicious perfume. Given in infusion, they appear to have an effect on the system somewhat similar to that of Chinese tea, and have been introduced into Paris as a rival of that popular beverage. The drink is made by putting the leaves and stalks, in the proportion of 15 grains to a teacupful, into cold water, boiling for about ten minutes, and then pouring into a closed vessel, and sweetening it when used. (*A. J. P.*, 1866, p. 441.)

ANILIN. *Aniline. Anilia.* $C_6H_5.NH_2$. This is an organic base obtained from coal tar or more immediately from nitrobenzol. It was first discovered by Unverdorben, in 1826, among the products of the dry distillation of indigo, and was named by him *crystalline.* Fritzsche, who obtained it afterwards from indigo by another process, seems to have been the first to give it the name of anilin, from the Portuguese word *anil* (indigo). In 1837, Runge obtained three volatile principles from coal tar, which he named *kyanol*, *leucol*, and *pyrrhol*. Of these, kyanol was afterwards found by Hoffmann to be identical with anilin, and leucol has been ascertained to be the same as quinolin (chinolin). Nitrobenzol is now the source whence most of the anilin of commerce is derived. Nitrobenzol, acetic acid, and iron turnings in equal weights are introduced into a cast-iron vessel, care being taken that the heat produced does not rise too high, when the following reaction takes place: $C_6H_5.NO_2 + H_6 = C_6H_5.NH_2 + (H_2O)_2$. The semi-solid mass which soon forms consists principally of ferrous acetate and acetate of anilin. This is distilled in a large cast-iron cylinder, and the distillate redistilled, the portion coming over between 175° C. (347° F.) and 190° C. (374° F.) being collected, and considered sufficiently pure for manufacturing purposes.

Properties. Pure anilin is a thin colorless fluid, of an oily appearance; but as found in commerce it is generally more or less colored, and sometimes of a deep reddish brown. It has a peculiar not disagreeable odor, and a pungent, aromatic, burning taste, and the sp. gr. 1·020 (*Hoffmann*), 1·028 (*Fritzsche*). It is not solidified at —20° C. (—4° F.), boils at 182° C. (360° F.), and its vapors are condensed unchanged. It is slightly soluble in water, but dissolves in all proportions in ether, alcohol, wood-spirit, aceton, bisulphide of carbon, and oils, fixed and volatile. Though possessed of strong basic powers, it does not restore the color of reddened litmus, nor does it redden turmeric. It changes, however, the violet color of dahlias to green. With the acids it forms soluble and readily crystallizable salts. It is inflammable, and absorbs oxygen from the air, becoming at first yellowish, afterwards reddish, and ultimately brown. A characteristic property is that it produces instantly a deep-blue or purple color when brought into contact with chlorinated lime or other hypochlorite. Dr. Letheby has described a very delicate test for this base. If a drop of a very weak solution of the sulphate be placed on a piece of clean platinum foil, and touched with the negative pole of a galvanic battery, the solution acquires a bluish, then a violet, and ultimately a pink color. (*P. J. Tr.*, Sept. 1862, p. 128.) It is a derived ammonia, having the group C_6H_5 in place of a hydrogen atom of the NH_3 molecule. It is hence often called *phenyl-amine.* The chief value of anilin at present is for the coloring matters derived from it. Beautiful reds, purples, yellows, and blues, and various other tints, are obtained from it, some of them truly magnificent. Some of these colors are advantageously used in the preparation of inks. For the mode of making these see *A. J. P.*, 1868, pp. 332 and 335.

Anilin black or *nigrosin* was discovered by Wolff in 1863 As it occurs in commerce at present (1882) it is a salt having the composition $C_{36}H_{29}N_3HCl$; if prepared from pure anilin it is of a deep-blue color; if toluidin is present, it approaches a black in direct proportion to the amount of toluidin in it; it is very soluble in water, and 10 grains dissolved in 1 fluidounce of water makes a good *nigrosin ink*, which, however, should not be exposed to too strong a light, as all anilin inks fade in time. Böttger uses anilin red in detecting cotton in any fabric with which it is mixed. He dips a portion of the texture in an alcoholic solution of this coloring matter, then washes it with water till the washings are colorless, and puts it into a watery solution of ammonia. If cotton be present, its threads will be deprived of color, while the linen will continue of a bright rose color. (See *A. J. P.*, Jan. 1866, p. 86.) Under the name of *anilin oil* a liquid is to be found in commerce which consists of a mixture of anilin, toluidin, xylidin, cumidin, and varying quantities of by-products found in the "tailings;" the boiling point ranges between 180° C. (356° F.) to 210° C. (410° F.), and the sp. gr. is also variable; it is used as a solvent for rubber, copal, etc.

Medical Properties and Uses. Anilin is said by Wöhler and Frerichs to have no poisonous action on dogs. This is, however, contradicted by the experiments of Dr. Letheby, who found that from 20 to 60 drops given to dogs and cats caused a rapid loss of respiratory powers, passing into coma, and ending in death. (*Guy's Hosp. Reports*, 1864, p. 198.) Some experiments have been made which show that it has a deleterious influence on leeches and frogs, and young rabbits were killed by it. A case is on record in which a workman having been exposed strongly to the vapors of anilin, in consequence of a vessel containing it having broken and spilled the contents over his person, was seized with symptoms of great prostration, from which, however, he recovered under stimulating treatment. (*Med. Times and Gaz.*, June 7, 1862.) Several other instances have since occurred, in which persons inhaling the vapor of anilin in the process of manufacture have been seriously affected; the prominent symptoms being violent attacks of neuralgia, heaviness in the head, giddiness, and apparent prostration, sometimes confining the workmen to bed for days; but in all instances recovery took place, leaving, so far as appears, no serious evil behind; showing that the action of the poison is directed mainly, if not exclusively, to the nervous system. (*B. and F. Med.-Chir. Review*, April, 1866, p. 539.) It would seem, however, from the experiments of Dr. Letheby, that the salts of anilin are destitute of the poisonous properties of the pure alkaloid; though a change of color is sometimes produced by them; a patient who had taken a considerable quantity of the sulphate having his skin, nails, and gums stained yellow. The color, however, disappeared in a few days. (*Jour. de Pharm.*, 4e sér., iii. 397.) Some of the anilin colors, or those derived from substances belonging to the same series, used in dyeing, are said to have a violently irritant effect upon the skin to which the fabric dyed with them may be brought into contact; and, in some instances, constitutional effects seem to have been induced. These are, however, probably due to the anilin being contaminated with arsenic, which is used in its manufacture. (*A. J. P.*, 1875, p. 210; *Med. Times and Gaz.*, Jan. 1870, p. 46.) For further observations on this point, see article on *coralline.* Dr. Turnbull, of Liverpool, has employed the sulphate remedially, and speaks favorably of its effects in chorea. A remarkable effect which he found it to produce was a transient blueness of the skin and lips, which he ascribed to the oxidation of anilin in the blood. (*P. J. Tr.*, Nov. 1861, p. 284.) In some instances headache and general symptoms of general depression were experienced, which, however, disappeared without leaving any unpleasant effect. The sulphate is made by simply saturating the alkaloid with the acid. Prof. Procter gives the following formula. Take 500 grains of pure anilin, 250 grains of sulphuric acid, and 4 fluidounces of distilled water. Mix the acid and water, add the anilin, and agitate till a thick mass is formed, and the odor of anilin is lost. Wash this with strong alcohol till the acid and coloring matter are removed, press the salt in bibulous paper, and dry it in the dark. (*A. J. P.*, July, 1862, p. 298.) The salt is liable to be decomposed, and to change color when exposed to air and light. Water at 15·6° C. (60° F.) dissolves about 6 per cent. It is only sparingly soluble in cold, but freely in hot absolute alcohol. It is more soluble in diluted alcohol, and insoluble in ether. The limits of the dose have not been satisfactorily determined. It has been given in the dose of three-fourths of a grain gradually increased to four or even seven grains, without any derangement of the functions, except the change of color above referred to; but how far the latter dose may be exceeded with impunity has not been ascertained. (*Ann. de Thérap.*, 1864, p. 101.) From trials which have been made of the remedy by Drs. Fraser and Davis, it has been inferred that the sulphate is much less powerful than the free alkaloid; and it is even stated that, while anilin itself is a powerful poison, the sulphate has little effect on the system. (*P. J. Tr.*, Sept. 1863, p. 133.) Since the statements here made, the sulphate of anilin has been used in chorea and epilepsy with varying success. After failure in several cases of chorea, Dr. Fraser treated the disease successfully in two cases of a rather unpromising character, giving 5 grains of the sulphate three times a day. About half an hour after the medicine was taken, the mucous membrane of the mouth, and the nails, became of a mauve color, which increased for about two hours, and then disappeared. The patients complained more or less of headache and giddiness in the course of the treatment. In one case 200 grains of the medicine were taken in about three weeks. (*Med. Times and Gaz.*, Aug. 1865, p. 142.) Dr. Filiberti, of Lyons, gives the sulphate with encouraging results in chorea and epilepsy. Beginning with a grain and one-half daily in two doses, he increases by the same amount daily till 15 grains is reached, when he diminishes it in the same proportion till reduced to from 3 to 7 grains daily, which is continued. (*Ann. de Thérap.*, 1865, p. 124.*)

ANIMÉ. *Gum Animé.* The substance known at present by the name of animé is a resin supposed to be derived from the *Hymenæa Courbaril*, a tree of South America; though this origin is denied by Hayne. According to Dr. W. Hamilton, the resin exudes from wounds in the bark, and is found also underneath the surface of the ground, between the principal roots. (*P. J. Tr.*, vi. 522.) It is in small, irregular pieces, of a pale lemon yellow color, sometimes inclining to reddish, more or less transparent, covered with a whitish powder, brittle, and pulverizable, with a shining fracture, a weak but agreeable odor, and a mild, resinous taste. It softens in the mouth, adheres to the fingers when in powder, and readily melts with heat, diffusing its agreeable odor in an increased degree. It consists of two resins, one soluble, the other insoluble in cold alcohol, and of a small proportion of volatile oil. There is a variety of a darker color, less transparent, and with small cavities in the interior; in other respects resembling the preceding. Another variety is the East Indian, supposed to be derived from *Vateria Indica;* but this never reaches American commerce. Animé formerly entered into the composition of various ointments and plasters; but is now used only as incense, or in the preparation of varnishes. The Brazilians employ it internally in diseases of the lungs.

ANNATTO. *Orleana.* The coloring substance called *annatto*, *arnatta*, or *roucou*, is the reddish pulp surrounding the seeds in the fruit of *Bixa Orellana*, a middling-sized tree, growing in Guiana, and other parts of South America. For a paper on the cultivation of this tree and the mode of preparing the annatto, by Mr. Th. Peckolt, see *A. J. P.*, July, 1859, p. 360. The pulp is separated by bruising the fruit, mixing it with water, then straining through a sieve, and allowing the liquid to stand till the undissolved portion subsides. The water is then poured off, and the mass which remains, having been sufficiently dried, is formed into flat cakes or cylindrical rolls, and sent into the market. Another mode is to bruise the seeds, mix them with water, and allow the mixture to ferment. The coloring matter is deposited during the fermentation, after which it is removed and dried. In commerce there are two kinds of annatto, the Spanish or Brazilian, and French; the former coming in baskets from Brazil, the latter in casks from French Guiana. The French, which is also called *flag annatto*, has a disagreeable smell, probably from having been prepared by the fermenting process; but is superior, as a dye-stuff, to the Spanish, which is without any disagreeable odor. Annatto is of a brownish red color, usually rather soft, but hard and brittle when dry, of a dull fracture, of a sweetish peculiar odor, and a rough, saline, bitterish taste. It is inflammable, but does not melt with heat. It softens in water, to which it imparts a yellow color, but does not dissolve. Alcohol, ether, the oils, and alkaline solutions dissolve the greater part of it. It contains a peculiar crystallizable coloring principle, to which M. Preisser, its discoverer, gave the name of *bixin*. (See *Journ. de Pharm.*, 3e sér., v. 258.) For the mode of obtaining and the properties of this principle, see *Journ. de Pharm.*, Janv. 1875, p. 78; also t. xxviii. p. 517, and *Ber. Deutsch. Chem. Ges.*, 1878, p. 864; *A. J. P.*, Aug. 1878. The chief uses to which annatto is applied are for dyeing silk and cotton orange-yellow, and for coloring cheese and butter. The color, however, which it imparts to cloth is fugitive. It has been given internally as a medicine; but is not now used, and probably exercises little influence upon the system. In pharmacy it is used to color plasters, and has occasionally been substituted for saffron. It is frequently adulterated with red ochre, powdered bricks, colcothar, farinaceous substances, chalk, sulphate of calcium, turmeric, etc. The mineral substances, if present, will be left behind when the annatto is burned. (See, in reference to its adulteration, *P. J. Tr.*, xv. 199, 299, and 323.)

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* For an article upon the methods of detecting anilin in the body, see *Journ. de Pharm.*, 4e sér., xix. 341, 417.

ANTENNARIA MARGARITACEA. This is one of our indigenous plants which are known commonly by the name of *life-everlasting*. (See Gray's *Manual of Botany*.) The flowers are of a pearly whiteness, and slightly fragrant. The leaves are the part used, having the credit, with the "eclectics," of being somewhat astringent and expectorant. (See *Gnaphalium margaritaceum.*)

ANTHRAKOKALI. This preparation, introduced by Dr. Polya, is of two kinds, the simple and the sulphuretted. The *simple anthrakokali* is formed by adding 160 parts of porphyrized mineral coal to 192 parts of a concentrated and boiling solution of caustic potassa, contained in an iron vessel, the whole being well stirred together. When the mixture is completed, the vessel is taken from the fire, and the stirring continued until the whole is converted into a homogeneous black powder. The *sulphuretted anthrakokali* is prepared in a similar manner, 16 parts of sulphur being mixed with the mineral coal before it is added to the caustic potassa solution. Dr. Polya recommends these preparations, both internally and externally, in scrofula, chronic rheumatism, rheumatic tumors of the joints, and certain herpetic affections. The dose is a grain and a half three or four times a day, mixed with two or three times its weight of powdered liquorice root. For external use, sixteen grains may be rubbed with an ounce of lard to form an ointment, to be used by friction night and morning.

ANTHRISCUS CEREFOLIUM. De Cand. *Chærophyllum sativum.* Lam. *Scandix Cerefolium.* Linn. *Chervil.* An annual European plant, cultivated in gardens as a pot-herb. It has a strong agreeable odor, especially when rubbed, and a pungent, slightly bitterish taste. These properties it owes to a volatile oil. It is said to be deobstruent, diuretic, and emmenagogue, and has been recommended by different authors in consumption, scrofula, dropsy, cutaneous and scorbutic affections, and as an external application to swollen breasts, bruises, and other local complaints or injuries. It is, however, very feeble, and is used chiefly as an addition to broths.

ANTIHYDROPIN. *Pulvis Taracanæ.* The powdered Russian cockroach (*Blatta Lapponica*), asserted, in the dose of 10 to 15 grains, to be actively diuretic and useful in dropsy. Bogomolow (*Ph. Centralb.*, July, 1879) found in them a crystalline principle, *antihydropia*, or *taracanin*.

ANTIMONIATED HYDROGEN. H_3Sb. This is a gaseous substance, and, being taken by inhalation, is prepared at the moment of administration. For process, see *Bouchardat's Annuaire* (1860, p. 143). A method of preparing pure antimoniated hydrogen will be found described in the *Med. Times and Gaz.* (Oct. 1865, p. 402).

ANTIRRHINUM LINARIA. Linn. *Linaria Vulgaris.* (Lindley.) *Common Toad-flax. Butter and Eggs. Ramsted.* This is a perennial herbaceous plant, from one to two feet high, with numerous narrow linear leaves, and a terminal crowded spike of large yellow flowers. It is a native of Europe, but has been introduced into this country, and now grows in great abundance along the roadsides, through the Middle States. It is readily distinguishable by the shape of its leaf, and its conspicuous yellow flowers, which appear in succession from June to October. The herb is the part used. It should be collected when in flower, dried quickly, and kept excluded from the air. When fresh it has a peculiar, heavy, rather disagreeable odor, which is in a great measure dissipated by drying. The taste is herbaceous, weakly saline, bitter, and slightly acrid. This plant is said to be diuretic and cathartic, and has been used in dropsy, jaundice, and cutaneous eruptions. It is most conveniently employed in infusion. The fresh plant is sometimes applied, in the shape of poultice or fomentation, to hemorrhoidal tumors; and an ointment made from the flowers has been employed for the same purpose, and also locally in diseases of the skin. The flowers are used in Germany for dyeing yellow.

APIUM PETROSELINUM. *Petroselinum. U. S.* 1870. (*Persil*, Fr.; *Petersilie*, G.; *Prezzemolo*, It.) *Petroselinum sativum.* Hoffman, *Umb.* i. t. 1, f. 2.—Parsley is an umbelliferous plant having a biennial root, with an annual, round, furrowed, jointed, erect, branching stem, about two feet in height. The radical leaves are compound, pinnated in ternaries, with the leaflets smooth, divided into three lobes, and notched at the margin. In the cauline leaves, the segments of the leaflets are linear and entire. The flowers are small, pale yellow, and disposed in terminal compound umbels, with a one or two-leaved general involucre, and partial ones composed of six or eight leaflets. The petals are five, roundish, and inflexed at their apex. The seeds (half fruits) are small, ovate, flat on one side, convex on the other, dark green, and marked with five longitudinal ridges. They have a strong terebinthinate odor, and a warm aromatic taste.

The plant is a native of Sardinia, and other parts of Southern Europe, and is cultivated everywhere in gardens. All parts of it contain a volatile oil, to which it owes its odor and mainly its taste, as well as its use in seasoning. This oil consists of a hydrocarbon, $C_{10}H_{16}$, and a camphor, $C_{12}H_{14}O_4$, crystallizing in white silky needles, which fuse at 30° C. (86° F.), and boil at about 300° C. (572° F.), subliming with partial decomposition. Braconnot obtained from the herb a peculiar substance, resembling pectic acid in appearance, which he named *apiin.* It differs from pectin in being more soluble in alcohol than in cold water, in not being precipitated by alcohol from its watery solution, and in being separated by acids from its alkaline solutions unaltered, whereas pectin is under these circumstances converted into pectic acid. (*Journ. de Pharm.*, 3e sér., xix. 448.) It is procured by boiling the herb in water, straining the liquor, and allowing it to cool. The apiin then forms a gelatinous mass, which requires only to be washed with cold water. Its formula is $C_{24}H_{28}O_{13}$. (*Philos. Mag.*, xxiv. 155.) Though the root is the part directed by the Pharmacopœia, the fruit is at least equally efficient. Examined by MM. Joret and Homolle, the seeds were found to contain a volatile oil, a crystallizable fatty matter, pectin, which they believe to be the apiin of Braconnot, chlorophyll, tannin, a coloring matter, extractive, lignin, various salts, and, in addition to these, a peculiar substance to which they gave the name of *apiol.* This is a yellowish oily liquid, not volatile, heavier than water, of a peculiar and tenacious odor distinct from that of the plant, and an acrid pungent taste. It is inflammable, insoluble in water hot or cold, very soluble in alcohol, and dissolved in all proportions by ether and chloroform. It is analogous to the fixed oils, but is not chemically modified by the alkalies. It contains no nitrogen. To obtain it MM. Joret and Homolle exhausted the seeds with alcohol, treated the tincture with purified animal charcoal, distilled off three-fourths of the alcohol, treated the residue with ether or chloroform, evaporated the solution thus formed, mixed the residuary liquid with an eighth of its weight of litharge, allowed the mixture to rest twenty-four hours, and then filtered through a light layer of charcoal.

According to Dr. L. Wolff (*A. J. P.*, 1877, p. 2), commercial apiol is merely the oleoresin: he proposes a very simple process for true apiol. Powdered parsley seed is exhausted with benzin, and the liquid is spontaneously evaporated; the residue is a mixture of fixed oil, wax, and apiol; the apiol alone being soluble in alcohol can easily be separated by repeated washings with strong alcohol; the washings evaporated over a water-bath at a gentle heat leave as a residue "true apiol."

Mr. H. C. Whitney (*N. R.*, January, 1880) proposes to change the name of commercial apiol, and call it oil of parsley seed. He believes that the volatile oil of parsley seed is the active and emmenagogue principle, and obtains it by distilling the freshly-powdered seed with salt water. The yield was 4·27 per cent. of an oil which corresponded closely with Joret and Homolle's apiol. Gerichten (*Berichte d. Deutsch. Chem. Ges.*, 16, 17) obtained besides the peculiar terpene, parsley camphor, which he thinks is alone entitled to the name of apiol. He gives its melting point at 30° C. (86° F.), boiling point 300° C. (572° F.), and sp. gr. 1·015.

The root is spindle-shaped, about as thick as the finger, externally white, and marked with close annular wrinkles, internally fleshy and white, with a yellowish central portion. It has a pleasant smell, and a sweetish, slightly aromatic taste, but loses these properties by long boiling, and by time. Parsley *root* in the recent state is said to be aperient and diuretic, and is occasionally used in nephritic and dropsical affections. The *juice* of the fresh herb has been employed as a substitute for quinine in intermittents;

and the *seeds*, as well as their supposed active principle, have been given with great asserted success in the same complaint. According to MM. Joret and Homolle, *apiol* produces, in the dose of about 15 grains (1 Gm.), a slight cerebral excitation without unpleasant effects of any kind, and, in double or quadruple the quantity, a species of intoxication, with giddiness, morbid sights and sounds, and frontal headache. They found it to cure intermittents; but subsequent observations have shown that it has very little antiperiodic power. MM. Joret and Baillot commend it in amenorrhœa and dysmenorrhœa, in the dose of about four grains morning and evening; in the former affection in anticipation of the menstrual period, in the latter during its continuance. Experience has confirmed its value as an emmenagogue, but it is best used in a single dose of fifteen grains, given in capsules, at the time of the molimen.

AQUILEGIA VULGARIS. *Columbine.* A perennial herbaceous plant, indigenous in Europe, but cultivated in our gardens as an ornamental flower. All parts of it have been medicinally employed. The root, leaves, and flowers have a disagreeable odor, and a bitterish, acrid taste. The seeds are small, black, shining, inodorous, and of an oleaginous sweetish taste, followed by a sense of acrimony. Columbine has been considered diuretic, diaphoretic, and antiscorbutic, and has been employed in jaundice, in smallpox to promote the eruption, in scurvy, and externally as a vulnerary. It is not used at present, and probably, like other Ranunculaceæ, possesses dangerous properties.

ARALIA (*Racine d'aralia nude*, Fr.; *Nackte Aralienwurzel*, G.). *Aralia Nudicaulis, False Sarsaparilla, Wild Sarsaparilla, Shotbush*, or *Small Spikenard*, is an indigenous perennial, belonging to the natural order Araliaceæ, with one leaf and one flower-stem, springing together from the root, or from a very short smooth stalk, and seldom rising two feet in height. The leaf, which stands upon a long footstalk, is twice ternate, or once and quinate, with oblong-oval, acuminate leaflets, rounded at the base, serrate on the margin, and smooth on both surfaces. The scape or flower-stem is naked, shorter than the leaf, and terminated by three small umbels, each consisting of from twelve to thirty small yellowish or greenish flowers. The fruit consists of small round berries, about as large as those of the common elder. The plant grows throughout the United States, from Canada to the Carolinas, inhabiting shady and rocky woods, and delighting in a rich soil. It flowers in May and June. The root is horizontal, creeping, sometimes several feet in length, about as thick as the little finger, more or less twisted, of a yellowish-brown color externally, of a fragrant odor, and a warm, aromatic, sweetish taste. It has not been analyzed. *Aralia racemosa* (*American Spikenard*) is distinguished by its herbaceous widely branched stem, which is furnished with leaves, whose leaflets are heart-ovate, pointed, doubly serrate, slightly downy, and also by its blackish or dark-purple fruit being in very numerous umbels, and so clustered as to make a large compound panicle. Its rhizome is short, two or more inches thick, furnished with closely placed, large, nodose stem-scars, and numerous roots one to two feet long, which are much branched below. In odor and taste it resembles *A. nudicaulis*, but is more spicy. *Aralia hispida* (*Bristly Sarsaparilla, Dwarf Elder*) closely resembles *A. nudicaulis*, but is distinguished by its larger stem, which is also bristly and leafy. Its root has been used as a diuretic in dropsy. (*Am. J. Med. Sci.*, xix. 117.)

Aralia racemosa and *A. nudicaulis* have been used especially in domestic practice as a gently stimulant diaphoretic and alterative, chiefly in rheumatic, syphilitic, and cutaneous affections, in the same manner and dose as genuine sarsaparilla. A strong decoction has proved useful as a stimulant to old ulcers.

ARALIA SPINOSA. This is an indigenous arborescent shrub, variously called *angelica-tree, Hercules' club, toothache-tree*, and *prickly ash*. The last name, however, should be dropped; as it belongs properly to *Xanthoxylum fraxineum*, and if retained might lead to confusion. The stem is erect, simple, from eight to twelve feet high, armed with numerous prickles, and furnished near the top with very large bipinnate or tripinnate leaves, which are also prickly, and are composed of oval, pointed, slightly serrate leaflets. It terminates in an ample panicle, very much branched, and bearing numerous small hemispherical umbels, in each of which are about thirty white flowers. This species of Aralia is found most abundantly and of the largest growth in the Southern States, where it is said sometimes to attain a height of from thirty to sixty feet. It grows also in the Western States, and as far north as New York. It is sometimes cultivated in the gardens of the North as a curious or ornamental plant. It flourishes in low, fertile woods, and flowers in August and September. The bark, root, and berries are medicinal.

The bark (*Ecorce d'aralia épineuse*, Fr.; *Dornige Aralienrinde*, G.), as in the shops, is usually in small quills or half quills, from two or three lines to half an inch in diameter, thin, fibrous, grayish externally, and armed with prickles or the remains of them, yellowish within, of an odor somewhat aromatic, and a bitterish taste, which becomes slightly acrid on chewing, and leaves a lasting sense of pungency upon the tongue. It yields its virtues to boiling water. C. W. Elkins found in the bark, starch, glucose, gum, pectin, two acrid resins, volatile oil in small quantity, and what he believed to be an uncrystallizable alkaloid. (*A. J. P.*, Aug. 1880.)

Medical Properties and Uses. The virtues of *Aralia spinosa* are those of a stimulant diaphoretic. According to Elliot, an infusion of the recent bark of the root is emetic and cathartic. The remedy is used in chronic rheumatism and cutaneous eruptions; and in some parts of the South has been employed in syphilis. Pursh states that a vinous or spirituous infusion of the berries is remarkable for relieving rheumatic pains; and a similar tincture is said to be employed in Virginia with advantage in violent colic. The pungency of this tincture has also been found useful in relieving toothache. The bark is most conveniently administered in decoction.

ARECA NUT. *Betel Nut.* This is the product of *Areca Catechu*, an East India tree belonging to the family of palms. The fruit, which is about the size and shape of a small egg, and of an orange-yellow color, contains the nut embedded in a fibrous, fleshy envelope, and invested with a brittle shell which adheres to the exterior flesh. The kernel, which is the betel nut of commerce, is of a roundish conical shape, rather larger than a chestnut, externally of a deep-brown, diversified with a fawn color, so as to present a reticular appearance, internally brownish red with whitish veins, very hard, of a feeble odor when broken, and of an astringent, somewhat acrid taste. It abounds in tannin, and contains also gallic acid, a fixed oil, gum, a little volatile oil, lignin, and various saline substances. Flückiger found that the tannic acid yielded a green color turning to brown with ferric salts (*Pharmacographia*, p. 671). It yields its astringency to water; and in some parts of Hindostan an extract is prepared from it having the appearance and properties of catechu. Immense quantities of the nut are consumed in the East, mixed with the leaves of the Piper Betel, and with lime, forming the masticatory so well known by the name of *Betel*. The red color which this mixture imparts to the saliva and the excrements is owing to the areca nut, which is also powerfully astringent, and, by its internal use, tends to counteract the relaxation of bowels to which the heat of the climate so strongly predisposes. (See *N. R.*, 1876, p. 71.) The nut is used in this country almost exclusively in the preparation of tooth powder, for which purpose it is first reduced by heat to the state of charcoal. The superiority of this form of charcoal over that from other sources is probably owing to its hardness. The nut has been used successfully by Dr. Edwin Morris in the treatment of the tapeworm, in doses of from four to six drachms. (*Am. J. Med. Sci.*, April, 1862, p. 496.) In India the fresh *grated* nut is used for the same purpose, a teaspoonful being given after twelve hours' fasting. (*P. J. Tr.*, Feb. 1874.)

ARGEMONE MEXICANA. *Prickly Poppy.* An annual plant, belonging to the Papaveraceæ, growing in our Southern and Western States, Mexico, the West Indies, Brazil, and in many parts of Africa and Southern Asia. According to Dr. E. Bonavia, it grows abundantly about Lucknow, in Hindostan. (*P. J. Tr.*, Nov. 1866, p. 297.) It has an erect, somewhat glaucous, bristly stem, with alternate sessile leaves, sinuated and prickly at the angles, and usually marked with white spots. The flowers are solitary, yellow or white, with two or three prickly deciduous sepals, four or six large petals, about twenty stamens, and four to six reflected stigmas. The whole plant abounds in a milky, viscid juice, which becomes yellow on exposure to the air. M. Charbonnier obtained from the plant a minute quantity of an alkaloid, which he believes to be morphia. (*Journ. de Pharm.*, Mai, 1868, p. 352.) From the statements of different authors, it may be inferred that the plant is emetic and purgative, and possesses also narcotic properties. The juice, which is acrid, has been used internally in obstinate cutaneous eruptions, and as a local application to warts and chancres, and in diseases of the eyes. The flowers are stated by De Candolle to have been employed as a soporific. But the seeds are most esteemed. They are small, round, black, and roughish. In the dose of two drachms, infused in a pint of water, they are said to act as an emetic. In smaller doses they are purgative. An oil may be obtained from them by expression, which has the cathartic property of the seeds, and, according to M. Lepine, might be advantageously used in the arts. (*Journ. de Pharm.*, Juillet, 1861, p. 16.) It may be separated by means of carbon disulphide, and it is described by M. Charbonnier as of a light-yellow color, limpid, transparent, retaining its fluidity at 5° C. (41° F.), of a somewhat nauseous odor, and of a slightly acrid taste, which, however, is not very disagreeable. It is a drying oil, and is entirely soluble in 5 or 6 measures of alcohol at 32·2° C. (90° F.). It is thought applicable to various purposes in the arts, especially to painting; and the cultivation of the plant with a view to its production is suggested as a promising enterprise. M. Charbonnier found it gently cathartic in the dose of 15 to 25 drops, and emeto-cathartic in larger doses. (*Journ. de Pharm.*, Mai, 1868, p. 348.) According to Dr. W. Hamilton, the seeds unite an anodyne and soporific with the cathartic property; and, in the hands of Dr. Affleck, of Jamaica, have proved useful in flatulent colic, given in emulsion, in the dose of about eight grains, repeated every half hour till three doses were taken. The pain was relieved, and the bowels opened. (*P. J. Tr.*, xiii. 642.) Dr. Bonavia also found it useful in colic with constipation, and, following a practice common in Upper India, applied it very successfully, as a local remedy, in a troublesome cutaneous affection about the waist, called the *dhad*, which is apt to occur in those regions.

ARSENATE OF AMMONIUM. *Ammonii Arsenias* $(NH_4)_2,H_1AsO_4$). This salt is obtained in crystals by saturating a concentrated solution of arsenic acid with ammonia or carbonate of ammonium, and allowing it to evaporate spontaneously. The crystals, which belong to the trimetric system, effloresce on exposure to the air, and lose half their ammonia; its solution is alkaline. It has been used with advantage by Biett in several inveterate diseases of the skin. It is administered in solution, one grain of the salt in a fluidounce of distilled water. Of this the dose is from twenty to twenty-five drops, given in divided portions in the course of the day, and gradually increased.

ARSENATE OF ANTIMONY. This is a heavy snow-white powder, containing 56 per cent. oxide of antimony, and 44 per cent. arsenic acid. It is stated that it is used in Russia in doses of 0·0012 gramme four times a day. (*A. J. P.*, xliv. 301.)

ARUM. The root or cormus of *Arum maculatum* is occasionally used as a medicine in Europe, and formerly held a place in the Dublin Pharmacopœia. Its properties closely resemble those of our *A. triphyllum.* Its constituents, according to Enz, are a neutral acrid volatile principle soluble in ether, starch, gum, mucilage, sugar, lignin, albumen, saponin, fixed oil, resin, and phosphate of calcium; the fresh cormus containing 58·4 per cent. of water, 5·2 of lignin, and 27·2 of starch. (*A. J. P.*, xxxi. 352.) In overdoses it is capable of producing fatal effects, through the violent inflammation caused by it in the mouth, fauces, œsophagus, and stomach. A fatal case, occurring in a child three years old, is recorded in the *Annuaire de Thérapeutique* (1862, p. 16), in which, besides the effects mentioned, profound torpor occurred at the end of three hours, followed by intense febrile reaction, and subsequent prostration. It is no doubt the acrid volatile principle to which these effects are to be ascribed. It is said that dried it is sometimes employed by the country people, in periods of great scarcity, as a substitute for bread; and an amylaceous substance is prepared from it, in small quantities, in the Isle of Portland, on the south coast of England, and called *Portland arrow-root*, or *Portland sago*. The root of *A. esculentum*, which abounds in starch, is much used by the natives of the Sandwich and other islands of the Pacific, as an article of food, having been previously deprived of its acrimony by heat.

Arum triphyllum, Willd. *Sp. Plant.* iv. 480; Bigelow, *Am. Med. Bot.* i. 52; *Arisæma Triphyllum*, Torr. The *dragon-root*, *Indian turnip*, or *wake-robin*, as this plant is variously called, has a perennial root or cormus, which, early in spring, sends up a large, ovate, acuminate, variously colored spathe, convoluted at bottom, flattened and bent over at top like a hood, and supported by an erect, round, green, or purplish scape. Within the spathe is a club-shaped spadix, green, purple, black, or variegated, rounded at the end, and contracted near the base, where it is surrounded by the stamens or germs in the diœcious plants, and by both in the monœcious, the female organs being below the male. The spathe and upper portions of the spadix gradually decay, while the germs are converted into a compact bunch of shining scarlet berries. The leaves, usually one or two in number, and upon long sheathing footstalks, are composed of three ovate acuminate leaflets, paler on their under than their upper surface, and becoming glaucous as the plant advances There are three varieties of this species, distinguished by the color of the spathe, which in one is green, in another dark-purple, and in a third white. The plant is a native of North and South America, and is common in all parts of the United States, growing in damp woods, in swamps, along ditches, and in other moist shady places. All parts of it are highly acrid, but only the root was formerly officinal. This is roundish, flattened, an inch or two in diameter, covered with a brown, loose, wrinkled epidermis, and internally white, fleshy, and solid. In the recent state it has a peculiar odor, and is violently acrid, producing, when chewed, an insupportable burning and biting sensation in the mouth and throat, which continues for a long time, and leaves an unpleasant soreness behind. According to Dr. Bigelow, its action does not readily extend through the cuticle, as the bruised root may lie upon the skin till it becomes dry, without producing pain or redness. The acrid principle is extremely volatile, and is entirely driven off by heat. It is not imparted to water, alcohol, or olive oil, but is probably soluble in ether. The root loses nearly all its acrimony by drying, and in a short time becomes quite inert. It was found by Mr. D. S. Jones, besides the acrid principle, and from 10 to 17 per cent. of starch, to contain albumen, gum, sugar, extractive, lignin, and salts of potassa and lime. (*A. J. P.*, xv. 83.) The starch may be obtained from it as white and delicate as from the potato. The Indian turnip may be preserved fresh for a year, if buried in sand.

Arum in its recent state is a powerful local irritant, possessing the property of stimulating the secretions, particularly those of the skin and lungs. It has been advantageously given in asthma, pertussis, chronic catarrh, chronic rheumatism, and various affections connected with a cachectic state of the system. As immediately taken from the ground, it is too acrid for use. The recently dried root, which retains a portion of the acrimony, but not sufficient to prevent its convenient administration, is usually preferred. It may be given in the dose of ten grains, mixed with gum arabic, sugar, and water, in the form of emulsion, repeated two or three times a day, and gradually increased to half a drachm or more. The powder, made into a paste with honey or syrup, and placed in small quantities upon the tongue, so as to be gradually diffused over the mouth and throat, is said to have proved useful in the aphthous sore-mouth of children.

ASARABACCA. This is the product of *Asarum Europæum*, an herbaceous perennial plant, growing in Europe, between 37° and 60° north latitude, in woods and shady places, and flowering in May. All parts of the plant are acrid. The leaves were specially directed by the London College, when the plant was recognized as officinal; but the whole plant, including the root, stem, leaves, and flowers, is usually kept in the shops. The root is about as thick as a goose-quill, of a grayish color, quadrangular, knotted and twisted, and sometimes furnished with radicles at each joint. It has a smell analogous to that of pepper, an acrid taste, and affords a grayish powder. The leaves, which have long footstalks, are kidney-shaped, entire, somewhat hairy, of a shining deep-green color when fresh, nearly inodorous, with a taste slightly aromatic, bitter, acrid, and nauseous. Their powder is yellowish green. Both parts rapidly lose their activity by keeping, and ultimately become inert. Geiger, however, asserts that they keep well if perfectly dry. Their virtues are imparted to alcohol and water, but are dissipated by decoction. According to MM. Feneulle and Lassaigne, the root contains a concrete volatile oil, a very acrid fixed oil, a yellow substance analogous to *cytisin*, starch, albumen, mucilage, citric acid, and saline matters. The latest analysis is by Gräger, who found in the *root* a liquid volatile oil, two concrete volatile substances called respectively *asarum camphor* or *asarone*, and *asarite*, a peculiar bitter principle called *asarin*, tannin, extractive, resin, starch, gluten, albumen, lignin, citric acid, and various salts; in the *leaves*, asarin, tannin, extractive, chlorophyll, albumen, citric acid, and lignin. The active principles appear to be the volatile oil, which is lighter than water, glutinous, yellow, of an acrid and burning taste, and a smell like that of valerian, and the asarin, which is soluble in alcohol and very bitter, and is probably the same as the *cytisin* of Feneulle and Lassaigne. (See *Cytisus Laburnum.*) The root and leaves of asarabacca, either fresh or carefully dried, are powerfully emetic and cathartic, and were formerly much used in Europe with a view to these effects. The dose is from thirty grains to a drachm. But as an emetic they have been entirely superseded by ipecacuanha; and they are now used chiefly, if not exclusively, as an errhine. One or two grains of the powdered root, snuffed up the nostrils, produce much irritation, and a copious flow of mucus, which is said to continue sometimes for several days. The leaves are milder, and generally preferred. They should be used in the quantity of three or four grains, repeated every night until the desired effect is experienced. They have been strongly recommended in headache, chronic ophthalmia, and rheumatic and paralytic affections of the face, mouth, and throat; and are in great repute in Russia, as a remedy for the deranged state of health consequent on habits of intoxication.

ASCLEPIAS. At the late revision two indigenous species of this genus were dropped from the U. S. Pharmacopœia.

Asclepias incarnata, or *Flesh-colored Asclepias*, has an erect downy stem, branched above, two or three feet high, and furnished with opposite, nearly sessile, lanceolate, somewhat downy leaves. The flowers are red, sweet-scented, and disposed in numerous crowded erect umbels, which are generally in pairs. The nectary is entire, with its horn exserted. In one variety the flowers are white. The plant grows in all parts of the United States, preferring a wet soil, and flowering from June to August. Upon being wounded it emits a milky juice. Dr. Griffith states that the root is a useful emetic and cathartic. (*Journ. of the Phil. Col. of Pharm.*, iv. 283.) Dr. Tully, of New Haven, has found it useful in catarrh, asthma, rheumatism, syphilis, and worms.

A. Syriaca. Willd. *A. Cornuti* (Decaisne, *Gray's Manual*). *Common Silk-weed*, or *Common Milk-weed*, has simple stems, from three to five feet high, with opposite, lanceolate-oblong, petiolate leaves, downy on their under surface. The flowers are large, of a pale-purple color, sweet-scented, and arranged in two or three nodding umbels. The nectary is bidentate. The pod or follicle is covered with sharp prickles, and contains a large quantity of silky seed-down, which has been used as a substitute for fur in the manufacture of hats, and for feathers in beds and pillows. It is very common in the United States, growing in sandy fields, on the roadsides, and on the banks of streams, from New England to Virginia. It flowers in July and August. Its milky juice has a faint smell, a sub-acrid taste, and an acid reaction. According to Shultz, 80 parts of it contain 69 of water, 3·5 of a wax-like fatty matter, 5 of caoutchouc, 0·5 of gum, 1 of sugar with salts of acetic acid, and 1 of other salts. (*Pharm. Centralblatt*, 1844, p. 302.) Dr. C. List has found the chief solid ingredient of the juice to be a peculiar crystalline substance, of a resinous character, closely allied to lactucon, and which he proposes to call *asclepion.* To obtain it, the juice is coagulated by heat, filtered so as to separate the liquid portion, and then digested with ether, which dissolves the asclepion, and yields it by evaporation. To purify it, the residue must be treated repeatedly with anhydrous ether, which leaves another substance undissolved. It is white, crystalline, tasteless, inodorous, fusible, insoluble in water and alcohol, soluble in ether, oil of turpentine, and concentrated acetic acid. A strong hot solution of potassa does not affect it. Its formula is $C_{20}H_{34}O_3$. (List, *Liebig's Annalen*, Jan. 1849.) Hinchman examined *A. Cornuti* in

1881, and found asclepion, caoutchouc, fixed oil, tannin, glucose, a bitter principle, gum, starch, volatile oil, and ash. (*A. J. P.*, liii. p. 435.) Anodyne, cathartic, and alterative properties have been claimed for the root of this plant, and it has been especially commended in asthma, and in scrofula, but probably is of very little medical value. A drachm of it in decoction may be given two or three times a day.

Mention may here be made of another indigenous species of Asclepias, *A. verticillata* (*Gray's Manual*, p. 354), which has reputation in some parts of the Southern States as a remedy in snakebites, and the bites of venomous insects. It is given in the form of a saturated decoction of the fresh plant (root, stem, and leaves), of which three gills are said to have been taken at a draught, with the effect of producing an anodyne and sudorific effect, followed by a gentle sleep. (See *Va. Med. Journ.*, Dec. 1858, p. 458.)

ASCLEPIAS CURASSAVICA. *Bastard Ipecacuanha. Redhead. Blood Weed.* This is a pretty species of Asclepias, from one to three feet high, and bearing umbels of bright-red flowers. It is a native of the West Indies, abounding especially in Nevis and St. Kitts, where it is considerably used as a medicine. Both the root and expressed juice are emetic, the former in the dose of one or two scruples, the latter in that of a fluidounce or more. They are also cathartic in somewhat smaller doses; and the expressed juice, made into a syrup with sugar, has been strongly recommended as a remedy in worms. The medicine, however, is somewhat uncertain in its operation. According to Dr. W. Hamilton, the plant may also be usefully employed in arresting hemorrhages, and in obstinate gonorrhœa. (See *A. J. P.*, xix. 19.)

ASPARAGUS OFFICINALIS. *Asparagus.* This well-known garden vegetable is a native of Europe. It is perennial and herbaceous. The *root*, which is inodorous, and of a weak, sweetish taste, was formerly used as a diuretic, aperient, and purifier of the blood; and it is stated to be still employed to a considerable extent in France. It is given in the form of decoction, made in the proportion of one or two ounces of the root to a quart of water. Hayne asserts that, in the dried state, it is wholly inert. In the *berries* H. Reinsch has found a large proportion of glucose and a yellowish-red coloring matter, *Spargin*. (*A. J. P.*, xlii. 371.) The *young shoots* are much used as food. Before being boiled they have a disagreeable taste; and their juice was found by Robiquet and Vauquelin to contain a peculiar crystallizable principle, called *asparagin*, $C_4H_8N_2O_3$, which has since been found in a number of plants. (See *Althea.*) This has been thought not to exert any special influence on the system; but Dr. Allen Dedrick, of New Orleans, has found it to be sedative to the circulation, eight grains of it having reduced his own pulse from 72 to 56 in the minute, while, at the same time, brief frontal headache, a sense of fulness of the eyes, and a feeling of muscular weakness were experienced. The effect on the pulse was perceived at the end of five minutes, was at its height in an hour, and continued so for half an hour, when it gradually subsided. The pulse was also rendered intermittent. (*N. O. Med. and Surg. Journ.*, xi. 198.) Asparagin is said to be obtained with facility by the process of dialysis. If the thick viscid mucilage of the marshmallow (*Althæa officinalis*) be put into a dialyzer, with distilled water outside, the asparagin passes into the water, and may be obtained in crystals by evaporating the solution. (See *P. J. Tr.*, May, 1862, p. 572.) It might probably be obtained in the same way from an infusion of asparagus.

The sprouts themselves are not without effect; as the urine acquires a disagreeable odor very soon after they have been eaten. They have been accused of producing irritation, with a morbid flow of mucus, of the urinary passages. (*Ann. de Thérap.*, 1861, p. 107.) They are considered by some writers as diuretic, aperient, and deobstruent, and as constituting a very wholesome and useful article of diet, early in the spring, when vegetables are scarce. Broussais thought that they were sedative to the heart, and recommended them especially in hypertrophy and other diseases of that organ attended with excessive action, and without phlogosis of the stomach. M. Gendrin, however, after much experience with asparagus, affirms that he never knew it to exercise the slightest influence over the heart, and ascribes its palliative effects, in diseases of that organ, to a diuretic action. He found it, in all the cases in which he administered it, to increase the quantity of urine, which, in some instances, was quintupled. The most convenient forms for exhibition are those of syrup and extract, prepared from the shoots. The former may be given in the dose of one or two fluidounces, the latter of half a drachm or a drachm. The syrup may be made by adding a sufficient quantity of sugar to the expressed juice of the shoots, previously deprived of its albumen by exposure to heat and by filtration; the extract, by evaporating the same juice to the consistence of a pilular mass. Dr. S. J. Jefferson, of England, has employed a tincture of asparagus for 16 years with great benefit, as an adjuvant to other diuretics. He prepares the tincture either by macerating 5 ounces of the dried tops in 2 pints of proof spirit; or by taking 5 pounds of the fresh tops, expressing the juice, evaporating it to a pint, straining, and adding a pint of rectified spirit. He gives from half a drachm to two drachms with each dose of the diuretic employed. (*Am. Journ. of Med. Sci.*, N. S., xxx. 490.) In their unripe state the berries possess the same properties as the shoots, and probably in a much higher degree. We have employed a syrup prepared from them, with apparent advantage, in a case of diseased heart. The seeds have been tried as a substitute for coffee. (See *Boston Med. and Surg. Journ.*, July 19, 1854.)

ASPLENIUM FILIX FŒMINA. R. Brown. *Female Fern.* This is the *Polypodium Filix fœmina* of Linn., the *Aspidium Filix Fœmina* of Swartz, and the *Athyrium Filix fœmina* of Roth. It has a root analogous in character to that of the male fern (*Aspidium Filix mas*), and has been supposed to possess similar vermifuge properties. At present, however, it is not used. The vulgar name of *female fern* is also given to the *Pteris aquilina*, or *common brake*, which is said by some authors to have the property of destroying the tapeworm. The leaves of two species of Asplenium, *A. Trichomanes*, or *common spleenwort*, and *A. Adiantum-nigrum*, or *black spleenwort*, are mucilaginous, and have been used as substitutes for the *maidenhairs* (*Adiantum Capillus Veneris* and *A. Pedatum*) as pectorals, though destitute of their aromatic flavor.

ASTER PUNICEUS. This is a common indigenous plant, growing from three to six feet high, in low swampy places. The rootlets are aromatic, bitterish, and astringent, and have been employed in domestic and irregular practice as a stimulating diaphoretic, in rheumatic and catarrhal affections. Other species also of Aster have attracted attention for supposed remedial powers.

ATHEROSPERMA MOSCHATA. *Australian Sassafras.* The bark of this tree contains a volatile oil which is obtained by distillation, and has some reputation in Australia as a remedy. It is said to be diaphoretic, diuretic, and sedative to the heart. The dose is a drop every 6 or 8 hours. An alkaloid called *athero-spermin* has been extracted from the bark by M. Zeyer, of Munich. (*P. J. Tr.*, April, 1863, p. 447.)

ATOMIZERS. *Pulverizers. Nebulizers.* These are instruments by which liquid substances, which cannot be wholly volatilized, as saline solutions for example, can be brought into a state of minute division, as in spray, whereby they may be introduced into the air-passages, and by inhalation into the lungs. Various soluble substances can thus be brought into contact with these surfaces in a diseased state, often with great advantage, which cannot otherwise be conveniently applied. The instruments are of various forms, but consist essentially of two tubes open at both ends, with a capillary opening at one end; and joined together so that they shall be perpendicular to each other with their capillary points in contact. One tube is perpendicular, and, when the instrument is in action, is inserted at its larger extremity into a vessel containing the liquid to be atomized; the other is horizontal. Through the latter a current of air is forced, which, on escaping at the capillary opening, carries with it a portion of the air in the orifice of the perpendicular tube, so that, to avoid a vacuum, the liquid is forced up by the atmospheric pressure, and mixes with the current of air as it escapes. It is thus minutely divided, and, accompanying the expanding current, may be received in the mouth or nostrils, and made to impinge on any part of these cavities or of the fauces, or be conveyed by inhalation into the lungs. For convenience of reference it may be proper to present here, in a tabular form, the most important substances used in this way, and the proportion to the fluid solvent which each one should bear. The number given opposite to each name represents the number of grains or of minims in which the substance named should be dissolved in a fluidounce of water.

Alum	10 to 30 grs.
Ammonium, chloride of	10 to 20 grs.
Arsenic (solution of arsenite of potassa)	1 to 20 mins.
Chloride of Sodium	5 to 20 grs.
Chlorinated Soda, solution of	30 to 60 mins.
Conium, fluid extract of	3 to 8 mins.
Copper, sulphate of	1 to 3 grs.
Hemp, tincture of	5 to 10 mins.
Hyoscyamus, fluid extract of	3 to 10 mins.
Iodine, compound solution of	2 to 15 mins.
Iron, perchloride of	$\frac{1}{8}$ to 2 grs.
Iron, solution of subsulphate of	8 to 16 mins.
Iron, sulphate of	1 to 2 grs.
Lead, acetate of	2 to 5 grs.
Lime-water	60 to 120 mins.
Mercury, corrosive chloride of	$\frac{1}{4}$ to 1 gr.
Morphia, solution of sulphate of	$\frac{1}{14}$ to $\frac{1}{8}$ gr.
Opium, tincture of	2 to 12 mins.
" watery extract of	$\frac{1}{4}$ to $\frac{1}{2}$ gr.
Silver. nitrate of	1 to 10 grs.
Tannin	1 to 20 grs.
Tar-water	60 to 120 mins.
Turpentine, oil of	1 to 2 mins.
Zinc, sulphate of	1 to 6 grs.

In general a substance may be used in this way of the strength in which it would be applied to the mucous membranes.

AZEDERACH INDICA. *Nim Tree.* The inner bitter bark of this tree is extensively used in India as a febrifuge and tonic, in the form of powder, or more usually in that of decoction. The roots are said to be vermifuge, and the seeds yield an oil largely used for lighting purposes and sometimes as a medicine. Mr. J. Broughton found in the bark a bitter resin to which he assigned the formula $C_{36}H_{50}O_{11}$, and a crystalline fat. (*P. J. Tr.*, June, 1873.)

BACCHARIS CORDIFOLIA. *Mio Mio.* This composite plant of Southeastern South America is notorious as a poison which destroys large numbers of sheep and cattle. Mr. Pedro N. Arata has isolated from it an alkaloid, to which he has given the name of *baccarinine.* (*P. J. Tr.*, x. 6.)

BALATA. This is the dried milky juice of the *Sapota Muelleri* or *Bully Tree*, a native of Guiana. It is an oxidized hydrocarbon, contains a little resin, and is said to be midway between caoutchouc and india-rubber in its physical properties. (*A. J. P.*, xlii. 178.)

BALM OF GILEAD. *Balsam of Gilead. Balsamum Gileadense. Baume de la Mecque.* Fr. The genuine balm of Gilead is the resinous juice of the *Amyris Gileadensis* of Linn., the *Balsamodendron Gileadense* of Kunth, a small evergreen tree, growing on the Asiatic and African shores of the Red Sea. It was in high repute with the ancients, and is still esteemed by the Eastern nations as a medicine and cosmetic. In Western Europe, and in this country, it is seldom found in a state of purity, and its use has been entirely abandoned. It is described as a turbid, whitish, thick, gray, odorous liquid, becoming solid by exposure. It possesses no medical properties which do not exist in other balsamic or terebinthinate juices. It was formerly known as *opobalsamum;* while the dried twigs of the tree were called *xylobalsamum*, and the dried fruit, *carpobalsamum.*

BALSAM OF SULPHUR. This name was formerly given to a substance recognized by the old Edinburgh Pharmacopœia under the name of *Oleum Sulphuratum.* The directions of the College were to boil *eight parts* of olive oil and *one part* of sublimed sulphur together, with a gentle fire, in a large iron pot, stirring them constantly till they united. The iron pot was directed to be large enough to hold three times the quantity of the materials employed, as the mixture might otherwise boil over. As the vapors which rose were apt to take fire, a lid was to be at hand to cover the pot, and thus extinguish the flame if necessary. Sulphur is soluble to a considerable extent in heated oil, from which, if the solution be saturated, it is deposited in a crystalline state on cooling. But it is not a mere solution which this process was intended to effect. The oil was partly decomposed, and the resulting preparation was an extremely fetid, acrid, viscid, reddish-brown fluid. In order that it might be obtained, it was necessary to heat the oil to the boiling point. *Sulphurated oil*, or *balsam of sulphur*, was formerly thought useful in chronic catarrh, consumption, and other pectoral complaints; but inconvenience arose from its acrid properties, and its internal use was abandoned. It is sometimes applied as a stimulant to foul ulcers. The dose is from five to thirty drops.

BALSAMUM ANTARTHRITICUM INDICUM. This is the product of an unknown leguminous tree which has recently attracted some attention in Europe. (See *Proc. Am. Pharm. Assoc.*, xxvii. 253; *A. J. P.*, 1880, p. 168.)

BALSAMUM TRANQUILANS. *Baume Tranquille.* This is a preparation of some note, directed by the French Codex, and consisting essentially of olive oil holding in solution the active matters of certain narcotic and aromatic plants. The fresh plants are boiled with the oil until all their water is driven off; the oil is then expressed and poured upon the dried plants properly comminuted; and the mixture, having been allowed to stand for a month, is strained, and the oil decanted. The preparation is used externally by friction as an anodyne in local pains, but especially to relieve earache, a few drops being placed in the ear on a pledget of cotton. A formula for it is contained in the *Journ. de Pharm.* (Aout, 1862, p. 121). An improved process is proposed by W. C. Bakes. (*A. J. P.*, 1862, p. 22.) We have still further modified this, and the formula is as follows. Take of Alcoholic Extract of Belladonna, Conium, Hyoscyamus, and Stramonium, each, 30 grains; Aqueous Extract of Opium, 12 grains. Soften the extracts with one fluidounce of Boiling Water, and add four fluidounces of Olive Oil. Digest this mixture with a gentle heat until the water has been evaporated, and then strain or filter. To this add 10 minims of each of the following volatile oils, Sage, Wormwood, Lavender, Thyme, Peppermint, Rue. It should be used with care.

BAPTISIA TINCTORIA. *Sophora tinctoria.* Linn. *Podalyria tinctoria.* Michaux. *Wild Indigo.* This is an indigenous perennial plant, found throughout the United States, growing abundantly in woods and dry barren uplands. It is from one to three feet high, with a smooth, very branching stem, small, ternate, cuneate-obovate, bluish-green leaves, and yellow flowers, which appear in July and August, and, like the whole plant, become black when dried. The root, which is the part most highly recommended, is of a dark-brown color, of a slight peculiar odor in the dried state, and of a nauseous, bitter, somewhat acrid taste. Its virtues appear to reside chiefly in the cortical portion. Mr. B. L. Smedley thought that he had found in it a peculiar alkaloid. (*A. J. P.*, July, 1862, p. 311.) Mr. Jno. A. Weaver has shown this to be a salt of lime. (*A. J. P.*, xliii. 251.) Dr. F. V. Greene, U.S.N., proved the presence of an alkaloid, and obtained its chloride in a crystalline condition. (*A. J. P.*, 1879, p. 577.) In large doses, it is said to operate violently as an emetic and cathartic; in smaller, to produce only a mild laxative effect. It is said to have proved useful in scarlatina, typhus fever, and in that state of system which attends gangrene or mortification. Dr. Thatcher spoke highly of its efficacy as an external application to obstinate and painful ulcers; and Dr. Comstock, of Rhode Island, found it extremely useful, both as an internal and external remedy, in threatened or existing mortification. By the latter physician it was given in decoction, made in the proportion of an ounce of the root to a pint of water, of which half a fluidounce was administered every four or eight hours, any tendency to operate on the bowels being checked with laudanum. Dr. Stevens, of Ceres, Pennsylvania, has employed a decoction of the root advantageously in epidemic dysentery. (*N. Y. Journ. of Med.*, iv. 358.) It may be used externally in the form of decoction or cataplasm. The stem and leaves possess the same virtues as the root, though in a less degree. A pale-blue coloring substance has been prepared from the plant as a substitute for indigo, but is greatly inferior. Another species, *B. Alba*, or *prairie indigo*, which is abundant in our N. W. prairies, is said to have similar properties, and to be sometimes used as a substitute for *B. tinctoria.*

BARBADOES NUTS. *Purging Nuts. Physic Nuts.* These are the seeds of the *Curcas purgans* of Adanson (*Jatropha Curcas* of Linnæus), growing in Brazil, the West Indies, and on the western coast of Africa. The fruit is a three-celled capsule, containing one seed in each cell, and is about the size of a walnut. The seeds are blackish, oval, about eight lines long, flat on one side, convex on the other; and the two sides present a slight longitudinal prominence. They yielded to Soubeiran, fixed oil, an acrid resin, sugar, gum, a fatty acid, gluten, a free acid, and salts. The oil may be separated by expression. When fresh it is without smell or color, but becomes yellowish and slightly odorous by time. When cold it deposits a white substance, which is probably palmitin. Alcohol does not readily dissolve it. Some call it *jatropha oil.* For an account of the chemical properties of this oil, see the *Chemical Gazette* (Dec. 15, 1854, p. 469). From three to five of the *seeds*, slightly roasted and deprived of their envelope, operate actively as a cathartic, and not unfrequently produce nausea and vomiting, with a sense of burning in the stomach. The *oil* purges in the dose of twelve or fifteen drops, and is analogous in its action to croton oil, though less powerful. The cake left after the expression of the oil is an acrid emeto-cathartic, operating in the dose of a few grains. Either of these substances may produce serious consequences in overdoses. The leaves of the plants are rubefacient, and the juice is said to have been usefully employed as a local remedy in piles.

The seeds of *Curcas multifidus* (*Jatropha multifida*, Linn.) have similar properties, and yield a similar oil. This species also grows in Brazil and the West Indies. *Jatropha urens* must be excessively poisonous, as accidental contact of the wrist of a gardener in Kew with a young plant produced such symptoms that for five minutes the man was thought to be dead. (*P. J. Tr.*, April, 1872, p. 863.)

BARII CHLORIDUM. *U. S.* 1870. *Chloride of Barium.* $BaCl_2,2H_2O$. "Take of Carbonate of Barium, in small pieces, Muriatic Acid, each, *four troyounces*; Water *a pint.* Mix the Acid with the Water, and gradually add the Carbonate of Barium. Towards the close of the effervescence apply a gentle heat, and, when chemical action has ceased, filter the liquid, and evaporate so that crystals may form when it cools." *U. S.* 1870. When carbonate of barium is employed for obtaining chloride of barium, as in the above process, the reactions are very simple. The hydrochloric acid displaces the carbonic acid with effervescence, and forms chloride of barium and water. The solution of chloride of barium, thus obtained, yields crystals of the chloride by concentration and cooling. Another plan is that which procures it from the sulphate, as directed in the late Edinburgh Pharmacopœia. In this the sulphate, previously ignited and powdered, is mixed with charcoal and exposed to a low white heat, by which its constituents are deoxidized, and sulphide of barium produced; the oxygen escaping in combination with the carbon as carbonic oxide and acid. The sulphide of barium, after having been dissolved in water, is decomposed by the addition of hydrochloric acid; sulphuretted hydrogen being evolved, and chloride of barium formed in solution, from which, in the usual manner, the solid salt is obtained. The reactions for these two processes are: 1. $BaCO_3 + 2HCl = BaCl_2 + H_2O + CO_2$. 2. $BaSO_4 + C_4 = BaS + (CO)_4$. 3. $BaS + 2HCl = BaCl_2 + H_2S$. Of these processes, that in which the native carbonate is used is the simplest and most convenient; but the carbonate is comparatively a rare mineral, and, as the sulphate in fine powder is a cheap article of commerce, being extensively employed for mixing with white lead, it is almost always used for obtaining chloride of barium and the other barium compounds.

Chloride of barium is a permanent white salt, possessing a bitter and disagreeable taste. It crystallizes in rhombic tables with bevelled edges. It dissolves in about two and a half times its weight of cold water, and in a little more than its own weight at 106° C. (222° F.), the boiling point of a saturated solution. It is scarcely soluble in absolute alcohol, but dissolves in rectified spirit. Alcohol, impregnated with it, burns with a yellow flame. When exposed to heat, it decrepitates and loses its water of crystallization, and at a red heat fuses. It is decomposed by the sulphates, oxalates, and tartrates, and the alkaline phosphates, borates, and carbonates; also by nitrate of silver, acetate and phosphate of mercury, and acetate of lead. When pure it does not deliquesce. Its solution is not affected by ammonia, which proves the absence of alumina and sesquioxide of iron, or by sulphuretted hydrogen, which shows that neither copper nor lead is present. After the whole of the barium has been precipitated by an excess of sulphuric acid, the supernatant liquid is shown to be free from lime by the non-action of carbonate of sodium. Lime may be separated by the process of Dr Wolcott Gibbs, which consists in adding to the solution of the chloride a small portion of the solution of hydrate of barium, and then passing through it a current of carbonic acid, when the whole of the lime will be thrown down as a carbonate. (Wurtz, *N. Y. Journ. of Pharm.*, i. 164.) If strontium be present, an alcoholic solution of the salt will burn with a red flame. Like all the soluble salts of barium, it is poisonous. *Liquor Barii Chloridi, U. S. P.* 1870, a troyounce in three fluidounces of water, is given in five-drop (0·3 C.c.) doses.

BASSORA GUM. *Caramania Gum. Hog Gum Tragacanth.* This substance came into commerce originally from the neighborhood of Bassora, on the Gulf of Persia; but is often found mixed with gum brought from other countries, and is said to be the product of the almond and plum trees. It is in irregular pieces, of various sizes, never very large, brown or yellow, intermediate in the degree of its transparency between gum arabic and tragacanth, inodorous, tasteless, and possessed of the property of yielding a slight sound when broken under the teeth. But a small portion of it is soluble in water, whether hot or cold. The remainder swells up considerably, though less than tragacanth, and does not, like that substance, form a gelatinous mass, as it consists of independent granules which have little cohesion. The soluble portion is pure gum or *arabin* (see *Acacia*), and, according to M. Guérin, constitutes 11·2 per cent. The insoluble portion consists of a peculiar principle called *bassorin* (see *Acacia*), associated with a small proportion of saline substances, which yield, when the gum is burnt, 5·6 per cent. of ashes. The gum is useless, but is employed to adulterate tragacanth, and for this purpose is sometimes whitened by means of white lead.

BATIATOR ROOT. This is the root of an unknown Brazilian plant, which has been commended as a substitute for ipecacuanha, both as an emetic and also in dysentery. (See *Bulletin Thérap.*, xcv. p. 74; *A. J. P.*, 1878, 478.)

BDELLIUM. This name has been given to two different gum-resins, distinguished as *Indian* and *African bdellium*. Dr. Royle was informed that the former was obtained from the *Amyris Commiphora* of Roxburgh, growing in India and Madagascar. The latter is said to be the product of *Heudelotia Africana*, which grows in Senegal. Bdellium sometimes comes mixed with gum arabic and gum senegal. It is either in small roundish pieces, of a reddish color, semi-transparent, and brittle, with a wax-like fracture, or in large irregular lumps, of a dark brownish-red color, less transparent, somewhat tenacious, and adhering to the teeth when chewed. It has an odor and taste like those of myrrh, but weaker. It is infusible and inflammable, diffusing while it burns a balsamic odor. According to Pelletier, it consists of 59 per cent. of resin, 9·2 of gum, 30·6 of bassorin, and 1·2 of volatile oil, including loss. In medical properties it is analogous to myrrh, and was formerly used for the same purposes; but it is now scarcely ever given internally. In Europe, it is still occasionally employed as an ingredient of plasters. The dose is from ten to forty grains.

BEDEGUAR. *Fungus Rosarum.* An excrescence upon the *sweetbrier* or *eglantine*, and other species of *Rosa*, produced by the puncture of insects, especially by one or more species of *Cynips*. It is of irregular shape, usually roundish, about an inch in diameter, with numerous cells internally, in each of which is the larva of an insect. It has little smell, and a slightly astringent taste. Though formerly considered diuretic, anthelmintic, and lithontriptic, and employed as a remedy for toothache, it has fallen into disuse. It was given in doses of from ten to forty grains.

BENZOIN ODORIFERUM. Nees. *Laurus Benzoin.* Linn. *Spice-wood. Spice-bush. Fever-bush.* An indigenous shrub, from four to ten feet high, growing in moist, shady places, in all parts of the United States. Its flowers appear early in spring, long before the leaves, and are succeeded by small clusters of oval berries, which, when ripe, in the latter part of September, are of a shining crimson color. All parts of the shrub have a spicy, agreeable flavor, which is strongest in the bark and berries. By warming and expression Dr. A. W. Miller obtained from the berries 50 per cent. of oily material, which, on distillation, yielded about two per cent. of volatile oil. The latter had a sp. gr. of 0·850, was thin, bright green, of a warm aromatic taste, and a fragrant odor. Mr. J. M. Jones found it to be of the cinnamyl series. (*Proc. A. P. A.*, xxvi. 772; also *A. J. P.*, xlv. 300; xlvii. 246.) The small branches are said to be employed, in the form of infusion or decoction, by the country-people, as a vermifuge, and an agreeable drink in low fevers; and the bark has been used in intermittents. The berries, dried and powdered, were sometimes substituted, during the Revolutionary War, for allspice. The oil probably shares the medical virtues of the aromatics. (*A. J. P.*, xlv. 300; *Ibid.*, xlvii. 246.)

BENZOL. (C_6H_6.) *Benzen. Benzene. Phene. Benzole. Phenyl Hydride.* This substance must not be confounded with the commercial article sold as *benzin*, which is a mixture of various hydrocarbons of light specific gravity, obtained in the distillation of coal-gas tar and petroleum. (See *Benzinum.*) Originally the two names benzol and benzin were applied to the same substance, but after the discovery of petroleum it was soon found that the coal tar produced artificially was quite different from that obtained from petroleum. Little by little in the United States it has become the custom to call the liquid obtained by the fractional distillation of petroleum having the sp. gr. 62° to 65° Baumé *benzin*. It is unfortunate that in Europe, and on the continent especially, the term benzin is used for both liquids. The two substances are essentially different, although resembling each other in their solvent powers. Benzol is a definite hydrocarbon of fixed constitution; benzin a complex body of varying constitution. Benzol can be frozen; benzin has never yet been consolidated. Benzin boils at from 54° C. (129·2° F.) to 56° C. (132·8° F.). Benzol can be converted into nitrobenzol, and by further treatment into anilin colors; benzin cannot. When benzin is shaken in the cold with one-third of its volume of fused crystals of absolute carbolic acid the latter remains undissolved, whilst benzol is miscible with absolute carbolic acid in all proportions. (Allen.) According to Pusch, it can be distinguished from benzin by dissolving iodine in it, benzol forming a violet red, and benzin a raspberry-colored solution. (*A. J. P.*, xlvii. 268.) Although the term *Benzene* is given above as one of the synonymes of *Benzol*, its use abroad is gradually becoming limited to the pure hydrocarbon C_6H_6, whilst *Benzol* is applied to the mixture of benzene with its homologues *Toluene*, *Paraxylene*, *Metaxylene*, *Mesitylene*, *Pseudo-cumene*, etc.

Benzol was originally obtained by distilling benzoic acid with lime. It was afterwards discovered by Faraday as a constituent of coal-gas tar. This tar, when distilled, furnishes *coal-naphtha* or light oil of tar, a complex substance, containing a number of hydrocarbons, among which is benzol. Upon distilling this naphtha from a metallic still, surmounted by an open vessel filled with water, and containing a worm terminating in a refrigerated receiver, the benzol will pass over and condense in the receiver; while the other substances associated with it, having higher boiling points, will condense in the worm, and fall back into the still. The benzol is then purified by distillation at a heat between 80° C. (176° F.) and 90° C. (194° F.), and by subjecting the product to a new distillation from one-fourth of its volume of sulphuric acid. A method of obtaining it pure is described by Mr. A. H. Church, consisting in the dry distillation of a compound made by treating the ordinary benzol of commerce with fuming sulphuric acid, then adding carbonate of ammonium, evaporating the whole to dryness, and exhausting the residue with alcohol. The alcoholic solution is distilled to dryness, and the remaining mass distilled at a higher heat. The distillate is washed with solution of potassa, and then rectified from caustic potassa. The product is perfectly pure benzol. (See *A. J. P.*, 1860, p. 144.) M. E. Kopp purifies benzol by taking advantage of its high congealing point. He exposes the impure mixture containing it to a degree of cold sufficient to solidify it,—15° C. (5° F.), presses the congealed mass to separate the liquid hydrocarbons, allows it to become fluid, then again freezes and presses it, and thus obtains it almost entirely pure. He obtains the impure mixture containing the benzol by decomposing the heavier tar oils by a high degree of heat. (*Chem. News*, May 14, 1864, p. 229.)

Prof. Calvert, of Manchester, purifies coal-naphtha, so as to render it a sufficiently pure benzol to be usefully applied to the purpose of removing fatty and oily matters from animal and vegetable substances, by subjecting it to the action of sulphuric acid, added in small quantities, so long as coloration is produced, then washing it with pure water, and afterwards subjecting it to distillation in an ordinary still. The sulphuric acid destroys the less volatile hydrocarbons present, which interfere with the solvent power of the benzol.

In consequence of the great volatility and extreme inflammability of benzol and its attendant hydrocarbons, much care is necessary both in their preparation and subsequent use to avoid any possible exposure to flame. Very serious results have taken place from want of caution in this respect.

Benzol is a colorless oleaginous liquid, possessing an agreeable odor. Its sp. gr. is 0·85, congealing point 0° C. (32° F.), and boiling point 80° C. (176° F.). Its powers as a solvent are very extensive. Among the substances soluble in it are sulphur, phosphorus, and iodine. It dissolves quinine, but not cinchonine, with which it forms a bulky gelatinous mass. Morphine and strychnine are sparingly soluble. Its solvent power over some of the organic alkaloids led Mr. John Williams, of London, to employ it in extracting them from the vegetables in which they are found; and he succeeded in obtaining them in several instances on a small scale. In this way he extracted quinine, quinidine, and amorphous quinine, together, from cinchona bark, but not cinchonine. In like manner he separated strychnine and brucine from nux vomica, and handsome crystals of cantharidine from cantharides. Mr. Williams supposes that benzol might form a good test of the value of Peruvian barks. Benzol is also a solvent of many of the resins, of mastic, camphor, wax, fatty and oily substances, essential oils, caoutchouc, and guttapercha. The last two substances may be obtained, without alteration of properties, in tough sheets of any desired tenuity, by spreading their benzol solutions on glass or other polished surface, and allowing the solvent to evaporate. The same solutions, brushed over the skin, form artificial cuticles, which have been found useful as coverings to wounds and burns. The vapor of benzol, when inhaled, acts as an anæsthetic. As benzol is often mixed, sometimes in but small proportion, with other hydrocarbons associated with it in coal tar and petroleum, it becomes desirable to be able to detect it in such an association. It often becomes a matter of great importance commercially to test the purity of commercial benzol, and a very thorough method of assay based on fractional distillation is proposed by A. H. Allen, in his *Commercial Organic Analysis*, 1882.

The following method, originating with M. Schorlemmer, is based on the conversion of this hydrocarbon into anilin, and of that into one of the characteristic colors derived from it. That part of the mixture which volatilizes at 150° C. (302° F.) is operated on. This is treated with fuming nitric acid, which, if benzol be present, gives rise to a nitrobenzol with its bitter-almond odor. The nitrobenzol is then converted by the action of granulated tin and hydrochloric acid into anilin, which is isolated by distilling the product with potassa. The anilin floats on the top of the liquid that passes. A little of this gives with hypochlorite of sodium a fine purple color; and a drop of it will yield the beautiful color of rosanilin, if heated with a little bichloride of mercury. (*Journ. de Pharm.*, 4e sér., ii. 177.) In relation to benzol, see the paper of C. B. Mansfield, in the *Chem. Gaz.* (No. 159, p. 224), from which many of the facts of this article have been taken.

M. Reynal, of the Veterinary School at Alfort, has long been in the habit of destroying parasites on domestic animals by benzol, and proposes its employment in the parasitic diseases of man. It has the advantage of not affecting the skin. For this purpose a mixture may be used, consisting of 10 parts of benzol, 5 of soap, and 85 of water.

M. Dragendorff proposes further to utilize benzol by substituting it for amylic alcohol in the search for strychnine and brucine, which it dissolves more freely, without affecting the sense of smell so strongly. The sulphates of these alkaloids, however, are insoluble in benzol. (*Journ. de Pharm.*, 4e sér., v. 473.)

Prof. Moslor proposes benzol as a remedy in trichiniasis, and it will no doubt destroy all the trichinæ remaining in the alimentary canal. After some encouraging results with the lower animals, he tried it in several cases of the disease as it prevailed at Quedlinburg early in 1864. He gave the antidote in the following manner. Two drachms of benzol, and an ounce, each, of liquorice juice (solution of the extract) and mucilage of gum arabic, were mixed with four ounces of peppermint-water; and a tablespoonful of the mixture, well shaken, was given every hour or two. The medicine was easily taken and well borne; and many of the patients found themselves relieved under the treatment. Dr. Rudolff gave as much as two drachms daily, continued from four to six days. No bad effects showed themselves, even in cases when the fever was high. But the ultimate result is not stated. (*Boston Med. and Surg. Journ.*, vol. lxxi. p. 381.) Benzol is probably not inert in its relations to the human system, and Dr. Guyot (*Brit. Med. Jour.*, 1879, ii. 825) has described several cases of chronic poisoning occurring in workmen exposed to its fumes. The symptoms were uncertainty of gait, mental disturbance, with a sort of wandering delirium, loss of sexual power, and epileptiform convulsions. A case is on record showing that, taken internally in a considerable quantity, it has a decided narcotic action, apparently intermediate between that of ardent spirit and opium. Swallowed accidentally, to the amount probably of one or two fluidounces, it produced vertigo with a sensation as of intoxication, followed by sleep for two hours, from which the patient awoke with a gay delirium, attended with bursts of laughter, and some impediment of speech, continuing for four hours. The pulse was slightly quickened, the surface warm, and the expression of face animated. Sleep then came on, from which the patient awoke next day, still feeling some dizziness. The breath had a strong smell of benzol. (See *Journ. de Pharm.*, Mars, 1861, p. 222.)

Nitrobenzol. Nitrobenzene. ($C_6H_5NO_2$.) Benzol by the action of strong fuming nitric acid is converted into *nitrobenzol*, $C_6H_6 + HNO_3 = C_6H_5NO_2 + H_2O$. The product, after having been washed with water, forms an oily, yellowish, intensely sweet liquid, with an odor like that of oil of bitter almonds. Its density is 1·186, and boiling point 213° C. (415° F.). It has become of commercial importance under the name of *artificial oil of bitter almonds*, or *oil of mirbane*, being employed in confectionery, for scenting soaps, and for flavoring articles of diet. To detect nitrobenzol in oil of bitter almond, see *Oleum Amygdalæ Amaræ.* Dr. F. Mahla, of Chicago, considers the commercial nitrobenzol as a different compound from the proper chemical article, which he has found to have an odor between that of oil of cinnamon and oil of bitter almond, but more closely analogous to the former. (*A. J. P.*, May, 1859, p. 202.)

A very interesting paper by Mr. H. Letheby, on the physiological and toxicological properties of nitrobenzol, is contained in the *P. J. Tr.* (Sept. 1863, p. 130). In manufactories where the fluid is prepared, the workmen are often affected with headache and sleepiness from exposure to the vapor which escapes; but the effects are quickly relieved by free air and a mild stimulant. Two fatal cases are, however, recorded, one from the inhalation of the vapor, proceeding from the poison spilled upon the person of the individual affected, the other from the accidental swallowing of a small portion. The effects were the same. For some time there was no feeling of discomfort; but, gradually, symptoms of stupor came on, with flushed face, ending in profound coma, in which state the patients died, about nine hours from the time of taking the poison, the coma having come on in four hours. The brain was found congested, the heart full, and the blood black and fluid. Chemical examination detected both nitrobenzol and anilin in the blood, showing that the former had been converted into the latter. Mr. Letheby also made experiments with the poison on domestic animals, and obtained some extraordinary results. From 30 to 60 drops were given by the mouth to cats and dogs. There was rarely vomiting or other sign of gastric irritation. Two classes of effects were observed, either rapid coma, or a slow occurrence of palsy and coma after a period of apparent inaction of the poison. Even in the rapidly comatose cases, paralytic symptoms were noticed in the earlier stage. The time between the exhibition of the poison and death varied in these cases from 25 minutes to 12 hours. In the slower cases there was no visible effect for hours and sometimes for days. Suddenly, however, the animal would be attacked with vomiting, followed by convulsions, which on their subsidence left more or less paralysis, first of the hinder and then of the fore limbs. After this the animal generally lay for days, more or less conscious, with now and then epileptic attacks, and at length died of exhaustion or gradually recovered. The time from the exhibition of the poison to the first epileptic fit was from 19 to 72 hours, in most cases about two days, and to the period of death was from 4 to 9 days. This apparent inaction of the poison at first is very extraordinary, almost justifying the belief in those cases of poisoning said to have occurred in ancient times, in which the substance given exerted no effect till a considerable time after it was exhibited. The explanation is that the nitrobenzol undergoes changes in the system into a more violent poison, and, as anilin is found after death, this may be the real agent. In the guinea-pig, but not in the dog, Dr. Ewald has found nitrobenzol to produce glycosuria. (*Phila. Med. Times*, iv. 312.)

The poisonous properties of nitrobenzol have been denied (*Ann. de Thérap.*, 1861, p. 3), but undoubtedly it is a violent poison. Fifteen drops taken by the mouth are said to have proved fatal (Taylor). According to Caspar, after death, prussic acid and nitrobenzol poisoning may be distinguished by the permanence of the odor of the latter substance when the body is left open. For an elaborate article on the toxicology of nitrobenzol, see *Journ. de Pharm.*, 1875, pp. 375, 455.

BERBERIS. *Barberry.* This genus, belonging to the natural order Berberidaceæ, comprises various shrubs having a yellow inner bark and wood, and probably most of them more or less medicinal. The bark of the root of *B. vulgaris* was formerly included in the secondary list of the U. S. Pharmacopœia, under the name of *Berberis.* (*Epine-vinette*, *Vinettier*, *Ecorce de racine de berbérides*, Fr.; *Fauerach*, *gemeiner Sauerdorn*, *Berberitze*, *Berberitzen-* (*Saurach*) *Wurzelrinde*, G.; *Berbero*, It., Sp.) The *Lycium*, or *λυχιον*, of the ancients, highly valued as a local application in affections of the eye and eyelids, and used for various other purposes, is supposed to be the medicine still used in India for the same affections, under the name of *rusot* or *ruswut.* This, according to Dr. Royle, is an extract from the wood or roots of different species of Berberis, as *B. Lycium*, *B. aristata*, etc., growing in Upper India, especially near Lahore. Combined with opium and alum, it is much used, and with great asserted benefit, in both incipient and chronic ophthalmia. It has been employed also by European practitioners for the same purpose, and especially by Mr. Walker, of Edinburgh, who found it very efficient. The preparation used by him consisted of equal parts of lycium and burnt alum, with half the quantity of opium, and was applied, mixed with lemon-juice to the consistence of cream, over the eyelids and eyebrows. (J. V. Simpson, *P. J. Tr.*, xiii. 415.) The remedy has also been used by Mr. L. W. Stewart, Surgeon in the Madras army, with highly favorable results, in the treatment of intermittent, remittent, and typhoid fevers, diarrhœa, and dyspepsia. (*P. J. Tr.*, Dec. 1865, p. 303.)

B. Aquifolium, *Oregon Grape Root*, is used in the mountainous parts of Oregon, Utah, California, Colorado, Nevada, etc. The root occurs in pieces about a foot long, one-fourth of an inch thick, of a brownish exterior, but yellowish within, yielding a bright lemon-colored bitter powder. It is said to be employed in its native country as an antiperiodic tonic. Mr. H. B. Parsons (*N. R.*, 1882, p. 83) found in it *berberine* and *oxyacanthine.*

Berberis vulgaris. Gray's *Manual of Botany*, p. 19; Woodv. *Med. Bot.*, p. 618, t. 219. This is a native of Europe, but grows wild in waste grounds in the eastern parts of New England, and is sometimes cultivated in gardens on account of its berries. It is a spreading shrub, from four to six feet or more in height, with thorny branches, a light-gray bark, and a fine yellow wood. The leaves are somewhat obovate, with ciliated teeth on their edges, and upon the young shoots three-parted and spiny. The flowers, which are in drooping many-flowered racemes, have yellow entire petals, and are succeeded by oblong scarlet berries. It is a vulgar error to suppose that the vicinity of this plant is injurious to wheat. Under the name of *Berberis Canadensis*, Pursh described an American plant, which grows in hilly districts, from the borders of Canada to the Carolinas, and which is characterized, according to Gray, by its repandly-toothed leaves, with the teeth less bristly-pointed, by its few-flowered racemes, its petals notched at the apex, and its oval berries. By Dr. Hooker, however, it is considered a variety of *B. vulgaris*, from which it differs only in the points mentioned. It is from one to three feet high.

The *berries* of *B. Vulgaris*, which grow in loose bunches, are oblong and of a red color, have a grateful, sour, astringent taste, and contain malic and citric acids. They are refrigerant, astringent, and antiscorbutic, and are used in Europe, in the form of drink, in febrile diseases and diarrhœas. An agreeable syrup is prepared from the juice; and the berries are sometimes preserved for the table. Dr. Graeger found in the ripe fruit 15·58 per cent. of integuments and seeds, 17·20 of soluble solid constituents, and 67·22 of water. The constituents of the juice in 100 parts of fresh berries were 5·92 parts of malic acid, 4·67 of sugar, 6·61 of gum, 67·16 of water, and 0·06 salts of potassa and lime. (*A. J. P.*, Jan. 1, 1873, p. 14.) The *root* and *inner bark* have been used for dyeing yellow. The bark of the root is grayish on the outside, yellow within, very bitter, and stains the saliva when chewed. Brandes found in 100 parts of the root 6·63 of bitter, yellow extractive (impure berberine), 1·55 of brown coloring matter, 0·35 of gum, 0·20 of starch, 0·10 of cerin, 0·07 of stearin, 0·03 of chlorophyll, 0·55 of a subresin, 55·40 of lignin, and 35·00 of water.

To a second alkaloid found in barberry bark the names of *vinetine*, *oxyacanthine*, and *berbine* have been applied. To procure it, the mother-liquor of berberine is precipitated by carbonate of sodium, the precipitate treated with dilute hydrochloric acid, and the liquid filtered and precipitated by ammonia. The impure alkaloid thus obtained may be purified by washing with water, drying, exhausting with ether, evaporating, dissolving the residue in dilute hydrochloric acid, and finally precipitating by ammonia. Vinetine is a white amorphous powder, crystallizable from its alcoholic and ethereal solutions, purely bitter, fusible unchanged at 139·5° C. (283° F.), insoluble or but slightly soluble in water, sparingly dissolved by cold but freely by hot alcohol and ether, and freely soluble in alcohol. It forms soluble salts with the acids, and its chloride is white.

Barberry is in small doses tonic, in larger cathartic, and was formerly given in jaundice, in which, though probably originally employed on account of its yellow color, it may be useful, when the influence of a gentle tonic and laxative is required. It may be used in the form of decoction.

BETAIN. This is a new alkaloid of weak basic properties which Scheibler discovered in the juice of the sugar beet. (*A. J. P.*, xli. 559.) Huseman believes it to be identical with *lycine*, and to have the composition $C_5H_{11}NO_2$. (*A. J. P.*, 1875, 209.) Liebreich also obtained it by the oxidation of cholin and called it *oxyneurine*. (*Ber. Chem. Ges.*, iv. p. 735.)

BETONICA OFFICINALIS. *Wood Betony.* A perennial European labiate herb, having a pleasant but feeble odor, and a warm, somewhat astringent, and bitterish taste. By the ancients it was much esteemed; but it is at present little used. It is a feeble, inferior aromatic. The root has been considered emetic and purgative.

BETULA ALBA. *Common European Birch.* Various parts of this tree have been applied to medical uses. The young shoots and leaves secrete a resinous substance, having acid properties, which, combined with soda, is said to produce the effects of a tonic laxative. (*Journ. de Pharm.*, xxvi. 208.) The *inner bark*, which is bitterish and astringent, has been employed in intermittent fever. The epidermis is separable into thin layers, which may be employed as a substitute for paper, and are applied to various economical uses. The bark contains an alkaloid, *betuline* (for process of preparation, see *A. J. P.*, 1879, 250). When the bark is distilled, it yields an empyreumatic oil, having the peculiar odor of Russia leather, in the preparation of which it is employed. This oil has been found very useful as a local application in chronic eczema. The *leaves*, which have a peculiar, aromatic, agreeable odor, and a bitter taste, have been employed, in the form of infusion, in gout, rheumatism, dropsy, and cutaneous diseases. The same complaints, particularly dropsy, are said to have been successfully treated by enveloping the body in the fresh leaves, which thus applied excite perspiration. When the stem of the tree is wounded, a saccharine *juice* flows out, which is considered useful in complaints of the kidneys and bladder, and is susceptible, with yeast, of the vinous fermentation. A beer, wine, spirit, and vinegar are prepared from it, and used in some parts of Europe. An empyreumatic oil from birch has been used under the names *Oleum Rusci*, *Betulinum*, *Muscoviticum*, etc., its common name being *degutt*. It is used by the Russians to give to Russia leather its peculiar odor, and is now largely employed here, in perfuming imitation leather. It has been used as an external remedy in skin diseases, but probably has no other properties than those of oil of cade or tar. *Tinctura Rusci* is made, according to Hager, by mixing Olei Rusci 10, Alcoholis, Ætheris, āā 15, Olei Lavandulæ, Rosmarini, Rutæ, āā 0·4 parts, and filtering. (*A. J. P.*, 1881.)

Of the American species of birch, *Betula lenta*, variously called *sweet birch*, *black birch*, *cherry birch*, and *mountain mahogany*, is remarkable for the aromatic flavor of its bark and leaves, which have the odor and taste of *Gaultheria procumbens*, due to the presence of a volatile oil, which has been proved by Prof. Procter to be identical with oil of gaultheria. This oil does not pre-exist in the dried bark of the birch, but is formed by reaction between water and a neutral principle in the bark, analogous to amygdalin, to which Prof. Procter has given the name of *gaultherin*. (*A. J. P.*, xv. 243 and 246.) Geo. W. Kennedy gives an interesting account of a visit to A. H. Seidle, Middleport, Pa., a manufacturer of the *oil of birch*, as it is called commercially. Mr. Kennedy examined it, and found it to have the sp. gr. 1·178, and boiling point of 228° C. (442·4° F.). The oil seems to be sold as oil of teaberry or wintergreen, and shipped to New York; this manufacturer labelling his product the same, whether obtained from gaultheria or birch, or a mixture of the two. (*A. J. P.*, 1882, p. 49.) This species also affords a saccharine liquor, which, indeed, appears to be common to all the birches. The bark of *B. papyracea* is employed by the Northern Indians for making canoes; and thin layers of the epidermis are placed inside of boots to prevent the access of moisture.

BEZOAR. This name has been given to concretions formed in the stomach or intestines of animals, which were formerly thought to possess extraordinary medical virtues. Many varieties have been noticed; but they were all arranged in two classes, the *oriental bezoar* (*lapis bezoar orientalis*), and *western bezoar* (*lapis bezoar occidentalis*), of which the former was most esteemed. They have fallen into merited neglect.

BICARBONATE OF AMMONIUM. *Acid Carbonate of Ammonium.* $H(NH_4)CO_3$ This salt has been brought into notice by Prof. Wm. Procter, in reference to its antacid properties. It is formed by exposure of the ordinary carbonate to the air, and is found in considerable quantities on the sides of casks in which that salt is imported, and less largely even in the bottles in which it is kept in the shops. When pure, the bicarbonate of ammonium is white, having the same crystalline form as the bicarbonate of potassium, of a saline slightly ammoniacal taste, and a feeble odor of ammonia, ascribable to a very slow volatilization. On exposure to heat, it gives off carbonic acid. It is soluble in 8 parts of water at 15·6° C. (60° F.), is nearly insoluble in officinal alcohol, but soluble in diluted alcohol; and its solution has an alkaline reaction with syrup of violets. It may be prepared by treating commercial carbonate of ammonium (sesquicarbonate of ammonium) with officinal alcohol, whereby the neutral carbonate is dissolved, and the bicarbonate left. To render this still purer it should be washed with alcohol and dried. It is obtained as a crystalline precipitate by adding alcohol to a saturated solution of the ordinary carbonate; or by passing carbonic acid through the same solution. It may be used as an antacid in the same manner and the same doses as bicarbonate of sodium, being preferable to that salt when a stimulant impression on the stomach is desired. (*A. J. P.*, July, 1869, p. 294.)

BIDENS BIPINNATA. (*Gray's Manual*, p. 222.) *Spanish Needles.* An indigenous composite plant, of which the root and seeds, as well as those of other species of the same genus, have a popular reputation as emmenagogue, and are given by the "eclectics" in laryngeal and bronchial diseases as expectorants.

BIRD-LIME. A viscid substance, existing in various plants, particularly in the bark of *Viscum album* and *Ilex aquifolium* or European holly, from the latter of which it is usually procured. The process for preparing it consists in boiling the middle bark for some hours in water, then separating it from the liquid, and placing it in proper vessels in a cool situation, where it is allowed to remain till it becomes viscous. It is then washed to separate impurities, and constitutes the substance in question. Bird-lime thus prepared is greenish, tenacious, glutinous, bitterish, and of an odor analogous to that of flaxseed oil. Exposed to the air in thin layers it becomes dry, brown, and pulverizable, but reacquires its viscidity upon the addition of water. It is a complex body, but is thought to owe its characteristic properties to a proximate principle, identical with that which exudes spontaneously from certain plants, and is called *glu* by the French chemists. This principle is without odor or taste, extremely adhesive, fusible by heat, inflammable, insoluble in water, nearly insoluble in alcohol, but dissolved freely by ether and oil of turpentine. According to M. Macaire, it is insoluble in the fixed oils, either hot or cold; a property which distinguishes it from the resins. M. Macaire proposes for it the name of *viscin.* (*Jour. de Pharm.*, xx. 18.) Bird-lime is so tenacious that it may be employed to catch small birds, which, when they alight on a stick thickly covered with it, are unable to escape.

BISTORT. This is the root of *Polygonum Bistorta*, a perennial herbaceous plant, growing in Europe and the north of Asia. The root is cylindrical, somewhat flattened, about as thick as the little finger, marked with annular or transverse wrinkles, furnished with numerous fibres, and folded or bent upon itself, so as to give it the tortuous appearance from which its name was derived. When dried, it is solid, brittle, of a deep brown color externally, reddish within, inodorous, and of a rough, astringent taste. It contains much tannin, some gallic acid and gum, and a large proportion of starch. It resembles the other vegetable astringents in medical properties, and is applicable to the same complaints; but is less efficient than catechu or kino, and in this country is seldom used. H. K. Bowman found 21 per cent. of tannin in bistort root. (*A. J. P.*, 1869, p. 193.) It may be employed in powder, decoction, or extract. The dose of the powder is 20 or 30 grains.

Besides the bistort, some other plants belonging to the genus Polygonum have been used as medicines. Among those are *P. aviculare*, or *knot grass*, a mild astringent, formerly employed as a vulnerary and styptic; *P. Persicaria* (*Persicaria mitis*), of a feebly astringent saline taste, and at one time considered antiseptic; and *P. Hydropiper* or water-pepper (*Persicaria urens*), the leaves of which have a burning and biting taste, inflame the skin when rubbed upon it, and are esteemed diuretic, and have been used with asserted success in amenorrhœa and other uterine disorders. Its irritant and also medicinal properties are due to an acid, *polygonic acid*, discovered by C. J. Rademaker. (*A. J. P.*, xliii. 490.) The *water-pepper* or *smart-weed* of this country—*P. punctatum* (Elliott), *P. hydropiperoides* (Michaux)—which grows abundantly in moist places, possesses properties similar to those of the European water-pepper, and is occasionally used as a detergent in chronic ulcers, and internally in gravel. Dr. B. Woodward finds that the dried plant contains 18 per cent. of tannin, and uses a saturated tincture with great advantage in diarrhœa and dysentery, in doses of 20 to 60 minims. Dr. Eberle very strongly recommended it in amenorrhœa, in which complaint he found no other remedy equally effectual. He gave a fluidrachm of the saturated tincture of the plant, or from four to six grains of the extract, three or four times a day. He found it to produce a warmth and peculiar tingling sensation throughout the system, with slight aching pains in the hips and loins, and a sense of weight and tension within the pelvis. (*Eberle's Mat. Med.*, 4th ed., i. 441.) Dr. Wilcox, of Elmira, New York, has found advantage from a decoction of the dried leaves, made in the proportion of an ounce to the pint, and applied locally, in mercurial salivation, and the sore-mouth of nursing women. (*Am. Jour. of Med. Sci.*, N. S., xvi. 248.) Prof. Aughey finds that *P. amphibium* is readily cultivated, with a yield of from three to six tons to the acre, that the roots contain 21·75 per cent., the stems 17·1 per cent. of tannic acid, and urges the growth of it for tanning purposes. (*N. R.*, 1876, 75.) *P. Fagopyrum* is common *buckwheat*. The leaves of this plant have been found by Mr. Ed. Schunck to contain a crystallizable coloring principle, identical with the *rutin* or *rutic acid* previously discovered by Weiss in the leaves of the common rue, and probably with the *ilixanthin* of Moldenhaus, existing in the leaves of *Ilex aquifolium* or common holly. Buckwheat leaves yielded to Mr. Schunck somewhat more than one part of rutin in a thousand. (*Chem. Gaz.*, No. 399, p. 201.)

BISULPHATE OF POTASSIUM. *Potassii Bisulphas. Acid Sulphate of Potassium* ($KHSO_4$). This salt, though formerly officinal in the Ed. and Dub. Pharmacopœias, has been omitted in the British. The following is the old formula of the Dublin Pharmacopœia. "Take of Sulphate of Potash, in powder, *three ounces* [avoirdupois]; Pure Sulphuric Acid *one fluidounce* [Imperial measure]. Place the Acid and Salt in a small porcelain capsule, and to this apply a heat capable of liquefying its contents, and which should be continued until acid vapors cease to be given off. The Bisulphate, which concretes as it cools, should be reduced to a fine powder, and preserved in a well-stopped bottle." It is frequently a by-product in chemical operations, being left as residue when potassium salts are decomposed by sulphuric acid.

Properties, etc. Bisulphate of potassium is a white salt, having the form of a right rhombic prism so flattened as to be tabular, and a bitter and extremely acid taste. It is soluble in twice its weight of cold, and in less than its weight of boiling water. Alcohol does not dissolve it, but, when added to an aqueous solution, precipitates the neutral sulphate. Exposed to the air, it effloresces slightly on the surface, and when moderately heated readily melts, and runs like oil. At a red heat it loses water and the excess of acid, and is reduced to the neutral sulphate. Owing to its excess of acid, it acts precisely as an acid on the carbonates, causing them to effervesce. It is incompatible with alkalies, earths, and their carbonates, with many of the metals, and most oxides. This salt was formerly called *sal enixum*.

Medical Properties and Uses. Bisulphate of potassium unites the properties of an aperient and tonic, and may be given in constipation with languid appetite, such as often occurs in convalescence. Dr. Paris states that it forms a grateful adjunct to rhubarb. It answers also, according to Dr. Barker, for preparing a cheap aperient effervescing draught. Equal weights, a drachm for instance, of the bisulphate and of carbonate of sodium, may be dissolved separately, each in two fluidounces of water, then mixed, and taken in the state of effervescence. The dose of the bisulphate is one or two drachms.

BLACK WAX. This appears to be a product of animal life, which has found its way to England from India and the Pacific Islands. (*P. J. Tr.*, 2d ser., x. 11, 219.)

BLOOD OF BULLOCKS. As long ago as 1852, Prof. Samuel Jackson, of this city, employed as a tonic the blood of bullocks carefully dried in vacuo, giving 5 to 10 grains of it as a dose. Recently it has been used considerably in Europe, and even drinking fresh bullock's blood has come to some extent into fashion. Under the name of *Sanguis Bovinus Exsiccatus*, Dr. F. E. Stewart has introduced defibrinated dried bullock's blood, claiming for it that, by the simple addition of water, bullock's blood can be reproduced minus a small quantity of fibrin. There is no reason for believing that dried blood is more valuable than more usual ferruginous tonics, if indeed it be of equal value.

BOLDO. This plant is an evergreen shrub, frequenting the meadows of the Andes, in Chili, where its yellowish-green fruit is eaten, its bark used in tanning, and its wood in charcoal-making. It is the *Peumus Boldo* of Molina (1782). The leaves, which contain a large amount of an aromatic volatile oil in especial cells, are the parts used in medicine. They are entire, reddish brown when dry, coriaceous, with a prominent mid-rib and very numerous small glands upon their surface. A peculiar alkaloid, *Boldine*, has been found in them by MM. Bourgon and Verne (*Journ. de Pharm.*, 4e sér., xvi. 191). In France the remedy has been employed as a tonic, especially in cases in which there existed chronic hepatic torpor. (*P. J. Tr.*, Nov. 1874, p. 405.) Fifty centigrammes (8 minims) of a tincture, made by macerating 100 parts of the drug in 500 parts of alcohol, are given at a dose, and increased gradually. Large doses are apt to vomit and purge. In South America it is used in gonorrhœa and chronic catarrh of the bladder. (*N. P.*, ii. 27; *Bull. de Thérap.*, lxxxvi. 165.)

BOLE ARMENIAN. The term *bolus* or *bole* was formerly applied to various forms of argillaceous earth, differing in color, or place of origin. Such were the *Armenian*, *Lemnian*, and *French boles*, and the *red* and *white boles*. Some of these substances were so highly valued as to be formed into small masses and impressed with a seal, and hence received the name of *terræ sigillatæ*. They were all similar in effect, though the small proportion of oxide of iron contained in the colored boles may have given them greater activity. The only one at present kept in the shops is that called *bole Armenian*, from its resemblance to the substance originally brought from Armenia. It is prepared, by trituration and elutriation, from certain native earths existing in different parts of Europe. It is in pieces of various sizes, reddish, soft, and unctuous, adhesive to the tongue, and capable of forming a paste with water. It consists chiefly of a hydrated silicate of aluminium with ferric hydrate. The boles were formerly employed as absorbents and astringents, and were undoubtedly useful in some cases of acidity of the stomach and relaxed bowels. Bole Armenian is used chiefly as a coloring ingredient in tooth powders.

BORAGO OFFICINALIS. *Borage*. This is an annual, hairy, succulent European plant, one or two feet high, with fine blue flowers, on account of which it is sometimes cultivated in our gardens. All parts of it abound in mucilage, and the stem and leaves contain nitrate of potassium with other salts. To these constituents the plant owes all its virtues. It is much used in France. An infusion of the leaves and flowers, sweetened with honey or syrup, is employed as a demulcent, refrigerant, and gently diaphoretic drink in catarrhal affections, rheumatism, diseases of the skin, etc. The expressed juice of the stem and leaves is also given in the dose of from two to four ounces. The flowers are sometimes applied externally as an emollient. A distilled water, extract, and syrup were formerly used, but have fallen into neglect. Borage is scarcely known in this country as a medicinal plant.

BORATE OF AMMONIUM. *Biborate of Ammonium.* $2(NH_4HB_2O_4)3H_2O$. By dissolving one part of boracic acid in excess, in three parts heated water of ammonia, sp. gr. 960, and allowing the solution to cool slowly, this salt is obtained in crystals. These are rhombic octahedrons, with truncated summits, and often truncated edges, and are semitransparent. The taste of the salt is alkaline, and it has an alkaline reaction. On exposure, it effloresces, losing ammonia, and becoming in time the quadriborate. It is soluble in about twelve parts of water. (*Gmelin*, ii. 435.) Attention has been called to this salt by M. Beeker, who has used it in stone in the bladder and renal colic, and, as he believes, almost constantly with an amelioration of the symptoms. Under its influence the urine becomes loaded with uric acid and the earthy phosphates. It is said also to be an excellent remedy in chronic catarrh of the bladder. It is believed by M. Beeker to be the *ludus* of Paracelsus, which had a great reputation in the treatment of urinary calculi. It may be given in the dose of from 10 to 20 grains every hour, in water sweetened with liquorice. (*Journ. de Thérap. Méd.-Chir.*, Sept. 1, 1866.)

BRAZIL NUTS. *Cream Nuts.* These are edible nuts imported from Brazil, and sometimes employed in making cream syrups for giving flavor to carbonic acid water. In Brazil an expressed oil is obtained from them, which is said to be used for burning, making ointments, and adulterating copaiba. Dr. Edward Donnelly, of Philadelphia, states (*Proceedings Am. Pharm. Assoc.*, 1858, p. 327) that the nuts are the product of the *Bertholletia excelsa* (Humboldt and Bonpland), a large and beautiful tree, growing over extensive regions in South America. The leaf and fruit are figured in the work just referred to. B. Corenwinder has found in the kernel of the nut 65·60 per cent. of oil, and 15·31 per cent. of nitrogenous matter. (*P. J. Tr.*, Aug. 1873, p. 86.)

BRAZIL WOOD. A red dye-wood, the product of different species of Cæsalpina, growing in the West Indies and South America. Two varieties are known in commerce: —1. The proper Brazil wood, said to be derived from *Cæsalpina echinata*, and sometimes called *Pernambuco* or *Fernambuco wood*, from the province of Brazil where it is collected; 2. the *brasiletto*, produced by *C. Brasiliensis* and *C. Crista*, which grow in Jamaica and other parts of the West Indies. The former is the most highly valued. The *sappan* or *sampfen wood* may be referred to the same head, being obtained from the *Cæsalpina sappan*, and possessing properties analogous to those of the brasiletto. The *Nicaragua* or *peach wood* is also analogous to the brasiletto, and is said by Bancroft to be derived from a species of Cæsalpina. It is produced in the East Indies. Brazil wood is nearly inodorous, has a slightly sweetish taste, stains the saliva red, and imparts its coloring matter to water. It was formerly used in medicine; but has been abandoned as inert. In pharmacy it serves to color tinctures, etc.; but its chief use is in dyeing. A red lake is prepared from it, and it is an ingredient in a red ink. Its dyeing properties are owing to a crystallizable coloring principle, named *brazilin* or *brasilin*, $C_{22}H_{20}O_7$. This, as usually obtained, is of a sulphur-yellow color, which it preserves in the dark, but soon loses in the sunlight, to which it is remarkably sensitive, changing to a reddish hue after a few minutes' exposure, and undergoing a similar alteration in diffused daylight, though more slowly. The principle should, therefore, be kept in perfectly opaque vessels. It is now stated that when absolutely pure it is colorless, and becomes red on exposure to the air.

It is sparingly soluble in water, yielding a sweet and almost colorless solution which is not changed by acids, but is deeply reddened by alkalies. In alcohol and ether it is somewhat more soluble than in water, giving a light-yellow solution. The colorless watery solution soon becomes reddish in the air, afterwards yellowish red, and acquires the curious property of phosphorescing in a golden-yellow light. (C. F. Schönbein, *Neues Repertor.*, 1868, vol. xvii., part vii., p. 390; *Journ. de Pharm.*, 4e sér., xix. 88.)

BROMAL. (C_2HBr_3O.) This substance resembles chloral in its chemical properties, like it existing as an oily colorless liquid, or, when united with water or alcohol, as a crystalline hydrate or alcoholate. It boils at about 100° C. (212° F.), and distils without decomposition. It is prepared by adding, little by little, 3 to 4 parts of bromine to refrigerated alcohol. After fifteen hours of contact the mixture is distilled. The bromine and other very volatile products come over first, and afterwards, at a temperature of 160° C. (320° F.) to 180° C. (356° F.), the bromal, with an oily substance insoluble in water. Water being added, the hydrate of bromal ($C_2HBr_3O,2H_2O$) is formed. By the action of an alkali, bromoform is produced from the hydrate of bromal. Its physiological action has been investigated by Dr. S. Steinauer. (*Virchow's Archiv*, May 19, 1870.) In frogs it produced at first great restlessness, followed by sleep of moderate intensity, accompanied by an almost complete analgesia. In warm-blooded animals similar symptoms were developed. Dyspnœa was usually very marked, and death sometimes occurred in convulsions. The cardiac ventricles after death were relaxed or tetanized, according as the dose had been large or small. Dr. Steinauer believes the succession of symptoms is due to the first action being that of the bromal, and the subsequent, that of bromoform and nascent bromides generated in the blood from the bromal hydrate. Dr. Steinauer administered the drug to several patients, in doses of three grains at bedtime, with the effect of relieving pain or producing sleep. In epileptics it seemed to avert the paroxysms.

BROMIDE OF CADMIUM. ($CdBr_2$.) This salt is not often used in medicine, but a case of severe poisoning by it (*Boston Med. and Surg. Journ.*, Oct. 1876) makes allusion to it here necessary. The symptoms were those of violent irritant poisoning.

BROMIDE OF CALCIUM. ($CaBr_2$.) This is prepared by M. Boedecker by first forming a bromide of sulphur by the addition of 20 parts of the flowers of sulphur to 240 parts of bromine; this is added to a milk of lime containing 140 parts of fresh lime. The sulphate and bromide of calcium are formed and are readily separated. (*Journ. de Pharm.*, 4e sér., viii. 463.) Mr. Jas. R. Mercein puts five ounces of bromine and two and a half pints of water in a half-gallon specie jar, passes a stream of sulphuretted hydrogen through the bromine until it is all taken up, filters, drives off excess of sulphuretted hydrogen by heat, distils the solution of hydrobromic acid thus obtained until four-fifths have passed over, saturates this with excess of precipitated carbonate of calcium, filters and evaporates. (*A. J. P.*, xliv. 100.) For Macdonald's process see 14th ed. U. S. D., p. 1597, or *A. J. P.*, xliv. p. 447. Bromide of calcium is a granular salt, of a hot, somewhat saline taste. It is freely soluble in twice its weight of water. It has been used in medicine for the same purposes as bromide of potassium. Dr. Guttmann (*Phila. Med. Times*, iv. 361) found it in its action on animals to be only one-third to one-fourth the strength of the potassium salt, and to be wanting in the action which is exerted by that salt upon the heart. The dose is one-half drachm to two drachms.

BROMIDE OF CERIUM. (Ce_2Br_6.) This salt is prepared by Mr. Charles Bullock by calcining the oxalate in a porcelain capsule until it becomes converted into the yellowish-brown sesquioxide, dissolving this in hydrochloric acid, precipitating with carbonate of sodium, dissolving in hydrobromic acid, and evaporating at a low temperature to dryness. As thus prepared, the salt is of a light chocolate color, and of a very styptic sweetish taste, soluble in 95 per cent. alcohol, partially soluble in water. (*A. J. P.*, xliii. 345.)

BROMIDE OF ETHYL. *Ethyl Bromide. Hydrobromic Ether.* (C_2H_5Br.) This ether was discovered by Serullas in 1827, who prepared it by acting on alcohol with bromine in the presence of phosphorus. (*Ann. Ch. Phys.*, xxxiv. 99.) Personne suggested the use of amorphous phosphorus, as less dangerous than ordinary phosphorus, and more convenient to manipulate. (*Compt.-Rend.*, iii. 468.) A process was also recommended by Prof. Remington, based upon Personne's suggestion. (*Proc. Amer. Pharm. Assoc.*, 1877.) De Vrij proposed to decompose bromide of potassium with sulphuric acid in the presence of alcohol, and a modification of this method is generally employed now for its production. We have obtained good results by the following process.

Take of potassium bromide (not powdered) 58 parts; sulphuric acid, sp. gr. 1·838, 44 parts; alcohol (clean), 95 per cent., 44 parts; water, 28 parts. Pour the water into a flask having double the capacity of the liquid ingredients above, and gradually add the acid; when the liquid has become cool, add the potassium bromide, and having placed the flask in a sand-bath, adjust a thermometer, and with a bent glass tube connect the flask with a well-cooled condenser; insert a narrow glass tube in the cork of the flask, and by means of a short rubber tube connect it with a narrow glass tube which is terminated by a siphon; the shorter limb of this siphon is inserted in the bottle containing the alcohol, which is elevated three feet or more above the flask. Heat the contents of the flask to 116° C. (240·8° F.), and having attached a screw pinch cock to the short rubber tube of the siphon, allow the alcohol to drop or flow in a small stream into the flask, carefully regulating the rate or flow so that the temperature shall not fall below 100° C. (212° F.), nor rise above 116° C. (240·8° F.). When all the alcohol has passed into the flask, continue the distillation until the temperature rises to 116° C. (240·8° F.), and then disconnect the receiving flask. Agitate the distillate with an equal bulk of distilled water, to which has been added five parts of solution of soda (or sufficient to render the liquid slightly alkaline), and when the mixture has clearly separated into two layers, pour off the uppermost layer, and having introduced the heavier liquid into a clean flask containing a few fragments of chloride of calcium, redistil it. For other methods of manufacture, see *N. R.*, 1877, p. 200; 1879, p. 8; *A. J. P.*, 1879, p. 292; 1880, pp. 248, 280, 298. Dr. L. Wolff's process for making it economically will be found in *A. J. P.*, 1880, p. 242.

Bromide of ethyl is a colorless, very volatile liquid, not inflammable, having an agreeable odor, and a hot, saccharine taste. Its specific gravity is 1·420. It boils at 40° C. (104° F.). It is very sparingly soluble in water, freely soluble in strong alcohol and ether. When a small portion is evaporated from a porcelain plate by causing it to flow to and fro over the surface, little or no foreign odor is yielded as the last portions pass off, and the plate is covered with a slight deposit of moisture.

Bromide of ethyl has been used as an anæsthetic, and at one time bade fair to become very popular. The occurrence of two deaths during its use, however, early arrested its successful career. It is a very prompt anæsthetic, in most cases acting even more quickly than does chloroform, but less agreeably to the patient. Recovery is very prompt. Its action upon the heart is the same as that of chloroform. Injected into the jugular vein, it arrests the heart's action, and one death produced by it was distinctly by syncope. In some cases it has seemed very irritant. It appears to be even more dangerous than chloroform, and will probably never be used to any extent in practical medicine.

BROMIDE OF IRON. *Ferri Bromidum.* ($FeBr_2$.) This bromide is obtained by heating gently, in thirty parts of water, two parts of bromine, and one of iron filings. When the liquid has become greenish, it is filtered and evaporated to dryness in an iron vessel; and the dry mass, again dissolved and evaporated to dryness, furnishes the bromide. Bromide of iron is a brick-red, deliquescent salt, very soluble, and extremely styptic. For medical employment it should be in aqueous solution, protected by sugar. Mr. Dillwyn Parrish has proposed the following formula. Take of bromine two hundred grains; iron filings eighty-five grains; distilled water four and a half fluidounces; sugar three ounces. Make a solution in the manner directed for preparing solution of iodide of iron. (*Med. Exam.*, vii. 162.) For other formulas, see *P. J. Tr.*, 3d ser., v. 67, 162. This solution is deemed tonic and alterative. It has been used with advantage by Dr. E. Gillespie, of Brady's Bend, Pa., in tetter, scrofulous tumors, inflammation of the glands both acute and chronic, erysipelas, and amenorrhœa. In tumors and erysipelas, Dr. Gillespie, besides giving the solution internally, applies it to the parts affected, by means of a feather, two or three times a day. Dr. David Alter, of Freeport, Pa., has employed it with seeming benefit in phthisis and other tuberculous diseases. It has also been found useful in bronchocele. The dose of Mr. Parrish's solution is twenty drops, three times a day, gradually increased until its effects are manifested. Bromide of iron is formed as the first step of the process for preparing bromide of potassium.

BROMIDES OF THE ALKALOIDS. These have been proposed as medicinal agents, but are devoid of any advantages. They may be made by precipitating bromide of barium by the sulphate of the alkaloid, as suggested by Geo. Macdonald. (*A. J. P.*, 1872, p. 447.)

BROMIDES OF MERCURY. *Mercurous bromide* (Hg_2Br_2) is formed by adding bromide of potassium to mercurous nitrate. It falls as a white curdy precipitate. *Mercuric bromide* ($HgBr_2$) may be obtained by digesting mercurous bromide in water containing bromine. Mr. A. E. Ebert prepares it by reaction between bromide of potassium and officinal solution of nitrate of mercury. For the particulars of the process, see a paper by Mr. Ebert in the *A. J. P.*, March, 1867, p. 107. It is in the form of colorless crystals, soluble in water and alcohol. Exposed to heat it melts and sublimes. These bromides are analogous in composition and medical properties to the corresponding iodides of mercury. Mercurous or *protobromide* is given in the dose of a grain daily, gradually increased. Mercuric or *bibromide*, like corrosive sublimate, is an irritant poison, and may be administered in doses of the sixteenth of a grain, gradually increased to the fourth, either in the form of pill, or in ethereal solution made by dissolving a grain in a fluidrachm of ether.

BUXUS SEMPERVIRENS. *Box.* This evergreen shrub is too well known to require description. Though much cultivated in this country as an ornamental plant, it is a native of Europe and Western Asia. The wood is considered diaphoretic in its native countries, and is used in decoction in rheumatism, secondary syphilis, etc. The leaves, which have a peculiar odor and a bitter and disagreeable taste, are said to be purgative in the dose of a drachm. A volatile oil distilled from the wood has been given in epilepsy. A tincture formerly enjoyed some reputation as an antiperiodic. (*Mérat et De Lens.*) In 1860 it was determined by Walz that *buxine*, an alkaloid which had been discovered in the leaves of this tree, was identical with the bebeerine of the bebeeru or nectandra bark. (See *Nectandra;* also *P. J. Tr.*, Oct. 1869, p. 194.)

BYTTERA FEBRIFUGA. *Bitter Ash.* The name *Byttera febrifuga* was given by M. Bélanger to a tree growing in Martinique, in the West Indies, the wood of which has tonic properties closely analogous to those of quassia. It appears to be one of the Simarubaceæ; but differs from the plants of the genus Simaruba of De Candolle, in having hermaphrodite flowers, resembling in this respect the Quassia of that author. A bitter principle has been separated from the wood by M. Gerardias, which is closely analogous if not identical with *quassin*, the active principle of quassia. The wood has long been used in the West Indies in the cure of intermittents, and probably has all the remedial properties of the simple bitters. (*Journ. de Pharm.*, xxxi. 110.) It seems, however, at present to be admitted that this Byttera of M. Bélanger is really the *Quassia excelsa* of Linn., the *Simaruba excelsa* of De Candolle, from which quassia is generally obtained (*Ann. de Thérap.*, 1858, p. 190); and a specimen of the wood of this supposed Byttera, said to be from the island of Guadeloupe or Martinique, which the late Dr. Geo. B. Wood saw at the Palais d'Industrie in Paris, bore a very close resemblance to the billets of quassia.

CABBAGE LEAVES. The leaves of ordinary cabbage have been highly praised by Dr. Blanc (*N. R.*, 1873, p. 407) as a stimulant application to foul, indolent ulcers.

CABBAGE-TREE BARK. The bark of *Andira inermis* (De Cand.), *Geoffroya inermis* (Willd.), *Woodv. Med. Bot.*, p. 416, t. 151. This is a leguminous tree, with a stem rising to a considerable height, branched towards the top, and covered with a smooth gray bark. The leaves are pinnate, consisting of six or seven pairs of ovate-lanceolate, pointed, veined, smooth, petiolate leaflets, with an odd one at the end. The flowers are rose-colored, and in terminal panicles, with very short pedicels. The tree is a native of Jamaica and other West India Islands. The bark, which is the part used, is in long pieces, thick, fibrous, externally of a brownish-ash color, scaly, and covered with lichens, internally yellowish, of a resinous fracture, a disagreeable smell, and a sweetish, mucilaginous, bitterish taste. Its powder resembles that of jalap. Huttenschmidt obtained from it a crystallizable, very bitter substance, having the composition and neutralizing properties of the vegetable alkaloids, and named it *jamaicine.* Two grains of it produced violent purging in pigeons.

Theodore Peckolt says of the wood of the tree, which he calls *Andira anthelmintica*, that the workmen engaged in sawing it are apt to be affected with inflammation of the eyes, constriction of the throat, excessive thirst, a bitter, burning taste, a troublesome itching over the body, and sometimes eruptions on the skin. By treating a concentrated decoction of the wood with hydrate of lime, filtering after 48 hours, evaporating to the consistence of syrup, and exhausting the residue with alcohol, Peckolt obtained a yellowish-brown coloring matter which he called *andirin.* He also obtained a peculiar resin by treating the wood with alcohol, filtering, distilling off most of the alcohol, and then precipitating by water. The resin is inodorous, of a bitter, acrid taste, soluble in alcohol, and but partially soluble in ether. This resin, and peculiarly the portion soluble in ether, gives its irritating properties to the sawdust. (*Chem. Centralbl.*, Nov. 17, 1858.)

On the continent of Europe, the bark of *Andira retusa* (*Geoffroya Surinamensis*), which grows in Surinam, has also been used. It is considered more powerfully vermifuge, and less liable to produce injurious effects. It has a grayish epidermis, beneath which it is reddish brown, laminated, compact, and very tenacious, and, when cut transversely, exhibits a shining and variegated surface. In the dried state it is inodorous, but has an austere bitter taste. The powder is of a pale cinnamon color.

Cabbage-tree bark is cathartic, and, in large doses, apt to occasion vomiting, fever, and delirium. It is said that these effects are more liable to result if cold water is drunk during its operation, and are relieved by the use of warm water, castor oil, or a vegetable acid. In the West Indies it is esteemed a powerful vermifuge, and is much employed for expelling lumbrici; but it is dangerous if incautiously administered, and instances of death from its use have occurred. It is almost unknown in this country. The usual form of administration is that of decoction, though the medicine is also given in powder, syrup, and extract. The dose of the powder is from a scruple to half a drachm, of the extract three grains, of the decoction two fluidounces.

CACTUS GRANDIFLORA. *Night-blooming Cereus.* This well-known flowering plant has recently been introduced into therapeutics. Dr. Rubini has used with success, in functional palpitations of the heart, a tincture made of four ounces of the fresh stems and flowers and a pint of strong alcohol, by macerating for a month, and filtering. He gives from one to five drops three times a day. (*N. Y. Med. Record*, Sept. 1868, 299.) Dr. R. E. Kunge confirms the statements of the value of the cactus in cardiac disease, using it with asserted good in angina pectoris and various organic disorders. He gives the tincture in doses of twenty drops. (*N. P.*, vol. ii.) We have made some trial of it without being able to perceive any effect from it.

CAHINCA. This medicine attracted at one time considerable attention. The name of *cahinca* or *cainca* was adopted from the language of the Brazilian Indians. The Portuguese of Brazil call the medicine *raiz pretta* or black root. When first noticed in Europe, it was supposed to be derived from the *Chiococca racemosa* of Linnæus, which was known to botanists as an inhabitant of the West Indies. But Martius, in his "Specimen Materiæ Medicæ Brasiliensis," describes two other species of Chiococca, *C. anguifuga* and *C. densifolia*, which afford roots having the properties of the root ascribed to *C. racemosa;* and, as the medicine was brought from Brazil, there seemed to be good reason for referring it to one or both of the plants named by that botanist. A. Richard, however, received from Brazil specimens of *C. racemosa* as the cahinca plant.

A specimen brought into this market consisted of cylindrical pieces, varying in size from the thickness of a straw to that of the little finger, somewhat bent or contorted, slightly wrinkled longitudinally, with occasional small asperities, internally ligneous, externally covered with a thin, brittle, reddish-brown bark, having a light-brown or brownish ash-colored epidermis. The cortical portion, which was of a resinous character, had a bitter disagreeable taste, somewhat acrid and astringent; the ligneous part was quite tasteless. The virtues of the root reside almost exclusively in its bark. They are extracted by water and alcohol. Cahinca has been analyzed by several chemists. Four distinct principles were discovered in it by Pelletier and Caventou:—1. a crystallizable bitter substance, believed to be the active principle, and called *cahincic acid*, $C_{40}H_{64}O_{18}$; 2. a green fatty matter of a nauseous odor; 3. a yellow coloring matter; and 4. a colored viscid substance. Rochleder and Hlasiwetz found also caffetannic acid. By these chemists a tincture, obtained by boiling the bark in alcohol, was precipitated first with a spirituous solution of acetate of lead, and afterwards, having been previously filtered, with the tribasic acetate of lead. The first precipitate consisted chiefly of caffetannate and a portion of cahincate of lead, the second of cahincate of lead exclusively. To obtain the caffetannic acid separate, the first precipitate was treated with sulphuretted hydrogen, and afterwards with neutral acetate of lead, and in like manner several times, until at length a pure caffetannate of lead remained, which, on decomposition, yielded an acid identical with the tannic acid of coffee. The cahincic acid was obtained by treating the second precipitate with sulphuretted hydrogen, and concentrating the resulting liquid. Cahincic acid is white, without smell, of a taste at first scarcely perceptible, but afterwards extremely bitter and slightly astringent, of difficult solubility in water, but readily soluble in alcohol, permanent in the air, and unaltered at 100° C. (212° F.) It reddens vegetable blues, and unites with the alkalies, but does not form crystallizable salts. It is thought to exist in the root as subcahincate of calcium.

Medical Properties. Cahinca is tonic, diuretic, purgative, and emetic. In moderate doses it gently excites the circulation, increases the discharge of urine, and produces evacuations from the bowels; but is rather slow in its operation. It may be made to act also as a diaphoretic, by keeping the skin warm, using warm drinks, and counteracting its purgative tendency. In some patients it occasions nausea and griping, and in very large doses always acts powerfully both as an emetic and cathartic. In Brazil it has long been used by the natives as a remedy for the bites of serpents; and its Indian name is said to have been derived from this property. According to Martius, the bark of the fresh root is rubbed with water till the latter becomes charged with all its active matters; and the liquid, while yet turbid, is taken in such quantities as to produce the most violent vomiting and purging, preceded by severe spasmodic pains. Patrick Brown speaks of the root of *C. racemosa* as very useful in obstinate rheumatism. But the virtues of cahinca in dropsy, though well known in Brazil, were first made known to the European public in the year 1826, by M. Langsdorf, Russian Consul at Rio Janeiro. Achille Richard afterwards published a few observations in relation to it in the *Journ. de Chimie Médicale;* and its properties were subsequently investigated by numerous practitioners. M. François, of Paris, contributed more than any other physician to its reputation. It was considered by him superior to all other remedies in dropsy. But general experience has not confirmed the partial estimate of Dr. François; and, having been found at least equally uncertain with other diuretics, the medicine is now little used. It was employed in substance, decoction, extract, and tincture. The powdered bark of the root was given as a diuretic and purgative, in a dose varying from a scruple to a drachm; but the aqueous or spirituous extract was preferred. The dose of either of these is from ten to twenty grains. Dr. François recommended that, in the treatment of dropsy, a sufficient quantity should be given at once to produce a decided impression, which should afterwards be maintained by smaller doses, repeated three or four times a day.

CALAMINA. *Calamine. Lapis Calaminaris.* Calamine is found in the United States, but more abundantly in Germany and England. It usually occurs in compact or earthy masses, or concretions, of a dull appearance, readily scratched by the knife, and breaking with an earthy fracture; but sometimes it is found crystallized. Its color is very variable; being, in different specimens, grayish, grayish yellow, reddish yellow, and, when very impure, brown or brownish yellow. Its sp. gr. varies from 3·4 to 4·4. Before the blowpipe it does not melt, but becomes yellow and sublimes. When of good quality, it is almost entirely soluble in the dilute mineral acids; and, unless it has been previously calcined, emits a few bubbles of carbonic acid. If soluble in sulphuric acid, it can contain but little carbonate of calcium, and no sulphate of barium.

Prepared Calamine. Calamina Præparata. Calamine must be impalpable before being used in medicine. The following is the U. S. formula of 1850. "Take of Calamine a convenient quantity. Heat it to redness, and afterwards pulverize it; then reduce it to a very fine powder in the manner directed for Prepared Chalk." The object of this process is to bring the native carbonate of zinc, or calamine, to the state of an impalpable powder. Calamine, as sold in England and the United States, was formerly almost always spurious, consisting wholly or principally of sulphate of barium, colored with sesquioxide of iron. Of six samples analyzed by Mr. F. Bringhurst, of Wilmington, Del., five were totally devoid of zinc, and the sixth contained only 2 per cent. of the oxide. (*A. J. P.*, July, 1857.) But more recently (*P. J. Tr.*, 1866), Mr. R. H. Davis has found that most of the calamine, sold as such in Great Britain, is genuine. Prepared calamine is in the form of a pinkish or flesh-colored powder, of an earthy appearance. Sometimes it is made up into small masses. It is used only as an external application, being employed as a mild astringent and exsiccant in excoriations and superficial ulcerations. For this purpose it is usually dusted on the part, and hence the necessity for its being in very fine powder. It is often employed in the form of cerate.

CALLITRICHE VERNA. (*Gray's Manual*, p. 384.) *Water Starwort.* This is a small, herbaceous, indigenous water-plant, which with other species of the genus is supposed to have diuretic properties, and is given in decoction in dropsical affections and complaints of the urinary organs.

CALOTROPIS GIGANTEA. Brown. *Asclepias gigantea.* Linn. *Madar* or *Mudar*, of the East Indies, is the bark of the root of a species of Calotropis, generally considered as *C. gigantea*, but asserted by Dr. Casanova to be a distinct species, and named by him *C. Madarii Indico-orientalis. C. gigantea* is a native of Hindostan, but is naturalized in the West Indies. The bark, as employed, is without epidermis, of a whitish color, nearly or quite inodorous, and of a bitter somewhat nauseous taste. It appears to have the general properties of many other acrid medicines; in small doses increasing the secretions, and in larger, producing nausea and vomiting. According to Dr. Casanova, it is especially directed to the skin, the capillaries and absorbents of which it stimulates to increased action. It is chiefly recommended as a remedy in the obstinate cutaneous diseases of tropical climates, such as elephantiasis and leprosy. It has been employed also in syphilis, dropsy, rheumatism, and hectic fever; and Mr. J. J. Durant states that he has found it an excellent substitute for ipecacuanha in acute dysentery, giving it in the same dose. (*Am. Journ. of Med. Sci.*, Oct. 1866, p. 526.) It is given in substance in the dose of from three to twelve grains, three times a day, and gradually increased till it affects the system. The plant has of late years been applied to various economical purposes in India. The most important of these is the manufacture of cords, ropes, etc., from the fibres of its branches, which are said to possess many of the properties of flax, and to be applicable to the making of cloth. (*Chem. News*, No. 167, p. 76.)

CAM WOOD. A red dye-wood, procured from the *Baphia nitida* of De Candolle, a leguminous tree, growing on the western coast of Africa. The wood is usually kept in the shops in the ground state. It yields its coloring matter scarcely at all to cold water, slightly to boiling water, and readily to alcohol and alkaline solutions. The coloring matter is thought to be identical with santalin.

CANARY SEED. The seeds of *Phalaris Canariensis*, an annual plant belonging to the grasses, originally from the Canary Islands, but now growing wild in Europe and the United States, and cultivated in many places. The seeds are ovate, somewhat compressed, about two lines long, shining, and of a light yellowish-gray color externally, and brownish within. Their chief constituent is starch. They were formerly esteemed medicinal, but are now used only for emollient cataplasms. They are nutritive, and their meal is said to be mixed, in some places, with wheat flour, and made into bread. They are used as food for canary birds.

CAOUTCHOUC. *Gum Elastic. India Rubber.* A small amount of India rubber is yielded to commerce by the climbing plants of the West Coast of Africa, but the great bulk of the product comes from India and South America. The chief caoutchouc plant of India is the *Ficus elastica.* This is a very large tree, whose seed usually germinates in the fork of a tree, and gives off as it grows aerial roots, which sink into the ground; by a continuation of this process at last a single tree will be possessed of a great many trunks and cover a large extent of ground. Recently the India economic botanists have discovered a new source of caoutchouc in the apocynaceous creeper *Chavannesia esculenta.* The most important India rubber trees of South America belong to the genera Castilloa and Hevea. The first genus belongs to the Artocarpaceæ, and is represented by two or more species (*C. elastica* and *C. Markhamiana*), which are scattered over all the equatorial western portions of South America. The genus Hevea occupies the valley of the Amazon, extending up to the Cordilleras. There are eight species of it enumerated by Mr. J. Collins. In the southern Brazilian province of Ceará, Mr. Cross, whilst collecting India rubber plants for the British Government, discovered a new tree (*Manihot Glagiovii*), resembling in appearance the birch, and yielding to commerce much caoutchouc. Whilst all the other South American rubber plants grow in an excessively moist climate, it flourishes in a dry district. (See Appendix to *Markham's Peruvian Bark*, London, 1880.) On being wounded, the various trees emit a milky juice, which concretes on exposure, and constitutes the substance in question. Caoutchouc comes to us in large flat pieces, or moulded into various shapes. The latter are formed by applying successive layers of the juice upon moulds of clay, which are broken and removed when the coating has attained a sufficient thickness and consistence. In the drying of these layers they are exposed to smoke, which gives to the concrete mass a blackish color. The juice, when it concretes by exposure to the air, assumes on the outer surface a yellowish-brown color, while the mass remains white or yellowish white within. It is said that a little alum facilitates the coagulation, while ammonia retards it; so that a little of the latter may be advantageously added, when it is desired to keep the milky juice in the liquid state. (R. Spruce, *P. J. Tr.*, xv. 118.) The recent juice contains, according to Faraday, 1·9 per cent. of vegetable albumen, traces of wax, 7·13 per cent. of a bitter azotized substance soluble in water and alcohol, 2·9 of a substance soluble in water but insoluble in alcohol, 56·37 of water with a little free acid, and only 31·7 of the pure elastic principle to which chemists have given the name of caoutchouc. Besides these principles the concrete juice, as it reaches us, generally contains soot derived from the smoke used in drying it. *Pure caoutchouc* is nearly colorless, and in thin layers transparent. It is highly elastic, lighter than water, without taste and smell, fusible at about 120° C. (248° F.), remaining unctuous and adhesive upon cooling, inflammable at a higher temperature, insoluble in water, alcohol, the weak acids, and alkaline solutions, soluble in ether when entirely freed from alcohol, soluble also in chloroform and most of the fixed and volatile oils, though, in the latter, at the expense of its elasticity. It is said, however, that the oils of lavender and sassafras dissolve it without change, and that, when precipitated by alcohol from its solution in cajeput oil, it is still elastic. But its best solvents, for practical purposes, are coal-naphtha or benzin, the empyreumatic oil obtained by distilling caoutchouc itself, and pure oil of turpentine. According to Dr. Bolley, the best method of effecting its solution, for the preparation of a varnish, is first to digest it, cut in small pieces, in bisulphide of carbon, which converts it into a jelly, and then to treat this jelly with benzin. A larger proportion is thus taken up than by any other method. (See *A. J. P.*, 1862, p. 414.) Caoutchouc is not affected by atmospheric air, chlorine, hydrochloric or sulphurous acid gas, or ammonia. It consists, according to Faraday, of 87·2 parts of carbon, and 12·8 of hydrogen. The unpleasant odor acquired by caoutchouc, through its property of absorbing gases, which almost unfits it sometimes for purposes to which it is otherwise applicable, may be obviated by exposing it to the still greater power of absorption possessed by charcoal. (See *A. J. P.*, 1867, p. 236.)

By the action of sulphur, caoutchouc acquires properties which greatly increase its value in the arts. It becomes of a black color and horny consistence, preserves its elasticity under the influence both of heat and cold, is compressible with great difficulty, and resists the ordinary solvents, such as petroleum and oil of turpentine. In this state it is said to be *vulcanized*. The discovery of the process of *vulcanization* is ascribed to Mr. Charles Goodyear, of New York. (*Chem. Gaz.*, x. 193.) It consists in submitting caoutchouc in thin sheets to the action of a mixture, composed of 40 parts of bisulphide of carbon and 1 of chloride of sulphur. For fuller details the reader is referred to the *Journ. de Pharm.* (3e sér., xvii. 205). But the same object may be effected by other methods. When thin layers of caoutchouc are immersed for two or three hours in melted sulphur at the heat of 116° C. (240° F.), they are penetrated by the sulphur, but undergo no change of properties. If now heated in an inert medium to a temperature of from 135° C. (275° F.) to 160° C. (320° F.), a chemical reaction takes place, and the vulcanized product is obtained. The same result takes place if the caoutchouc be first pounded with from 12 to 20 per cent. of finely powdered sulphur, and then heated to the temperature requisite for vulcanization. In either case, a portion of uncombined sulphur remains mechanically mixed with the vulcanized caoutchouc, from which it may be separated by various solvents, such as solutions of caustic soda or potassa, bisulphide of carbon, oil of turpentine, anhydrous ether, etc. The *desulphurated* product thus obtained, while exempt from the disadvantages arising from the reaction of free sulphur, is more porous than before. (*Ibid.*, xxi. 366.) Another mode of vulcanization, proposed by Mr. Humphrey, is based on the property of dissolving chloride of sulphur possessed by petroleum, which is substituted for bisulphide of carbon. It is necessary that the petroleum should be perfectly freed from water, by which the chloride of sulphur is immediately decomposed. This is effected by agitating the petroleum of commerce long and energetically with one-tenth of concentrated sulphuric acid; after which, the acid being allowed to subside, the petroleum is decanted, and treated with 200 to 250 grammes (about half a pound) of powdered quicklime for each hectolitre (26·4 gallons), with a little black oxide of manganese. The liquid, being now distilled, is fit for the vulcanization of the caoutchouc. According to the *Chemist*, there is no economy in the substitution of petroleum for the bisulphide of carbon, but a great advantage in regard to the health of the workmen, and the facility of the work. (*Ibid.*, 4e sér., ii. 386.)

Caoutchouc is used enormously in the arts for an infinite variety of purposes. In chemistry and surgery it has also numerous applications. It is now asserted that caoutchouc, whether vulcanized or not, is unfit for effecting the junction of chemical apparatus, when it is necessary to obtain gases quite pure; as it admits the escape of a portion of the gas and the entrance of the air, according to the law of diffusion established by Prof. Graham. This inconvenience, however, may be remedied by covering the caoutchouc with a coating of asphaltum dissolved in tar. An excellent *glue* may be made by dissolving, with the aid of heat and agitation, 3 parts of caoutchouc in 30 of naphtha, and adding 64 parts of finely-powdered shellac. It may be obtained in sheets by pouring it when hot on plates of metal (*A. J. P.*, 1867, p. 185). Caoutchouc has been given internally in phthisis, in the dose of one or two grains, gradually increased.

CAOUTCHOUC, ARTIFICIAL. Prof. Sonnenschein has discovered that an elastic mass resembling caoutchouc may be obtained by combining tungstate of sodium with certain organic substances. If tungstic acid or tungstate of sodium be added to a solution of glue and afterwards hydrochloric acid, a compound of tungstic acid glue is precipitated, which is so elastic at 29.4° C. (85° F.) to 40.5° C. (105° F.) that it can be drawn out into very thin fibres. On cooling, the mass becomes very solid and brittle. (*A. J. P.*, xliii. 471.)

CAOUTCHOUC, MINERAL. Large tracts of ground in Australia are said to be covered by this substance, in many places to a foot in depth. It is stated to resemble caoutchouc closely, and not to be of a petroleum nature. It has not been determined whether it is of mineral or vegetable origin. (*P. J. Tr.*, 3d ser., ii. 763.)

CAPPARIS SPINOSA. *Caper-bush.* A low, trailing shrub, growing in the South of Europe and North of Africa. The buds or unexpanded flowers, treated with salt and vinegar, form a highly esteemed pickle, which has an acid, burning taste, and is considered useful in scurvy. The dried bark of the root was formerly officinal. It is in pieces partially or wholly quilled, about one-third of an inch in mean diameter, transversely wrinkled, grayish externally, whitish within, inodorous, and of a bitterish, somewhat acrid, and aromatic taste. It is considered diuretic, and was formerly employed in obstructions of the liver and spleen, amenorrhœa, and chronic rheumatism.

CAPSELLA BURSA-PASTORIS. *Shepherd's Purse. Thlaspi Bursa-Pastoris.* Linn. This very common weed is bitter and pungent, yields a volatile oil on distillation identical with oil of mustard, and has been used as an antiscorbutic, also in hæmaturia and other hemorrhages, as well as in dropsy. Two to four fluidounces of the fresh expressed juice may be given at a dose. (See *Ann. de Thérap.*, 1854, 216.)

CARANNA. *Gum Caranna.* A resinous substance, in pieces of a blackish-gray color, externally dark brown, internally somewhat shining and translucent, brittle and pulverizable when dry, but, in the recent state, soft and adhesive, like pitch, easily fusible, of an agreeable balsamic odor when heated, and of bitterish resinous taste. (*Geiger.*) It is said to be derived from the *Amyris Caranna* of Humboldt, a tree growing in Mexico and South America. Geiger refers it also to *Bursera gummifera* of the West India Islands; but the resin obtained from this tree is described by the French writers under the name of *resine de Gomari* or *resine de chibou* or *cachibou*, and is said to bear a close resemblance to the resin *tacamahac.* It is probable that in different parts of South America the name Caranna is applied to the products of different trees. (*A. J. P.*, xli. 233.)

CARBONIC OXIDE. *Carbon monoxide.* (CO.) Dr. Ozanam has proposed this gas as an anæsthetic, having used it in twenty-five experiments on rabbits, and in five on man: but his results show it to be dangerous, on account of the suddenness of its action. (*B. and F. Medico-Chir. Rev.*, Am. ed., July, 1857, p. 176.)

CARDAMINE PRATENSIS. *Cuckoo-flower.* This is a perennial herbaceous plant, with a simple, smooth, erect stem, about a foot in height. The leaves are pinnate; the radical, composed of roundish irregularly toothed leaflets, those of the stem alternate, with leaflets which become narrower, more entire, and pointed as they ascend. The flowers are purplish white or rose-colored, and terminate the stem in a raceme approaching the character of a corymb. The plant is a native of Europe, and is found in the northern parts of our continent, about Hudson's Bay. It is a very handsome plant, abounding in moist meadows, which it adorns with its flowers in the months of April and May. The leaves are bitterish, and slightly pungent, resembling in some measure those of water-cresses, and like them supposed to be possessed of antiscorbutic properties. In Europe they are sometimes added to salads. The flowers have the same taste as the leaves, and, when fresh, a somewhat pungent odor. When dried they become inodorous and nearly insipid. They formerly possessed the reputation of being diuretic, and, since the publication of a paper by Sir George Baker, more than half a century ago, have been occasionally used as an antispasmodic in various nervous diseases, such as chorea and spasmodic asthma, in which they were successfully employed by that physician. They produce, however, little obvious effect upon the system, and are not employed in this country.

CARICA PAPAYA. A curious-looking tree growing on the islands of Bourbon and Mauritius, the West Indies, and other tropical countries, furnishes a liquid, by incision, called *papaw juice.* This contains, according to Wurtz and Bouchat, a principle called *papaïn*, a peculiar, soluble, digestive ferment, which has been shown to have the property of dissolving fibrin. Some recent experiments of Wurtz (*Compt.-Rend.*, 9, 787; *N. R.*, 1882, p. 19) seem to show that a combination takes place, at first, between the papaïn and the fibrin; by contact with water the fibrin is hydrated, soluble substances produced thereby, and the liberated ferment permitted to exercise its action on a new portion of fibrin. (See *Papaya.*) A peculiar property of papaïn, and one which distinguishes it from pepsin, is that it dissolves fibrin, not only in the presence of a small quantity of acid, but even in a neutral or slightly alkaline solution. (*A. J. P.*, 1880, p. 567; 1881, p. 75.)

CARNALLITE. This mineral, found in Stassfurt, Prussia, is very extensively used in the preparation of potassium salts. It is a double chloride of magnesium and potassium, associated with rock salt. (See *P. J. Tr.*, March, 1872, p. 787.)

CARNAULIA ROOT. This root, the product of *Corypha cerifera*, a wax palm of Brazil, is several feet in length, about three-eighths of an inch thick, with a thick friable cortex of a mixed grayish and reddish brown color. (*A. J. P.*, 1875, p. 349.) Mr. E. L. Cleaver found in it tannic acid, an acrid resinous body, a red coloring matter, and a minute portion of volatile oil and of an alkaloid. (*P. J. Tr.*, 1875, p. 965.) It is said to resemble sarsaparilla in its action.

CAROTA. *U. S.* 1870. *Daucus Carota.* (*Carotte*, Fr.; *Gemeine Mohre*, *Gelbe Rübe*, G.; *Carota*, It.; *Lanahoria*, Sp.) The *wild carrot* has a biennial spindle-shaped root, and an annual, round, furrowed, hairy stem, which divides into long, erect, flower-bearing branches, and rises two or three feet in height. The leaves are hairy, and stand on footstalks nerved on their under side. The lower are large and tripinnate, the upper, smaller and less compound; in both, the leaflets are divided into narrow pointed segments. The flowers are small, white, and disposed in many-rayed compound umbels, which are at first flat on the top and spreading, but, when the seeds are formed, contract so as to present a concave cup-like surface. A sterile flower, of a deep-purple color, is often observable in the centre of the umbel. The general involucrum is composed of several leaves, divided into long narrow segments; the partial is more simple. The petals are five, unequal, and cordate. The fruit consists of two plano-convex hispid portions, connected by their flat surfaces. *Daucus Carota* is exceedingly common in this country, growing along fences, and in neglected fields, which, in the months of June and July, are sometimes white over their whole surface with its flowers. It grows wild also in Europe, from which it is supposed by some botanists to have been introduced into the United States. The well-known garden carrot is the same plant, somewhat altered by cultivation. The seeds or fruits are very light, of a brownish color, an oval shape, flat on one side, and convex on the other, and on their convex surface present four longitudinal ridges, to which stiff, whitish hairs or bristles are attached. They have an aromatic odor, and a warm, pungent, and bitterish taste. By distillation they yield a pale-yellow volatile oil, upon which their virtues chiefly depend. Boiling water extracts their active properties. The root of the wild plant may be substituted for the seeds. The root of the wild carrot is whitish, hard, coriaceous, branched, of a strong smell, and an acrid, disagreeable taste; that of the cultivated is reddish, fleshy, thick, conical, rarely branched, of a pleasant odor, and a peculiar, sweet, mucilaginous taste. The constituents of the root are crystallizable and uncrystallizable sugar, a little starch, extractive, gluten, albumen, volatile oil, vegetable jelly or *pectin*, malic acid, saline matters, lignin, and a peculiar crystallizable, ruby-red, neutral principle, without odor or taste, called *carotin.* This latter principle has been well studied by Husemann, who gives it the formula $C_{18}H_{24}O$. Husemann has also described a colorless compound, *hydrocarotin*, $C_{18}H_{30}O$, which exists with carotin in the juice of the carrot, and is probably changed into the latter by oxidation as the plant develops in growth. According to MM. Frorde and Sœauer, carotin, as well as the modification which has been named *hydrocarotin*, is in fact *cholesterin* colored by a red pigment (*A. J. P.*, 1866, p. 505), but Husemann seems to have disproved this assertion. The substance called *vegetable jelly* was by some considered a modification of gum or mucilage, combined with a vegetable acid. Braconnot found it to be a peculiar principle, and named it *pectin*, from the Greek (*πηκτις*), expressive of its characteristic property of gelatinizing. It exists more or less in all vegetables, and is abundant in certain fruits and roots from which jellies are prepared. It may be separated from the juice of fruits by alcohol, which precipitates it in the form of a jelly. This, being washed with weak alcohol and dried, yields a semi-transparent substance bearing some resemblance to ichthyocolla. Immersed in 100 parts of cold water, it swells like bassorin, and ultimately forms a homogeneous jelly. With a larger proportion it exhibits a mucilaginous consistence. It is less acted on by boiling than by cold water. When perfectly pure it is tasteless, and has no effect on vegetable blues. A striking peculiarity is that, by the agency of a fixed alkali or alkaline earthy base, it is instantly converted into pectic acid, which unites with the base to form a pectate. This may be decomposed by the addition of an acid, which unites with the base, and separates the pectic acid. *Pectic acid* thus obtained is in the form of a colorless jelly, slightly acidulous, with the property of reddening litmus paper, scarcely soluble in cold water, more soluble in boiling water, and forming with the latter a solution, which, though it does not become solid on cooling, is coagulated by alcohol, lime-water, acids, or salts, and even by sugar if allowed to stand for some time. With the alkalies it forms salts, capable of gelatinizing; with the earths and metallic oxides, insoluble salts. Braconnot thinks that pectic acid exists in many plants already formed. M. Frémy found that pectin results, in fruits, from the reaction of acids upon a peculiar insoluble substance they contain when immature, called by him *pectose;* and that pectin is changed into pectic acid not only by alkalies, but also by vegetable albumen. Carrot seeds are moderately excitant and diuretic, and are employed in chronic nephritic affections, and in dropsy. As they possess the cordial properties of the aromatics, they are especially adapted to cases in which the stomach is enfeebled. They are said to afford relief in the strangury from blisters. From thirty grains to a drachm of the bruised seeds may be given at a dose, or a pint of the infusion, containing the virtues of half an ounce or an ounce of the seeds, may be taken during the day. The whole umbel is often used instead of the seeds alone. The root of the garden plant has acquired much reputation as a stimulant application to phagedenic, sloughing, ill-conditioned, and even cancerous ulcers. The root is brought to the proper consistence by scraping. In this state it retains a portion of the active principles of the plant, which render it somewhat stimulant. Boiled and mashed, as usually recommended, the root is perfectly mild, and fit only to form emollient cataplasms. An ointment was prepared by the late Prof. Procter as follows. Take of grated carrot root half a pound, lard a pound, wax four ounces. Melt the lard and wax, add the carrot root, evaporate with a moderate heat the moisture of the root, and strain.

CARTHAMUS. *Carthamus tinctorius.* Willd. *Sp. Plant.* iii. 1706. The *African, false, American* or *dyers' saffron* or *safflower* is an annual plant, with a smooth, erect stem, somewhat branched at top, and a foot or two in height. The leaves are alternate, sessile, ovate, acute, entire, and furnished with spiny teeth. The flowers are compound, in large terminal, solitary heads. The florets are of an orange-red color, with a funnel-shaped corolla, of which the tube is long, slender, and cylindrical, and the border divided into five equal, lanceolate, narrow segments. The plant is a native of India, the Levant, and Egypt, and is cultivated in those countries, as well as in various parts of Europe and America. The florets are brought to us chiefly from the ports of the Mediterranean. Safflower (*Flores Carthame ; Fleurs de carthame, Safran bâtard,* Fr.; *Safflor,* G.; *Cartamo,* It., Sp.) in mass is of a red color, diversified by the yellowness of the filaments contained within the floret. It has a peculiar slightly aromatic odor, and a scarcely perceptible bitterness. It contains two coloring substances—one red, insoluble in water, slightly soluble in alcohol, very soluble in alkaline liquids, and called *carthamin* or *carthamic acid* by Dōbereiner, who found it to possess weak acid properties ; the other yellow, and soluble in water. Carthamin, $C_{14}H_{16}O_7$, exists to the amount of 0·3 to 0·6 per cent. only in the safflower, while the safflower-yellow is present to the amount of 24 to 30 per cent. It is the former which renders safflower useful as a dye-stuff. These flowers are sometimes fraudulently mixed with saffron, which they resemble in color, but from which they may be distinguished by their tubular form, and the yellowish style and filaments which they enclose. In large doses carthamus is said to be laxative; and, administered in warm infusion, diaphoretic. It is used in domestic practice, as a substitute for saffron, in measles, scarlatina, and other exanthematous diseases, to promote the eruption. An infusion, made in the proportion of two drachms to a pint of boiling water, is usually employed, and given without restriction as to quantity.

CARUBA DI GUIDEN. Under this name are largely used, for the relief of asthma, certain gall-like bodies, formed on various species of Pistacia (especially *P. terebinthina*), as the result of the stings of an hemipterous insect. According to Ignaz Hoffmann, they are used by smoking and fumigation. For this purpose they are coarsely pulverized and burnt in the bowl of a pipe, or in a dish, with some arrangement by which the fumes may be inhaled. Preparations should be made beforehand, so that the smoke may be inhaled at the commencement of the attack. They appear to act by exciting free secretion, probably through the turpentine with which they are saturated. They are also said to be very useful in other lung affections besides asthma, even in chronic organic diseases. (*Schmidt's Jahrbücher,* Jan. 1872.)

CARYA. *Hickory. Juglans.* Linn. Several species of the genus Carya, of Nuttall, separated by that botanist from the *Juglans* of Linnæus, grow within the limits of the United States, of which *C. olivæformis* bears the *pecan-nut* of the South-West, *C. alba,* the fruit so well known by the name of *shell-bark,* derived probably from the ragged state of the bark of the stem, *C. sulcata,* another variety of shell-bark, and *C. tomentosa,* the common thick-shelled hickory-nut. Other indigenous species are *C. amara, C. glabra,* and *C. microcarpa.* The leaves of most if not all of these trees are somewhat aromatic and astringent, and the bark astringent and bitter. In the bark of *C. tomentosa* Mr. F. R. Smith found a crystalline principle, *caryin*, which he believes to be identical with *quercitrin.* Mr. Caffinbury, of Michigan, has found great advantage from chewing the inner bark of the hickory in dyspepsia, and has used a tincture with great success in the treatment of intermittent fever. (*Proc. A. P. A.*, 1859, p. 249.)

CASCARA SAGRADA. *Sacred Bark.* The bark of the *Rhamnus Purshiana*, De Cand. The *California Buckthorn* is a small tree, attaining at most a height of twenty feet. Its leaves are rather thin, elliptic, mostly briefly acutely pointed, finely serrated, at the base obtuse, somewhat pubescent beneath, from two to seven inches long, one to three wide. The rather large flowers are in somewhat umbellate cymes; the sepals five; the minute, cucullate petals bifid at the apex. The fruit is black, broadly obovoid, four lines long, three-lobed, and three-seeded. The seeds are convex on the back, with a lateral raphé. It is found in California, extending northward to the British Territories. The bark occurs in curved pieces or quills, its surface smooth, the outer gray, sometimes with white spots, the inner surface yellowish, the fracture nearly smooth, yellowish or reddish brown, and colored red by potash. The taste is bitter, the odor scarcely perceptible. It is sometimes called *Chittem Bark.* According to the analysis of Prof. A. B. Prescott (*New Preparations*, Feb. 1879), it contains a very bitter brown resin (which is colored a vivid purple red with caustic potash); a red resin; a light yellow resin; tannic, malic, and oxalic acids; a neutral crystallizable substance; and a volatile oil. It has been highly commended as a laxative in habitual constipation, given usually in the form of a fluid extract in doses of half a drachm to a drachm.

CASSIA MARILANDICA. *American Senna* is an indigenous perennial plant, of vigorous growth, sending up annually numerous round, erect, nearly smooth stems, which are usually simple, and rise from three to six feet in height. The leaves are alternate, and composed of from eight to ten pairs of oblong-lanceolate, smooth, mucronate leaflets, green on their upper surface, pale beneath, and connected by short petioles with the common footstalk, which is compressed, channelled above, and furnished near its base with an ovate, stipitate gland. The flowers, which are of a beautiful golden-yellow color, grow in short axillary racemes at the upper part of the stem. The calyx is composed of five oval, obtuse, unequal yellow leaves; the corolla of the same number of spatulate, concave petals, of which three are ascending, and two descending and larger than the others. The stamens are ten, with yellow filaments and brown anthers, which open by a terminal pore. The three upper stamens bear short abortive anthers; the three lowermost are long, curved, and tapering into a beak. The germ, which descends with the latter, bears an erect style terminating in a hairy stigma. The fruit is a pendulous legume, from two to four inches long, linear, curved, swelling at the seeds, somewhat hairy, and of a blackish color. The *American senna*, or *wild senna*, is very common in all parts of the United States south of New York, and grows as far northward as the southern boundary of Massachusetts. It prefers a low, moist, rich soil, in the vicinity of water, and, though frequently found in dryer and more elevated places, is most abundant and luxuriant in the flat ground on the borders of rivers and ponds. The leaves, which should be collected in August or the beginning of September, are sometimes brought into the market, compressed into oblong cakes, like those prepared by the Shakers from most herbaceous medicinal plants. The leaflets are from an inch and a half to two inches long, from one-quarter to half an inch in breadth, thin, pliable, and of a pale-green color. They have a feeble odor, and a nauseous taste, somewhat analogous to that of senna. Water and alcohol extract their virtues. They were analyzed by Mr. Martin, of Philadelphia, and found to contain a principle analogous to *cathartin*, albumen, mucilage, starch, chlorophyll, yellow coloring matter, volatile oil, fatty matter, resin, and lignin, besides salts of potassa and lime. (*A. J. P.*, i. 22.)

American senna is an efficient and safe cathartic, closely resembling the imported senna in its action, but less active; and, to produce an equal effect, must be administered in a dose at least one-third larger. Like senna, it is most conveniently given in the form of infusion, and should be similarly combined in order to prevent its griping.

CASTANEA PUMILA. *Chinquapin.* The chinquapin is a shrub or small tree, which, in the Middle States, rarely much exceeds seven or eight feet in height, but, in the Carolinas, Georgia, and Louisiana, sometimes attains an elevation of thirty or forty feet, with a diameter of trunk equal to twelve or fifteen inches. The leaves are oblong, acute, mucronately serrate, and distinguished from those of the chestnut, which belongs to the same genus, by their whitish and downy under surface. The barren flowers are grouped upon axillary peduncles, three or four inches long; the fertile aments are similarly disposed, but less conspicuous. The fruit is spherical, covered with short prickles, and encloses a brown nut, which is sweet and edible, but differs from the chestnut in being much smaller, and convex on both sides. The tree extends from the banks of the Delaware southward to the Gulf of Mexico, and south-westward to the Mississippi. It is most abundant in the southern portions of this tract of country. The bark is the part used. It is astringent and tonic, and has been employed in the cure of intermittents.

CATALPA BIGNONIOIDES. (*Walt.*) *Bignonia Catalpa.* Linn. *Catalpa-tree*, or *Catawba-tree.* This is a beautiful indigenous flowering tree, the seeds of which have been employed in asthma. Mr. Eugene O. Rau obtained from them a bitter crystalline principle. (*A. J. P.*, xlii. 204.) M. Automarchi recommends a decoction, made by boiling twelve ounces of water with three or four ounces of the seeds down to six ounces, the whole to be given morning and night; but, if there be any foundation for the prevalent opinion as to the poisonous character of the tree, this might be a hazardous dose; and it would be advisable to begin with much smaller doses, and to increase until the effects of the medicine on the system are ascertained.

CATARIA. *Nepeta Cataria. Catnep* or *Catmint* (*Cataire*, Fr; *Katzenmünze*, G.; *Cattara*, It.; *Gatera*, Sp.) is a perennial labiate plant, with a quadrangular, branching, somewhat hoary stem, from one to three feet high, and furnished with opposite, petiolate, cordate, dentate, pubescent leaves, which are green above and whitish on their under surface. The flowers are whitish or slightly purple, are arranged in whorled spikes, and appear in July and August. The plant is abundant in the United States, but is supposed to have been introduced from Europe. The whole herb is used: it has a strong, peculiar, rather disagreeable odor, and a pungent, aromatic, bitterish, camphorous taste. The active constituents are volatile oil, and tannin of the kind which produces a greenish color with the salts of iron. In its operation upon the system, catnep is tonic and excitant, bearing considerable resemblance to the mints. It has had the reputation also of being antispasmodic and emmenagogue. Cats are said to be very fond of it, and it has been asserted to act as an aphrodisiac in these animals. It is employed as a domestic remedy, in the form of infusion, in amenorrhœa, chlorosis, hysteria, the flatulent colic of infants, etc., but is little known in regular practice. Two drachms of the dried leaves or herb may be given as a dose in infusion.

CEANOTHUS AMERICANUS. *New Jersey Tea. Red-root.* A small indigenous shrub, growing throughout the United States. The root is astringent, and imparts a red color to water. H. K. Bowman found in it 9·21 per cent. of tannin. (*A. J. P.*, 1869, 195.) It is said to be useful in syphilitic complaints, in which it is given in the form of decoction. Schoepf states that it is purgative. The leaves were used during the Revolutionary War as a substitute for tea. Dr. Hubbard recommends a strong infusion of the dried leaves and seeds, as a local application in aphthous affections of the mouth and fauces, and the sore throat of scarlatina, and as an internal remedy in dysentery. (*Boston Med. and Surg. Journal*, Sept. 30, 1835.)

CEDRON. The seeds of a tree growing in New Granada and Central America, and described by M. Planchon under the name of *Simaba Cedron* in the *London Journ. of Botany* (v. 566), from specimens sent by Mr. Wm. Purdie, curator of the Botanical Garden at Trinidad, to Sir Wm. J. Hooker. Mr. Purdie had received the first intimation of the value of this medicine from Dr. Cespedes, a physician of Bogota. The first account of it, however, which reached Europe appears to have been that of Dr. Luigi Rotellini, a physician of St. Domingo, who had previously resided in New Granada. It was published in an Italian journal so early as the year 1846. In France it was known through M. Jamord, who received his information from M. Herran. The fullest account that we have seen of the plant and its product is from the pen of Sir Wm. J. Hooker. (*P. J. Tr.*, Jan. 1851, x. 344.)

Simaba Cedron belongs to the natural family of Simarubaceæ. It is a small tree, with an erect stem not exceeding six inches in diameter, branching at top in an umbellate form, with large, glabrous, pinnate leaves, and pale-brown flowers, in long, branching racemes. The fruit is a large, solitary drupe, containing a single seed. The whole plant appears to be impregnated with a bitter principle, but it is the seed only that is used. A specimen of the dried fruit, sent to Dr. G. B. Wood from Cartago, in Costa Rica, by Dr. Guier, formerly of Philadelphia, was light, of a yellowish-ash color, flattish-ovate, with one edge convex and the other nearly straight, the convex outline terminating at each end in an obtuse point, of which that at the apex was most prominent. It was about two inches long, and sixteen lines in its greatest breadth. Within, the seed was loose and movable. The seed itself was about an inch and a half long, ten lines broad, and half an inch thick. It was convex on one side, flat or slightly concave on the other, and presented an oval scar near one extremity of the flat surface. It was hard and compact, but was readily cut with a knife. Cedron seed is inodorous, but of a pure and intensely bitter taste, not unlike that of quassia. It yields its virtues to water and alcohol. M. Lowry obtained from it a crystalline substance, intensely bitter, freely soluble in boiling water, and neutral to test paper, which he supposes to be the active principle, and named *cedrin.* He first exhausted the cedron with ether, then treated it with alcohol, and crystallized from the tincture. (*Journ. de Pharm.*, xix. 335.)

This medicine has long had great reputation in New Granada and Central America, as a remedy for the bite of serpents, being mentioned in the *History of the Buccaneers*, published in 1699, as useful for this purpose; and such continues to be the confidence of the natives in its virtues, that they have no fears of the poisonous bite of these reptiles, if provided with the antidote. It is also highly esteemed for the prevention of hydrophobia, and in the treatment of intermittent fever, spasm of the stomach and bowels, and dyspeptic affections. Dr. Guier informed us that he had seen it once apparently successful in curing the bite of a poisonous serpent, and had used it effectually in cholera morbus, colic, and neuralgia of the face. In the hands of Dr. J. B. Thompson, of London, it has proved useful in gout. (*Med. Times and Gaz.*, April, 1852.) Dr. S. S. Purple, of New York, has found it promptly effectual in a number of cases of intermittent fever, and believes it to possess valuable antiperiodic properties. (*N. Y. Journ. of Med.*, N. S., xiii. 173.) To us the medicine appears to be closely analogous to quassia, with which it is botanically allied. The dose used in Central America is one or two grains. M. Herran states that he had employed the remedy in eight cases of poisoning, and that his mode of using it was to administer five or six grains with a spoonful of brandy, and to dress the bite with the tincture. He had rarely occasion to repeat the dose to effect a cure. Dr. Rotellini says that it is poisonous in overdoses, and has occasioned death in the quantity of twenty-five or thirty grains. A vinegar has been prepared in London by macerating for seven days two scruples of the cedron in an ounce of distilled vinegar. The dose is from twenty minims to a fluidrachm. (*P. J. Tr.*, xii. 63.) From the statements of Dr. Purple, it appears that the doses above given are too small, and that from any ordinary quantity no fear of injurious consequences need be entertained. He gave from ten to thirty grains every four hours, and found that though, in very large doses, it may produce griping and diarrhœa, these effects are easily controlled.

CELASTRUS SCANDENS. *Climbing Staff-tree.* The bark of this climbing indigenous shrub is said to be emetic, diaphoretic, and narcotic. It has been used in chronic affections of the liver and secondary syphilis. Various foreign species of Celastrus have been employed in medicine, though with little reputation.

CENTAUREA BENEDICTA. *Blessed Thistle. Carduus Benedictus. Cnicus benedictus.* (De Cand.) This is an annual herbaceous plant, the stem of which is about two feet high, branching towards the top, and furnished with long, elliptical, rough leaves, irregularly toothed, barbed with sharp points at their edges, of a bright green color on their upper surface, and whitish on the under. The lower leaves are deeply sinuated, and stand on footstalks; the upper are sessile, and in some measure decurrent. The flowers are yellow, and surrounded by an involucre of ten leaves, of which the five exterior are largest. The calyx is oval, woolly, and composed of several imbricated scales, terminated by rigid, pinnate, spinous points. The plant is a native of the south of Europe, and is cultivated in gardens in other parts of the world. It has become naturalized in the United States. The period of flowering is June, when its medicinal virtues are in greatest perfection. The leaves were the officinal portion. They should be gathered when the plant is in flower, quickly dried, and kept in a dry place. The herb has a feeble, unpleasant odor, and an intensely bitter taste, more disagreeable in the fresh than in the dried plant. Water and alcohol extract its virtues. The infusion with cold water is a grateful bitter; the decoction is nauseous, and offensive to the stomach. The bitterness remains in the extract. The active constituents are volatile oil, and a peculiar principle for which the name of *cnicin* has been proposed. This is crystallizable, inodorous, very bitter, neutral, scarcely soluble in cold water, more soluble in boiling water, and soluble in all proportions in alcohol. Its formula is $C_{42}H_{56}O_{15}$, and it is analogous to salicin in composition. In the dose of 4 or 5 grains, it is said often to vomit, and in that of 8 grains, to be useful in intermittent fevers. (*Ann. de Thérap.*, 1843, p. 206.) The drug may be so administered as to prove tonic, diaphoretic, or emetic. The cold infusion, made with half an ounce of the leaves to a pint of water, has been employed as a mild tonic in debility of the stomach. A stronger infusion, taken warm while the patient is confined to bed, produces copious perspiration. A still stronger infusion or decoction, taken in large draughts, provokes vomiting, and has been used to assist the operation of emetics. The herb, however, is at present little employed. The dose of the powder as a tonic is from a scruple to a drachm, that of the infusion two fluidounces.

Carduus or *Cnicus marianus* was of old used for the same purpose as the *C. benedictus.* Rademacher is stated to have found a decoction of the seeds of great use in hemorrhages, particularly when connected with diseased liver or spleen. Dr. Lobach considers no other remedy so efficacious in uterine hemorrhage and melæna. He has also found it useful in amenorrhœa when connected with derangement of the portal circulation. He gives the decoction (two ounces to the pint of water) in doses of a tablespoonful every hour. (See *Am. Journ. of Med. Sci.*, April, 1859, p. 537.)

CENTAURY. *Common European Centaury. Centaurium.* This long-used remedy, which held a place in the Edinburgh Pharmacopœia even to its latest edition, has been omitted in the British Pharmacopœia. It consists of the herb, and more especially of the flowering heads, of *Erythræa Centaurium* (Persoon), *Chironia Centaurium* (Willd. *Sp. Plant.* i. 1068). It is a small, annual herbaceous plant which grows wild in most parts of Europe. It rises about a foot in height, with a branching stem, which divides above into a dichotomous panicle, and bears opposite, sessile, ovate-lanceolate, smooth, and obtusely pointed leaves. The flowers are of a rose color, sessile in the axils of the stems, with their calyx about half as long as the tube of the corolla.

The herb, though without odor, has a strong bitter taste, which it imparts to water and alcohol. The flowering summits are the officinal part. We have seen no satisfactory analysis of this plant. The fresh herb yields by distillation an odorous watery product, of sharp taste (*Geiger*, ii. 482), in which M. Méhu, a French pharmaceutist, has detected valerianic acid. The same chemist claims to have discovered a peculiar colorless crystallizable, non-nitrogenous substance, which he names *erythrocentaurin* ($C_{27}H_{24}O_8$). He obtained it by exhausting the tops with water, evaporating a portion of the water. allowing the residue to stand, separating the precipitated matter or apotheme, adding alcohol to the remaining liquid, which now deposited a bitter substance, and, after the separation of this by decantation, evaporating the liquid to the consistence of syrup, and treating the residue with ether. The ethereal solution, upon evaporation, yielded the erythrocentaurin in crystals. These are needle-shaped, soluble in the ordinary menstrua, and possessed of the remarkable property of being strongly reddened by exposure to solar light, and reacquiring their colorless character upon being again dissolved and crystallized. The bitter substance before mentioned may be separated by menstrua into two portions, one soft and the other dry, the former of which it is that gives its strong smell to the distilled water. J. F. Huneker believes that erythrocentaurin exists also in American centaury. (See *Sabbatia.*) Besides these principles, M. Méhu found also in centaury a *wax-like substance*, and saline matter. (*Journ. de Pharm.*, xliii. 38.)

Medical Properties and Uses. The common centaury of Europe has tonic properties very closely resembling those of gentian, with which it is associated in the same natural family. It is employed on the other side of the Atlantic in dyspeptic complaints, and formerly had considerable reputation in the treatment of fever. It was one of the ingredients of the *Portland powder*. The dose of the powder is from thirty grains to a drachm. Another species of Erythræa (*E. Chilensis*) possesses similar properties, and is employed to a considerable extent in Chili as a mild tonic. For details see *Journal de Pharmacie* (3e sér., xxv. 434). *E. acaulis*, which grows in great abundance in the territory of French Algiers, bordering on the Sahara, yields a root, which, under the name of *rejagnou*, is much employed by the natives for dyeing yellow. (*Ibid.*, 4e sér., v. 87.)

CEPHALANTHUS OCCIDENTALIS. *Button-bush.* (*Gray's Manual*, p. 172.) A common indigenous shrub which grows in moist places, as along streams or on the borders of swamps. Its bark is bitter, is said to be laxative as well as tonic, and has been given in periodical fevers, in decoction or infusion. Mr. E. M. Hattan found in it a crystallizible fluorescent acid, a bitter uncrystallizable principle, a principle resembling saponin, tannin, two resins, fatty matter, gum, glucose, and starch. (*A. J. P.*, xlvi. 314.)

CERESIN. Under this name there has been introduced into commerce, as a substitute for wax, a substance which closely resembles white wax, but which, according to Prof. Jos. P. Remington, is a mixture of paraffins. (See *A. J. P.*, xlv. 11.) It is made in Vienna from Galician ozokerite, by treatment with sulphuric acid and filtration through bone-black or the black residue from yellow prussiate of potash works. (See *Paraffin.*)

CHELIDONIUM MAJUS. *Celandine.* A perennial herbaceous plant, growing wild in this country, about old houses and in rocky places ; supposed to have been introduced from Europe, where it is indigenous. It is one or two feet high, bears pinnate leaves and small peduncled umbels of yellow flowers, and, when wounded, emits a yellow, opaque juice. The whole plant is used. It has a faint unpleasant odor, and a bitter, acrid, durable taste, which is stronger in the roots than in the leaves. The odor is nearly lost by drying, but the taste remains. The yellow juice is bitter and exceedingly acrid, and when applied to the skin produces inflammation and even vesication. The plant, analyzed by MM. Chevallier and Lassaigne, afforded a bitter resinous substance of a deep yellow color; a kind of gum resin of an orange-yellow color, and bitter, nauseous taste; mucilage; albumen ; and various saline substances, besides free malic acid and silica. Dr. Probst, of Heidelberg, afterwards found in it a peculiar acid denominated *chelidonic acid;* two alkaline principles, one of which forms neutral salts with the acids, and is called *chelerythrine* (*chelerythria*) in consequence of the intense redness of its salts, the other unites with but does not neutralize the acids, and is named *chelidonine* (*chelidonia*) ; and lastly a neutral crystallizable, bitter principle, which from its yellow color he calls *chelidoxanthin.* Chelerythrine appears to be an acrid narcotic poison. (*Annal. der Pharm.*, xxix. 113.) It has been shown by Dr. James Schiels, of St. Louis, to be identical with *sanguinarine*, and may be prepared in the same manner. (See *Sanguinaria*, Part I.) Zwenger has lately isolated another acid, which he names *chelidoninic acid*, although both Walz and Kraut consider it to be only succinic acid. (See a paper by Prof. J. M. Maisch, in *A. J. P.*, 1861, p. 7.)

Celandine is an acrid purgative, possessed also of diuretic, and perhaps diaphoretic and expectorant properties. In overdoses it produces unpleasant effects, and is by some considered poisonous. By the ancients it was much esteemed as a remedy in jaundice; and it has been found useful in the same complaint by some modern physicians. It was the chief ingredient of the old *decoctum ad ictericos* of the Edinburgh Pharmacopœia. It has been given also in other complaints, especially those of a scrofulous character, affecting the mesenteric and lymphatic glands, the skin, and the eyes. It is used in

Indiana and other parts of the West as a remedy in phthisis by macerating for one week three ounces of the bruised fresh root in one pint of whisky, and taking a teaspoonful of the tincture three times daily. (C. O. Thiebaud, *A. J. P.*, 1881, p. 624.) The yellow juice is often applied to corns and warts, which it destroys by stimulating them beyond their vital powers, and is said to be very useful in eczema, urticaria, and other itching eruptions. The fresh herb is also applied locally about the pelvis, with asserted benefit, in amenorrhœa, and is much used in the south of Europe as a vulnerary. The dose of the dried root or herb is from thirty grains to a drachm, that of the fresh root one or two drachms, and the same quantity may be given in infusion. The watery extract and expressed juice have also been employed. The dose of the former is from five to ten grains, of the latter from ten to twenty drops, to be gradually increased.

CHELONE GLABRA. *Snake-head. Turtle-head.* The leaves of this very common indigenous, perennial, herbaceous plant have a bitter taste, and are said to be tonic and aperient, with a supposed peculiar action on the liver. The decoction (two ounces of the fresh herb to the pint) may be given in the dose of one or two fluidounces.

CHELTENHAM SALT, ARTIFICIAL. Several artificial mixtures have been prepared as exact imitations of the ingredients in the chalybeate Cheltenham water. One frequently used is equal parts of sulphate of magnesia, sulphate of soda, and common salt.

Robert Alsop's artificial mixture is in the form of a powder, nearly white, possessing a saline and slightly ferruginous taste. It forms a good combination, in which the aperient property of the salts present is combined with the tonic virtue of the iron. It is considered to be useful in glandular obstructions, especially of the liver, and in scrofuleus affections, attended with feeble digestion, sluggish bowels, and pallidness of skin. It is employed, also, with advantage in sick-headache, habitual costiveness, and hemorrhoids. The dose is a teaspoonful, quickly dissolved by brisk stirring in half a pint of cold water, and swallowed immediately, before the iron has time to separate in an insoluble state. This quantity may be taken in the morning, fasting, and repeated once or twice after an interval of twenty minutes, or in the course of the day. To obtain its full tonic and alterative effects, it should be persevered with for a month or six weeks.

CHINOLINE. *Quinoline. Leucoline.* (C_9H_7N.) This is an artificial alkaloid prepared by the destructive distillation of quinine or cinchonine with potassium hydrate, and also synthetically by Koenig's process. In 1839 Runge obtained a base from coal tar which he called *leucol.* Gerhardt in 1842 obtained a product, called *quinoline*, by distilling quinine and other bases with potash. Hofmann believed that leucol and quinoline were identical, but Greville Williams subsequently pointed out some differences between them, and proved that the quinoline was not pure. Two kinds of chinoline may be found in the market, one made from coal tar, and the other from cinchonine. Chinoline from cinchonine gives with bichromate of potassium a yellow crystalline precipitate, and with iodide of amyl and potassium hydrate a blue color (cyanine); whilst chinoline from coal tar gives neither of these reactions. The German chinoline, which is that usually sold, differs considerably in its properties as sent out by different manufacturers. Chinoline is a colorless, strongly refractive oily liquid, having a specific gravity of 1·081 at 10° C. (50° F.) (Hofmann), boiling at 238° C. (460.4° F.) without decomposition; the oily stain left on bibulous paper disappearing readily on exposure. Its odor is aromatic, resembling that of oil of bitter almond. It is sparingly soluble in cold water, more so in hot water, soluble in alcohol, and mixes in all proportions with ether, bisulphide of carbon, methylic alcohol, etc. It also dissolves camphor and resin. It gradually turns reddish brown in color on exposure to the air. It forms readily crystallizable salts with acids, the tartrate now being a commercial article; these salts are decomposed by contact with fixed alkalies and the peculiar odor of chinoline developed. Ekin (*P. J. Tr.*, Feb. 11, 1882) found a sample of commercial German chinoline to consist largely of a mixture of anilin and nitrobenzol, although labelled pure. *Tartrate of chinoline* is in the form of a white, micaceous crystalline powder, having a peculiar pungent odor and a rather sharp though not unpleasant taste. (See *A. J. P.*, 1881, p. 623; *N. R.*, 1881, p. 364.)

Chinoline was first brought forward as a substitute for quinine by Dr. Julius Donath, of Hungary, who, as the result of numerous experiments (*Ber. Deutsch. Chem. Gesell.*, xiv.), arrived at the conclusion that when absorbed by the blood-vessels it lowers the temperature very noticeably. In 0·2 per cent. solution it delays the decomposition of easily decomposed substances (urine, glue, etc.), the formation of bacteria in prepared nitrogenous solutions, and also the fermentation and coagulation of milk. It is a stronger antiseptic than sodium salicylate, carbolic acid, quinine, boracic acid, blue vitriol, or alcohol. In 0·4 per cent. solution it arrests the putrefaction of blood, and the curdling of milk. By a 1 per cent. solution the coagulability of the blood was completely destroyed. Chinoline corresponds with quinine in preventing the coagulation of egg albumen except at abnormally high temperatures. It acts as a poison to the yeast cells and prevents their formation, in which point it also resembles quinine. Drs. Donath, Loewy, Jakowsky, and other continental physicians, have used the remedy in intermittent fevers with asserted excellent results. They give the tartrate in doses of 15·34 grains (1 Gm.), administered either in wafers or in solution, in distilled water and some pleasantly flavored syrup, with a little cherry-laurel water, following the same rules as govern the use of quinine. The tendency to disagree with the stomach can be obviated, in a measure, by giving a teaspoonful of lemon-juice or small pieces of ice at the time of administering the dose. In this country, so far as we are aware, no extensive trials of the drug have yet been made (1881); in the Jewish Hospital in this city its virtues were tested as an antiperiodic with entirely unfavorable results.

CHIONANTHUS VIRGINICA. *Fringe Tree.* In the bark of this indigenous plant Mr. R. S. Justice has found *saponin.* (*A. J. P.*, xlvii. 195.)

CHLORAL BUTYLICUM. *Butyl-chloral Hydrate* (*Croton-chloral*). ($C_4H_5Cl_3O$, H_2O.) Under the name of Croton-chloral hydrate this preparation was introduced to the profession as a remedy in certain cases of neuralgia by Dr. Liebreich in 1870; the credit of the discovery of the new chloral was due to Krämer and Pinner, of Berlin, who found it during the course of an investigation having for its object the introduction of any useful substances which might be brought to light through the examination of the accumulated by-products of the chloral factory of Schering. It was named croton-chloral hydrate, because it was believed to bear a relationship to crotonic acid, the peculiar acid of croton oil; this was subsequently disproved by Pinner, who showed that it belonged to the butyl series. (*Deuts. Chem. Ges. Ber.*, vii. 1321, 1561.) It is made by passing dry chlorine through aldehyd cooled to —10° C. (14° F.), in an apparatus similar to that used in making chloral. Fractional distillation is resorted to, and the product boiling between 163° C. (325·4° F.) and 165° C. (329° F.) is reserved; this is butyl-chloral, a colorless oily liquid. The necessary amount of water is added, and butyl-chloral hydrate is obtained in the form of crystalline, micaceous scales, possessing a pungent odor, sparingly soluble in water, freely soluble in alcohol, hot water, and glycerin, but insoluble, or nearly so, in chloroform, a property which may be employed to separate it from ordinary chloral hydrate. When treated with caustic alkalies it is converted into formic acid, potassium chloride, and allylene dichloride, $C_3H_4Cl_2$. (See *Lancet*, Jan. 31, 1874.)

Prof. Liebreich found that a drachm of croton-chloral will cause in man deep sleep and anæsthesia, and claimed that it is especially valuable on account of a peculiar paralyzing action upon the trigeminal nerve in all cephalic neuralgias, and is peculiarly safe in having no depressing power over the heart. These statements have, however, not been borne out by subsequent investigators. Careful studies by I. V. Mering have shown that in dogs, cats, and rabbits the blood-pressure is reduced temporarily by small doses, permanently by larger ones, and that intravenous injections of sufficient quantity and concentration are followed by immediate arrest of the heart. Altogether, the symptoms caused by croton-chloral seemed to be parallel with those induced by chloral hydrate. Further clinical and experimental studies of it should, however, be made. It is usually administered in doses of from five to twenty grains, in syrup. The safest plan is to give five grains every half-hour until thirty grains have been taken or relief is afforded. Liebreich uses it according to the following formula: butyl-chloral hydrate 5 parts; glycerin 20 parts; distilled water 130 parts. Dose, half an ounce, followed in five minutes by a second, ten minutes later by a third, unless relief is afforded.

CHLORIDE OF ALUMINIUM. This substance, which has been proposed, and to some extent used, in England as a disinfectant, may be prepared by double decomposition between sulphate of aluminium and chloride of calcium in solution; the resulting sulphate of calcium being separated by filtration and the chloride obtained in crystals by evaporation at a very gentle heat. Under the name of *chloralum* and *chloralum powders* various mixtures have been put upon the market, all containing more or less of the chloride of aluminium. (*A. J. P.*, xliv. 398.) They appear to be feeble and uncertain disinfectants.

CHLORIDE OF BROMINE. *Brominii Chloridum.* This chloride is prepared by passing chlorine gas through bromine, and condensing the vapors which form by a freezing mixture. It is a reddish-yellow, very mobile and volatile liquid, emitting dark-yellow fumes, which have a very powerful odor, and cause a flow of tears. Its taste is hot and unpleasant. Chloride of bromine is used by Prof. Landolfi, of Naples, in the treatment of malignant tumors, internally and as an ingredient in his caustic.

CHLORIDE OF ETHYL. *Muriatic Ether. Æther Muriaticus.* This ether was discovered by Rouelle, but first obtained in sufficient quantities to permit the examination of its properties by Basse. It may be procured by several processes, but the following is the best. Distil a mixture of equal measures of concentrated hydrochloric acid and alcohol, and receive the product, by means of a curved glass tube, in a tubulated bottle, half filled with water at a temperature between 21·1° C. (70° F.) and 26·6° C. (80° F.), and connected by means of a second tube with another bottle, loosely corked, and surrounded by a mixture of common salt with snow or pounded ice. The ether, as it enters the first bottle, is mixed with alcohol and acid, which are retained by the water; while the pure ether passes forward, and is condensed in the refrigerated bottle. It must be kept in strong bottles, well secured with ground stoppers covered with leather. Before being opened, the bottle should be cooled to the freezing point.

Chloride of ethyl is a colorless liquid, having a strong, slightly saccharine, alliaceous taste, and a penetrating, ethereal, alliaceous smell. Its sp. gr. at the temperature of 0° C. (32° F.) is 0·9214. It is extremely volatile, entering into ebullition at 12·5° C. (54° F.), so that in summer it may be collected in the gaseous state, in bell-glasses over water. Its sp. gr. in the state of vapor is 2·22. When kindled as issuing from a fine orifice, it burns with an emerald-green flame without smoke, diffusing a strong odor of hydrochloric acid; but, when set on fire in quantities, it burns with a greenish-yellow, smoky flame. Water dissolves one-fiftieth of its weight of this ether, and acquires a sweetish, ethereal taste; and alcohol unites with it in all proportions. These solutions are not precipitated by nitrate of silver, showing that the chlorine present is in a peculiar state of combination. Like common ether and ethyl nitrate, it dissolves sulphur and phosphorus, the fixed and volatile oils, and many other substances. It consists of one atom of chlorine, combined with the monatomic radical or group C_2H_5, *ethyl*, and its composition is sufficiently shown by the reaction for its production:

$$C_2H_5,OH + HCl = C_2H_5,Cl + H_2O.$$

Chloride of ethyl is a diffusible stimulant, but, owing to its extreme volatility, cannot be kept readily. It may, however, be preserved in a cool cellar, the temperature of which does not rise above 7·2° C. (45° F.) or 10° C. (50° F.), being well secured in bottles, which should be placed reversed. When used as a medicine, it is generally mixed with an equal bulk of alcohol, forming what is called *alcoholic muriatic ether.* The dose is from five to thirty drops, given in sweetened water, or other convenient vehicle.

CHLORIDE OF MAGNESIUM. *Magnesii Chloridum.* ($MgCl_2$.) When a concentrated solution of this salt is evaporated to dryness, it is partially decomposed into magnesia and hydrochloric acid, the latter being evolved. By a careful evaporation, stopping it so soon as the vapor begins to redden litmus paper, the chloride may be obtained in the state of a fused hydrate, having the composition MgCl,6HO. (Casaseca, *Chem. Gaz.*, 1853, p. 384), or, by adding ammonium chloride to the solution, the mixed chlorides can be evaporated to dryness, and the sal-ammoniac volatilized without decomposing the magnesium chloride. Dr. Lebert finds this bitter and very deliquescent salt to act mildly and favorably as a purgative, producing a flow of bile, and an increase of appetite. On account of its extreme deliquescence, he recommends it in the liquid form, prepared by dissolving the salt in its weight of water. Of this solution he gives an ounce sufficiently diluted to an adult, and half an ounce to a child from 10 to 14 years of age. (*Arch. Gén.*, 4e sér., iii. 448.)

CHLORIDE OF MERCURETHYL. $Hg(C_2H_5)Cl$. This has been proposed as a substitute for corrosive sublimate, but is not at all likely to come into use. For an account of it and its method of preparation, see *A. J. P.*, xlv. 337.

CHLORIDE OF SILVER. *Argenti Chloridum.* (AgCl.) This is readily prepared by adding a solution of common salt to one of nitrate of silver, as long as it produces a precipitate. As first thrown down, it is a white, curdy substance, but it soon becomes discolored when exposed to the light. It is decomposed by solutions of the caustic alkalies, which convert it into oxide, but not by their carbonates. After the formation of the oxide in this way, the addition of sugar reduces it, and revives the silver. (*Levol.*) Chloride of silver has been used, rubbed on the tongue, in syphilis, and internally in epilepsy, chronic dysentery and diarrhœa, and other diseases in which nitrate of silver has been given. The dose is from one to three grains or more, four or five times a day. Dr. Perry administered it at the Philadelphia Hospital, Blockley, in chronic dysentery, with the immediate effect of diminishing the number of stools. The crystallized *ammonio-chloride of silver* has been given in syphilitic affections, in the dose of the fourteenth of a grain. It is formed by saturating solution of ammonia, by the aid of heat, with chloride of silver, and allowing the liquid to cool in a stoppered bottle. It crystallizes in cubes, and is very liable to decomposition.

CHLORIDE OF TIN. *Stannous Chloride.* ($SnCl_2$.) This chloride has been recommended by M. Mallez as a local application in cases of gonorrhœa and purulent discharges from the vagina. He injects daily, in divided portions, a solution containing half a drachm of the salt in three fluidounces of distilled water. He has employed the same solution with complete success in a case of obstinate purulent otitis. (*Ann. de Thérap.*, 1868, p. 175.)

CHLORINATED ANÆSTHETIC COMPOUNDS. *Bichloride of Ethylene. Ethene Dichloride. Dutch Liquid.* ($C_2H_4Cl_2$.) By the mutual action of chlorine and olefiant gas, an oily liquid is obtained, discovered by four associated Dutch chemists, and called *Dutch liquid.* The Dutch liquid has been tried as an anæsthetic by Prof. Simpson and Mr. Nunnely. Prof. Simpson was not satisfied with its effects; but Mr. Nunnely, having administered it frequently in practice, found it perfectly agreeable in every respect. Its use, he alleges, is not attended by the troublesome excitement produced by ether, or by the tendency to collapse caused by chloroform. Two forms of the Dutch liquid have been experimented with by Dr. Aran, of Paris; and one of them furnished very satisfactory clinical results. The liquid which gave the favorable results has been ascertained by Mialhe and Flourens to be the monochlorinated Dutch liquid (monochlor-ethylene chloride, $CH_2Cl,CHCl_2$), but its cost proved to be too high to allow of its general use at that time as a therapeutic agent. In consequence of this objection to the monochlorinated liquid, Mialhe and Flourens were induced to search for a substitute in the corresponding compound of a parallel series of ethers, formed by the action of chlorine on hydrochloric ether. When ethyl chloride (hydrochloric ether, C_2H_5Cl) is acted on by successive portions of chlorine, the hydrogen is replaced by the latter, atom for atom, and there are formed the five following compounds: $C_2H_4Cl_2 — C_2H_3Cl_3 — C_2H_2Cl_4 — C_2HCl_5 — C_2Cl_6$. Of this series, the first member is isomeric with the Dutch liquid; the second, third, and fourth with the mono-, bi-, and trichlorinated Dutch liquid, and the fifth is a chloride of carbon, frequently called the "sesquichloride of carbon." The first member, though identical with the Dutch liquid in elementary composition, and having a vapor of the same density, has, nevertheless, a lower boiling point, 60°–64° C. (140°–147° F.), while the Dutch liquid boils at 84·9° C. (185° F.),—and is different in chemical properties. Thus, it is not decomposed by an alcoholic solution of potassa, as the Dutch liquid is, and is not acted on by potassium, while the Dutch liquid is immediately attacked by it. The explanation of these facts is that the two compounds, while *isomeric*, or having the same empirical formula, are differently constituted molecularly. Thus Dutch liquid is known chemically as *ethene dichloride*, CH_2Cl,CH_2Cl, while the chlorinated ethyl chloride is known as *ethylidene chloride*, $CH_3,CHCl_2$. This difference of molecular structure, of course, runs all through their derivatives until the final product C_2Cl_6 is reached in both cases, and here we have identity of product.

The conclusion arrived at by Mialhe and Flourens appears to be that the four chlorinated hydrochloric ethers all possess anæsthetic properties; and, as it would be difficult to separate them, they propose the use of the mixed ethers, consisting principally of the tri- and quadrichlorinated compounds, as an anæsthetic, under the indefinite name of *chlorinated muriatic ether*. Since the time of Mialhe and Flourens' experiments, the matter has been taken up again, and Dr. Taube (*A. J. P.*, 1880, p. 603, and 1881, p. 119) has proved the availability as anæsthetics of monochlorethylidene chloride, CH_3,CCl_3, and of monochlorethylene chloride, $CH_2Cl,CHCl_2$.

The precise action of the various ethers upon the organism is at present unknown. The committee of the British Association found (*Brit. Med. Journ* , i., 1879) the ethene dichloride ("formerly named *ethylene* dichloride, or Dutch liquid, $C_2H_4Cl_2$") to cause convulsions in the lower animals; whilst recently (*Phila. Med. Times*, xi. 518) Dr. E. T. Reichert, of the University of Pennsylvania, has found that the "ethylene dichloride" produces anæsthesia marked by the usual stages, and that, like chloroform, it depresses the heart and steadily lowers the arterial pressure. His experiments seem to show, however, that its action upon the heart is much less powerful than that of chloroform, and in all of his trials the animal died of centric respiratory paralysis whilst the heart was still maintaining some degree of circulation. He believes, therefore, that it is a much safer agent than chloroform, ranking it between the latter and ether. It is evident that Dr. Reichert was not using the same agent as the English committee were, but exactly what he did have, is uncertain.

The above bodies are produced sometimes on a considerable scale in the manufacture of chloral. A very variable mixture of the middle members of the series is at present an article of commerce under the name of *Liquor anæstheticus*. Another similar mixture containing the less chlorinated bodies is the *Æther anæstheticus Aranii*, boiling between 84° C. (183·2° F.) and 103° C. (217·4° F.). The *Æther anæstheticus Wiggers* contains the more highly chlorinated products.

ETHYLIDENE CHLORIDE, *Chlorinated muriatic ether* ($CH_3,CHCl_2$), is a colorless, very mobile, neutral liquid, having an aromatic ethereal odor, and hot, saccharine taste. It is sparingly soluble in water, but readily soluble in alcohol, ether, and most of the fixed and volatile oils. It is not inflammable, in which respect it agrees with chloroform. Being a mixture of different liquids, its sp. gr. is not uniform. Its boiling point varies from 110° C. to 130° C. (230° to 266° F.). According to Flourens, its action is similar to that of chloroform. It has been studied to some extent by the British Association Committee (*Brit. Med. Journ.*, 1879, i.), who believe it to be a most valuable anæsthetic, exerting little or no depressing effect upon the heart; but the work of the committee was not sufficiently thorough to be conclusive. Many years ago, Dr. Snow used it on man, and gave judgment in its favor, and recently Prof. Binz has produced anæsthesia with it in the same way satisfactorily, and thinks it increases the circulation (*Lond. Med. Times and Gaz.*, 1879, i.); but Dr. Reeve finds (*N. R.*, 1880, 334) that in animals it lowers the arterial pressure, but does not suddenly paralyze the heart, as does chloroform. It is extremely probable that the liquid used by Dr. Reichert was this substance, and not the ethylene dichloride, as he thought. (See Ethylene dichloride, above.)

Within a very short time various other chlorinated compounds have been brought forward as having anæsthetic virtues, of which those most deserving of attention are probably *methylene dichloride* and *carbon tetrachloride*. It will be more convenient to consider these under the general name at the head of this article, than to scatter them here and there according to the position of their titles in an alphabetical catalogue.

METHYLENE DICHLORIDE. *Dichloro-methane. Bichloride of Methylene* (CH_2Cl_2.) This was introduced by Dr. B. W. Richardson, of London. It may be prepared by exposing to sunshine, in a glass globe, chlorine and gaseous chloride of methyl. The globe has two lateral apertures for the admission of the gases, and below an open neck, which communicates with one of the tubulures of a Woulfe's bottle, of which the other tubulure communicates by a bent tube with a second Woulfe's bottle, and this by another bent tube with a flask. The second bottle is surrounded with ice, and the flask immersed in a freezing mixture, to condense the volatile products. The dichloride condenses in the flask in a pure state, while the contents of the two Woulfe's bottles consist chiefly of chloroform. (*Gmelin*, vii. 288.)

The chloride of methyl may be made for the purpose by heating together 1 part of wood-spirit, 2 parts of common salt, and 3 of sulphuric acid, and collecting the evolved gas over water, which retains the impurities. Chloride of methyl is a colorless gas, having an ethereal odor and a sweet taste. (*Gmelin.*) Dr. Richardson found it to possess anæsthetic properties, but to be less manageable than the methylene dichloride.

Methylene dichloride is a colorless liquid, of an odor analogous to that of chloroform, of the sp. gr. 1·344, and the boiling point 40° C. (104° F.). The density of its vapor is 3·012 (*Gmelin*), 2·937 (*Richardson*). In its preparation, chlorine replaces one atom of hydrogen in the chloride of methyl; thus converting CH_3Cl (chloride of methyl) into CH_2Cl_2 (methylene dichloride). The vapor of the dichloride does not, like that of chloroform, extinguish the flame of a taper, but itself takes fire, burning with a brilliant flame, and yielding, as the result of its combustion, carbonic and hydrochloric acids. Methylene dichloride mixes readily with absolute ether, and, as the boiling points of the two approach nearly, they volatilize evenly and equably. It is neutral to test paper; and an acid reaction in any specimen would be an evidence of the presence of hydrochloric acid, and should preclude its use as a respiratory anæsthetic. To prevent the generation of the acid, the liquid should be kept carefully secluded from the sunlight.

Dr. Richardson, in his experiments with animals, found it, when inhaled, to produce insensibility without previous excitement, and the insensibility, when produced, continues longer without an additional administration than that caused by other anæsthetics. Like the others, it may be made to destroy life; but it has this advantage over them, that, after death, the muscular irritability remains longer; and consequently the chances are greater of a restoration of the vital functions by the means employed. The condition in which the heart and lungs are left after death from it is favorable to resuscitation. On the whole, Dr. Richardson gives, as the result of his experiments both with the inferior animals and man, the following conclusions. 1. The dichloride produces as deep insensibility as chloroform. 2. Its action is rather more rapid; but more is required to produce the desired effect, in the proportion of about six to four. 3 It produces a less prolonged second degree of narcotism than other anæsthetics. 4. The narcotism, when induced, is very prolonged, and may be reproduced with great ease. 5. It acts equably through the nervous centres of respiration and circulation; producing no break in the natural relation between these functions. 6. It rapidly escapes from the system, so that recovery is sudden when it begins. 7. It sometimes, like ether and chloroform, causes vomiting. 8. When it kills, it is by equally paralyzing the circulation and respiration. 9. It interferes with muscular irritability less, probably, than any other anæsthetic. 10. It combines with ether and chloroform in all proportions. It has been tried in several cases of severe surgical operations, and with results thus far altogether satisfactory. The quantity used averaged about a drachm every five minutes. (Dr. B. W. Richardson, *Med. Times and Gaz.*, 1867, pp. 423 and 479.)

Upon the recommendation of Dr. Richardson, the dichloride has been used by several others, with satisfactory results. Dr. A. Russell Strachan, of New York, has published an account of his experience with it in the *Medical Record* (1868, p. 22). Trying it first on himself, he inhaled it from lint upon which about a drachm had been poured, and at once began to experience pleasant and extremely composing sensations, soon followed by an "irresistible tendency to somnolence," without any of the disagreeable sensations in the head usually attendant on the inhalation of ether and chloroform. Feeling that he would soon be beyond his own control, he poured about three drachms more of the liquid on the lint, and continued to inhale until entirely unconscious. About half an hour from the beginning, he suddenly reacquired consciousness, feeling perfectly well and fit to attend to his affairs. There was no nausea, oppression, or other unpleasant feeling; and nothing remained to remind him of the experiment but a somewhat disagreeable flavor in the mouth and throat. Encouraged by the results of this trial, he used the anæsthetic afterwards in one surgical and in one obstetrical case with complete success; the patients having been speedily narcotized, in one instance in three minutes, afterwards kept insensible as long as was needful, and in the end suddenly awaking, with nothing but comfortable sensations. In the surgical case two drachms were at first administered on a folded napkin, four minutes afterwards another drachm, and in the course of the operation, which lasted nearly three-quarters of an hour, somewhat more than an ounce and a half. In the obstetrical case a drachm and a half of the dichloride was sufficient to produce unconsciousness in three minutes, which was afterwards maintained without difficulty, so far as was necessary, until the birth of the child.

The anæsthetic has since been used successfully by various English surgeons, also in Germany and this country. In the convenience of its administration, dichloride of methylene enjoys at least an equal superiority with chloroform over ether; but experience has shown the fallaciousness of the first estimates of its safety, as several deaths have been produced by it. (See *British Med. Journ.*, Oct. 1869; *Dublin Quarterly Journ.*, Aug. 1870; *P. J. Tr.*, 1871, p. 875.) Even the mixture of dichloride of methylene and absolute ether, which Dr. Richardson has introduced under the name of *methylene ether* (*Med. Times and Gaz.*, ii. 1872; i. 1873), has caused death. (*Phila. Med. Times*, iii. 718; *Med. Times and Gaz.*, July, 1873.)

The dichloride of methylene may be used in the dose of from ten to thirty minims, or be given in dilute spirit. (*Lancet*, ut supra.)

CARBON TETRACHLORIDE. *Tetrachlor-methane.* This substance, though discovered by Regnault so early as 1839, did not come into general notice until December, 1865, when it was suggested as an anæsthetic by Prof. Simpson, of Edinburgh, in a paper published in the *Med. Times and Gaz.* (Dec. 1865). It appears, however, that it had been previously used as an anæsthetic by Dr. A. E. Sansom and Dr. John Harley, who experimented with it in 1864, and recorded their experience in Dr. Sansom's work on Chloroform, published in May, 1865. (*B. and F. Med.-Chir. Rev.*, 1867, p. 551.) To procure it, dry chlorine is passed first through a bottle containing carbon disulphide, and then through a porcelain tube, filled with pieces of porcelain, and kept at a bright-red heat. The vapors are condensed in a cooled receiver, forming a yellowish-red liquid, which is a mixture of carbon tetrachloride and chloride of sulphur. The chloride of sulphur is removed by slowly adding the liquid to an excess of potash lye or milk of lime; the mixture being set aside, and agitated from time to time till the sulphur compound is decomposed, and then distilled. Carbon tetrachloride passes over, sometimes mixed with a portion of carbon disulphide which has escaped decomposition, but which may be separated by occasionally bringing the mixture into contact with potash lye. There are other modes of preparing it, which will be found in *Gmelin's Handbook* (vii. 356). By one of these, chloroform is made to yield it by the substitution of an atom of chlorine for one of hydrogen; thus $CHCl_3$ (chloroform) becomes CCl_4 (carbon tetrachloride).

Carbon tetrachloride is a transparent colorless liquid, of the sp. gr. 1·599 (Regnault), boiling at 77° C. (170·6° F.), with a vapor density 5·33, and an agreeable aromatic flavor. Its formula is CCl_4, and its derivation from methane or marsh-gas is expressed in the term *tetrachlor-methane.* Dr. P. Smith describes its effects as follows. About half a drachm on a handkerchief was inhaled. The vapors had an agreeable odor, not unlike that of the quince; a sense of coolness in the fauces was experienced similar to that caused by oil of peppermint; and this was followed by a feeling of warmth on the surface of the body generally. A feeling of calmness and comfort succeeded, which continued until the end of the day; and the sleep at night was sounder than usual. Similar effects were afterwards obtained in greater degree upon a repetition of the experiment with an increased dose. Rapid anæsthetic effects were produced, followed, in about two minutes, by calm sleep, and in about a minute longer, by a complete return of consciousness. The carbon tetrachloride was then tried on animals, with the result, in small doses, of causing entire loss of power and consciousness, from which they soon recovered entirely; but larger doses occasioned death; the animal becoming first unconscious, then gradually ceasing to respire, and dying in eight minutes. The heart was not felt to beat after the breath had ceased. Similar experiments were performed by Dr. John Harley with essentially similar results. From numerous trials afterwards made on human subjects in various morbid conditions, the conclusion was arrived at, that the tetrachloride of carbon may be usefully employed, by inhalation, for the relief of pain, especially headache, tic douloureux, toothache, the sufferings of dysmenorrhœa, etc., that it will be a valuable agent for mitigating the pains of labor, and that its local use may prove serviceable for similar purposes. In the majority of instances there was no supervening nausea or vomiting; and no unpleasant effect on the skin or mucous membrane. It is pleasanter to inhale than chloroform, and produces anæsthesia with less previous muscular spasm. Though slower in escaping from the system, yet its effects on perception are more evanescent, and consciousness usually returns in a few moments after the cessation of inhalation. Pain, however, and voluntary muscular power, may be suspended without the complete loss of consciousness. Like all anæsthetics, it may destroy life if recklessly used. (*Lancet*, June 1, 8, and 29, 1867, pp. 661, 692, and 791.)

Sir J. Y. Simpson says, of this anæsthetic, that the effects of its vapor approach nearer to those of chloroform than any other similar agent. Its primary effects are very analogous to those of chloroform, but it takes a longer time to produce the same degree of anæsthesia, and generally longer to recover from it. Its depressing influence, however, on the heart, he observes, is far greater, and, consequently, its employment far more dangerous. It is less irritant to the skin, and, therefore, may sometimes be preferable as a local anæsthetic. The injection of its vapor into the rectum is also less irritating. Its vapor, applied to the eye by sprinkling a few drops on the hand, is one of the most effectual means of relieving some forms of conjunctivitis, ulceration of the cornea, photophobia, etc. Injected subcutaneously, in the dose of 10 to 20 drops, it relieved pains in the walls of the chest and abdomen, without subsequent nausea. Internally, Sir James tried it only in small doses in gastrodynia, in which it had the same effects as chloroform. (*Med. Times and Gaz.*, 1865, p. 651.)

CHLORINATED MAGNESIA, SOLUTION OF. Mr. Robert E. Fairthorne has suggested this solution as a substitute for solution of chlorinated soda or chlorinated lime, in cases in which, whether internally or externally, the influence of the chlorine is especially required, and in which the irritant or corrosive quality of the soda or lime might be contraindicated. He proposes the following formula. "Dissolve eight ounces of sulphate of magnesia in two pints of water. Triturate in a mortar four ounces and one drachm of chlorinated lime with an equal amount of the same fluid. Mix the solution, and agitate occasionally. After standing twelve hours, pour off the supernatant liquid." Mr. Fairthorne found that each ounce of the solution contains somewhat less than nine grains of magnesia." (*A. J. P.*, 1868, p. 70.)

CHLORINATED POTASSA, SOLUTION OF. *Liquor Potassæ Chlorinatæ. Javelle's Water. Eau de Javelle.* This is prepared from carbonate of potassium precisely as the solution of chlorinated soda from carbonate of sodium, and probably has an analogous composition. (See *Liquor Sodæ Chlorinatæ.*) It is employed for taking out fruit stains, etc., from linen.

CHROME YELLOW. *Lemon Yellow. Leipsic Yellow. Paris Yellow.* ($PbCrO_4$.) This is the neutral chromate of lead, prepared by precipitating a solution of the nitrate of lead with chromate of potassium. It is of a beautiful lemon-yellow color. The basic chromate of lead ($PbO,PbCrO_4$) possesses a red color and is sometimes used as a pigment. *Chrome green* is a mixture of chrome yellow and Prussian blue. The chromates are often adulterated with sulphate of lead. M. Duviller (*Journ. de Pharm.*, Août, 1873, p. 114) detects this by heating one part of the suspected pigment with a mixture of 2 to 3 parts nitric acid, sp. gr. 1·420, one to two parts of water, and one-fourth part of alcohol. The chromate is all dissolved, but any sulphate present remains unaffected.

CHROMIUM. As it has been customary, in this work, to notice more or less fully the metals of which one or more compounds are officinal, even though the metal may not hold the same position, it is proper to give a brief notice in this place of the metal chromium, of which two compounds, chromic acid and bichromate of potassium, are officinal in our Pharmacopœia. Chromium was discovered by Vauquelin in 1797. Its most common ore is the chrome iron, consisting of ferrous oxide and sesquioxide of chromium. This is not an abundant mineral; and one of the most copious sources of it is in the chrome mines of southeastern Pennsylvania. Chromium is obtained by igniting its oxide intensely in contact with charcoal. It is a brittle metal, of a grayish-white color like platinum, with some lustre, and very hard, so that it scratches glass. Its sp. gr. is 5·9, atomic weight 52·4, and symbol Cr. It does not change by exposure to the air, and is with difficulty attacked by the acids. It forms with oxygen five compounds: 1, the monoxide (CrO), 2, the sesquioxide (Cr_2O_3), 3, the trioxide or chromic acid (CrO_3). Of the two others, one may be considered as a compound of the monoxide and sesquioxide (CrO,Cr_2O_3), and the other, called *perchromic acid*, is said to consist of two atoms of chromium and seven of oxygen (Cr_2O_7). Chromium combines with chlorine in two proportions, forming the monochloride and sesquichloride. The chief value of chromium in the arts is as the source of bichromate of potassium, extensively used in dyeing, and valuable for the facility with which it parts with oxygen, and as the base of certain beautiful pigments.

CICHORIUM INTYBUS. *Chicory. Succory.* A perennial herbaceous plant, indigenous in Europe, but naturalized in this country, where it grows in fields, and in roads along the fences, in neighborhoods which have been long settled. It is one or two feet high, with large, compound, beautifully blue flowers, which appear in July and August, and serve to distinguish the plant at first sight. The whole plant has a bitter taste, without acrimony, or any very peculiar flavor. The taste is strongest in the root, and weakest in the flowers. The leaves, when young and tender, are said to be sometimes eaten as salad in Europe. Chicory is gently tonic without being irritating, and is considered by some authors as aperient and deobstruent. It is said to be useful, if freely taken, in hepatic congestion, jaundice, and other visceral obstructions in the early stages; and is affirmed to have done good even in pulmonary consumption. The usual form of administration is that of decoction, which is prepared by boiling one or two ounces of the root, or a handful of the herb, in a pint of water. The root, dried and roasted, is much used in certain parts of Europe as a substitute for coffee, and is also mixed fraudulently with ground coffee for sale. In preparing it for coffee, Dausse recommends that the dried root should be cut into rather large and equal pieces, which are to be roasted until they lose 140 out of 500 parts. The pieces are then easily ground in a mill, and afford a yellowish-brown powder. (*Pharm. Centralbl.*, 1850, p. 688.) The plant is now largely cultivated both in England and on the Continent, to supply the demand for its root, which has grown out of its use for admixture with coffee, or as a substitute. In France alone the annual consumption is said to be 16 millions of pounds. (*P. J. Tr.*, 1860, p. 125.) An instrument by means of which it may readily be detected when used to adulterate coffee, will be found described and figured in the *P. J. Tr.*, 1867, p. 141. Mr. J. R. Leebody gives (*Chem. News*, 1874, p. 243) the following method of estimating the percentage of chicory in adulterated coffee. "Take one gramme of the unknown mixture and one gramme of a standard mixture of equal parts chicory and coffee, and remove all the coloring matter from each sample by repeated extraction with boiling water. Make the cooled extract from each up to the same volume (actual volume of no consequence, about 700 C.c. a convenient amount), and filter off a portion for the assay. Put 50 C.c. of the filtered extract from the unknown mixture in a Nessler cylinder, and determine by trial how many C.c. of the extract from the standard mixture, together with sufficient distilled water to make up to 50 C.c., will give the same color. Let a C.c. be required: then, assuming the tinctorial power of chicory to be m times that of coffee, the percentage (x) of chicory in the sample is given by the formula: $x = a\frac{m+1}{m-1} - \frac{100}{m-1}$." The *garden endive* is a species of Cichorium, denominated *C. Endivia.*

CICUTA VIROSA. *Water Hemlock. Cowbane.* A perennial, umbelliferous European plant, growing on the borders of pools and streams. It is very poisonous, proving fatal to most animals which feed upon it, though said to be eaten with impunity by goats and sheep. According to the researches of Dr. Wikszemski, it acts upon frogs in the same manner as picrotoxin, at first stimulating the convulsive centres in the medulla and producing violent general spasms, and later causing general centric paralysis. (Dragendorff, *Jahresbericht*, 1875, 494.) Upon man it operates as an acrid narcotic, producing inflammation of the stomach,* vertigo, intoxication, and convulsions, followed by general paralysis and death. Infusion of galls is recommended as an antidote, but should not be relied on to the exclusion of emetics. When the plant causes vomiting, as it frequently does, fatal effects are less apt to ensue. It is said to be less poisonous dried than fresh; and it has been inferred that the active principle is volatile. The presence of a volatile alkaloid resembling *conine*, and termed *cicutine*, has been observed by Wittstein and Buignet. But the volatile oil, obtained by distillation, was found by Simon, of Berlin, not to be poisonous. Indeed, from the experiments of M. Julius Trapp, of St. Petersburg, it appears to be identical with the volatile oil of cummin seeds (*Cuminum Cyminum*), which rank among the aromatics. (*Chem. Centralblatt*, 1858, p. 414.) On the other hand, the alcoholic extract of the dried root operated as a violent poison upon animals. (*Annal. der Pharm.*, xxxi. 258.) At present the plant is never used internally, having been superseded by *Conium maculatum.* Externally it is sometimes employed as an anodyne poultice in local pains, particularly those of a rheumatic or gouty nature.

Cicuta maculata, or *American water hemlock*, which grows in meadows and on the borders of streams throughout the United States, is closely analogous, in botanical character and in effects, to the European species. In several instances, children have been fatally poisoned by eating its root. This consists of several oblong, fleshy tubers, sometimes as long as the finger, spreading out from the base of the stem, and having a smell and taste not unlike those of parsnep. Until recently it has not been used in medicine; but we are told in Mr. Stearns's account of the medical plants of Michigan, that Dr. Norton, of Minnesota, highly recommends it as a specific in nervous and sick headache. (*Proc. A. P. A.*, 1858, p. 253.) For a full account of the plant, see *Bigelow's Medical Botany*, i. 125. The seeds have been analyzed by Mr. J. E. Young, who found in them albumen, tannic acid, gum, fixed oil, resin, volatile oil, chlorophyll, coloring matter, a peculiar acid, and an organic alkaloid supposed to be identical with *conine.* (*A. J. P.*, xxvii. 294.)

In cases of poisoning by either of these species of Cicuta, vomiting should be induced as speedily as possible, and maintained till the stomach is thoroughly evacuated, after which the system must be supported.

CITRATE OF IRON AND BISMUTH. A solution of this so-called salt has been proposed as a remedy in dyspepsia. It is made by dissolving citrate of bismuth in a watery solution of ammonia, and adding the ammonio-citrate of iron. It is a mere mixture of the substances. (*A. J. P.*, xliv. 246.)

CITRATE OF IRON AND MAGNESIUM. *Ferri et Magnesii Citras.* This double salt was introduced to the notice of the profession by M. Van der Corput. It is made by dissolving two ounces of freshly precipitated ferric hydrate in a moderately heated solution of three ounces of citric acid, and saturating the liquor with carbonate of magnesium. The solution, after filtration, is evaporated by means of a water-bath to a syrupy consistence, and spread on glass to dry in scales. The quantity of carbonate required is nearly an ounce. Three and a quarter ounces of sulphate of iron will furnish by decomposition the necessary hydrated oxide for three ounces of the acid. (See formula for *Ferri Oxidum Hydratum.*) This salt is in transparent, greenish-yellow scales, having a slightly ferruginous, somewhat acid taste. It is very soluble in water, but insoluble in alcohol and ether. It may be given in doses of from five to ten grains, in the form of solution, syrup, or pill. See the remarks of Prof. Procter on this preparation, *A. J. P.*, 1850, p. 315.

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* It is denied by some recent authorities that the poison causes gastroenteritis. (Dragendorff, *Jahresbericht*, 1875, 495.)

CITRATE OF SODIUM. *Sodii Citras.* ($2C_6H_5Na_3O_7 + 11H_2O$.) This salt may be formed by saturating a solution of citric acid with bicarbonate of sodium, evaporating the liquid, and setting it aside to crystallize. It is a white salt, crystallized in rhombic pyramids, and having a saline taste without any bitterness. Citrate of sodium has been proposed by M. Guichon, of Lyons, as a pleasant purgative, having properties similar to those of citrate of magnesium, and, though possessing a taste more decidedly saline than the latter, having the advantages of cheapness, and of a constant solubility, which permits it to be associated with other medicinal preparations. M. Dannecy recommends it in diabetes, in daily doses of from half a drachm to a drachm. (*Bulletin Gén. de Thérap.*, Avril 15, 1866.) The dose, as a cathartic, is from ten to fourteen drachms, given in simple aqueous solution, or acidulated with citric acid and sweetened.

CIVET. *Zibethum.* This is an odorous substance, obtained from two animals of the genus Viverra; the *V. Civetta* or civet cat of Africa, and the *V. Zibetha*, which inhabits the East Indies. It is secreted into a cavity opening between the anus and external genitals, and is collected from animals confined for the purpose. It is semi-liquid, unctuous, yellowish, becoming brown and thicker by exposure to the air, of a very strong, peculiar odor, similar to that of musk, though less agreeable and less diffusible, and of a bitterish, subacrid, disagreeable fatty taste. When heated it becomes quite fluid, and at a higher temperature takes fire, and burns with a clear flame, leaving little residue. It is insoluble in water, and only slightly soluble in ether and cold alcohol; but heated alcohol dissolves it almost entirely, depositing it again upon cooling. It contains, among other ingredients, a volatile oil, fat, and free ammonia. In medicine it was formerly employed as a stimulant and antispasmodic, like castor and musk; but is now used exclusively as a perfume.

CLEMATIS ERECTA. *Upright Virgin's Bower.* A perennial European plant. The leaves and flowers have an acrid, burning taste. When bruised in a mortar they irritate the eyes and throat, giving rise to a flow of tears and to coughing; and applied to the skin they produce inflammation and vesication; hence their old name of *flammula Jovis.* The acrimony is greatly diminished by drying. Störck found this species of Clematis useful in secondary syphilis, cancerous and other foul ulcers, and severe headaches. He gave it internally, and at the same time applied the powdered leaves to the surface of the sore. It acted as a diuretic and diaphoretic. Two or three drachms of the leaves were infused in a pint of water, of which he administered four ounces three times a day. He also employed an extract, in the dose of a grain or two in the course of a day. At present the plant is little used; but M. Sauveur commends an infusion of the seeds in Bright's disease. (*Ann. de Thérap.*, 1866, p. 130.)

Other species of Clematis have the same acrid properties. Among these are *C Flammula* or *sweet-scented virgin's bower*, which, though a native of Europe, is cultivated in our gardens, *C. Vitalba* or *traveller's joy*, also a native of Europe, and several indigenous species, of which *C. Virginica* or *common virgin's bower*, *C. Viorna* or *leather flower*, and *C. crispa* have been particularly cited by authors as proper substitutes for the *C. erecta* used by Störck. All these are climbing plants. *C. Vitalba* has been used in Europe with success in the cure of itch. For this purpose the roots and stems, bruised, and boiled for a short time to diminish their acrimony, were infused in boiling oil, which, thus impregnated, was applied to the skin several times a day. Twelve or fifteen applications were usually sufficient. M. Gaube has found in this species an alkaloid, which he names *clematine*, and which forms with sulphuric acid a salt crystallizable in six-sided needles; and besides this, an acrid volatile oil analogous to mezereon in its properties, tannic acid, mucilage, and earthy salts. (*Journ. de Pharm.*, Août, 1869, p. 122.)

COAL TAR. When bituminous coal is subjected to dry distillation, besides the incondensible gases which serve for lighting, and the charcoal left behind as *coke*, which is a valuable fuel, there are formed, through the reactions between the disengaged principles of the coal, numerous other products, necessarily more or less varying in character and amount, not only according to the kind of coal used, but also with the varying circumstances of the decomposing process. Most of these newly-formed bodies, all of which are volatile, are condensed into a dark thick liquid or semi-liquid substance called coal tar. Formerly this was considered as refuse matter, and the most embarrassing problem for the manufacturer was how to get rid of it most conveniently. But science and industry have combined to wrest from this seemingly useless mass many substances of great value in the arts, and several which have entered into the catalogue of remedies. In an excellent paper by M. E. Kopp, an abridgment of which is published in *A. J. P.*, vol. xxxiii.

pp. 39, 129, and 245), a general view is given of the constituents of coal tar Our purpose is to give a condensed view of these substances, and when found of importance in their therapeutical relations, to treat of them more fully, should they not have been already commented on under distinct heads. The composition of coal tar varies considerably with the temperature at which the distillation of the coal is effected, the yield of solid bodies and of gases being larger when the temperature is higher, while at a lower temperature the liquid portion of the tar is in increased amount When coal tar is submitted to distillation and rectification, it yields the following products in variable proportion. They may be arranged in the three divisions of solids, liquids, and gases.

1. *Solids.* Naphthalin, $C_{10}H_8$, methyl-naphthalin, $C_{11}H_{10}$. acetyl-naphthalin and diphenyl, $C_{12}H_{10}$, fluoren, $C_{13}H_{10}$. anthracen and phenanthren, $C_{14}H_{10}$, fluoranthen, $C_{15}H_{10}$, methyl-anthracen, $C_{15}H_{12}$, reten, $C_{16}H_{12}$, chrysen, $C_{18}H_{12}$, pyren, $C_{16}H_{10}$, and carbazol, $C_{16}H_{11}N$

2. *Liquids.* These may be neutral hydrocarbons, acids, and ethers of the same, or bases. The *neutral hydrocarbons* are benzol, C_6H_8, toluol, C_7H_8, methyl-toluol, and iso-xylol, C_8H_{10}, pseudocumol, and mesitylen, C_9H_{12}, cymol, $C_{10}H_{14}$. The *acid constituents* are phenol, C_6H_6O, kresol, orthokresol, parakresol, and metakresol, C_7H_8O, phlorol, $C_8H_{10}O$, rosolic acid, $C_{20}H_{16}O_3$, pyrocatechin, $C_6H_6O_2$, and kreosot, consisting of the methyl ethers of pyrocatechin and its homologues, $C_7H_8O_2$, $C_8H_{10}O_2$, and $C_9H_{12}O_2$. There are also present, probably in combination with the ammonia of the ammoniacal liquor, acetic, butyric, carbonic, hydrocyanic, sulphocyanic, and hydrosulphuric acids. The *bases* are ammonia, NH_3, methylamine, CH_3,NH_2, ethylamine, C_2H_5,NH_2, phenylamine, C_6H_5,NH_2, pyridine, C_8H_5N, picoline, C_6H_8N, lutidine, C_7H_9N, collidine, $C_8H_{11}N$, leukoline, C_9H_7N, iridoline, $C_{10}H_9N$, kryptidine, $C_{11}H_{11}N$, acridine, $C_{12}H_9N$, coridine, $C_{10}H_{15}N$, rubidine, $C_{11}H_{17}N$, and viridine, $C_{12}H_{19}N$

3. *Gases.* (1.) *Illuminating gases.* Acetylen, C_2H_2. ethylen, C_2H_4, propylen, C_3H_6, butylen, C_4H_8. allylen, C_3H_4, crotonylen, C_4H_6, teren, C_5H_8. and vapors of benzol, C_6H_6, styrolene, C_8H_8, naphthalin, $C_{10}H_8$, methyl-naphthalin, $C_{11}H_{10}$, fluoren, $C_{13}H_{10}$, fluoranthen, $C_{15}H_{10}$, propyl, $(C_3H_7)_2$ and butyl, $(C_4H_9)_2$.

(2.) *Heating and diluting gases* Hydrogen, H_2, marsh-gas (methane), CH_4, carbon monoxide, CO.

(3) *Impurities.* Carbon dioxide, CO_2, ammonia, NH_3. cyanogen, $(CN)_2$, methyl-cyanide, CH_3,CN, sulphocyanic acid, CN,SH, hydrogen sulphide, H_2S, carbon disulphide, CS_2, carbon oxysulphide, COS and nitrogen, N_2

Valuable researches have also been made in this field by Mr. C. M Warren, which are contained in the *Memoirs of the American Academy* (N. S , ix. 135), and in the *Amer. Journ. of Sci. and Arts* (1865, vol. xl. p. 89); to these, and to a résumé in the *Chemical News*, 1874, p. 180, the reader is referred.

COBALT. (Co. 58·6.) This not very abundant metal is usually found associated with arsenic, and is rarely used in its pure condition in medicine or pharmacy. It occurs as *smaltine* or *tin-white cobalt*, *cobalt glance*, or *sulpharsenate; cobalt bloom*, *erythrine*, or *arsenate; earthy cobalt* or *wad*, a mixture of cobaltous oxide and black oxide of manganese, and *speiss cobalt* $(Co,Ni,Fe)As_2$.

Speiss cobalt is frequently employed as the source of cobalt salts, and the substance called in commerce *zaffre* is an impure arsenate of cobalt, made by simply roasting the crude cobalt ores or calcining them, with access of air, and is used to give a blue color to glass, enamels, and pottery glaze. The native ore is frequently found in commerce under the name of *flystone*, and is used for poisoning flies, by roughly grinding it and putting a small quantity in a saucer with sweetened water. *Smalt* is the common name used for glass colored by fusing with oxide of cobalt, producing a blue pigment, for coloring glass, etc. The soluble salts of cobalt, particularly the *chloride* and *sulphocyanate*, have been used to impregnate paper, etc., giving it ordinarily a pink tint, indicative of the presence of moisture, while on elevation of temperature the color changes to blue. Advantage has been taken of this fact to produce the so-called *barometer paper.*

COBALT BLUE. This beautiful pigment is a compound of oxide of cobalt and alumina, obtained by precipitating the mixed solution of a salt of alumina and of cobalt by means of an alkali, and washing, drying, and strongly calcining the precipitate. (*Berzelius.*) The cobalt blue of Thenard is made by heating together the hydrated subphosphate of cobalt and hydrate of alumina. It is used in painting. An oxide of cobalt, prepared by precipitating the chloride with potassa, has been employed in rheumatism. It is emetic in the dose of 10 or 20 grains. The salts of the metal are irritant poisons.

COBWEB. *Spiders' Web. Tela Araneæ.* The genus *Aranea* of Linn. has been divided by subsequent naturalists into several genera, of which the *Tegeneria* of Walkenaer is the one that includes the medicinal species of spider. The *T. domestica* of Europe, and *T. medicinalis* of this country (Henz, *Jour. Acad. of Nat. Sci.*, ii 53), are the particular species which have attracted most attention. They inhabit cellars, barns, and other dark places, and are of a brown or blackish color. It is affirmed that the web of the field spider is inefficacious, while that collected in the cellars of houses, etc., has extraordinary medical virtues. It is said to be useful in various spasmodic and nervous diseases, controlling and tranquillizing irregular nervous action, exhilarating the spirits, and disposing to sleep. Among the complaints in which it has been found useful, besides intermittent fever, are periodical headache, hectic fever, asthma, hysteria, and nervous irritations attended with morbid vigilance and irregular muscular action. (See *Lancet*, 1867, p. 212.) It will be observed that these are, for the most part, affections over which the imagination has much control. The dose of spiders' web is ten grains, to be given in the form of pill, and repeated every three or four hours. According to Dr. Jackson, twenty grains are not more effective than are ten. Spiders' web is also useful as a styptic, especially after extraction of teeth, the socket being stuffed full of the web.

COCCULUS. *Cocculus Indicus. Anamirta Cocculus.* Wight and Arnott, *Flor. Penins. Ind. Orient.* i. 446; Lindley, *Flor. Med.* 371.—*Menispermum Cocculus* Linn.—*Cocculus suberosus.* De Cand. *Prodrom.* i. 97. This is a climbing shrub, with a suberose or corky bark; thick, coriaceous, smooth, shining, roundish or cordate leaves, sometimes truncate at the base; and the flowers in lateral compound racemes. It is a native of the Malabar Coast, and of Eastern Insular and Continental India. The fruit is the officinal portion

This plant was proved to be the source of Cocculus indicus by Roxburgh, who raised it from genuine seeds which he had received from Malabar. It is believed that other allied plants, bearing similar fruit, contribute to furnish the drug; and the *Cocculus Plukenetii* of Malabar, and *C. lacunosus* of Celebes and the Moluccas, are particularly designated by authors. It was known to the Arabian physicians, and for a long time was imported into Europe from the Levant, from which circumstance it was called *Cocculus levanticus.* It is now brought exclusively from the East Indies.

Properties, etc. Cocculus indicus, as found in the shops, is roundish, somewhat kidney-shaped, about as large as a pea; having a thin, dry, blackish, wrinkled exterior coat, within which is a ligneous bivalvular shell, enclosing a whitish, oily, very bitter kernel. It is without smell, but has an intensely and permanently bitter taste. It bears some resemblance to the bayberry, but is not quite so large, and may be distinguished by the fact that in the Cocculus indicus the kernel never wholly fills the shell. When the fruit is kept long, the shell is sometimes almost empty. The Edinburgh College directed that "the kernels should fill at least two-thirds of the fruit." M. Boullay discovered in the kernel a peculiar bitter principle which he denominated *picrotoxin.* This is white, crystallizable in quadrangular prisms, soluble in 25 parts of boiling and 150 of cold water (*Glover*), and very soluble in alcohol and ether, but insoluble in the oils. Its composition was stated to be $C_{12}H_{14}O_5$. Barth and Kretschy have investigated its chemical constitution, and believe it to be a body consisting of three constituents. They retain the name picrotoxin for the most important one, which is exceedingly bitter and very poisonous, and has the composition $C_{15}H_{16}O_6$. The second is very bitter, *not* poisonous, and was named *picrotin*, with its formula $C_{25}H_{30}O_{12}$. The third constituent exists only in the proportion of 2 per cent., is not bitter and not poisonous, and was called *animirtin.* (*Wien. Anz.*, 1880, *A. J. P.*, 1880, pp. 320, 495.) According to M. Blas, the solutions of Boullay's picrotoxin have a decidedly acid reaction, and potassa renders it soluble in water. (*Journ. de Pharm.*, 4e sér., xvi. 215.) M. Boenhuke-Reech has found that it forms with ammonia a very unstable compound. (*Journ. de Pharm* , 4e sér., xix. 465.) It is poisonous, and, given to strong dogs in the quantity of from five to ten grains, produces death, preceded by convulsions, which, according to Dr. R. M. Glover, are very similar in character to those produced by Flourens by section of the corpora quadrigemina and cerebellum; being attended with backward and rotary movements and tetanic spasms. It also greatly increases the animal heat. (*Ed. Monthly Journ. of Med. Sci.*, N. S., iii. 303.) To procure it, the watery extract of the seeds is triturated with pure magnesia, and then treated with hot alcohol, which dissolves the picrotoxin, and yields it upon evaporation. In this state, however, it is impure. To obtain it colorless it must be again dissolved in alcohol, and treated with animal charcoal. After filtration and due evaporation, it is deposited in the crystalline form. Besides picrotoxin, Cocculus indicus contains a large proportion of fixed oil, and other substances of less interest. In the shell MM. Pelletier and Couerbe discovered two distinct principles; one alkaline and named *menispermine* (menispermia), the other identical with it in composition, but distinguishable by its want of alkalinity, its volatility, and its solubility and crystalline form, and denominated *paramenispermin.* They found also in the shell a new acid, which they called *hypopicrotoxic.* The picrotoxin of M. Boullay they believed to possess acid properties, and proposed for it the name of *picrotoxic acid.* (*Journ. de Pharm.*, xx. 122.) In Europe, picrotoxin is said to be added to malt liquors in order to give them bitterness and intoxicating properties; although the practice is forbidden by law, in England, under heavy penalties.

Gunckel proposes the following mode of detecting and separating picrotoxin from liquids containing it, founded on the facts that it is soluble in dilute acids though not combining with them, and that ether extracts it from its acidulous solutions, but not from those in water or alcohol, even with the presence of potassa. The substance suspected to contain it, having been brought to the consistence of paste, is to be digested with alcohol and a little tartaric acid, the liquid separated, the alcohol evaporated, the residue diluted with a little water and then treated with ether, and, finally, the ethereal solution submitted to evaporation in a watch-glass Picrotoxin, if present, is deposited, recognizable by its feathery crystallization, its bitter taste, and the property of reducing the tartrate of copper and potassium. If strychnine, which perhaps resembles it most closely in its effects, is present, it will be left behind in the acidulated solution. (*Journ. de Pharm.*, 1858, p. 78; from *Archiv der Pharm.*, xciv. 14.) In the instance of adulterated malt liquor, in consequence of the resin of hops it contains, it might be expedient first to evaporate the liquor to dryness, and prepare a watery extract of the residue, and then to proceed as stated.

Mr. J. W. Langley proposes, as a means of detection, the oxidation of picrotoxin. When to a little of this substance, mixed with nitrate of potassium in a watch-glass, a drop of sulphuric acid is added, no observable reaction takes place; but, if a very strong solution of caustic potassa or soda be now added, a bright reddish-yellow color is produced, which is highly characteristic. A very minute quantity may thus be detected. Mr. Langley, however, thinks it extremely probable that this phenomenon is owing to a minute quantity of some nitrogenous principle strongly attached to the picrotoxin; for, if this principle be purified by combining it in solution with potassa, and then precipitating it with an acid, it does not answer the test. (*Am. Journ. of Sci. and Arts*, 1862, p. 109.)

Medical Properties, etc. Cocculus indicus acts in the manner of the acrid narcotic poisons, but is never given internally. In India it is used to stupefy fishes in order that they may be caught; and it has been applied to the same purpose in Europe and this country. It is asserted that the fish thus taken are not poisonous. The powdered fruit, mixed with oil, is employed in the East Indies as a local application in obstinate cutaneous affections. An ointment made with the powder has been used in tinea capitis, and to destroy vermin in the hair. It is a popular remedy in this country for this purpose, and great caution should be used in its employment. A *tincture of Cocculus indicus* is sometimes used, made by macerating the ground fruit in diluted alcohol two weeks, in the proportion of four ounces in a pint. Picrotoxin has been successfully substituted by Dr. Jeager for the drug itself. Rubbed up with lard in the proportion of ten grains to the ounce, it usually effected cures of tinea capitis in less than a month. A case is recorded by W. B. Thompson, of New York, in which death in a child six years old, preceded by tetanic spasms, and extremely contracted pupil, resulted from the application of a strong tincture of the fruit to the scalp. (*Med. Exam.*, N. S., viii. 227.) It should be used with great caution when the surface is abraded. Mr. J. Crichton Browne has found that picrotoxin and chloral are, within certain limits, antagonistic. (*N. R.*, Oct. 1875.)

Fluid Extract of Cocculus Indicus is a convenient form for external use. Prof. Procter prepared it by moistening a moderately coarse powder, obtained from 16 troyounces of the fruit, with 6 ounces of a menstruum composed of two parts of alcohol and one of water; packing the mixture, after two hours, in a conical percolator; pouring upon it a similar menstruum till twelve fluidounces have passed; digesting the coatings, from which the powder was sifted, in two pints of diluted alcohol; pouring the whole, when cool, into the percolator; after the liquid has disappeared, pouring on diluted alcohol until two pints of filtered liquor are obtained; evaporating this to four fluidounces; mixing the residue with the reserved tincture; and, after 24 hours, filtering through paper. (*A. J. P.*, 1863, p. 112.)

COCHLEARIA OFFICINALIS. *Common Scurvy-grass.* This is an annual or biennial plant, sending up early in the spring a tuft of radical leaves, which are heart-shaped, roundish, of a deep shining green color, and supported on long footstalks. The leaves of the stem are alternate, oblong, somewhat sinuate, the lower petiolate, the upper sessile. The stem is erect, branched, angular, six or eight inches high, and bears, at the extremity of the branches, numerous white cruciform peduncled flowers in thick clusters. The fruit is a roundish two-celled pod, containing numerous seeds. The whole plant is smooth and succulent. It is a native of the northern countries of Europe, where, as well as in the United States, it is occasionally cultivated in gardens. The whole herb is officinal. It has, when fresh, a pungent, unpleasant odor if bruised, and a warm, acrid, bitter taste. These properties are lost by drying. They are imparted to water and alcohol by maceration, are retained by the expressed juice, and probably depend on a peculiar volatile oil, which is separable in very small quantity by distillation with water. Dr. Geiseler has shown that, when the dried herb is mixed with water and a little myrosin (see *Sinapis*), the taste and smell of the fresh plant are developed; proving that, as in black mustard, the volatile oil is produced by reaction between a fixed principle in the plant and water, under the influence of myrosin acting as a ferment. (*Chem. Centralb.*, 1856, p. 124.) The oil was at first supposed to be identical with the oil of mustard, but Geiseler considered it to have a different composition, giving as its formula $(C_3H_5)_2OS$. (See *A. J. P.*, 1859, p. 416.) The boiling point also differs, being, according to Dr. A. W. Hofmann, about 160° C. (320° F.); while that of mustard is 147° C. (296·6° F.). (*Chem. News*, 1869, p. 286.) According to the later researches of Dr. Hofmann, it is shown to be a mustard oil of the butylic series, having the formula $C_5H_9NS = C_4H_9,CSN$. Dr. Hofmann has also made it synthetically.

Common scurvy-grass is gently stimulant, aperient, and diuretic. It is highly celebrated as a remedy in sea-scurvy, and has been recommended in chronic obstructions of the viscera, and in certain forms of chronic rheumatism. The fresh plant may be eaten as a salad, or used in the form of infusion in water or wine; the expressed juice has also been used. Alcohol and water are impregnated with its virtues by distillation; and the distilled spirit has been found useful in paralysis, in the dose of thirty drops several times a day. The expressed juice may be used as a local application in scorbutic affections of the gums.

COCO-NUT OIL. *Cocoa-nut Oil. Cocoa-nut Butter.* This must not be confounded with the fixed oil of the chocolate nut, which is often called *cocoa-butter.* (See Part I.) The substance here considered is the fixed oil of the coco-nut, which is the fruit of a species of palm, denominated botanically *Cocos nucifera*, and universally known by the name of *coco-nut tree*, or, as it is frequently spelled, *cocoa-nut tree.* The oil is obtained either by expression or decoction. It is of a fine white color, of the consistence of lard at ordinary temperatures, becoming solid, like suet, between 40° F. and 50° F., and liquid at about 80° F., of a bland taste, and a peculiar, not disagreeable odor. It is readily dissolved by alcohol. It consists mainly of a peculiar fatty principle, called *cocinin,* with small amounts of olein. The cocinin when saponified with alkalies yields glycerin and *cocinic acid* (coco-stearic acid), $C_{13}H_{26}O_2$. It has also been found to contain several solid and volatile acids, as caproic, caprylic, capric, and pichuric acids. (*Journ. de Pharm.*, 3e sér., xv. 69.)

This oil has been used for various purposes in medicine and pharmacy. Dr. Theophilus Thomson has found it to possess virtues similar to those of cod-liver oil, and has used it with advantage in consumption. In some instances it appeared to arrest the progress of phthisis as decisively as that oil, over which it has the advantages of being cheaper, more palatable, and less apt to produce nausea. (*Clin. Lect. on Pulmonary Consumption*, Am. ed., p. 128.) Dr. J. H. Warren, of Boston, gives similar testimony in its favor. (*Bost. Med. and Surg. Journ.*, lii. 377.) In Germany it has been used in pharmacy, to a considerable extent, as a substitute for lard, to which, according to Pettenkofer, it is preferable on account of its less tendency to rancidity, its more ready absorption when rubbed on the surface of the body, and its less liability to produce chemical changes in the substances with which it is associated. Thus, the ointment of iodide of potassium, when made with lard, becomes yellow in a few days; while, if made with coco-nut oil, it remains unchanged for two months or more. Vegetable substances also keep better in ointment prepared with this oil than with lard. Besides, it takes up one-third more water, which is a useful quality when it is desirable to apply saline solutions externally. To prepare it for use, nothing more is ordinarily necessary than to melt it at a moderate heat, and strain it through linen. If colored, it may be digested with powdered animal charcoal, and subsequently filtered through paper. (*A. J. P.*, xxix. 331.) Coco-nut oil is used in the manufacture of soap, particularly in the transparent varieties, for which purpose it is largely used abroad for giving firmness to the ordinary soap; this property also permits of the addition of a large quantity of water, an advantage likely to be adopted by all, but unfortunately coco-nut oil soap is very apt to contain free caprylic acid; and the persistent rancid odor, resembling that of infant's vomit, left upon the skin after washing with such soap, is an effectual bar to its very extended use. A preparation has been shown to us, said to be the liquid part of coco-nut oil, prepared in London, and, under the name of *coco-olein*, used, instead of the oil itself, as a substitute for cod-liver oil. The dose of this, as well as of the oil, is half a fluidounce three times a day. If the oil is used, it may be readily brought to the liquid state by a gentle heat.

CŒLOCLINE POLYCARPA (Alphonse De Candolle). *Unona polycarpa* (De Cand.). *Berberin Tree. Yellow-dye Tree of Soudan.* This is a small tree, growing in Soudan, Sierra Leone, and certain parts of Western Africa, the bark of which has come into notice through the researches of Dr. Wm. F. Daniell, who has described both the tree and its bark. (*P. J. Tr.*, Feb. 1857.) When wounded, the tree exudes a juice which produces a yellow stain upon linen, that cannot be washed out. The epidermis of the bark is greenish gray, interrupted by occasional blackish patches; the inner layers are of a golden yellow, and very fibrous, so that they can be separated in ribbon-like bands. The bark is moderately but disagreeably bitter, and stains the saliva yellow. Water extracts its color and bitterness. Dr. Stenhouse has ascertained that it contains *berberine.* The bark is much used in Africa for dyeing yellow. In Sierra Leone it is employed topically in the treatment of obstinate ulcers, in the state of powder or decoction.

COLLINSONIA CANADENSIS. *Horse-weed. Horse-balm. Richweed. Heal-all. Stone-Root. Knot-root.* An indigenous plant, with a perennial, knotty root, and an herbaceous simple stem, about two feet high, furnished with two or three pairs of broad cordate-ovate, smooth leaves, and terminating in a panicle of yellow flowers in branched racemes. The flowers are diandrous and monogynous, with a labiate calyx and corolla, the latter of which has the lower lip fringed. The plant grows in woods from Canada to the Carolinas, and flowers from July to September. The whole plant has a strong disagreeable odor, and a warm pungent taste, due to the presence of a volatile oil. It is considered tonic, astringent, diaphoretic, and diuretic; and the root, in substance, is said to irritate the stomach, and produce vomiting, even in small doses. A decoction of the fresh root is said to have been used with advantage in catarrh of the bladder, leucorrhœa, gravel, dropsy, and other complaints; and the leaves are applied by the country-people, in the form of cataplasm or fomentation, to wounds, bruises, and sores, and in cases of internal abdominal pains.

COLUTEA ARBORESCENS. *Bladder Senna.* A shrub growing spontaneously in the southern and eastern parts of Europe, and cultivated in gardens as an ornamental plant. Its leaves are pinnate, consisting of from three to five pairs of leaflets, with an odd one at the end. The leaflets are obovate, slightly emarginate, smooth, and of a deep green color on the upper surface, grayish green and somewhat pubescent beneath. The flowers are yellow, and the fruit vesicular, whence the plant derived its vulgar name. The leaflets are purgative, and in some parts of Europe are used as a substitute for senna, which is said to be sometimes adulterated with them. Bladder senna is comparatively very feeble. It is administered in infusion or decoction, of which the dose is about half a pint, containing the virtues of from one to three ounces of the leaves.

COLZA OIL. This is an oil expressed from the seed of the *Brassica campestris*, or field cabbage, a cruciferous plant which grows wild through the greater part of Europe, and is largely cultivated in France and Germany, where the fields, at its period of flowering, are beautiful with its bright yellow blossoms. It is cultivated for the sake of the oil, obtained by expression from its seeds, which is largely used in the arts, though, in consequence of its unpleasant taste, unfitted for the table.

COMPTONIA ASPLENIFOLIA. *Sweet Fern.* A shrubby, indigenous plant, named from the resemblance of its leaves to the *spleenwort fern.* It grows in thin sandy or stony woods, from New England to Virginia. All parts of it possess a resinous spicy odor, which is increased when the plant is rubbed. Mr. R. T. Chiles has found in it tannic and gallic acid, volatile oil, extractive, gum, resin, and a substance resembling saponin. (*A. J. P.*, xlv. 306.) H. K. Bowman found it to contain 8·20 per cent. of tannin. (*A. J. P.*, 1869, p. 193.) It is said to be tonic and astringent, and to be occasionally used in domestic practice as a remedy in diarrhœa and various other complaints. It is employed in the form of decoction.

CONIOSELENIUM CANADENSE. *Hemlock Parsley.* (*Gray's Manual*, p. 154.) This plant grows in swamps in the northern parts of the United States and in Canada. (See *Edin. Med. Journ.*, 1865, p. 1106.) It is occasionally used as a remedy in dysentery.

CONTRAYERVA. *Contrayerva.* This is the root of *Dorstenia Contrayerva*, of the natural order Urticaceæ. The following is its generic character:—"*Receptacle* common, one-leafed, fleshy, in which solitary *seeds* are nestled." (*Willd.*) This plant has a perennial, fusiform, branching, rough, compact root or rhizome, which sends up several leaves of an irregular shape, about four inches in length, lobed, serrated, pointed, and placed upon long radical footstalks, which are winged towards the leaves. The scapes or flower-stems are also radical, rise several inches in height, and support irregular quadrangular receptacles, which contain male and female flowers, the former having two stamens, the latter a single style. The capsule, when ripe, possesses an elastic power, by which the seeds are thrown out with considerable force. The plant grows in Mexico, the West Indies, and Peru. The root (rhizome) is the officinal portion. According to Pereira and Dr. Martius, however, the contrayerva of the shops is the product of *D. Brasiliensis*, and is brought from Brazil. The term contrayerba, in the language of the Spanish Americans, signifies *counterpoison* or *antidote*, and was applied to this root under the impression that it had the property of counteracting all kinds of poison. The probability is that the root sold as *contrayerva* is derived from several species of Dorstenia, among which, besides *D. Contrayerva*, two others are mentioned by Dr. Houston, *D. Houstonia* and *D. Drakena*, the former growing near Campeachy, the latter near Vera Cruz.

The root, as found in our shops, is oblong, an inch or two in length, of varying thickness, very hard, rough, and solid, of a reddish-brown color externally, and pale within; and has numerous, long, slender, yellowish fibres attached to its inferior part. The odor is aromatic; the taste warm, slightly bitterish, and pungent. The fibres have less taste and smell than the tuberous portion. The sensitive properties are extracted by alcohol and boiling water. The decoction is highly mucilaginous. The tincture reddens infusion of litmus, and lets fall a precipitate on the addition of water. The root, so far as we know, has not yet been analyzed, but contains starch and a volatile oil. Contrayerva is a stimulant tonic and diaphoretic, and has been given in low states of fever, malignant eruptive diseases, some forms of dysentery and diarrhœa, and other diseases requiring gentle stimulation. It is very seldom used in this country. The dose of the powdered root is about half a drachm.

CONVALLARIA MAJALIS. *Lily of the Valley.* G. F. Walz found in this garden plant *convallarin* and *convallamarin.* (*A. J. P.*, 1859, p. 577.) Convallarin is in colorless rectangular prisms, scarcely soluble in water, but sufficiently so to render the solution acrid, and to cause it when shaken to foam like soap and water. It is easily dissolved by alcohol. Its composition is represented by the formula $C_{34}H_{31}O_{11}$. It is a glucoside. Convallamarin is a white powder, very bitter and afterwards sweetish, soluble in water and alcohol, but not in ether. This also is a glucoside. Its composition is $C_{23}H_{44}O_{12}$. Taken internally the flowers are said to be emetic and cathartic, and their extract purges actively in the dose of half a drachm. They were formerly used in epilepsy and against worms. The *root*, which is also bitter, has similar purgative properties, and in powder is said to be sternutatory. The effects on the system of the two principles above mentioned have been investigated by Dr. H. Marmé, of Germany, with the following results. *Convallarin*, in doses of 3 or 4 grains, acts as a purgative, without observable inconvenience to the animals acted on; *convallamarin*, even in small doses, produces active vomiting, whether given by the mouth or injected into the subcutaneous tissue, or directly into the veins. The latter principle acts especially on the heart, at first diminishing the number of its pulsations, and afterwards rendering them more frequent and irregular, and causing death in a few minutes after the introduction of the poison. The heart appears to be paralyzed, and cannot be excited after death. The principle acts on the heart through the vagi nerves. From 6 to 8 milligrammes (one-tenth to one-eighth of a grain) caused death when injected into the cervical vein in rabbits. (*N. Y. Med. Journ.*, 1867, p. 166; *Schmidt's Jahrbuch.*, 1867, v. 166.) Very recently (*Bull. Thérap.*, July, 1882) Prof. Sée has elaborately investigated the action of the extract of the whole plant, and concluded that it is a very important cardiac remedy, acting as a direct stimulant to the heart muscle, and in overdose causing systolic arrest. He found that it elevates the blood pressure, and acts very much like digitalis, but depresses the inhibitory nerves. It is especially useful in cardiac valvular affections when the heart is weak and dropsy exists. Under these circumstances it is actively diuretic. We have known an infusion (eight ounces to a pint of boiling water) of the plant used in several cases with excellent results in doses of two fluidounces. Prof. Sée gave from a half to one Gm. of the extract daily (grs. 7·5 to 15·34).

CONVALLARIA POLYGONATUM. Linn. *Polygonatum uniflorum.* Desfontaines.—*Solomon's Seal.* A perennial, herbaceous European plant, the root of which is horizontal, jointed, white, and marked at short intervals with small circular impressions, which bear a remote resemblance to those made by a seal, and have served to give a name to the plant. The root is inodorous, and of a sweetish mucilaginous taste, followed by a slight degree of bitterness and acrimony. It is said to be emetic. In former times it was used externally in bruises, especially those about the eyes, in tumors, wounds, and cutaneous eruptions, and was highly esteemed as a cosmetic. At present it is not employed, though recommended by Hermann as a good remedy in gout and rheumatism. The berries and flowers are said to be acrid and poisonous. *C. multiflora* (*Polygonatum multiflorum*, Desf.), which grows both in this country and in Europe, is analogous to the preceding in properties. Dr. John H. Rauch found two fluidounces of a decoction, made by boiling two ounces of the root in a pint of milk, to produce nausea, a cathartic effect, and either diaphoresis or diuresis. He used it advantageously as an internal remedy in piles, and externally in the form of decoction, in the affection of the skin resulting from the poisonous exhalations of certain plants. (*Inaugural Essay*, March, 1849.)

CONVOLVULUS PANDURATUS. *Wild Potato.* The wild potato plant (for a figure of which see *Barton's Med. Bot.* i. 249) has a perennial root, and a round, purplish, procumbent or climbing stem, which twines around neighboring objects, and grows sometimes twelve feet in length. The leaves, which stand alternately on long petioles, are broad, heart-shaped at the base, entire or lobed on the sides like a guitar or violin, somewhat acuminate, deep green on the upper surface, and paler beneath. The flowers are in fascicles, upon long axillary peduncles. The calyx is smooth and awnless; the corolla tubular, campanulate, very large, white at the border, but purplish red at the base. The plant is indigenous, growing throughout the United States in sandy fields and along fences, and flowering from June to August. A variety with double flowers is cultivated in the gardens for the sake of ornament. The root, which was the officinal part, is very large, two or three feet in length, about three inches thick, branched at the bottom, externally of a brownish-yellow color, and full of longitudinal fissures, internally whitish and milky, and of a somewhat acrid taste. The wild potato is feebly cathartic, and has been proposed as a substitute for jalap, but is scarcely used. It is thought to be diuretic, and has been employed with supposed advantage in strangury and calculous complaints. Dr. G. M. Maclean considers it one of the best diuretics he has used, when given in infusion. (*N. Y. Journ. of Med.*, x. 375.) Forty grains of the dried root are said to purge gently.

COPAL. A resinous substance, brought from the East Indies, South America, and the eastern and western coasts of Africa, but most abundantly from the first mentioned source. It is the concrete juice of different trees, and is furnished by exudation. The East India copal has been ascribed to the *Vateria Indica* of Linn., the *Elæocarpus copaliferus* of Retzius; and the Brazilian, by Martius and Hayne, probably with justice, to different species of Hymenæa. There is some reason to believe that the East India copal is also the product of a Hymenæa; at least a specimen of this resin was collected by M. Perottet from the *Hymenæa verrucosa*, which he found growing in the Isle of Bourbon. This tree is a native of Madagascar, and probably of the neighboring parts of Africa; and M. Perottet was informed that the copal of India is taken thither by the Arabs of Muscat, who obtain it from the east coast of Africa. (*Journ. de Pharm.*, 3e sér., i. 406.) It is stated by Mr. James Vaughan, who was stationed as army surgeon at Aden in Arabia, that copal is taken to that port from the African coast opposite the island of Zanzibar, where it is said to be dug up from the earth. (*Pharm Journ* , xii. 385.) Col. Playfair, British Consul at Zanzibar, has sent to the Kew Museum specimens of the bark of a tree, with the resin *in situ*, and specimens of the collected resin, and of the fruit of the tree, which leave little doubt that the Zanzibar copal is obtained from the *Hymenæa Mozambicensis.* In a communication from Dr. John Kirk, dated Zanzibar, March 20, 1865, it is stated that the smooth copal, exported from that region, is obtained from the *Trachylobium Mozambicense*, Kl., a small tree or bush, distinguished by its rounded head of glossy leaves, with groups of white flowers at the ends of the branches. The trunk and limbs are covered with a clear resinous exudation, portions of which, after solidifying, drop to the ground and are collected, while other portions are broken from the tree. This kind of resin is always smooth, and is exported to India. Another variety, with an indented goose-flesh surface, known in the English market as *animé*, is dug from the earth, and, though the product of forests now extinct, originated probably from the same tree, as specimens of the recent gum, which had dropped from the tree and been some time buried in the sand, present similar surface-marking, and in other respects exhibit similar physical properties. (*P. J. Tr.*, 1869, p. 654.) In papers contained in the *P. J. Tr.* (xvi. 369 and 423), Dr. W. F. Daniell has given an account of several varieties of copal produced on the coast and interior parts of Western Africa, from Sierra Leone to Angola and Benguela, and exported in large quantities. Those from Sierra Leone, which are most highly valued for their superior hardness and transparency, are said by Dr. Daniell to be derived from the *Guibourtia copallifera* of Bennett, a large tree, growing preferably in mountainous regions, and very nearly related, botanically, to the Hymenææ, which produce copal in other regions. The drug is mostly collected, not from the tree itself, but from the beds and borders of streams, into which it is washed down, during the rains, from the hill-sides, in the soil of which it had been deposited. Copal varies in appearance and properties as procured from different sources. It is in roundish, irregular, or flattish pieces, often rough over the surface, probably from the impression of sand in its soft state, colorless, yellowish, or brownish yellow, more or less transparent, very hard, with a shining, conchoidal fracture, inodorous and tasteless, of a sp. gr. varying from 1·045 to 1·139, insoluble in alcohol, partially soluble in ether and slightly so in oil of turpentine. Some varieties unite with alcohol, if suspended in its vapor while boiling. By heat it melts and emits gases, loses from 5 to 12 per cent. of weight, and is converted into *pyrocopal*, which is soluble in ether, alcohol, and oil of turpentine, and out of which varnishes are usually made. It is not a proximate principle, but consists of various resins united in different proportions, the average composition of which very nearly corresponds to the formula $C_{10}H_{16}O$, showing it to have arisen from the oxidation of various terpenes, $C_{10}H_{16}$. The East India or African copal is described by Mr. Schindler as of a globular form, softer and more transparent than the other varieties, with a surface always clear, and having an agreeable smell when heated. It is readily and freely dissolved by the oils of turpentine and rosemary when pure, but not by these fluids when rendered resinous by age. It is more readily fusible than the others, and makes the best varnish. The West India copal is in flat pieces, seldom weighing more than three ounces, rarely containing insects, very hard, of a rough appearance, of a yellowish color, and without smell or taste. It is much less readily dissolved by oil of turpentine than the East India variety, swells but does not dissolve in oil of rosemary, and is slightly soluble in absolute alcohol. A third kind, probably also American, is in convex or concave pieces, about a pound in weight, often containing insects and other impurities. In solubility it resembles the last mentioned variety, in fusibility is intermediate between it and the East Indian, and is altogether inferior. (*P. J. Tr.*, 1850.) The African or Sierra Leone copal is described by Dr Daniell as occurring "in small round tears, or irregular conical and smooth nodulated masses, seldom exceeding in size an ordinary duck egg. They are covered, to a greater or less extent, by a peculiar white efflorescence, which increases by age. Their color graduates from a pale green to a lemon or dull yellow." (*Ibid.*, xvi. 369.) Dr. Welwitsch, in "Notes and Observations" on the subject of copal, made during his travels in West Africa, states that this drug is mostly found in sandy soil, in the hilly districts, along the whole coast of Angola, where its prevalence coincides with that of *Adansonia digitata*. It is dug from the earth, or found in spots where it has been collected by the washing of the rains, or laid bare by earth-falls; and the quantity annually collected in this region, and exported from Benguela, from 1850 to 1860, was 1,600,000 pounds. There were received at the port of New York in the year 1880, 17,887 packages of gum copal valued at 654,860 dollars, and in 1881, 15,309 packages valued at 354,559 dollars. The surface, like that described by Dr. Daniell, is covered with a whitish earthy crust, sometimes exhibiting veins or net-work, probably produced by attrition in their conveyance by floods from their original site. (*A. J. P.*, 1866, p. 439; from *Gardener's Chronicle.*) *Crude* and *scraped* copal are also known in the market; the former of a dull opaque appearance externally, the latter much clearer and more transparent, in consequence of being deprived of its outer coat. The process of *scraping* is said to consist in the removal of the exterior portion by means of an alkaline solution, which readily dissolves copal. This resin is used chiefly in making varnishes. For a paper by M. H. Violette on the preparation of copal varnish, see the *A. J. P.* (1863, p. 140). M. Violette states that certain varieties of copal used for varnish, which are not naturally soluble in ether, oil of turpentine, benzin, petroleum, etc., become soluble in these menstrua, whether cold or hot, by being heated in close vessels to the temperature of 350° to 400°, and thus yield excellent varnishes without loss of matter; and the same resin, heated as above with one-third of linseed oil and three-fourths of oil of turpentine, gives directly a clear, limpid, slightly yellowish varnish, fit for the most delicate uses. (*Journ. de Pharm.*, 4e sér., iv. 284.) Edison found anilin oil a good solvent for copal. (See *Anilin.*)

COPPER, BLACK OXIDE OF. CuO, or cupric oxide, is obtained most conveniently by heating to redness the nitrate. This oxide, in the form of ointment, made by mixing four parts with thirty of lard, has been used in frictions, practised twice a day, for the removal of chronic indurations of the glands. (Hoppe, *Ann. de Thérap.*, 1855, p. 251.)

COPTIS. The slender, bright yellow root of the indigenous creeping plant *Coptis trifolia*, or *goldthread*, was formerly officinal in the U. S. Pharmacopœia. The plant belongs to the Ranunculaceæ; the leaves, which stand on long slender footstalks, are ternate, with firm, rounded or obovate, sessile leaflets, having an acute base, a lobed and acuminately crenate margin, and a smooth veined surface. The flower-stem is slender, round, rather longer than the leaves, and surmounted by one small white flower, with a minute mucronate bract beneath it. The five or six caducous petals are oblong, concave, and white; the nectaries inversely conical, hollow, and yellow at the top. The stamens have capillary filaments and globose anthers. The germs are from five to eight, stipitate, oblong, compressed, and support short recurved styles, with acute stigmas. The capsules, which diverge in a star-like form, are pedicelled, compressed, beaked, and contain numerous black seeds attached to the inner side. The goldthread inhabits the northern regions of this continent and of Asia, and is found in Greenland and Iceland. It delights in the dark shady swamps and cold morasses of northern latitudes and Alpine regions, and abounds in Canada, and in the hilly districts of the Northern United States. Its blossoms appear in May. All parts of the plant possess more or less bitterness; but this property is most intense in the root.

Dried goldthread, as brought into the market, is in loosely matted masses, consisting of the long, thread-like, orange-yellow roots, frequently interlaced, and mingled with the leaves and stems of the plant. It is without smell, and has a purely bitter taste, unattended with aroma or astringency. It imparts a bitterness and yellow color to water and alcohol, but most perfectly to the latter, with which it forms a bright yellow tincture. The infusion is precipitated by nitrate of silver and acetate of lead. (*Bigelow.*) It affords no evidence of containing either resin, gum, or tannin. The plant undoubtedly contains *berberine*, which, according to Prof. F. F. Mayer (*A. J. P.*, 1863) and Mr. E. Z. Gross (*Ibid.*, 1873), is associated with another alkaloid. Mr. Gross states that *coptine* differs from berberine in its colorless crystals, and by forming with iodohydrargyrate of potassium a crystalline instead of flocculent precipitate. Goldthread is a simple tonic bitter, bearing a close resemblance to quassia in its mode of action, and applicable to all cases in which that medicine is prescribed, though, from its higher price, not likely to come into general use as a substitute. In New England it is employed as a local application in aphthous ulcerations of the mouth; but it probably has no other virtues in this complaint than such as are common to the simple bitters. It may be given in substance, infusion, or tincture. The dose of the powder is from ten to thirty grains, of a tincture made with an ounce of the root to a pint of diluted alcohol, one fluidrachm.

Another species of Coptis has been described by Dr. Wallich, under the name of *Coptis teeta*, which grows in the mountainous regions bordering on Assam, and is much used as a tonic by the natives, and by the Chinese. It appears to be closely analogous in properties to *C. trifolia*, and is said to contain 8½ per cent. of berberine. It has been introduced into use in British India. It is highly commended by Mr. Twining as a stomachic tonic. (*P. J. Tr.*, 1870, p. 161.) In Japan the rhizome of the *Coptis anemonæfolia* is used.

CORAL. A substance found at the bottom of the Mediterranean, and other seas, formerly considered as a plant, but now universally admitted to belong to the animal kingdom. The *red coral* (*Corallium rubrum* of Lamarck, *Isis nobilis* of Linn.) is in the form of a small shrub, a foot or two in height, with a stem sometimes an inch or two in thickness, fixed to the rock by an expansion of the base, divided above into branches, and covered with a pulpy membrane, which is properly the living part, and which is removed when the coral is collected. The central portion is extremely hard, of various shades of red, susceptible of a brilliant polish, longitudinally striated, and formed of concentric layers, which are rendered obvious by calcination. Its chief constituent is carbonate of calcium, which is colored by oxide of iron, and united, as in similar calcareous products, with more or less animal matter. It was formerly highly esteemed as a remedy, but is in no respect superior to prepared oyster-shell, or other form of carbonate of calcium, derived from the animal kingdom. It was employed in fine powder, or in different preparations, such as troches, syrups, conserves, etc. At present it is valued chiefly as an ornament.

CORALLIN. *Pæonin.* A coloring or dyeing material, derived from *rosolic acid* or *aurin*, which is itself derived from *carbolic acid* or *phenol* by the joint action of sulphuric and oxalic acids upon it. It is formed by exposing together rosolic acid and alcoholic ammonia to a heat of 149° C. (300° F.). A solid substance is thus obtained, in scales of a peony redness, with reflected green or dull yellow rays, almost insoluble in water, soluble in alcohol and the fixed oils. Dr. Ambrose Tardieu, having met with some extraordinary cases of a severe vesicular eruption upon the feet, attended with violent inflammation and swelling, and with general febrile symptoms, and having been disposed to ascribe the affection to the poisonous properties of the coloring matter contained in a red silk, out of which socks, slippers, stockings, etc., worn by the sufferers, had been made, resolved to determine the accuracy of his impressions by experiment. He first satisfied himself that the suspected material contained no mineral substance, and then, aided by a chemist, M. Z. Roussin, proceeded to search for some organic principle to which the effects might be traced. The red silk socks, to which the eruption in the first case that occurred to him was ascribed, were first treated by water in different states, cold, hot, feebly acidulated, and alkaline, but yielded nothing to the solvent. They were then immersed in boiling alcohol of 85°, which quickly dissolved the red coloring matter. By evaporating the alcoholic solution thus made, an extract was obtained, which, on being injected in alcoholic solution into the areolar tissue of a dog, rabbit, and frog, produced death in all, in the frog in 4 hours, in the dog after 36 hours, and in the rabbit later; the two latter animals having been copiously and almost incessantly purged. The coloring matter was thus shown to be very poisonous. To determine whether the poisonous coloring material was corallin, as they suspected, some of this substance was obtained from M. Persoz. Three varieties of corallin were presented: one pure, the other the corallin red of commerce, and the third corallin yellow. It was with the pure corallin that they operated. An alcoholic solution was injected into animals as before, with the same result. A dog was killed by 20 centigrammes (about 3 grains), a rabbit by half the quantity, and a frog by 5 centigrammes, or less than a grain. In the dog and rabbit there was violent purgation, with intense fever and progressive prostration, and the leg of the side in which the injection had been made was very painful. After death the neighborhood of the wound was found suppurating, the stomach sound, and the intestines distended, with signs of violent inflammation of the mucous membrane; the liver presented evidences of fatty degeneration; and the lungs appeared as if dyed by the coloring matter, exhibiting a very beautiful scarlet hue throughout their whole extent, and over their whole surface. M. Roussin succeeded in extracting a portion of the coloring matter from the lungs and liver, and dyeing with it a skein of silk. These experiments are very interesting in a medico-legal point of view; as corallin might be readily detected in this way, if at any time, accidentally or otherwise, the cause of fatal results. Hitherto the effects on the human subject have been confined to the painful cutaneous affection, which has been so satisfactorily traced to contact of the skin with the silk fabrics dyed with it; but even in these cases there were serious constitutional symptoms, as fever, headache, giddiness, and nausea, which probably proceeded in part from the absorption of the poison. (*Journ. de Pharm.*, 1859, p. 262.)

From a late communication by M. Tardieu, it appears that corallin is not the only coloring material capable of producing local poisoning; as red socks or stockings dyed with anilin red have given rise to accidents. These two colors may be distinguished in tissues. *Anilin red* disappears very rapidly by contact with ammonia; but the color reappears by the addition of an acid, or by the evaporation of the alkali. *Corallin red* is not dissolved by cold water, yields a slight color to boiling water, but rapidly disappears from the tissue under the action of boiling alcohol. Alkalies brighten the color without changing it; acids precipitate the coloring matter in yellow flakes. (*Ibid.*, 1869, p. 371.) Other cases of local poisoning from the wearing next the skin of silks dyed with corallin, or other similar matter, have been recorded in the journals, among which may be mentioned two described in the *Med. Times and Gaz.* (1869, p. 421). There is, however, much reason for believing that absolutely pure corallin is not poisonous, but that the symptoms have been produced by arsenic or other contaminating substances. (See *P. J. Tr.*, 2d ser., xi. 360; also, *New York Med. Journ.*, 1870, p. 599; *N. R.*, i. 288.)

CORALLORHIZA ODONTORHIZA. (*Gray's Manual.*) *Coral-root.* This is a leafless herb, sending up from a coral-like rhizome, a simple scape or flower-stem, from 6 to

16 inches high, furnished with sheaths instead of leaves, of a light-brown or purplish color, and bearing small, greenish-brown flowers in a long spike. The plant grows throughout the United States east of the Mississippi. It is supposed by some to be parasitic, attaching itself to the roots of trees, and nourished from them. The root or rhizome is the part used. It is much branched and toothed, and of a brown color, and from its resemblance to coral in appearance gave name to the plant. It has a strong peculiar odor, and an astringent bitterish taste. It holds a high place in the Materia Medica of the "eclectics," being considered by them as an energetic diaphoretic, and, as it is destitute of general stimulant properties, is given in fevers and inflammatory affections. It is administered in powder, in the dose of thirty grains, every two hours.

CORIARIA MYRTIFOLIA. *Currier's Sumach. Redoul*, Fr. This is a shrub growing wild in Southern Europe, which is sometimes cultivated in gardens on account of its handsome foliage. The leaves, which are used for dyeing black, were at one time employed to a considerable extent in France in the adulteration of senna. The fruit, resembling berries in form, are black, and about the size of a pea. Both these and the leaves are poisonous in large doses, and several instances of death are on record from eating the fruit. They are supposed to act as a narcotic, as a child under their influence appeared, half an hour after taking them, as if in a state of drunkenness, with loss of speech, foaming at the mouth, livid face, and convulsive movements, and died at the end of 17 hours. The stomach upon examination showed scarcely any signs of phlogosis. (*Mérat et de Lens.*) M. Riban has discovered in the fruit a peculiar principle, on which he believes their poisonous properties depend, and to which he has given the name of *coriamyrtin*. This is in the form of white crystals, inodorous, excessively bitter, and extremely poisonous. It is but slightly soluble in water, hot or cold, but freely so in alcohol, ether, chloroform, and benzol Its composition is represented by the formula $C_{30}H_{36}O_{10}$. It ranks with the glucosides. About three grains of it killed a dog, causing first vomiting, then severe convulsions, and death in an hour and a quarter. M. Riban obtained it by treating the juice of the fresh or an infusion of the dried fruit and leaves first with acetate of lead, then with sulphuretted hydrogen to throw down the lead, concentrating the filtered liquid to a syrupy consistence, and agitating this with ether, which extracted the poison, and yielded it on evaporation. (*Journ. de Pharm.*, 1864, p. 487.)

Toot-poison. In New Zealand a poisonous plant, known as the *toot-plant*, has proved very destructive to the domestic animals of the settlers. Dr. W. Lauder Lindsay, in a journey through New Zealand, had an opportunity of examining the plant and its effects. He found it to be the *Coriaria ruscifolia* of Linnæus (*C. sarmentosa*, Forst.), and in its action on the system to be an irritant narcotic. For an elaborate account of the *toot-plant*, and its poisonous effects, the reader is referred to papers by Dr. Lindsay in the *British and Foreign Medico-Chirurgical Review* (1865, p. 153, and 1868, p. 465). From these it appears that more than one species of Coriaria inhabit New Zealand, *C. thymifolia*, and *C. angustissima*, besides the *ruscifolia;* though Dr. Lindsay appears to think that the two former may be merely varieties of the third; as the species of the genus are very variable; and the three indigenous in New Zealand pass into each other by gradations. It is not only cattle that are poisoned by the plant; but not unfrequently also, children, who are apt to eat the fruit, and occasionally even an adult. The cattle are probably, in general, poisoned by eating the young shoots. It has been conjectured that the same narcotic principle found in *C. myrtifolia* (*coriamyrtin*) is that which renders the New Zealand species poisonous. Mr. W. S. Key has found an oil in it, to which he attributes the poisonous qualities. (*Chem. News*, 1870, xxii. 315.) The prominent symptoms of the poisoning in man are giddiness, stupor, and coma with or without delirium or convulsions. Occasionally the delirium resembles that of alcoholic intoxication, in other instances approaches that of acute mania, and is attended with violent muscular action. The loss of memory is one of the characters of convalescence.

CORK. *Suber*, Lat. *Liége*, Fr. The great use made of this substance in pharmacy and the arts justifies a brief notice of it. Though in general ascribed exclusively to the *Quercus Suber*, a large oak growing in Spain, the south of France, north of Italy, Algeria, and some of the Mediterranean islands, it is said by M. Cassimer de Candolle to be obtained also for commercial purposes from another species, the *Q. occidentalis*, growing in the southwest of France and in Portugal. It consists of the exterior layers of the bark beneath the epidermis, which acquire in these species an extraordinary development, becoming thick, and of that peculiar spongy consistence which characterizes cork. The tree begins to yield cork when fifteen or sixteen years old, and every six or eight years furnishes a fresh supply, even for a century and a half, before it perishes; that interval of time being required for the renewal of the suberose layers by the living portions of the bark beneath. There are four constituent layers of the bark, the epidermis, within this the cork, next the cellular envelope, and lastly the liber which lies upon the wood. Each of these increases year by year; but the cork thus naturally produced is not valued. The commercial product is obtained by an artificial process. The exterior layers are removed, and the liber exposed. In the interior of this, at a variable distance from the surface, a layer of the proper cork is now formed, apparently by a change in the substance of the liber, the outer portions of which perish, while annually a new layer is added to the cork already existing, until it acquires a thickness which will justify its removal. Incisions are made in such a way that the cork is removed in large concave plates, which are then flattened under pressure, and dried very slowly. From ordinary accounts, it might be supposed that the cork-tree was very common in Spain; but in a long journey through that country from the north to the extreme south, Dr. Geo. B. Wood had no opportunity of seeing the trees from which the cork was obtained, except in the Eastern Pyrenees, where it appeared to be abundant.

In selecting cork for use, those parts should be preferred which are soft and of uniform consistence; and in the choice of the larger plates those should be selected which are thick, flexible, elastic, finely porous, and of a reddish color. (*Guibourt.*) Boiling hot alcohol extracts from rasped cork tissue some 10 per cent. of soluble principles. From the hot alcoholic solution a substance crystallizes then which was first noticed by Chevreul under the name of *cerin*, but which Siewert (*Jour. f. Chem.*, 104, p. 118) says is *phellyl alcohol*, $C_{17}H_{28}O$. After this *dekacrylic acid*, $C_{10}H_{18}O_2$, separates out, a yellowish-white mass fusing at 86° C. On evaporating the residue to dryness and taking up with water, *eulysin*, $C_{24}H_{36}O_2$, a yellowish fatty mass, is obtained. From this residue, a cinnamon-colored precipitate, *corticinic acid*, $C_{12}H_{10}O_6$, is obtained. After cork has been treated with alcohol, ether, dilute sulphuric acid, and water, the cork tissue remaining has, according to Mitscherlich (*Ann. Chem. und Pharm.*, 75, p. 310), the composition, carbon 65·7 per cent., hydrogen 8·3 per cent., nitrogen 1·5 per cent., and oxygen 29·5 per cent. When treated with nitric acid, cork yields a peculiar acid, which has been denominated *suberic acid.* This is a dibasic acid homologous with oxalic acid, and has the formula $C_8H_{14}O_4$. It is formed by the oxidation of many other substances, such as linseed oil, castor oil, coco fat, almond oil, spermaceti, etc.

M. Stanislaus Martin has called attention in France to the use of refuse corks in Paris, where they are collected by the scavengers, and sold to persons whose business it is to revive them; recutting such as are of unsuitable shape, filling up the vacuities with mastic, and covering them over with some powder which may give them a fresh and proper appearance. In consequence of the high price of cork, those which are thus prepared over again are said to be used in the bottling of beverages. Corks are sometimes bleached with sulphurous acid, and the odor of sulphuretted hydrogen has been noticed in prescriptions which have been compounded, when such corks have been used in the dispensing bottle. (*P. J. Tr.*, 1881, p. 1080.) Mohr has found that old corks may be regenerated by allowing them to soak for twenty-four hours in hot water, washing well several times, allowing to stand for a few hours in a mixture of one part of hydrochloric acid and fifteen parts of hot water, and finally washing well in pure water. (See also *A. J. P.*, 1875, p. 467.) It is easy to conceive that a cork at one time used to enclose arsenical or other deadly solution may become saturated with the poison, and afterwards impart enough of it to another liquid, if not to produce dangerous effects on the health, at least to give to tests evidence of its presence, and thus lead to serious suspicions. No cork, therefore, which has been used in a bottle containing a poisonous substance should be employed a second time.

CORTEX CARYOPHYLLATA. *Cassia Caryophyllata. Clove Bark.* These names have been given to a bark, brought from the West Indies, and derived from a tree belonging to the family of Myrtaceæ, supposed to be the *Myrtus acris* of Schwartz. It is usually in cylinders from one to two feet long by an inch in diameter, composed of numerous separate pieces rolled around one another, having a dark-brown color, a pungent taste, and an odor similar to that of cloves. It is sometimes in fragments, of a similar color, taste, and smell, but softer and lighter, and supposed to be derived from older branches. A similar bark is said to be derived from the *Myrtus caryophyllata* of Linn., which grows in Ceylon. The clove bark has aromatic properties not unlike those of the spice from which it derived its name; but it is much inferior, and is not used in this country. Some authors have confounded with it a different bark, produced in the Moluccas, and known by the Indian name of culilawan. (See *Culilawan.*)

CORYDALIS FORMOSA. (*Pursh.*) Tubers of *Dicentra Canadensis*, De C. *Turkey Corn. Turkey Pea.* This pretty little indigenous plant, growing in the Middle and Western States, is highly esteemed by the practitioners calling themselves "eclectics." The root is the part used. It is a small roundish tuber, having a slight peculiar smell, and a bitterish somewhat pungent and persistent taste. It is said to yield its active properties to water and alcohol. According to Mr. W. T. Wenzell (*A. J. P.*, 1855, p. 205), it contains an alkaloid denominated *corydaline*, fumaric acid, bitter extractive, an acrid resin with volatile oil, a tasteless resin, brown coloring matter, starch, albumen, arabin, bassorin, cellulose, and various inorganic salts. The alkaloid was obtained by making a hydro-alcoholic tincture, distilling off the alcohol, filtering, precipitating with ammonia in slight excess, washing the precipitate, treating it with boiling alcohol, evaporating the solution to dryness, treating the residue with dilute hydrochloric acid, precipitating with ammonia, dissolving the precipitate in boiling alcohol, concentrating the tincture and allowing it to stand. The corydaline was deposited in crystals, and was purified by repeated solution in alcohol and crystallization. The crystals, which are slender four-sided prisms, are inodorous, tasteless, insoluble in water, soluble in alcohol, ether, and chloroform, reddened by nitric acid, and capable of forming soluble salts with the acids. It appears to be identical with the alkaloid found in European species of Corydalis, whose formula, according to H. Wicke, is $C_{18}H_{19}NO_4$.

The corydaline of the *Corydalis tuberosa*, of Europe, was discovered in 1826 by Wackenroder. Wicke obtains it from the tubers by heating their watery infusion acidulated with sulphuric acid to 120° F., precipitating with phospho-tungstate of sodium (made by treating metatungstate of sodium with sufficient phosphate of sodium to prevent turbidness from acids), washing the yellowish precipitate, then treating it, hot, with chalk rubbed up with water, evaporating by a water-bath, and exhausting with alcohol. The solution, after evaporation, deposits, on standing, a portion of the alkaloid in star-shaped prisms. It is soluble in alcohol, ether, chloroform, amylic alcohol, carbon disulphide, benzol, and oil of turpentine. The alcoholic solution has a bitter taste and alkaline reaction. Corydaline forms crystallizable salts with hydrochloric, acetic, and other acids. It is precipitated by tannic acid, and the precipitate is white if treated by sulpho-cyanide of potassium, bichloride of mercury, iodide of potassium, and metatungstate of sodium, and yellow by picrate of sodium, chromate of potassium, iodohydrargyrate of potassium, and the chloride of gold and platinum. (*Journ. de Pharm.*, 4e sér., iii. 395.)

The root of *C. formosa* is supposed to be tonic, diuretic, and alterative, and is given in syphilitic, scrofulous, and cutaneous affections, in the dose of from ten to thirty grains. It is also used in the form of tincture and decoction. The "eclectics" use a preparation which they call *corydaline* or *corydalia*, made by precipitating a tincture of the root with water, in the dose of half a grain or a grain. It is, of course, not the active principle, and therefore has no claim to the title; yet it no doubt contains more or less of the proper alkaloid.

CORYLUS ROSTRATA. *Beaked Hazel.* This is a small indigenous shrub, growing especially in mountainous districts. The nut is invested with a scaly involucre, projecting beyond it like a beak, and thickly covered with short spicula like those of *Mucuna pruriens.* These spicula have been employed by Dr. Huebener, of Bethlehem, Pa., as an anthelmintic, and found to be efficacious. They operate in the same way as cowhage, and may be administered in the same manner and dose. (See a communication by the late Mr. Duhamel, in *A. J. P.*, xiv. 280.)

COTO BARK. In the years 1873 and '74 a bark bearing this name appeared in the London drug market, coming from Bolivia; its botanical origin at this time (1882) is unknown. It occurs in irregular pieces, a foot or more in length, 3 to 4 inches wide, and $\frac{1}{2}$ to $\frac{3}{4}$ inch thick. The outer surface is irregular, often looking as though it had been shaved or split off, its other parts are covered with a fine adherent epidermis free from lichens; the inner surface also is irregular, with numerous rather closely placed, longitudinal projecting bark bundles. The general color approaches cinnamon-brown; upon fresh cross-section the bark is seen to be filled with yellowish spots, except in the outer portions. The odor is aromatic, and much more apparent if bruised; the taste hot, and somewhat aromatic; the powder is very pungent to the nostrils. The microscope shows the outer bark to be composed of thin-walled, colorless, parenchymatous cells, containing starch granules, with numerous yellowish sclerenchymatous cells joined into groups. The inner bark contains numerous yellow bark cells, mostly joined into bundles of 20 to 50. (For an elaborate account of its microscopic structure, see *P. J. Tr.*, vi. 301.) The coto bark which we have seen in the American market conforms with the original description, but other barks are said to pass under the name. The most important of these is the so-called *Paracoto bark*, which is stated to closely resemble the true coto bark, but to differ in its having a less pungent odor and taste, and being marked with deep whitish furrows upon its surface. Wittstein found in coto bark a volatile alkaloid, volatile oil having a pungent aromatic taste, yellowish-brown soft resin, brown hard resin, starch, gum, sugar, oxalate of calcium, tannin; formic, butyric, and acetic acids. (*Archiv d. Pharm.*, iii. 4, 219.) Jobst and Hesse have obtained a crystallizable body from coto bark (true), which they have named *Cotoin.* It is prepared by making an ethereal extract from the powdered bark, treating this with warm benzin, and allowing the mixture to stand until clear. The clear liquid yields cotoin in crystals on spontaneous evaporation. The oily resinous residue contains considerable cotoin, which may be obtained by boiling with milk of lime and adding to the solution hydrochloric acid. After twenty-four hours the clear liquid will be found studded with large, glistening, laminated crystals of cotoin, of a pale yellow color. Cotoin, $C_{22}H_{18}O_6$, is sparingly soluble in cold water, more soluble in hot water, insoluble in benzin, very soluble in alcohol, chloroform, benzol, aceton, bisulphide of carbon. Nitric acid becomes blood-red in contact with cotoin, sulphuric acid is colored brownish yellow, and ferric chloride blackens a dilute solution of cotoin. *Paracotoin*, $C_{19}H_{12}O_6$, is extracted from paracoto bark, in which it exists associated with *oxyleucotin*, *leucotin*, and *dibenzoylhydrocotin.* Paracotoin may be distinguished from cotoin by giving no reaction with ferric chloride. *Piperonylic* acid, $C_8H_6O_4$, is present in both barks. Coto bark is decidedly irritating; its powder, rubbed upon the skin, is said to produce heat and redness; and, according to Dr. Burkart, 15 grains of it taken into the stomach produce persistent burning pain, followed by repeated vomiting. The remedy was first introduced as serviceable in diarrhœa, and seems to have established its reputation. Although observers are not explicit upon this point, it is evident that when there is a tendency to acute inflammation it must be used with great caution. The *paracoto* bark is said to resemble it in its action, but to be much less powerful. The fluid extract and tincture are very eligible preparations, the former made with alcohol in the usual way, and the tincture 1 part in 10 of alcohol, which may be given in 5 to 15 minim doses every two or three hours. The alkaloid cotoin is given by Dr. Burkart in doses of 0·7 grain every two or three hours. He states that he could detect it in the urine 4 to 6 hours after the ingestion of the dose. Prof. Balz (Tokio, Japan) is said to have treated Asiatic cholera successfully by hypodermic injections of three grains of paracotoin; oxyleucotin, leucotin, and hydrocotin are very feeble. It is not probable that cotoin has any general action upon the system, as Jobst found that even 15 grains of it injected hypodermically into the rabbit produced no other than local symptoms. It is affirmed, however, that coto bark is used in rheumatism in South America.

COTULA. *U. S.* 1870. *Mayweed.* (*Camomille puante*, *Maroute*, Fr.; *Hunds-Kamille*, *Stinkende-Kamille*, G.; *Camomilla fetida*, *Cotula*, It.; *Manzanilla loca*, Sp.) *Anthemis Cotula. Maruta Cotula.* De Cand. The mayweed is an annual plant, with a fibrous root, and an erect, striated stem, very much branched even to the bottom, from one to two feet in height, and supporting alternate, sessile, flat, doubly pinnated, somewhat hairy leaves, with pointed linear leaflets. The flowers stand singly upon the summits of the branches, and consist of a central, convex, golden-yellow disk, with white radial florets, which spread horizontally during the day, but are reflexed, or bent towards the stem, at night. The calyx, which is common to all the florets, is hemispherical, and composed of imbricated hairy scales. The receptacle is conical or nearly cylindrical, and surmounted by rigid, bristle-shaped paleæ, shorter than the florets. The seeds are naked. This plant grows abundantly both in the United States and Europe. In this country it is found in the vicinity of inhabited places, growing among rubbish, along the sides of roads, and in waste grounds. Notwithstanding its extensive diffusion, it is generally believed to be a naturalized and not an indigenous plant. It is frequently called *wild chamomile.* It flowers from the middle of summer till late in autumn. Mr. W. H. Warner, from a chemical examination of the flowers, concluded that they contain volatile oil, oxalic, valerianic, and tannic acids, coloring matter, acrid fatty matter, bitter extractive, and salts of potassa, lime, magnesia, and iron. (*A. J. P.*, 1858, 390.) The whole plant has a strong, disagreeable smell, and a warm, bitter taste, and imparts these properties to water.

The medical properties of this species of Anthemis are essentially the same as those of chamomile, for which it may be substituted; but its disagreeable odor is an obstacle to its general use. On the continent of Europe it has been given in nervous diseases, especially in hysteria, under the impression, probably derived from its peculiar smell, that it possesses antispasmodic powers. It has also been thought to be emmenagogue. It is said to have the property of vesicating, if applied to the surface fresh and bruised. In this country it is scarcely employed, except as a domestic remedy. The whole plant is active; but the flowers, being less disagreeable than the leaves, are preferred for internal use. The remedy is best administered in the state of infusion.

COTYLEDON UMBILICUS. *Navel-wort. Penny-wort.* This is a perennial, herbaceous, succulent plant, belonging to the natural family of Crapulaceæ. It is about six inches high, with fleshy, peltate, crenate leaves, and a flower-stem bearing, in the form of a spike, pale yellow, belt-shaped, pendulous flowers, which appear in June and July. The plant is a native of England, where it grows upon old walls and rocks, and dry sandy banks. It was first brought before the profession, as a remedy in epilepsy, by Mr. Thos. Salter, of Poole, who had found its expressed juice very efficient in that disease. (*London Medical Gazette* for March, 1849.) Contradictory testimony has since been given to the value of the remedy. (See *Prov. Med. and Surg. Jour.*, May, 1849; *Dublin Quart. Jour. Med. Sci.*, xiv. 264; *Med. Times and Gaz.*, April, 1854; *Ann. de Thérap.*, 1868, p. 56), but it has failed to establish a reputation. The medicine is said to have no other observable effect than that of a gentle tonic to the nervous system. The part used is the expressed juice, which should be obtained when the leaves are most succulent, before the appearance of the flowers. An extract, and a fluid extract, have also been employed. The juice has been given in doses varying from a fluidrachm to a fluidounce twice or three times a day, and should be long persevered with. The dose of the fluid extract is stated at a fluidrachm, that of the dry extract at five grains, to be increased if necessary. From the researches of M. Flétet, it appears to contain a principle analogous to propylamine, at one time thought to be identical with it, yet now admitted to be distinct, though isomeric with it; namely, *trimethylamine*, which exists in it combined with a yet unknown acid. When the powder of the plant is exposed to the air, it attracts moisture, and exhales a disagreeable smell strikingly analogous to that of fish; and an extract, treated with a fixed alkali, disengages, even in the cold, an odor which, at first ammoniacal, soon acquires the fishy character referred to. The presence of this ammoniacal compound, concurrently with that of a salt of ammonia, together with a notable portion of nitre, is sufficient to prove that the plant is not entirely inert, as it has generally been thought to be. We might expect in it virtues somewhat analogous to those of ergot, which owes a similar odor to propylamine. Besides this salt of trimethylamine, which, with an ammoniacal salt, constitutes 2 parts in 1000 of the plant, it contains cellulose, starch, glucose, mucilage, chlorophyll, yellow coloring matter, a volatile oil smelling like sandarac, tannin, iron, and salts of potassa, soda, lime, and oxide of iron, with 0·9 per cent. of nitre, and 95 of water. (*Ann. de Thérap.*, 1865, p. 125.)

COURT PLASTER. The following formula for preparing court plaster, so much used as a means of drawing small wounds together, was devised by Mr. Arthur S. Vende (*A. J. P.*, xlv. 207). Take of Russian Isinglass ℥j; Water Oj; Alcohol f℥j; Glycerin fʒss. Soak the isinglass in the water for one day, then dissolve it by the aid of gentle heat, after which strain it and add the alcohol and glycerin. The mixture, being now ready for use, is spread on a fine quality of silk stretched on a frame, each successive coat being allowed to dry before applying the next. Heat should not be used in drying the plaster, as it is apt to drive the glycerin out and leave the plaster streaked. By another formula. Take of Russian Isinglass ℥iss; Resin ʒxiv; Alcohol, Water, of each, q. s.; Glycerin ʒss. Beat the resin in a mortar until perfectly powdered, then dissolve it in alcohol q. s, and mix with the isinglass solution; strain, and add the glycerin. Court plaster made in this way is very adhesive, but not as handsome as when made by the previous formula. In another formula, gelatin is used instead of isinglass, and makes a very handsome plaster. Gelatin ℥iss; Water Oj; Glycerin f℥i. Soak the gelatin in the water for one day, then dissolve it by the aid of a gentle heat, and after it is dissolved, add the glycerin. This mixture, if spread on coarse, heavy silk, makes a white and opaque plaster; while, if spread on thin and finer silk, the plaster will be nearly transparent and of a yellowish tint. (See *Emplastrum Ichthyocollæ.*)

COW TREE. The milky juice of the *Brosimum Galactodendron* is much used in South America instead of milk in tea and coffee, etc. It is obtained by making incisions in the tree, is white and viscous, turns sour on exposure to the air, and deposits a caseous substance. According to the analysis of M. Boussingault, its composition varies very much, but it always contains a large percentage of fatty matters, and much less casein, albumen, sugar, and phosphates. It is comparable to cream rather than to milk. (*P. J. Tr.*, ix. 679.)

CRAB ORCHARD SALT. This is a mild, saline purgative, obtained by evaporating the waters of springs at Crab Orchard, Lincoln County, Kentucky. Its principal active ingredients are sulphates of magnesium, sodium, and potassium; it contains, also, a little iron and lithium. In its crude form it is not wholly soluble, and sometimes it is purified by dissolving and straining through flannel, and evaporating. As thus prepared, it is white, and as a purgative is about 20 per cent. stronger than the crude salt. It, however, lacks the tonic properties of the latter. The dose of it is from one to two teaspoonfuls. (See a paper by Dr. Mattison, *A. J. P.*, 1874, p. 5; also analyses of water and of dried salt, article on *Mineral Spring Waters*, Part III.)

CRABS' CLAWS. *Chelæ Cancrorum.* These, finely powdered, were formerly officinal. In the 100 parts are 60 parts of carbonate and 14 of phosphate of calcium, with 26 of animal matter. They were formerly used as an absorbent and antacid in the same dose as prepared chalk.

CRABSTONES. *Lapilli Cancrorum. Crabs' Eyes.* These are concretions found in the stomach, one on each side, of the European crawfish, at the time the animal is about to change its shell. They are most abundantly procured in the province of Astracan, in European Russia. The crawfish are bruised with wooden mallets and laid up in heaps to putrefy. The animal remains are then washed away, and the stones picked out. They are inodorous, insipid bodies, somewhat hemispherical in shape, of a whitish or reddish color, hard and stony consistence, and laminated texture. They are very variable in size, weighing from one to twelve grains each. They effervesce with acids, and, without dissolving, become converted, owing to the animal matter which they contain, into a soft transparent mass, retaining the original shape of the stone. By this character they are distinguished from counterfeit stones, which are sometimes fabricated of chalk, mixed with mucilaginous substances. They consist of carbonate and phosphate of calcium, cemented together by animal matter. Crabstones, finely powdered, have been used as an absorbent and antacid, given in the same dose with prepared chalk.

CRANBERRIES. Fruit of *Vaccinium Macrocarpon*, Aiton. These familiar berries, so well known as an article of diet, have come into notice as a source of citric acid. For a method of obtaining the acid from them, see *Journ. de Pharm.*, 4e sér., xviii. 439.

CROCUS OF ANTIMONY. *Saffron of Antimony.* This compound is formed during the deflagration of a mixture of equal weights of tersulphide of antimony and nitrate of potassium, to which one-twelfth of hydrochloric acid has been added. Fused crocus of antimony is in masses of a liver-brown color. As obtained without fusion, it is a saffron-brown insoluble powder, containing about four-fifths of its weight of teroxide, the remaining fifth being tersulphide. In the London Pharmacopœia of 1836, the unfused crocus was adopted for preparing tartar emetic; but in the edition of 1851 it was abandoned, and the subsulphate of antimony substituted for it.

CUCUMBER OINTMENT. An emollient ointment, prepared from the common cucumber (fruit of *Cucumis sativus*), has been considerably employed in irritated states of the skin. The following is the mode of preparing it, recommended by Prof. Procter. Take of green cucumbers 7 pounds avoirdupois, pure lard 24 ounces, veal suet 15 ounces. Grate the washed cucumbers to a pulp, express, and strain the juice. Cut the suet into small pieces, heat it over a water-bath till the fat is melted out from the membrane; then add the lard, and, when melted, strain through muslin into an earthen vessel capable of holding a gallon, and stir until thickening commences, when one-third of the juice is to be added, and the whole beaten with a spatula till the odor has been almost wholly extracted. The portion which separates is to be decanted, and the remaining two-thirds of the juice are to be consecutively incorporated and decanted in the same manner. The jar is then closely covered and placed in a water-bath, until the fatty matter entirely separates from the juice. The green coagulum floating on the surface is now removed, and the jar put in a cool place that the ointment may solidify. The crude ointment is then separated from the watery liquid on which it floats, melted and strained, and placed in glass jars, which must be kept closely sealed. A layer of rose-water upon its surface will favor its preservation. A portion may be triturated with a little rose-water until white and creamy, and put into a separate jar for present use. (*A. J. P.*, xxv. 409.)

M. Emile Mouchon prepares the ointment by obtaining the juice mixed with a little alcohol, and incorporating this with benzoinated lard and stearin. He directs 16 parts of the cucumber to be reduced to a pulp, 1 part of alcohol of 36° B. to be added, and the mixture to be placed on the diaphragm of a percolator. Twenty-four hours afterwards 10 parts of the liquid are obtained of 19° B. Of this liquid 6 parts are to be incorporated with 37·5 parts of benzoinated lard and 12·5 of stearin; the fatty matters having been previously melted together by means of a water-bath, and beaten vigorously on cooling. The liquid is to be added before the completion of the beating, which should then be continued until the whole becomes as light and white as possible. The benzoin and alcohol enable the ointment to keep a long time. (*Journ. de Pharm.*, Juillet, 1854, p. 41.) We prefer to make this ointment by incorporating one part of distilled *spirit of cucumbers* with seven parts of benzoated ointment. The spirit is made by distilling a mixture of one part of grated cucumbers with three parts of diluted alcohol, retaining the first two parts of distillate which come over. This spirit is permanent, and cucumber ointment or cream made from it extemporaneously keeps well.

CUCURBITA CITRULLUS. *Watermelon.* The seeds of the watermelon are employed, to a considerable extent, as a domestic remedy in strangury and other affections of the urinary passages. They have similar properties with the seeds of the other Cucurbitaceæ, of which four different kinds were formerly officinal under the name of the *greater cold seeds*,—viz., those of the *Cucurbita Pepo* or pumpkin, the *Cucurbita Lagenaria* or gourd, the *Cucumis Melo* or muskmelon, and the *Cucumis sativus* or cucumber. These, when bruised and rubbed up with water, form an emulsion, which was formerly thought to possess considerable virtues, and was much used in catarrhal affections, disorders of the bowels and urinary passages, fever, etc., but they have been superseded by other more agreeable demulcents. Watermelon seeds are also esteemed by some as a diuretic. They are given in infusion, made with one or two ounces of the bruised seeds to a pint of water, and taken *ad libitum.* The juice of the melon itself is undoubtedly diuretic, and might be very properly recommended as an adjuvant to other remedies in many cases of dropsy.

The pulp of the root of *Cucurbita Lagenaria*, or gourd, is said by Dr. Chapin to be a powerful and even drastic purgative, and to be used by the natives of the Sandwich Islands successfully in dropsy. (See *N. Y. Journ. of Med.*, 1855, p. 203.)

CULILAWAN. *Cortex Culilaban.* An aromatic bark, produced by *Cinnamomum Culilawan* (*Laurus Culilawan*, Linn.), a tree of considerable size, growing in the Molucca Islands, Cochin-China, and other parts of the East. It is usually in flat or slightly rolled pieces, several inches long, an inch or more in breadth, and one or two lines thick. Sometimes the bark is thinner and more quilled, bearing considerable resemblance to cinnamon. The epidermis is for the most part removed, but when present is of a light brownish-gray color, soft to the touch, and somewhat spongy. The color of the bark itself is a dull, dark, cinnamon-brown, the odor highly fragrant, the taste agreeably aromatic, and not unlike that of cloves. The active constituent is a volatile oil, smelling like a mixture of the oils of cajeput and cloves, which may be separated by distillation. Culilawan has the medical properties of the aromatics, but is scarcely used at present. (See *Cortex caryophyllata.*)

CUMIN SEED. CYMINUM, *Lond.* CUMINUM, *E.* Cumin seeds are the fruit of the *Cuminum Cyminum*, an annual umbelliferous plant, about six or eight inches high, having a round, slender, branching stem, with numerous narrow, linear, pointed, smooth, grass-like leaves, of a deep green color. The white or purple flowers are in numerous terminal umbels, which have very few rays, and are attended with general and partial involucres, consisting of three or four linear leaflets. The plant is a native of Egypt, but is cultivated for its fruit in Sicily, Malta, and other parts of Europe.

The cumin fruits (seeds) are elliptical, flat on one side, convex, furrowed, and rough on the other, about one-sixth of an inch in length, and of a light brown color. Each has seven longitudinal ridges. Two fruits are sometimes seen united together. Their odor is peculiar, strong, and heavy; their taste warm, bitterish, aromatic, and disagreeable. They contain much essential oil, which is lighter than water, yellowish, and has the sensible properties of the seeds. It consists of three distinct oils, one a hydrocarbon, called *cymene* ($C_{10}H_{14}$), another *cuminol*, consisting of carbon, hydrogen, and oxygen ($C_{10}H_{12}O$), which may be regarded as *cumin aldehyd* ($C_{10}H_{11}OH$), and the third a terpene ($C_{10}H_{16}$). Dumas, a long time since, obtained a cymene identical with that of oil of cumin seeds, by dehydrating camphor, and M. Paternó prepared it in a similar way from oil of turpentine. (*Journ. de Pharm.*, 4e sér., xx. 409.) In his discovery M. Paternó seems, however, to have been preceded by several chemists, Mr. C. R. A. Wright apparently having the priority. (*A. J. P.*, xlvi. 117.) For details in regard to the question of priority and the method of preparing the cymene, the reader is referred to the papers just quoted, and to the *A. J. P.*, xliv. 452. Cumin aldehyd has also, together with cymene, been obtained from the seeds of *Cicuta virosa.* (Trapp., *Ann. Ch. Pharm.*, 108, 386.) In medical properties cumin seeds resemble the other aromatic fruits of umbelliferous plants, but are more stimulating. They are seldom used in the United States. The dose is from fifteen grains to half a drachm.

CUNDURANGO. *Condurango.* This drug some few years since attracted a great deal of attention as a remedy in cancerous disease, but further experience has demonstrated its uselessness. It appears, however, to be used largely in South America as an alterative in chronic syphilis, and merits a brief notice here. According to an official investigation (*A Report on the Origin and Therapeutic Properties of Cundurango.* By Dr. W. S. W. Ruschenberger, U. S. N., Washington, 1873) made by Passed Assistant Surgeon Jos. G. Ayers, U. S. N., there are at least ten different plants known in New Granada as cundurango. For a description of them the reader is referred to the report of Dr. Ruschenberger. The variety which has been used in cancer is the *cundurango blanco.* The plant which yields it is a vine from ten to thirty feet in length, and from one to two inches in diameter. It is stated to belong to a previously undescribed genus of Asclepiadaceæ, and the name *Pseusmagenuetus Equatorium* has been proposed for it. The bark is prepared by pounding the stem with a mallet, to separate it, and then drying it in the sun. It is from one-sixteenth to one-sixth of an inch thick, with a smooth external surface of an ash-gray color, diversified with greenish and blackish lichens. When dried on the stem the bark has a darker color. Dr. Thos. Antisell (*A. J. P.*, xliii. 289) found in it tannin, extractive matter, and a yellow resin, to which he attributes whatever of virtue the plant may contain. Of the physiological action of cundurango blanco we have no definite knowledge. It is stated that the roots and seeds will kill dogs. Dr. H. Chiriboga states that two or three drachms of it taken by himself in the form of decoction, produced considerable activity of the circulation, copious diaphoresis, increased secretion of urine, and even some vertigo and disturbance of vision.

CUNILA MARIANA. *American Dittany.* A small indigenous perennial herb, growing on dry, shady hills, from New England to Georgia, and flowering in June and July. The whole herb has a warm pungent taste, and a fragrant odor, dependent on an essential oil, which, according to Mr. Philip Milleman, of Chicago, is of a reddish-amber color, becoming light yellow by exposure to light, of a delicate, fragrant odor, very similar to that of oil of monarda, of a warm, pungent taste, and of the sp. gr. 0·920. It is readily soluble in alcohol, ether, and chloroform. On spontaneous evaporation, it leaves a small crystalline residue. Iodine decomposes it, producing white vapors; by sulphuric acid it is reddened and decomposed, by nitric acid resinified, and by hydrochloric acid decolorized, though its color returns on exposure. It is slightly rubefacient; in the dose of five or ten drops is carminative, and of fifteen to twenty drops diaphoretic. The same author found in the dried herb tannic acid, a trace of glucose, gum, bitter extractive, resin, and salts of potassa, lime, magnesia, and iron. (*A. J. P.*, Nov. 1866, p. 495.) American dittany is a gently stimulant aromatic, analogous to the mints, pennyroyal, etc., and is used for the various purposes to which the aromatic herbs are thought applicable.

CUPRUM AMMONIATUM. *Ammoniated Copper.* (*Cuprum sulfuricum ammoniatum*, P. G.; *Ammonio-sulphate of copper*, E.; *Sulfate de cuivre ammoniacal*, *Cuivre ammonical*, Fr.; *Schwefelsaures Kupferoxyd-Ammoniak* (*Kupfer-Ammonium*, *Cuprammonium*), G.) "Take of Sulphate of Copper *half a troyounce;* Carbonate of Ammonium *three hundred and sixty grains.* Rub them together in a glass mortar until effervescence ceases. Then wrap the Ammoniated Copper in bibulous paper, dry it with a gentle heat, and keep it in a well-stopped glass bottle." *U. S.* 1870.

When the two salts above mentioned are rubbed together, a reaction takes place between them, attended with the elimination of the water of crystallization of the sulphate of copper, which renders the mass moist, and with the simultaneous escape of carbonic acid gas from the carbonate (sesquicarbonate) of ammonium, which occasions an effervescence. The color is at the same time altered, passing from the light blue of the powdered sulphate of copper to a beautiful deep azure. The nature of the chemical changes which take place in the formation of what is commonly called "ammoniated copper" depend somewhat upon the conditions of action. When anhydrous cupric sulphate is exposed to the action of dry ammonia gas, the mass becomes heated, and a deep-blue powder, $CuSO_4 + 5NH_3$, results, which on exposure to the air is capable of exchanging the 5 mols. of ammonia for a corresponding amount of water. If, on the other hand, one part of powdered cupric sulphate is added to 3 parts of ammonia solution (sp. gr. ·960), and after the subsidence of any ferric hydrate present as impurity, 6 parts of alcohol be added to the clear liquid, crystals are formed of the composition $CuSO_4 + H_2O + 4NH_3$. If this preparation be allowed to remain exposed to the air, it loses ammonia and water, and is changed into a mixture of basic sulphates. Ammoniated sulphate of copper loses one molecule of NH_3 at 200° C. (392° F.), and at 260° C. (500° F.), only anhydrous sulphate remains, which frequently, however, contains cuprous oxide.

This salt has a beautiful deep azure-blue color, a strong ammoniacal odor, and a styptic, metallic taste. It is soluble in water, and the solution has an alkaline reaction on vegetable colors; but, unless there is excess of sesquicarbonate of ammonium, the solution deposits subsulphate of copper if much diluted. When exposed to the air it parts with ammonia, and is said to be ultimately converted into sulphate of ammonium and carbonate of copper. This change is apt to occur, to a greater or less extent, while it is drying. It should not, therefore, be prepared in large quantities at a time, and should be kept in well-closed bottles. By heat the whole of it is dissipated, except the oxide of copper. Arsenious acid precipitates a green arsenite of copper from its solution. Potassa, soda, lime-water, and the acids are incompatible with it.

Medical Properties and Uses. Ammoniated copper has been thought to exercise an influence over the nervous system which renders it antispasmodic, and was formerly much employed in epilepsy, chorea, hysteria, etc. It is at present very seldom exhibited. In overdoses it produces vomiting, and the poisonous effects which result from the other preparations of copper. (See *Cuprum.*) The dose is a quarter or half a grain (0·016–0·03 Gm.), repeated twice a day, and gradually increased to four or five grains (0·26–0·33 Gm.). It may be given in pill or solution.

CURCUMA. *U. S.* 1870. *Turmeric. Curcuma longa.* The root of this zingiberaceous plant is perennial, tuberous, palmate, and internally of a deep yellow or orange color. The leaves are radical, large, lanceolate, obliquely nerved, sheathing at their base, and closely embrace each other. The scape or flower-stem, which rises from the midst of the leaves, is short, thick, smooth, and constitutes a spike of numerous imbricated bracteal scales, between which the flowers successively make their appearance. The plant is a native of the East Indies and Cochin-China, and is cultivated in various parts of southern Asia, particularly in China, Bengal, and Java, whence the root is exported. The best is said to come from China.

The dried root (*Safran des Indes*, Fr.; *Kurkuma*, *Gelbwurz*, G.; *Curcuma*, It., Sp.; *Zirsood*, Arab.; *Huldie*, Hindoo) is in cylindrical or oblong pieces, about as thick but not as long as the finger, tuberculated, somewhat contorted, externally yellowish brown or greenish yellow, internally deep orange-yellow, hard, compact, breaking with a fracture like that of wax, and yielding a yellow or orange-yellow powder. Another variety, comparatively rare, is round or oval, about the size of a pigeon's egg, and marked externally with numerous annular wrinkles. Sometimes it comes cut into two transverse segments. It is distinguished by the name of *curcuma rotunda*, the former being called *curcuma longa.* The two varieties have a close resemblance in sensible properties, and are thought to be derived from the same plant, though formerly ascribed to different species of Curcuma. The odor of turmeric is peculiar; the taste warm, bitterish, and feebly aromatic. It tinges the saliva yellow. Analyzed by Pelletier and Vogel, it was found to contain lignin, starch, a peculiar yellow coloring matter called *curcumin*, a brown coloring matter, gum, an odorous and very acrid volatile oil, and a small quantity of chloride of calcium. Curcumin was obtained, mixed with a little volatile oil, by digesting the alcoholic extract of turmeric in ether, and evaporating the ethereal tincture. It has been obtained, by F. A. Daube, in deep yellow crystals, of a diamond lustre, by a process which may be found in the *A. J. P.* (1871, p. 308). C. L. Jackson and Menke have recently submitted turmeric to a thorough examination, and give the following results. The turmeric oil is first removed from the ground root by treatment with ligroine, then the curcumin mixed with a large quantity of resin is extracted with ether, and finally purified by crystallization from alcohol. The oil extracted by ligroine was dark yellow, and amounted to 11 per cent. of the root. The purified curcumin amounted to 0·3 per cent., and melted at 178° C. (352·4° F.). Analyses of the pure curcumin, several of its salts, and of derivatives, show its formula to be $C_{14}H_{14}O_4$. (*Am. Chem. Journ.*, iv. 77.) It is brown in mass, but yellow in the state of powder, without odor or taste, insoluble in benzin, scarcely soluble in water, but very soluble in alcohol, ether, and the oils. The alkalies rapidly change its color to a reddish brown; and paper tinged with tincture of turmeric is employed as a test of their presence. When treated with a mixture of sulphuric and boric acids it yields a product called *rosocyanin*, because it dissolves in alcohol with a fine red color, and is turned blue by alkalies. Its alcoholic solution produces colored precipitates with acetate of lead, nitrate of silver, and other salts. Turmeric is used for dyeing yellow; but the color is not permanent. Mr. James Cook has found in turmeric an alkaloid, which forms crystallizable salts with sulphuric and nitric acids, and, separated from these acids by ammonia, yields a semi-crystalline precipitate. He observed also indications of a second base. (*P. J. Tr.*, Nov. 1870.) Ivanow Gajewsky also states that there is an alkaloid in the root. (*Pharmacographia*, p. 641.)

This root is a stimulant aromatic, bearing some resemblance to ginger in its operation, and is much used in India as a condiment. It is a constant ingredient in the curries so generally employed in the East. In former times it had some reputation in Europe as a remedy in jaundice and other visceral diseases; but at present it is employed only to impart color to ointments and other pharmaceutic preparations.

Turmeric paper, used as a test, is prepared by tinging white unsized paper with a tincture or decoction of turmeric. The tincture may be made with one part of turmeric to six parts of proof spirit; the decoction, with one part of the root to ten or twelve of water. The access of acid or alkaline vapors should be carefully avoided.

AFRICAN TURMERIC. Dr. Wm. F. Daniell has brought into notice a product, much used by the native Africans of Sierra Leone in dyeing, consisting of rhizomes, closely resembling the East Indian turmeric, having a similar odor and taste, and in like manner tinging the saliva yellow, and imparting their coloring matter readily to alcohol and water. He found it to be derived from a species of Canna, supposed to be the *C. speciosa* of Roscoe. (*P. J. Tr.*, 1859, p. 258.)

CUTTLE-FISH BONE. *Os Sepiæ.* This is a calcareous body, situated underneath the skin, in the back of the *Sepia officinalis*, or *cuttle-fish*, which inhabits the seas of Europe, especially the Mediterranean, in the waters of which the bone is not unfrequently found floating. It is oblong-oval, from five to ten inches long, and from one and a half to three inches broad, somewhat convex on both sides, with thin edges, of a rather firm consistence upon the upper surface, very friable beneath, and composed of numerous layers, loosely connected, so as to give to the mass a porous consistence. It is lighter than water, of a white color, a feeble sea odor, and a saline taste. It contains, according to John, from 80 to 85 per cent. of carbonate of calcium, besides animal matter, a little common salt, and traces of magnesia. Reduced by levigation and elutriation to a fine powder, it may be given as an antacid like chalk or oyster-shell. It is sometimes used as an ingredient of tooth-powders. Small pieces of it are often put into bird-cages that the birds may rub their bills against them; and the powder is employed for polishing. Another product of the cuttle-fish is a blackish-brown liquor, secreted by a small gland into an oval pouch, communicating externally near the rectum by a long excretory duct, through which the animal is said to have the power of ejecting it at will. This, when taken from the fish, is dried, and used in the preparation of the water-color called *sepia*.

CYANIDE OF ZINC. *Zinci Cyanidum. Cyanuret of Zinc.* ($ZnCy_2$.) This cyanide is precipitated as a white insoluble powder, by adding cautiously, until it ceases to produce a precipitate, a recently filtered solution of cyanide of potassium to a solution of sulphate of zinc. It is used in Germany as a substitute for hydrocyanic acid, and is said to be anthelmintic. It has been employed in epilepsy, chorea, and neuralgia, in several painful affections of the stomach, and in the colics attendant on difficult menstruation. The dose is a quarter of a grain, gradually increased to a grain and a half, given in mixture. It is included in the officinal list of the French Codex.

CYCLAMEN EUROPÆUM. *Pain de Porceau*, Fr. *Sow-bread.* This is an herbaceous, perennial, stemless plant, belonging to the natural order Primulaceæ, which is indigenous in the south of Europe, and cultivated in gardens for the beauty of its purple flowers with reflected petals. The root is globular, with many branched fibres, almost black without, and white within, inodorous, and, when fresh, of a bitter, acrid, burning taste. By drying it loses much of its acrimony, and is said to be rendered edible by roasting. Hogs are said to root it up from the ground and to eat it with impunity; and hence its common French name. The root is a drastic cathartic, and is thought to have the power of producing abortion, for which purpose it is sometimes employed among the peasantry, who habitually use it as a cathartic. Sometimes, however, it has produced very serious effects, as inflammation of the alimentary canal, with bloody stools, cold sweats, and convulsive movements, which have even ended fatally. It is supposed to be capable of acting on the bowels when applied to the skin; and, in the form of ointment, is said to be rubbed on the surface of the abdomen in children for the expulsion of worms. (*Mérat et De Lens.*) The root probably owes its acrimony, if not all its medicinal properties, to an active principle, first discovered many years since by Saladin, and named by him *arthanitin*, and more recently by S. De Luca, who has given it the more appropriate name of *cyclamin.* It is a glucoside, when boiled with diluted acids splitting into *cyclamiretin* and glucose. It is white, amorphous, inodorous, and, when held a short time in the mouth, intensely acrid, extending its action even to the throat. With cold water it swells and becomes gelatinous, but is readily dissolved, and forms a solution which froths like soap and water, and is coagulated by a heat of about 65·5° C. (150° F.). Alcohol dissolves it with difficulty when cold, but freely when hot; it is soluble in glycerin with the aid of heat; and is insoluble in ether, chloroform, bisulphide of carbon, and the essential oils. It contains no nitrogen; its formula being, according to an analysis by Klinger, $C_{20}H_{34}O_{10}$. Dr. T. W. C. Martius recommends the following method of preparing it. The tubers, collected in the autumn, dried and powdered, are mixed with animal charcoal, and exhausted at a boiling heat by alcohol of 0·825; the tincture is filtered, concentrated, and set aside for six or eight weeks, when the cyclamin is deposited. This should be washed on a filter with alcohol till it passes colorless; and if the filtrate be concentrated, and set aside, it will deposit a further quantity in a few weeks. The whole is then mixed with animal charcoal, and treated with boiling alcohol, which will slowly deposit the pure cyclamin on cooling. This principle was found by M. De Luca, by experiments on animals, to be poisonous, and he supposed it to resemble curare in its action, though less violent. Mutschler (*Annalen der Chimie*, 185, 2, 3) believes that cyclamin is identical with saponin. The dose of the powdered root is said to be from twenty to forty grains.

CYNANCHUM VINCETOXICUM. R. Brown. *Asclepias Vincetoxicum.* Linn. *White Swallow-wort. Vincetoxicum.* A perennial, herbaceous European plant, the root of which was formerly esteemed a counterpoison, and hence the botanical name. It has a bitterish acrid taste, and, when fresh, a disagreeable odor, which is diminished by drying. Taken internally, especially in the recent state, it excites vomiting, and is capable, in larger quantities, of producing dangerous if not fatal inflammation of the stomach. It is said to be useful in cutaneous diseases, scrofula, etc., but is little employed. The leaves of the plant also are emetic. Feneulle found in the root a peculiar principle analogous to emetin.

CYNARA SCOLYMUS. *Garden Artichoke.* This is a perennial plant, indigenous in the south of Europe, and cultivated in our gardens as a culinary vegetable. The receptacle and the lower portion of the fleshy leaflets of the flower-heads are eaten, and the other parts rejected. When young, the heads are cut up raw and eaten as salad; when older, they are boiled, and dressed variously. The flowers are said to curdle milk, and the plant to yield a good yellow dye. The leaves and their expressed juice are very bitter, and have been thought to be actively diuretic. They have long had some reputation in the treatment of dropsies. Dr. Badely, of Chelmsford, England, recommends a tincture and extract, prepared from the leaves, in rheumatic, gouty, and neuralgic affections. (See *Lancet*, 1843, p. 556; also *Edinb. Med. Journ.*, xx. 958.)

CYNOGLOSSUM OFFICINALE. *Hound's Tongue.* A biennial plant, common both in Europe and in this country, and named from the shape of its leaves. The leaves and root have been employed, but the latter has been generally preferred. The fresh plant has a disagreeable narcotic odor resembling that of mice, which is dissipated by drying. The taste is nauseous, bitterish, and mucilaginous. Different opinions as to its powers have been entertained, some considering it nearly inert, others as a dangerous poison. Dr. Diedülin, of St. Petersburg, Russia, affirms that an extract of this plant will paralyze the motor nerves in vertebrate animals; and J. Setschenow, of Grätz, states that, upon introducing a piece of the extract, about as large as the head of a pin, which he had received from Dr. Diedülin, into the dorsal lymph sac of each one of four frogs, he produced total paralysis of motion in from five to ten minutes; the heart continuing to beat, the irritability of the muscles continuing, and sensation remaining undisturbed. (See *Med. and Surg. Reporter*, 1868, p. 153.) Hound's tongue has been used as a demulcent and sedative in coughs, catarrh, spitting of blood, dysentery, and diarrhœa; and has been applied externally in burns, ulcers, scrofulous tumors, and goitre. The *pilulæ de cynoglosso*, which are officinal in some parts of Europe, though they contain the root of hound's tongue, owe their properties chiefly to opium.

CYTISUS LABURNUM. *Laburnum.* The laburnum is a small tree, indigenous in the higher mountains of Europe, and cultivated, throughout the civilized world, in gardens and pleasure-grounds for the beauty of its flowers, which appear early in the spring in rich pendent yellow clusters. All parts of the plant are probably poisonous. Fifty-eight boys of the Forest Gate School, England, were poisoned by the roots; the symptoms were intense sleepiness, vomiting, convulsive movements, coma, slight frothing at the mouth, and unequally dilated pupils. (*Med. Times and Gaz.*, vol. ii. 1875. For other cases see *Le Mouvement Méd.*, 1875, No. 28; *Dub. Quart. Journ.*, 1863, p. 248; *Med. Times and Gaz.*, Sept. 1862; *Lancet*, Aug. 1870.) Caventou found in the flowers an odorous fixed oil, gum, lignin, gallic acid, and traces of sulphate and chloride of calcium. MM. Chevallier and Lassaigne discovered in the seeds a peculiar principle, to which they gave the name of *cytisin.* This was a white, amorphous, deliquescent, non-nitrogenous substance, of a bitter nauseous taste, soluble in water and weak alcohol, and insoluble in ether. In small doses it produced, in several animals of different species, vomiting, convulsions, and death; and eight grains taken by Chevallier himself caused threatening symptoms, which disappeared under the free use of lemonade. Five grains appeared equal to three of tartar emetic. (*Méret et De Lens.*) Dr. Th. Scott Gray found in laburnum three distinct principles, an acid which he named *laburnic*, and two other substances, both of them bitter and neutral, which he proposed to call *laburnin* and *cystin*. These are contained in variable proportions in all parts of the plant, but most largely in the bark and seeds. As all of them are soluble in water, and only a portion in alcohol, the former is the proper menstruum for extracting the virtues of the plant. Drs. Husemann and Marmé discovered in 1864 an alkaloid in laburnum, which they called *cytisine*, and described as a white, crystalline solid, of a bitter somewhat caustic taste, soluble in water and alcohol, but scarcely at all soluble in ether, chloroform, benzol, or carbon disulphide. It is strongly basic, and has the composition $C_{20}H_{27}N_3O$. A second alkaloid, *laburnine*, was also announced by them. (*Chem. News*, July 16, 1869, p. 36.) Cytisine is stated to be found also in arnica flowers. In reference to the physiological effects of laburnum, Dr. Gray found that, after a slight excitement of the nervous and circulatory systems, there was a diminution of the pulse and a disposition to sleep. Decided narcotic effects were produced, with a moderate increase of urine, and a tendency to increased action of the liver. Dr. Gray employed the preparations of the plant therapeutically, and thought them useful in bilious dyspepsia with periodical vomiting and alternations of constipation and diarrhœa; in infantile vomiting; in allaying the cough in bronchitis, and the violence of the paroxysms of hooping-cough and asthma; in the vomiting of pregnancy; and, finally, given in large doses four times a day, in the treatment of prurigo; the decoction being at the same time applied externally. (*Journ. de Pharm.*, 1862, p. 160; from the *Edinb. Med. Journ.*)

DAJAKSCH. *Arrow Poison of Borneo.* This extract is of unknown origin. According to Dr. P. M. Braidwood, it kills by paralyzing the heart. It is thought to be distinct from the Java arrow poison, made from the *Upas Antiar.* (*Edinb. Med. Journ.*, 1864, p. 127.)

DAMIANA. This is a remedy recently introduced from Mexico, and stated to be a powerful aphrodisiac useful in cases of sexual atony. It cannot be doubted that very different substances are sold under this name. Mr. Wellcome (*A. J. P.*, xlvii. 47) states that there are in the market at least three distinct drugs all claiming to be the genuine article. One of these has a smooth, dark green, broadly lanceolate, dentate leaf, usually having six teeth on each side, heavy mid-rib, and ribs extending to the point of the teeth, from two to five lines in width and from six to twelve in length; the stem is red and woody, and the leaves give a minty flavor when chewed. The second variety has a light green obovate, deeply toothed leaf, having three and occasionally four teeth on each side, with a heavy mid-rib, and branching ribs extending to the edge. The surface is rough, and both sides are covered with short hairs. It is from two to five lines in width and five to eight in length. Its flavor, when chewed, reminds of sage; the stem is very woody, and near the apex it is quite hairy. In the third variety the leaf is light green, lanceolate, three teeth on each side, which terminate in hard, sharp points; it has a distinct mid-rib, and is rather indistinctly veined; is from one and a half to three lines in width and four to ten in length. It is quite thick and has a rough surface, with occasional black dots. To the naked eye the leaf appears to be covered with shining scales, which, under the glass, appear as minute resin-like globules. This is the only specimen accompanied by flowers. They are compound, with yellow florets and white pappus; the stem is woody with green epidermis, and covered with resinous secretion. At present (1882) there are two damianas in the Philadelphia market. One is chiefly composed of pieces of stems and branches, but contains enough of floral heads and leaves to show that it is the third variety of Mr. Wellcome, and is the product of *Bigelovia veneta*, Gray (*Aplopappus discoideus*, De C.). (*Med. and Surg. Rep.*, xxxiv. 180.)

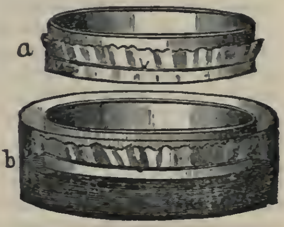
The other variety is believed to be the leaves of a species of Turnera, either *T. microphylla*, D. C., or a new species, for which the name of *T. aphrodisiaca* has been proposed. The leaves are from three to eight lines long, one to three lines broad, obovate to lanceolate, 8 to 10 sharp-toothed, smooth or with a few hairs on ribs below, mid-rib marked, with, in some cases, strong, straight veins running to the edge between the teeth; in other cases veins branched and sending a final vein into the tooth; stems fine, woody, reddish, ends of branches hairy. This is now regarded by the introducers as genuine *damiana*.

The published reports as to the value of the drug vary greatly, some having had great success with it, others finding it useless; it is probably merely tonic. An ounce of the leaves, either in the form of infusion or fluid extract, may be given daily.

DIALYSIS. This name has been given by the late Prof. Graham, Master of the Mint, London, to a process based upon the different diffusibility of liquids, by which mixed substances may often be separated from each other, and important ends thus obtained. Though not yet officinally employed in pharmacy, it is capable of useful application in many instances by the apothecary, and therefore demands a brief description. (See *Fer-*

rum Dialysatum.) It is well known that substances in the liquid state have the property of diffusing themselves, by their own inherent power, through other liquids. Mr. Graham ascertained that this property was possessed by different substances in very unequal degrees; and, on pushing his investigations into the subject, found that there was good reason to divide bodies into two classes based on their degree of diffusibility, one class consisting generally of crystallizable substances, which are highly diffusible, the other of uncrystallizable substances, especially those capable of forming a gelatinous mass with water, which diffuse themselves very slowly. The first class Mr. Graham proposed to name *crystalloids*, from their property of crystallizing, the second *colloids*, from their resemblance to glue in the power of gelatinizing. An example of the first we have in sugar, of the second in gum. Another discovery made by Mr. Graham was that a thin layer of gelatin in the form of jelly, interposed between two liquids, offered no obstacle to the passage of the crystalloids from one to the other, while it completely prevented the passage of the colloids; and this property he found to belong not only to gelatin, but to other substances having a similar molecular constitution, as bladder, parchment, paper sized with starch paste, etc., of which the most convenient is the texture known as *parchment-paper*, prepared by immersing unsized paper in a cold mixture of two measures of sulphuric acid and one of water, and subsequently thoroughly washing it to free it from acid. Great care must be used in selecting the paper to see that it is free from minute holes. Rube & Co., Göttingen, make a good paper especially for dialysis. (*N. R.*, 1877.)

Upon the principles here stated, Mr. Graham contrived a very simple apparatus, which he called the dialyzer, a figure of which is given in the margin. It consists of two parts, one a circular glass recipient (*b*), about a foot in diameter and six inches deep, the other (*a*) a similar circular vessel from six to ten inches in diameter and about two inches deep, the circumference of which consists of a band of gutta-percha, and the bottom of a circular piece of parchment-paper, the edges of which are brought over the lower rim of the gutta-percha band nearly to the top, and fastened outside of it by a string, or by a narrow hoop of gutta-percha. The first part, or circular basin, is to receive distilled water, and should contain from five to ten times the quantity of the liquid that may be introduced into the smaller vessel. The latter is to float upon the surface of the water in the former, and is to receive the liquid to be submitted to dialysis, which should not be more than half an inch deep on the paper bottom. It is important that the parchment-paper employed should have no rent or aperture and should be brought well up, and well secured on the outside of the gutta-percha, to prevent the liquid from passing between them. If any liquid containing a mixture of colloid and crystalloid matter be placed in the floating vessel, after some hours it will be found that a portion of the latter has passed through the parchment-paper, and is held in solution by the distilled water of the larger vessel, while the colloid matter remains. The distilled water thus impregnated is called the *diffusate*. The parchment-paper, or any similar material used as the septum, is applicable to the dialysis only of substances held in watery solution, and will not answer for alcoholic or ethereal liquids. M. Guignot has found that *porous or unglazed earthenware* is capable of acting efficiently as a dialyzing septum. Thus, a porous vessel containing pure water was placed in another vessel containing a solution of sugar and gum; and, at the end of twenty-four hours, a greater portion of the sugar had passed into the inner vessel, but not a discoverable particle of gum. (*P. J. Tr.*, iv. 317.) It is obvious that very different arrangements might be made to accomplish the same ends. Thus, a bladder containing a similar mixture, three-fourths full, suspended in a jar of distilled water, yields similar results. Graham's apparatus is preferable to others only for its convenience.



It is not our purpose to treat of all the applications of the process of dialysis. We shall refer to those only in which it may prove useful to the pharmacist. 1. It facilitates in many instances the separation of the active matter of any artificial or natural mixture, to a considerable extent, from the inert and useless, the former being very often crystalline, and the latter colloidal. Thus, infusions or decoctions of medicines, such as opium, belladonna, aconite, etc., submitted to dialysis, might give up more or less completely their crystalline principles, such as the salts of morphine, atropine, aconitine, etc., to the water, while the gummy, resinoid, extractive, and coloring matters, etc., might remain behind. In effecting the analysis of organic bodies, one of the most embarrassing problems is to get rid of the inert principles, which interfere with the action of chemical reagents; and the process of dialysis may here often be brought to the aid of the operator. 2. In searching for poisons in organic mixtures, as in the contents of the stomach, in which the application of tests is often rendered abortive by the colloidal matter present, the problem of the presence of the poison may be sometimes solved by submitting the suspected matter to dialysis. The poison will often be found in the diffusate, separated from the other matters, and may then be detected by the ordinary tests.

(See *A. J. P.*, 1864, p. 414.) 3. In pharmaceutic operations, it often happens that salts and other crystallizable substances are thrown away as refuse matter, because they would not repay the cost of time and material necessary for their recovery. It is possible that, by this simple inexpensive process, these substances may be separated from the useless matters and thus saved. 4. An economical application has recently been made of the process to the restoration of salted meat to the fresh state. If some salt beef with its brine be enclosed in a bag of material suitable for dialysis, as of untanned leather, and the bag be immersed in sea-water, in the course of some days the beef and brine will have been rendered sufficiently fresh for use, the salt having passed out into the sea-water. (*Chem. News*, May 28, 1864.) B. F. McIntyre, of New York, has recently introduced (1882) a class of preparations called *Dialysates*. These are prepared from various drugs by dialysis, and it is claimed that they contain the active crystallizable constituents in their original combination, deprived of the inert colloidal substances. (See, on the subject of dialysis, papers by Prof. Redwood in the *P. J. Tr.*, 1862, p. 515, and by Prof. Procter in the *A. J. P.*, 1862, p. 312; 1878, p. 102; 1879, p. 1; *N. R.*, 1877, p. 228; 1882, p. 28.)

DIANTHUS CARYOPHYLLUS. *Clove Pink.* Of the ordinary garden pink those specimens should be selected for medicinal use which have the deepest red color, and the most aromatic odor. The petals should not be collected till the flower is fully blown, and should be employed in the recent state. They have a fragrant odor, thought to resemble that of the clove. Their taste is sweetish, slightly bitter, and somewhat astringent. Both water and alcohol extract their sensible properties, and they yield a fragrant essential oil by distillation. In Europe they are employed to impart color and flavor to a *syrup*, which serves as a vehicle for other less pleasant medicines. According to the directions of the former Edinburgh Pharmacopœia, this was prepared by macerating one part of the flowers, without their claws, in four parts of boiling water for twelve hours, then filtering, and adding seven parts of sugar.

DIAPHORETIC ANTIMONY. *Antimonium Diaphoreticum. Potassii Biantimonias.* This compound is directed, in the French Codex, to be formed by deflagrating in a red-hot crucible, and keeping red-hot for half an hour, a mixture of pure antimony with twice its weight of nitrate of potassium, both being in fine powder. The product is washed with water and dried, and forms the *washed diaphoretic antimony.* For an improved process by M. Figuier see 14th edition of U. S. Dispensatory, p. 1640. The dose is two or three drachms. On account of its weak and variable nature, it has been generally laid aside in practice.

DICTAMUS ALBUS. *White Fraxinella. Bastard Dittany.* The aromatic bitter bark of the root of this European plant was formerly used. Störck gave it in intermittents, worms, amenorrhœa, hysteria, epilepsy, and other nervous diseases. The dose is from a scruple to a drachm.

DIERVILLA TRIFIDA. (Mœnch.) *D. Canadensis.* (Muhl.) *Bush Honeysuckle.* A low, erect, indigenous shrub, growing especially in rocky places throughout the Northern States. The whole plant is supposed to be possessed of diuretic and astringent properties, and is given in infusion by the "eclectics" in diseases of the urinary passages.

DIOSCOREA VILLOSA. (*Gray's Manual*, p. 480.) *Wild Yam-root. Colic-root. Rheumatism-root.* An indigenous perennial creeper, with long, branching, contorted, fibrous, ligneous roots. It grows from Maine to Wisconsin, and southward also. The roots are used by the "eclectics," who consider them efficacious in bilious colic, and by the Southern negroes in rheumatism. A half pint of a decoction (f℥j–Oj) may be given at the dose; or a tincture may be administered. They are administered in decoction and tincture; and a substance called improperly *dioscorein*, obtained by precipitating the tincture with water, is used for the same purpose in a dose of from one to four grains.

DIOSPYROS. *U. S.* 1870. *Persimmon.* The *Diospyros Virginiana*, or persimmon, is an indigenous tree, rising sometimes in the Southern States to the height of sixty feet, with a trunk twenty inches in diameter; but seldom attaining more than half that size near its northern limits, and often not higher than fifteen or twenty feet. The stem is straight, and in the old tree covered with a furrowed blackish bark. The branches are spreading; the leaves ovate-oblong, acuminate, entire, smooth, reticulately veined, alternate, and supported on pubescent footstalks. The buds are smooth. The male and female flowers are on separate trees. They are lateral, axillary, solitary, nearly sessile, of a pale orange color, and not conspicuous. The fruit is a globular berry, dark yellow when ripe, and containing numerous seeds in a soft yellow pulp. The dried, roasted, and ground seeds are used in some parts of Georgia as a substitute for coffee. (*Med. and S. Reporter*, 1873, p. 437.)

This tree is very common in the Middle and Southern States, but, according to Michaux, does not flourish beyond the forty-second degree of north latitude. The flowers appear in May or June; but the fruit is not ripe till the middle of autumn. While green, the fruit is excessively astringent, and in this form was formerly included in the U. S. Secondary list; but, when perfectly mature, and after being touched by the frost, it is sweet and palatable. The unripe fruit, according to Mr. B. R. Smith, of Philadelphia, contains tannic acid, sugar, malic acid, coloring matter, and lignin. (*A. J. P.*, xviii. 167.) The tannic acid was considered by Mr. John E. Bryan not to be of the kind existing in galls and oak-bark. (*Ibid.*, xxxii. 215.) Charropin (*Pharmacographia*, p. 403), however, believes the tannic acid to be identical with that of nutgalls, and finds besides an abundance of pectin, glucose, and a yellow coloring matter insoluble in water, but dissolving freely in ether. It has been used by Dr. Mettauer, of Virginia, in diarrhœa, chronic dysentery, and uterine hemorrhage. He gave it in infusion, syrup, and vinous tincture, prepared in the proportion of about an ounce of the bruised fresh fruit to two fluidounces of the liquid, and administered in the dose of a fluidrachm or more for infants, and half a fluidounce or more for adults. The bark is astringent and very bitter, and is said to have been used advantageously in intermittents, and in the form of a gargle in ulcerated sore throat.

DIPPEL'S ANIMAL OIL. *Oleum Cornu Cervi.* This oil was formerly produced in the process of obtaining ammoniacal products from bone or horn. It is at present never used in medicine, and the reader is referred for an account of it to earlier editions of the Dispensatory.

DIRCA PALUSTRIS. *Leather Wood.* An indigenous shrub, usually very small, but sometimes attaining the height of five or six feet, growing in boggy woods, and other low wet places, in almost all parts of the United States. The berries, which are small, oval, and of an orange color, are said to be narcotic and poisonous. The tough bark, in the fresh state, has a peculiar rather nauseous odor, and an unpleasant acrid taste, and when chewed excites a flow of saliva. It yields its acrimony completely to alcohol, but imperfectly to water even by decoction. In the dose of six or eight grains, the fresh bark produces violent vomiting, preceded by a sense of heat in the stomach, and often followed by purging. Applied to the skin it excites redness and ultimately vesicates; but its epigastric operation is very slow. It appears to be analogous in its properties to mezereon, to which it is botanically allied.

DITA. This is the bark of a tree, *Alstonia Scholaris*, R. Br. (*Echites Scholaris*, L.), belonging to the family of Apocynaceæ, and growing in the Philippine Islands. It occurs in pieces three to six inches long and three to four lines thick, sometimes flat, sometimes slightly curved; its internal surface is fibrous and of a brown sepia tint; its section has the color of leather, and its external surface is of the same tint, with brown spots. It is compact, but readily pulverized; is without odor, and has a taste at first slight, afterwards decidedly bitter. M. Gruppe extracted from it, by a process similar to that used in obtaining quinine, an uncrystallizable, hygroscopic, very bitter principle, to which he gave the name of *Ditaine*, and which has been used with asserted success as a substitute for quinine. (*Journ. de Pharm.*, 4e sér., xviii. 225; xix. 84; *P. J. Tr.*, Aug. 1875.) Several conflicting accounts of the composition of the bark having been published, O. Hesse (*P. J. Tr.*, Oct. 23, 1880) submitted it to an elaborate investigation, with the following results.

He finds three alkaloids: *ditamine*, $C_{16}H_{19}NO_2$, the relative amount of which he estimates at 0·04 per cent.; *echitamine*, $C_{22}H_{28}N_2O_4 + H_2O$, and *echitenine*, $C_{20}H_{27}NO_4$.

Of these, the second is the strongest base, and resembles ammonia in its chemical characters. Hesse considers the compound given above with one molecule of water as the hydroxide of a strong basic radical, *echitammonium*, $C_{22}H_{29}N_2O_4$. The solutions of *echitammonium-hydroxide* are so strongly basic that they precipitate the hydrates of copper, iron, aluminium, and lead, and decompose sodium and potassium chlorides, liberating the corresponding hydrates. Hesse considers echitammonium the most strongly basic of all the alkaloids.

DRACONTIUM. *U. S.* 1870. *Skunk Cabbage. Symplocarpus fœtidus.* Salisbury. (*Dracontium fœtidum.* Willd. *Ictodes fœtidus.* Bigelow.) The rhizome is perennial, large, abrupt, and furnished with numerous fleshy fibres, which penetrate to the depth of two feet or more. The spathe, which is the first part of the plant to appear, is ovate, acuminate, obliquely depressed at the apex, auriculated at the base, folded inwards at the edges, and of a brownish-purple color, varied with spots of red, yellow, and green. Within the spathe, the flowers, which resemble it in color, are placed in great numbers upon a globose peduncled spadix, for which they form a compact covering. After the spathe has decayed, the spadix continues to grow, and when the fruit is mature, has attained a size exceeding several times its original dimensions. At the base of each style is a roundish seed, immersed in the spadix, about the size of a pea, and speckled with purple and yellow. The leaves, which appear after the flowers, are numerous and crowded, oblong-cordate, acute, smooth, strongly veined, and attached to the rhizome by long petioles, which are hollowed in front, and furnished with colored sheathing stipules. At the beginning of May, when the leaves are fully developed, they are very large, being from one to two feet in length, and from nine inches to a foot in breadth. The plant is abundant in wet places throughout the northern and middle sections of the Union. Its flowers appear in March and April, and in the lower latitudes often so early as February. The fruit is usually quite ripe and the leaves are decayed before the end of August. All parts of it have a fetid odor, dependent upon an extremely volatile principle, which is rapidly dissipated by heat. The rhizome should be collected in autumn, or early in spring, and dried with care.

The rhizome consists of two portions; the body either whole or in transverse slices, and the separated radicles. The former, when entire, is cylindrical or in the shape of a truncated cone, two or three inches long by about an inch in thickness, externally dark brown and very rough from the insertion of the radicles, internally white and amylaceous. The latter are of various lengths, about as thick as a hen's quill, very much flattened and wrinkled, white within, and covered by a yellowish reddish-brown epidermis, considerably lighter colored than the body of the rhizome. More or less of the fetid odor remains for a considerable period in the dried rhizome. The taste, though less decided than in the fresh, is still acrid, manifesting itself, after it has been chewed for a short time, by a pricking and smarting sensation in the mouth and throat. The acrimony, however, is dissipated by heat, and is quite lost in decoction. It is also diminished by time and exposure; and it should not be kept longer than a single season. The radicles are said to have less acrimony than the caudex. The seeds are very acrid, and, though inodorous when whole, give out strongly, when bruised, the peculiar odor of the plant.

Medical Properties and Uses. The rhizome is stimulant, antispasmodic, and narcotic. In large doses it occasions nausea and vomiting, with headache, vertigo, and dimness of vision. Dr. Bigelow has witnessed these effects from thirty grains of the recently dried rhizome. The medicine was introduced into notice by the Rev. Dr. Cutler, who recommended it highly in asthma; and it has been subsequently employed with apparent advantage in chronic catarrh, chronic rheumatism, chorea, hysteria, and dropsy.

It is best given in powder, of which the dose is from ten to twenty grains, to be repeated three or four times a day, and gradually increased till some evidence of its action is afforded. The rhizome itself, as kept in the shops, is of uncertain strength, in consequence of its deterioration by age.

DRAGON'S BLOOD. *Sanguis Draconis.* This is a resinous substance obtained from the fruit of several species of *Calamus*, especially *C. Rotang* and *C. Draco*, small palms, growing in Siam, the Molucca Islands, and other parts of the East Indies. On the surface of the fruit, when ripe, is an exudation, which is separated by rubbing, or shaking in a bag, or by exposure to the vapor of boiling water, or finally by decoction. The finest resin is procured by the two former methods. It comes in two forms: sometimes in small *oval masses*, of a size varying from that of a hazelnut to that of a walnut, covered with the leaves of the plant, and connected in a row like beads in a necklace; sometimes in *cylindrical sticks*, eighteen inches long and from a quarter to half an inch in diameter, thickly covered with palm leaves, and bound round with slender strips of cane. In both these forms, it is of a dark reddish-brown color, opaque, and readily pulverizable, affording a fine scarlet powder. It sometimes comes also in the form of a reddish powder, and in small irregular fragments or tears. An inferior kind, said to be obtained by boiling the fruit in water, is in *flat circular cakes*, two or three inches in diameter and half an inch thick. This also yields a fine red powder. A fourth variety, much inferior even to the last mentioned, is in *large disks*, from six to twelve inches in diameter, by an inch in thickness, mixed with various impurities, as pieces of the shell, stem, etc., and supposed to be derived from the fruit by decoction with expression. A substance known by the name of dragon's blood is derived by exudation from the trunk of *Dracæna Draco*, a large tree inhabiting the Canary Islands and the East Indies, and another from *Pterocarpus Draco*, a tree of the West Indies and South America, by incision into the bark. These last, however, are little known in commerce. *Drop Dragon's Blood* is the product of the *Dracæna schizantha* of Socotra. It is occasionally seen in the London market. It is in small tears and fragments, seldom exceeding an inch in length, has a clean glassy fracture, and in thin pieces is transparent and of a splendid ruby color. It may be distinguished from true dragon's blood by the absence of shell-like scales, and by not evolving the irritating fumes of benzoic acid when heated.

Dragon's blood is inodorous and tasteless, insoluble in water, but soluble in alcohol, ether, and the volatile and fixed oils, with which it forms red solutions. According to Herberger, it consists of 90·7 parts of a red resin, which he calls *draconin*, 2·0 of fixed oil, 3·0 of benzoic acid, 1·6 of oxalate of calcium, and 3·7 of phosphate of calcium. By distilling the resin, *toluol*, C_6H_5,CH_3, and *styrol*, C_8H_8, have been obtained. *Cinnamic acid* has also been noted. By distillation with caustic potash, it yields *phloroglucin*, *protocatechuic acid*, *para-oxybenzoic* and *oxalic acids*. (*Pharmacographia*, p. 674.) It was formerly employed in medicine as an astringent, but is nearly or quite inert, and is now never given internally. It is sometimes used to impart color to plasters, but is valued chiefly as an ingredient of paints and varnishes.

DROSERA. *Sundews.* Attention has been recently called to *D. rotundifolia* and *longifolia* as remedies in phthisis, but they are probably of no value. (See *Proc. A. P. A.* xxvii. 225.)

DUBOISIA MYOPOROIDES. *R. Br.* The genus Duboisia belongs to the Salpiglossideæ, a suborder of the Scrophulariaceæ, which differs so widely from its associate suborders that by some botanists it is believed to be more closely related with the Solaneæ than with the order in which it is usually placed. It is positively known to contain but a single species, and is especially distinguished by its anthers being one-celled, and its fruit an indehiscent berry, with a few curved seeds and a crustaceous tubercular rugose testa. There are two other Australian plants which probably belong to the genus, and have received the names of *Duboisia Hopwoodii* and *Duboisia Leichardtii*, Mueller; but as fruiting specimens of them have never been obtained by botanists, it is still uncertain whether they belong to the genus Duboisia or the allied genus Anthocercis, which has a capsular fruit. The fact that *D. Hopwoodii*, or *Pituri*, appears to share the medical properties of *Duboisia myoporoides*, and probably contains the same alkaloid (see *Lancet*, i. 1879; *Journ. Physiol.*, ii. 132), lends credence to the belief in the generic identity of the two plants.

D. myoporoides is a tall, glabrous shrub or small tree, with alternate obovate-oblong or oblong-lanceolate entire leaves, which are two to four inches long, about an inch wide, and contracted into the petiole. The small flowers are of a white or pale lilac color, arranged in terminal panicles. The berry is nearly globular. The tree is a native of Australia, and has been found in New South Wales, New Caledonia, and Queensland. The medical properties of the leaves of this plant were made known by Baron von Mueller, who received them from Dr. J. Bancroft, with the statement that they would be found to act like stramonium leaves.

The alkaloid *duboisine* was discovered in the leaves by A. W. Gerrard (*P. J. Tr.*, viii. 787), who obtained it by treating the aqueous extract with alcohol, filtering, evaporating, dissolving the residuum in a small portion of water, treating with ammonia, agitating with chloroform, decanting and distilling the chloroform, dissolving the residue in dilute sulphuric acid, precipitating with ammonia, and abstracting with ether. For an account of the chemical and medicinal properties of this alkaloid, see *Belladonna*, in Part I.

EMERY. A very hard mineral, the powder of which is capable of wearing down all other substances except the diamond. As existing in commerce, it is said to be derived chiefly from the island of Naxos, in the Grecian Archipelago; but, according to Landerer, it has been found also in Asia Minor and the Morea. Within recent years a locality for emery has been discovered at Chester, Hampden County, Mass., where a vein of this valuable mineral exists, of an average width of four feet, and several miles in length. For details in reference to this subject, the reader is referred to a paper by Prof. J. Lawrence Smith, in the *American Journal of Sciences and Arts* (1866, 2d ser., xlii. 83). Emery is pulverized by grinding it in a steel mill, and the powder is kept in the shops of different degrees of fineness. It is used for polishing metals and hard stones. The method, adopted in Smyrna, of ascertaining its purity, is to rub a plate of glass of known weight with a certain quantity of the suspected mineral until it ceases to have any effect. The loss of weight in the glass is the measure of the value of the emery. (See *A. J. P.*, 1862, p. 187.)

EOSIN. ($C_{20}H_8Br_4O_5$.) This is one of the recently discovered brilliant dye-colors obtained from the action of phthalic acid upon phenols. When phthalic acid acts upon resorcin, $C_6H_4(OH)_2$, in the presence of a dehydrating agent like sulphuric acid or stannic chloride, at a temperature of 120° C., there is formed a compound *Resorcin-phthalein*, $C_{20}H_{12}O_5$, better known as *Fluorescein*. By the action of bromine upon this, is formed *tetra-brom-fluorescein* or *Eosin*, $C_{20}H_8Br_4O_5$. Soluble eosin is the potassium salt of this compound, $C_{20}H_6Br_4O_5K_2$. It forms a bronze-colored crystalline powder having a strong green reflection. Its solution in water is a red liquid having a fine green fluorescence. On the addition of hydrochloric acid the fluorescence is destroyed, the liquid becoming yellow. Eosin is largely used at present as a dye, and for making a brilliant red ink, by dissolving 5 grains in a fluidounce of water in which 10 grains of gum arabic have been dissolved.

EPIGÆA REPENS. *Trailing Arbutus. Ground Laurel. May-flower.* This is a small trailing plant, with woody stems from six to eighteen inches long, entire, cordate-ovate leaves, and small, very fragrant flowers, which appear early in the spring. It is found in the woods, and affects the sides of hills with a northern exposure. Dr. Darlington states that the plant has been supposed to be injurious to cattle, when eaten by them. (*Flora Cestrica*, p. 259.) Mr. Jefferson Oxley has found in this plant *arbutin*, $C_{12}H_{16}O_7$, *urson*, $C_{20}H_{32}O_2$, *ericolin*, $C_{34}H_{56}O_{21}$ (the same constituents as are in uva ursi), tannic and formic acids, and a principle allied to gallic acid. (*A. J. P.*, xliv. 253.) The late Dr. Eli Ives, of New Haven, Connecticut, furnished the following account of its virtues and uses, founded on his own observation. "The *Epigæa repens* has been freely used for many years in diseases of the urinary organs, and of the pelvic viscera generally, particularly of irritated action, in those cases in which the uva ursi and buchu are indicated. The leaves and stems are prepared in the same manner and administered in the same dose as uva ursi. The Epigæa has given relief in some cases where uva ursi and buchu have failed. May 4th, 1849."

EPILOBIUM ANGUSTIFOLIUM. *Willow-herb.* There are several indigenous species of Epilobium, which have the common name of willow-herb from the resemblance of their leaves to the willow, and probably have nearly identical properties. They are all perennial and indigenous. The *E. angustifolium* is the largest of them. Its leaves and roots are said to be demulcent, tonic, and astringent, and yield their virtues to water and alcohol. They are used by the "eclectics," generally and locally, in decoction, infusion, or cataplasm, in cases which call for the use of astringent remedies.

EQUISETUM HYEMALE. *Horsetail. Scouring Rush.* An indigenous cryptogamous plant, with slender annual stems from a foot and a half to three feet high, growing abundantly in the Northern States, and preferring wet places, as the banks of streams, etc. The plant derives its name of scouring rush from its use in scouring, for which it is fitted by the silicious character of the stems. It has the reputation of being diuretic, and is used sometimes in dropsical diseases and those of the urinary passages. The whole plant is employed, usually in the form of infusion.

ERECHTHITES HIERACIFOLIA. *Fireweed.* An annual indigenous plant, growing in moist woods and recent clearings, and having a rank somewhat aromatic odor. Its taste is bitterish, slightly acrid, and disagreeable. It yields these and what medical virtues it may possess to water. It has been especially recommended in dysentery. This plant is apt to infest the peppermint fields of Michigan; and its oil is said sometimes to deteriorate the oil of peppermint from that region. It has been shown, however, that another plant, *Erigeron Canadense*, is a far more injurious weed.

ERIGERON. *Fleabane.* Under this name the U. S. Pharmacopœia of 1870 recognized the herbal portions of *E. heterophyllum* and *E. Philadelphicum.*

E. heterophyllum, Willd., is the *E. strigosum* of Bigelow (not of Muhlenberg), and is now properly known as *E. annuum.* Pers. It is a biennial herbaceous plant, belonging both to North America and Europe. It has a branching root, with several erect, roundish, striated, pubescent stems, much divided near the top, and two or three feet high. The lower leaves are ovate, acute, deeply toothed, with long winged footstalks; the upper are lanceolate, acute, deeply serrate in the middle, and sessile; the floral leaves are lanceolate and entire; all, except the radical, are ciliate at the base. The flowers are in terminal corymbs. The florets of the disk are yellow; those of the ray numerous, very slender, and of a white, pale blue, or pale purple color. The flowering period is from June to October.

E. strigosum, Muhl., grows with *E. annuum*, and is frequently collected with it. It is distinguished by its leaves being nearly entire, and by both stems and leaves being almost smooth or furnished only with minute appressed hairs.

Erigeron Philadelphicum. L. *Philadelphia fleabane* is perennial and herbaceous, with a branching yellowish root, and from one to five erect stems, which rise two or three feet in height, and are much branched at top. The whole plant is pubescent. The lower leaves are ovate-lanceolate, nearly obtuse, ciliate on the margin, entire or marked with a few serratures, and supported on very long footstalks; the upper are narrow, oblong, somewhat wedge-shaped, obtuse, entire, sessile, and slightly embrace the stem; the floral leaves are small and lanceolate. The flowers are numerous, radiate, and disposed in a panicled corymb, with long peduncles bearing from one to three flowers. They resemble those of the preceding species in color, and make their appearance about the same period.

The three species are abundant in the middle portions of the United States, grow in open fields, and are probably of identical medical value. They are popularly known as *scabious.* The whole herb is used, and should be collected while the plants are in flower. It has a feebly aromatic odor and bitterish taste, and imparts its properties to boiling water. Mr. F. L. John, of Philadelphia, obtained from *E. Philadelphicum* a volatile oil by distillation, but in exceedingly small proportion; 45 pounds of the herb having yielded only half a drachm of the oil. As described by Prof. Procter, this is of a greenish-yellow color, a powerful, penetrating, aromatic odor, and a bitterish, pungent, disagreeable taste. It is more viscid than the oil of *E. Canadense*, has a higher sp. gr. (0·946), and contains more oxygen. (*A. J. P.*, xxvii. 105.) Fleabane is diuretic, without being offensive to the stomach. It has been a favorite remedy, with some highly respectable practitioners of Philadelphia, in gravel and other nephritic diseases, and has been used advantageously in dropsy. It is most conveniently given in infusion or decoction, of which a pint, containing the virtues of an ounce of the herb, may be taken in twenty-four hours.

The U. S. Pharmacopœia also formerly recognized *Erigeron Canadense.* L. Canada fleabane is an indigenous annual plant, with a stem from two to six feet high, covered with stiff hairs, and divided into many branches. The leaves are linear-lanceolate, and edged with hairs; those at the root are dentate. The flowers are very small, numerous, white, and arranged in terminal panicles. They differ from those of the other species of Erigeron in having an oblong calyx, the rays very minute and more numerous than the florets of the disk, and the seed-down simple. Hence by some botanists the plant is placed in a sub-genus with the title *Cænotus.* Another variety of *E. Canadense,* which Mr. Nuttall makes a distinct species, with the title *E. pusilum,* is not more than from four to six inches high, and has an erect smooth stem, less branched than the preceding, with all its leaves entire, and scabrous on the margin. The panicle is simple, and the peduncles filiform, nearly naked, divaricate, each bearing two or three flowers.

Canada fleabane is very common throughout the northern and middle sections of the United States, and has become naturalized in many parts of Europe. It abounds in neglected fields, and is reported to be a very troublesome weed on the peppermint plantations of the West. It blooms in July and August. The plant, all parts of which are medicinal, should be collected while in flower. The leaves and flowers are said to possess its peculiar virtues in greatest perfection.

This species of Erigeron has an agreeable odor, and a bitterish, acrid, somewhat astringent taste. Among its constituents, according to Dr. De Puy, are bitter extractive, tannin, gallic acid, and volatile oil. Both alcohol and water extract its virtues. Its acrimony is diminished by decoction, in consequence, probably, of the escape of the oil, upon which its virtues in part depend. (See *Oleum Erigerontis Canadensis.*)

Medical Properties and Uses. From the observations of Dr. De Puy, Canada fleabane appears to be diuretic, tonic, and astringent; and has proved useful in dropsical complaints and diarrhœa. It may be given in substance, infusion, tincture, or extract. The dose of the powder is from thirty grains to a drachm; of an infusion, prepared with an ounce of the plant and a pint of boiling water, from two to four fluidounces; of the aqueous extract, from five to ten grains; each repeated every two or three hours. The oil is certainly of value in uterine, pulmonary, and other internal hemorrhages, in doses of from five to ten drops every two or three hours.

ERIODICTYON GLUTINOSUM. Benth. (*E. Californicum* of various pharmaceutical papers.) Under the name of *Yerba Santa* or *Mountain Balm* the *E. glutinosum,* and probably also to some extent *E. tomentosum,* have long been used in pectoral complaints by Californians. The Eriodictyons are low shrubs belonging to the Hydrophyllaceæ, with coriaceous alternate pinnately-veined leaves, flowers arranged in a terminal thyrsus, and a two-celled ovary. *E. glutinosum* grows upon dry hills abundantly in California. It is glabrous, resinous to the feeling, with lanceolate leaves three to six inches long, irregularly more or less serrate, sometimes entire, whitened beneath, between the reticulations, by a minute and close tomentum, above glabrous. The corolla is half an inch long, tubular funnel-form; the calyx about one-sixth of an inch long, slightly and sparsely hirsute. (Gray, *Flora of North America,* vol. ii. p. 175.) The whole herb is used. H. S. Wellcome (*Pharmacist,* 1876, p. 73) found it to contain two aromatic resins, whilst an aqueous infusion of leaves, which had been exhausted by alcohol, yielded an intensely bitter extract. According to the analysis of Chas. Mohr (*A. J. P.,* 1879, 549), it contains tannic acid and 8 per cent. of an acrid, bitter resin, upon which its activity is believed to depend, also a minute quantity of volatile oil. Dr. Kier (*Ibid.,* 258) states that its syrup or elixir has a very remarkable power of disguising quinine, but that it is therapeutically inert. There is, however, considerable testimony to the value of the remedy as a stimulating expectorant in asthma, chronic bronchitis, and allied complaints. It is best exhibited in the form of tincture, or of a fluid extract prepared with alcohol. Mr. Holmes uses a tincture made with 75 per cent. alcohol in the proportion of four ounces in a pint. The dose would be two drachms; the fluid extract may be administered in doses of half a drachm.

ERODIUM CICUTARIUM. *Storksbill.* An annual hairy plant, with spreading stems, pinnate leaves, and several-flowered peduncles, belonging to the Balsaminaceæ. It is highly recommended by Dr. W. Abbotts Smith in the treatment of dropsy. He uses the decoction, made by boiling two ounces of the dried bark with three pints of water down to two. (See *Am. Journ. of Med. Sci.,* 1865, p. 240.)

ERYNGIUM AQUATICUM. *Button Snakeroot.* The *button snakeroot* or *water eryngo* is an indigenous umbelliferous plant, with a perennial tuberous root, and a stem two or three feet high, sometimes, according to Pursh, six feet, generally branching by forks, but trichotomous above. The leaves are very long, linear-lanceolate on the upper part of the stem, sword-shaped below, with bristly spines at distant intervals upon their margin. The floral leaves are lanceolate and dentate. The flowers are white or pale, and in globose heads, with the leaflets of the involucrum shorter than the head, and, like the scales of the receptacle, entire. This plant is found in low wet places, as far south as Virginia and North Carolina. Its period of flowering is August. The root, which is the medicinal portion, has a bitter, pungent aromatic taste, provoking, when chewed, a flow of saliva. It is diaphoretic, expectorant, in large doses occasionally emetic, and has been used by some physicians in decoction as a substitute for seneka. (*Bigelow.*) We are told in Barton's *Collections* that it is nearly allied to the contrayerva of the shops.

ERYTHRONIUM AMERICANUM. (Muhl. *Catalogue,* 84; Bigelow, *Am. Med. Bot.,* iii. 151.)—*E. lanceolatum.* (Pursh, p. 320.) This is an indigenous, perennial, liliaceous plant, sometimes called, after the European species, *dog's tooth violet.* The bulb (cormus), which is brown externally, white and solid within, sends up a single naked slender flower-stem, and two smooth, lanceolate, nearly equal leaves, sheathing at their base, with an obtuse, callous point, and of a brownish-green color diversified by numerous irregular spots. The flower is solitary, nodding, yellow, with oblong-lanceolate petals obtuse at the point, a club-shaped undivided style, and a three-lobed stigma. The Erythronium grows in woods and other shady places throughout the Northern and Middle States. It flowers in the latter part of April or early in May. All parts of it are active. In the dose of twenty or thirty grains, the recent bulb operates as an emetic. The leaves are said to be more powerful. The activity of the plant is diminished by drying.

ETHYLIDENE CHLORIDE. ($C_2H_4Cl_2$.) This substance, which has recently been brought forward in Germany as a new anæsthetic, has been already noticed under the general heading "CHLORINATED ANÆSTHETIC COMPOUNDS." (See *page* 1606.)

EUCALYPTUS MANNA. This substance exudes during the summer months from punctures made in the bark and leaves of the Australian trees *Eucalyptus mannifera* and *E. viminalis.* It occurs in small rounded opaque masses, and is said to resemble ordinary manna in its medical properties.

EULACHON OIL. The fish known by the Indians of the North Pacific under the name of *Eulachon* or *Oulachon*, and by the English as *Hoolakins* or *Candle fish*, the *Thaleichthys Pacificus* of scientists, yields a great abundance of an oil which has been proposed as a substitute for cod-liver oil. According to the editor of *N. R.* (1881, 356), this oil first begins to congeal and become opaque at —7° C. (19·4° F.), although authorities state that at ordinary temperatures it grows solid and lard-like.

EUPHORBIA. The genus Euphorbia contains numerous species, having the common property of yielding a milky juice. They are herbaceous or shrubby, with or without leaves; and the leafless species, which are chiefly confined to the African deserts, have fleshy, naked, or spiny stems, like those of the Cactus. They nearly all afford products which act powerfully as emetics and cathartics, and in overdoses occasion dangerous if not fatal prostration, with symptoms of inflamed gastro-intestinal mucous membrane. Their milky juice, which concretes on exposure, usually possesses these properties in a high degree, and, in addition, that of powerfully irritating the skin when applied to it. Two species were formerly acknowledged in our national Pharmacopœia, *E. corollata* and *E. Ipecacuanha*, which are both indigenous. *E. hypericifolia*, which is also indigenous, has been highly commended by Dr. W. Zollickoffer as a remedy in dysentery after due depletion, and in diarrhœa, menorrhagia, and leucorrhœa. He infuses half an ounce of the dried leaves in a pint of boiling water, and gives half a fluidounce every hour in dysentery till the symptoms begin to yield, the same quantity after every evacuation in diarrhœa, and two fluidounces morning, noon, and night, in menorrhagia and fluor albus. The herb is at first sweetish, afterwards harsh and astringent to the taste, and appears to contain tannin. Its effects upon the system are those of an astringent and feeble narcotic. It differs, therefore, considerably, both in sensible and medicinal properties, from most of the other species. (*Am. Journ. of Med. Sci.*, xi. 22.) In a subsequent communication, it is stated that *E. maculata* possesses similar properties. (*Ibid.*, N. S., iii. 125.) Dr. B. J. D. Irwin, of the U. S. Army, having heard much, while in New Mexico and Arizona, of the efficacy, among the native Mexicans, of a certain plant called by them *gollindrinera*, as an antidote to the poison of serpents, was induced to make trials of it, which convinced him that its reputation was merited. A specimen of the plant having been sent to Prof. Torrey was pronounced by him to be *Euphorbia prostrata*, which is abundant in the southwestern parts of the United States and in Mexico. Dr. Irwin thinks that the virtues reside in the milky juice of the plant, but the liquid obtained by bruising the herb is commonly used. Like other Euphorbiæ, it is emetic and cathartic in large quantities, but he heard of no injurious effects from its use. (*Ibid.*, 1861, p. 89.) In Chili, the juice of the *Euphorbia Chilensis* is said to be used as a drastic purgative. (*A. J. P.*, 1866, p. 102; from the *Revista Farmaceutica*, of Buenos Ayres.)

Euphorbia corollata. Willd. *Sp. Plant.* ii. 916; Bigelow, *Am. Med. Bot.* iii. 119. The *blooming* or *large-flowering spurge*, frequently called *milk-weed*, is an erect plant, with a large, perennial, branching, yellowish root, which sends up several stems from two to five feet in height, round and generally simple. The leaves, which stand irregularly upon the stem, and without footstalks, are oblong-obovate, wedge-form or linear, flat or revolute at the margin, smooth in some plants, and hairy in others. The flowers are disposed upon a large terminal umbel, with a five-leaved involucrum, and five trifid and dichotomous rays, at each fork of which are two oblong bractes. The calyx is large, rotate, white, with five obtuse segments closely resembling a corolla, from which the species has been named. At the base of these divisions are five interior smaller segments, which are described as nectaries by many systematic writers, while the larger are considered as belonging to a real corolla. The stamens are twelve, evolving gradually, with double anthers. Many flowers have only stamens. The pistil, when existing, is stipitate, nodding, rounded, with three bifid styles. The fruit is a smooth, three-celled, three-seeded capsule.

The plant grows in various parts of the United States, from Canada to Florida, and abounds in Western Pennsylvania, Maryland, and Virginia. It prefers a dry, barren, and sandy soil, seldom growing in woods or on the borders of streams. Its flowers appear in July and August. The root is the only part used; when full grown, it is sometimes an inch in thickness, and two feet in length. It is without unpleasant taste, producing only a sense of heat a short time after it has been taken. The medical virtues are said to reside in the cortical portion, which is thick, and constitutes two-thirds of the whole root. They are taken up by water and alcohol, and remain in the extract formed by the evaporation of the decoction or tincture.

In a full dose, the root of *E. corollata* operates actively and with sufficient certainty as an emetic, producing ordinarily several discharges from the stomach, and sometimes acting with considerable energy upon the bowels. In quantities insufficient to vomit, it excites nausea, almost always followed by brisk purging. In still smaller doses it is diaphoretic and expectorant. It cannot, however, like ipecacuanha, be given largely in cases of insensibility of the stomach, without the danger of producing hypercatharsis with inflammation of the mucous coat of the stomach and bowels. It is greatly inferior to this emetic in mildness, while it is no less inferior to tartar emetic in certainty. It is objectionable as a purge, in consequence of the nausea which it occasions when given in cathartic doses. Dr. Zollickoffer was the first to introduce it to the particular notice of the medical profession. It is little prescribed, and seldom kept in the shops. The dose of the dried root as an emetic is from ten to twenty grains, as a cathartic from three to ten grains. The recent root, bruised and applied to the skin, produces vesication.

Euphorbia Ipecacuanha. Willd. *Sp. Plant.* ii. 900; Barton, *Med. Bot.* i. 211; Bigelow, *Am. Med. Bot.* iii. 108. *Ipecacuanha spurge*, or *American ipecacuanha*, is a singular plant, varying so much in the shape and color of its leaves, and in its whole aspect, that mere individual peculiarities might without care be attributed to a specific difference. The root is perennial, yellowish, irregular, and very large, penetrating sometimes to the depth of six or seven feet in the sand, and in its thickest part, when full grown, from three-quarters of an inch to an inch and a half in diameter. The stems are numerous, herbaceous, erect or procumbent, smooth, dichotomous, jointed at the forks, white under the ground, red, pale green, or yellow above, sometimes almost buried in the sand, usually forming thick low bunches upon its surface. The leaves are opposite, sessile, entire, smooth, generally oval, but sometimes round, obovate, or even lanceolate or linear. They are small early in the spring, and increase in size with the age of the plant. Their color varies from green to crimson. The flowers are solitary, on long axillary peduncles. The calyx is spreading, with five exterior obtuse segments, and the same number of inner, smaller segments. The fertile flowers have a roundish drooping pedicelled germ, crowned with six revolute stigmas. The capsule is three-celled, and contains three seeds.

E. Ipecacuanha is indigenous, growing in pine-barrens and other sandy places in the Middle and Southern States, especially along the sea-board, and abundantly in New Jersey, on the banks of the Delaware. It blooms from May to August. The root, which was the officinal portion, is, according to Dr. Barton, equally efficacious at whatever period collected.

The dry root is light and brittle, of a grayish color externally, white within, inodorous, and of a sweetish not unpleasant taste. Its active principle has not been isolated. Dr. Bigelow inferred from his experiments that it contained caoutchouc, resin, gum, and probably starch. Mr. C. Petzelt has found, as the result of an examination, wax, fixed oil, resin, starch, glucose, and various salts, among which was sulphate of calcium. The resinous matter, as obtained by him, was a dark mass, of a taste slight at first but after a time nauseous and pungent, readily dissolved by alcohol, but insoluble in ether and benzin, and, when swallowed, producing in half-grain doses watery stools, and in one and a half or two grain doses, nausea and vomiting. It gave no evidence of the presence of an alkaloid. Though complex in composition, and therefore not the pure active principle of the root, it no doubt contains it. (*A. J. P.*, 1873, p. 255.)

Medical Properties and Uses. Ipecacuanha spurge is an active, tolerably certain emetic, rather milder than *E. corollata*, but, like it, disposed to affect the bowels, and liable, if given in overdoses, to produce excessive nausea and vomiting, general prostration, and alarming hypercatharsis. It is, therefore, unfit to supersede ipecacuanha. In small doses it is diaphoretic. The specific name of the plant indicates that the emetic property of the root has been long known. The late Professor Barton alluded to it in his "Collection;" but it did not come into general notice till after the publication of Dr. W. P. C. Barton's Medical Botany. The late Dr. Hewson, of Philadelphia, stated that this emetic was the subject of an inaugural essay by Dr. Royal, and that experiments, conducted with it among the convicts in the old Walnut Street prison, proved it to be advantageously available for all the purposes of an emetic; while, in consequence of its want of nauseous taste, it seemed to answer even better than ipecacuanha as an expectorant and diaphoretic. The dose of the powdered root is from ten to fifteen grains.

EUPHORBIUM. The concrete resinous juice of one or more species of Euphorbia; but its precise source is uncertain. It has been ascribed to *E. officinarum*, growing in the north of Africa and at the Cape of Good Hope, *E. Canariensis*, a native of the Canary Islands and Western Africa, and *E. antiquorum*, inhabiting Egypt, Arabia, and the East Indies, and supposed to be the plant from which the ancients derived this resinous product. These species of Euphorbia bear some resemblance in form to the *Cactus*, having leafless, jointed, angular stems, divided into branches of a similar structure, and furnished with double prickles at the angles. When wounded they yield an acrid milky juice, which concretes on the surface, and, being removed, constitutes the euphorbium of commerce. The oil of *E. lathyris* is stated to act upon the human system in much the same manner as croton oil. (*Proc. A. P. A.*, xxvi. 305.)

Euphorbium occurs in the shape of tears, or in oblong or roundish masses, about the size of a pea or larger, often forked, and perforated with one or two small conical holes, produced by the prickles of the plant, around which the juice has concreted, and which sometimes remains in the holes. The masses are occasionally large and mixed with impurities. The surface is dull and smooth, bearing some resemblance to that of tragacanth; the consistence somewhat friable; the color light yellowish or reddish; the odor scarcely perceptible; the taste at first slight, but afterwards excessively acrid and burning. The color of the powder is yellowish. The sp. gr. of euphorbium is 1·124. Triturated with water, it renders the liquid milky, and is partially dissolved. Alcohol dissolves a larger portion, forming a yellowish tincture, which becomes milky on the addition of water. Its constituents, according to Pelletier, are resin, wax, malate of calcium, malate of potassium, lignin, bassorin, volatile oil, and water. Brandes found caoutchouc. It contains no soluble gum. The proportions of the ingredients are variously stated by different chemists, and probably vary in different specimens. The most abundant is resin, and the remainder consists chiefly of wax and malate of calcium. The resin is excessively acrid, is soluble in alcohol, and, when exposed to heat, melts, takes fire, and burns with a brilliant flame, diffusing an agreeable odor, and has, according to Flückiger, the formula $C_{10}H_{16}O_2$. Flückiger also found a substance analogous to lactucon, which he names *euphorbon.* It is neutral, fusible above 106° C. (223° F.), readily dissolved by boiling alcohol, and soluble in ether, benzin, amylic alcohol, chloroform, aceton, and glacial acetic acid. From its solution in ether and benzin, it separates, on spontaneous evaporation, in feathery needles. Its solution in sulphuric acid, spread on a plate, is colored violet by nitric acid. Its composition is $C_{13}H_{22}O$. While the acrid resin constitutes 38 per cent. of euphorbium, euphorbon constitutes 22 per cent. (*A. J. P.*, 1868, p. 393; from *Schweizerische Wochenschrift.*)

Medical Properties and Uses. Euphorbium taken internally is emetic and cathartic, often acting with great violence, and in large doses producing severe gastric pain, excessive heat in the throat, and symptoms of great prostration. In consequence of the severity of its action, its internal use has been entirely abandoned. Applied to the mucous membrane of the nostrils, it excites violent irritation, attended with incessant sneezing and sometimes bloody discharges. They who powder it are under the necessity of guarding their eyes, nostrils, and mouth against the fine dust which rises. Largely diluted with wheat flour or starch, it may be used as an errhine in amaurosis, deafness, and other obstinate affections of the head. Externally applied, it inflames the skin, often producing vesication; and on the continent of Europe it is sometimes used as an ingredient of epispastic preparations. It is employed in veterinary practice, with a view to its vesicating power.

EUPHRASIA OFFICINALIS. *Eyebright.* A small annual plant, common to Europe and the United States, without odor, and of a bitterish, astringent taste. It was formerly used in various complaints, and among the rest in disorders of the eyes. The probability is that it is nearly inert.

EXTRACTUM CARNIS. *Extract of Flesh. Extract of Meat.* The nature of this preparation is truly expressed by its name. Its object is to obtain the nutritive matters of the flesh of animals in a concentrated state, in which they may be long kept without change. Two great advantages are thus gained, cheapness of carriage, and the facility of transfer from places, however remote, where meat is plentiful, to others where it is most needed. Thus, the cattle so abundant on the plains of South America, Australia, and Russia may be made to contribute to the support of the people of Europe and North America; and this object has already been in some degree accomplished; as factories are in operation in these regions by which, in the condition of *extract of flesh*, beef is very largely prepared; and South American extract of beef is well known all over the world. Though to Liebig belongs the credit of setting this movement on foot, and his process is probably most extensively used, others have employed processes of their own, and some are perhaps equal if not superior to his.

Liebig's extract of beef, besides what is made by various independent operators, who, employing his process, take advantage of the popularity of his name in spreading their products abroad, is now largely prepared by a company which, under his supervision, has established itself in South America. According to M. Poggiale, the process there in use consists in preparing a broth with equal parts of the meat cut fine and of cold water, straining this through a linen cloth, evaporating it in a boiler over a naked fire till reduced to one-sixth of its volume, and then at a lower temperature, by means of a vacuum apparatus, bringing it to the consistence of an extract. The extract thus made is introduced into varnished stoneware jars, which are carefully closed to exclude the air. It is said that 100 parts of meat yield 2·5 of extract. The preparation keeps well, contains neither fat nor gelatin, and is rich in the nitrogenous principles. It is of a reddish-brown color, a slightly acrid taste, and an odor that is not agreeable; so that when dissolved in hot water to make soup, it is necessary, in order to make a savory dish, to add leguminous fruits to the extract. To avoid this flavor it would be necessary to effect the evaporation out of contact with the air, and if possible altogether in a vacuum.

The following more particular account of the South American establishment is given by Mr. Hutchinson, in his "*Parana and South American Recollections.*" The works are situated at Fray Bentos, and would appear, from a statement in the *Buenos Ayres Standard* (Sept. 3, 1868), to be of very great extent, covering 20,000 square feet, and "working off" 400 oxen daily. There are four processes in the manufacture: 1. chopping the flesh into mincemeat; 2. the digestive process, in which the chopped meat is exposed to steam in vast iron digesters, each holding 12,000 lbs.; 3. the separation, by straining through wire gauze and clarification, of the fat, albumen, and fibrin; and, 4. evaporation, which is wonderfully accelerated by the rotary motion of thin, circular, steel plates, by means of which more than two millions of square feet of a thin layer of the liquid are exposed to the air in one minute. Liebig directs that, in the preparation of beef-tea, 1 part of the extract should be employed to 100 of water; but the nutritive matter in the extract is said to vary greatly; and Dr. Letheby, in specimens examined by him, found 45 per cent. of water; so that the proportion fixed by Liebig must be greatly increased in reference to inferior specimens. The varying quality of the extract is ascribed, in part at least, to the character of the meat; that from grown animals differing from that of young, and of the male from the female; while, altogether, the mode of living of the roving cattle of the plains would be likely to lead to inferior results. (*Med. Times and Gaz.*, 1869, p. 92.) In a letter from Baron Liebig to the *P. J. Tr.* for Nov. 1866, it is stated that the meat of oxen always yields an extract darker and more strongly flavored, resembling somewhat the flavor of fresh venison, pleasant when diluted; that of cow's meat lighter-colored, and of a mild flavor; while that of young animals, under four years, is unfit for the preparation of extract, which from such a source is pappy, of a feeble taste like veal, and without flavor. (*A. J. P.*, 1867, p. 145.)

In preparing his extract, M. Bellat exhausts the meat, deprived of fatty matter and tendinous and membranous tissues, and very finely divided, with cold water by the process of percolation, and, setting aside the infusion thus obtained, puts the residuary matter into vats heated by vapor and hermetically closed by strong covers; adds an equal weight of water, and a small quantity of bones; digests for six hours at about 93·3° C. (200° F.), agitating occasionally; then submits the material to the action of an hydraulic press, adds a suitable proportion of water and legumes, and boils the whole. The liquids prepared with heat and without it are now mixed, heated in boilers so as to coagulate any blood present, and, having been rapidly filtered, are evaporated in a vacuum apparatus to the consistence of very thick honey. Thus made, the extract is finally introduced into tin cans, and closed after the manner of Appert. This extract is of a yellowish-brown color, rather soft, very soluble in water, and possessed of the smell and taste of fresh soup. By adding 25 grammes of it to a litre of boiling water, with sufficient salt, M. Poggiale obtained a soup having all the characters of that recently made from fresh meat. (*Journ. de Pharm.*, 1868, p. 172.)

M. Martin de Lignac prepares the extract by boiling 100 kilogrammes of beef (flesh and bones), 20 of fresh pulse, 5 of knuckles of veal, and 100 grammes of common salt, all well divided, in one and a half times their weight of water, and, when the soup is prepared, allowing it to rest, decanting, filtering, and lastly evaporating, by means of a water-bath, at about 71·1° C. (160° F.), down to 10° of Baumé. The extract is then put into metallic boxes, and preserved by the method of Appert. It is in the form of a translucent jelly, of sufficient firmness, which it owes to the gelatin of the bones. It has a very agreeable smell and taste, and, dissolved in boiling water, yields an excellent soup. This is said to be much used in Paris. (*Journ. de Pharm.*, 1868, p. 173.)

M. F. J. Tourtelot gives the following formula of an extract prepared by him, which has been employed in the U.S. Army, and in private practice in this country. His process is based on the propriety of preserving the albumen in the extract, which is undoubtedly beneficial so far as its nutrient qualities are concerned. The fresh beef, deprived of bone, fat, and sinew, and finely chopped, is macerated with cold water for about two hours; steam is then introduced into the vats until the temperature rises to 48·8° C. (120° F.), care being taken to stir the meat frequently; and the resulting liquid, which contains the albumen, is drawn off, strained, and set aside. The residue is boiled with water for some hours, the liquor separated by gentle pressure, and immediately transferred to the vacuum pan, where it is reduced to one-fourth, when the liquid first obtained is added; after which the evaporation is continued until one pound of the extract represents 20 pounds of meat. It is then poured into china jars, and covered with wax paper, coated with tincture of tolu. (See *A. J. P.*, 1869, p. 158.)

Essence of Beef or *Beef tea*, and *Essence of Mutton* are similar in their powers to the extracts, but are much preferable to them. They may be used with advantage as stimulants in low fevers, etc., in doses of from half an ounce to two ounces, and are prepared as follows. The flesh, having been deprived as far as possible of fatty matter, and cut into very small pieces, is introduced without water into a convenient long-necked bottle (a common quart porter-bottle will answer the purpose very well) until this is filled; the bottle is then placed upright in a pot of boiling water, so that the top of the bottle shall be above the surface of the liquid, and is exposed to a boiling heat for an hour or more; the mouth of the bottle being closed with a cork so tightly as to prevent the escape of vapor, but not so as to endanger the breaking of the vessel. At the end of the process, the liquid is to be poured out of the bottle, and, when sufficiently cool, is ready for use.

Under the name of *Johnston's Fluid Beef*, a preparation, made in Philadelphia, has been introduced, which differs from other extracts in the fact that albumen is replaced by the finely powdered dried residue of the meat; the muscular fibre is plainly visible under the microscope. The name *fluid* beef is a misnomer, as it is of extractiform consistence; it is, however, a good extract.

The extract of meat is much used as an article of diet in making soups. It by no means represents the nutritive qualities of the meat itself; as the two most nutritious ingredients of flesh, albumen and fibrin, are almost wholly wanting; and efforts are made as far as possible to get rid of fat, and in most instances of gelatin also, though, in relation to the latter principle, with, in our opinion, questionable propriety. In low fevers, it is recommended by some as possessing, in addition to its slightly nutritious qualities, the somewhat stimulant properties characteristic of the meat essences. For an account of the chemical constitution of extract of flesh, by Messrs. H. Deane and H. B. Brady, for which we have no space here, the reader is referred to the *Pharmaceutical Journal* (Oct. 1866, p. 199).

FERRIDCYANIDE OF POTASSIUM. *Red Prussiate of Potassium.* ($K_6Fe_2Cy_{12}$.) This is formed by passing a current of chlorine through a solution of ferrocyanide of potassium, until the liquid ceases to form a precipitate with a solution of ferric chloride, a proof that the whole of the ferrocyanide has been converted into the ferridcyanide. The solution, by due evaporation, yields the compound in question. It may also be prepared, in the dry way, by agitating finely powdered ferrocyanide with chlorine as long as it is absorbed. The theory of the formation of this compound is that two atoms of chlorine withdraw from two mols. of the ferrocyanide two atoms of potassium, forming chloride of potassium, which remains in the mother-water, while the two atoms of iron, having assumed the ferric condition, together with the remaining potassium, saturate the cyanogen. The reaction is explained by the following equation: $2K_4Fe(CN)_6 + Cl_2 = K_6Fe_2(CN)_{12} + 2KCl$. The radical ferridcyanogen is supposed to be formed by the coalescence of two mols. of ferrocyanogen, and is sometimes represented by the symbol Cfdy. This salt, discovered by Gmelin, is in beautiful deep hyacinth-red anhydrous crystals, which are soluble in four parts of water. Its solution forms a delicate test for ferrous salts, with which it produces a blue precipitate; but with ferric salts it only strikes a green or brown color. It is used in dyeing and calico-printing.

FERROCYANIDE OF ZINC. *Zinci Ferrocyanidum. Ferrocyanuret of Zinc.* ($Zn_2FeCy_6 + 3H_2O$.) Formed by double decomposition between hot solutions of ferrocyanide of potassium and sulphate of zinc. It is thrown down as a white powder. It has similar medical properties to those of the cyanide, and is used in the same diseases. The dose is from one to four grains, given in pill. (See *Cyanide of Zinc.*)

FERRUM DIALYSATUM. *Dialyzed Iron.* This preparation has recently been extensively used both abroad and in this country, under the belief that it would prove serviceable in anæmia, but is probably destined to soon sink into merited disuse. It is made by treating a solution of ferric chloride with ammonia, whereby ferric hydrate is precipitated, which by agitation is dissolved, placing the thick liquid in a dialyzer and suspending this in water, which is to be constantly renewed as long as any traces of hydrochloric acid are found in it. (See *Dialysis.*) To 100 parts of solution of chloride of iron, sp. gr. 1·26, 35 parts of water of ammonia, sp. gr. 0·923, may be gradually added. The precipitate, which almost immediately forms, is redissolved, and the solution introduced in the dialyzer, which is then suspended upon the water, contained in a suitable vessel. When this ceases to produce a precipitate with nitrate of silver, or to show an acid reaction, it is assayed by evaporating 10 C.c. to dryness on a water-bath, to ascertain the amount of ferric oxychloride in solution; then the final solution is diluted, so that it shall contain 10 per cent. of dry oxychloride.

Dialyzed iron is a solution of ferric oxychloride in water. Although the amount of chlorine present is very small, it is not correct to speak of it as a solution of ferric oxide. Its composition may vary from $Fe_2Cl_6,12Fe_2O_3$ to $Fe_2Cl_6,95Fe_2O_3$ (*Graham*), and solutions which contain a large quantity of oxide in proportion to chloride are less stable, and more prone to gelatinize. Solutions containing a large proportion of chloride may be evaporated to dryness, if care is used, without the residue becoming insoluble. The solution is of a transparent reddish-brown color, free from the usual astringent, styptic taste of iron preparations. It mixes in all proportions with distilled water, alcohol, syrup, and glycerin, but water containing any saline impurity is apt to cause precipitation. When gelatinization occurs, agitation with a small quantity of solution of ferric chloride will usually restore it to fluidity, care being observed not to add an excess. Contact with the alkalies should be avoided, even in minute quantity; indeed, it is best administered without addition of any kind, or simply diluted with distilled water.

There is good reason to believe that much of the so-called dialyzed iron found in commerce is made by adding freshly precipitated ferric hydrate to solution of chloride of iron until it ceases to be dissolved, and then filtering the solution. (Prof. Scheffer, *A. J. P.*, March, 1878.) *Ferrum Catalyticum*, or *Catalytic Iron*, used on the Continent, is now probably made in this way.

E. B. Shuttleworth (*Can. Pharm. Jour.*, Dec. 1877) recommends a solution which has the sp. gr. 1·040 and yielding 5 per cent. of residue, when well dried on a water-bath, as the best for medicinal use. The specific gravity test can be relied upon, if the solution does not give a precipitate with nitrate of silver or become of a blackish-blue color upon treatment with tannin, showing the absence of ferric chloride. (See also *N. R.*, 1879, p. 46, for a new process by F. Schneider, from *Schw. Wochen.*, 1878, p. 409.)

Dialyzed iron has already been noticed in Part I. as an antidote to arsenic. It is a very feeble chalybeate, incapable of passing through animal membranes, and therefore of absorption, by yielding on contact with the gastro-intestinal juices a hydrated sesquioxide, which is slowly worked up in the alimentary canal. The dose is from ten drops to half a fluidrachm.

FLAVORING EXTRACTS. Under this name, preparations from various aromatics are considerably used for culinary purposes. They are in the liquid form, and are generally alcoholic solutions of the sapid and odorous principles of substances having an agreeable flavor. For *Extract of Lemon*, *Orange*, *Cinnamon*, *Teaberry*, the officinal formulas may be used or modified to suit individual purposes. (See *Spiritus Limonis*, *Aurantii*, *Cinnamomi*, *Gaultheriæ*, in Part I. of this work.) *Extract of Almond* may be made by dissolving one fluidounce of oil of bitter almond, deprived of hydrocyanic acid, in one pint of alcohol; *Extract of Rose*, by dissolving half a fluidrachm of otto of rose in a pint of alcohol, macerating half an ounce of red rose leaves in the solution until the extract is of the desired depth of color, and filtering. For *Extracts of Vanilla* and *Ginger*, see Tinctura Vanilla and Zingiberis (Part I.). *Extracts of Celery Seed*, *Thyme*, *Sweet Marjoram*, *Sweet Basil*, *Summer Savory*, etc., may be made by bruising well two ounces of either, moistening with half a fluidounce of diluted alcohol, packing in a percolator, and pouring on diluted alcohol until a pint is obtained. Formulas given by Prof. Procter may be found in the *A. J. P.*, 1856, p. 215, and 1866, p. 294.

FLUORESCENCE. It has been proposed to use this property of various drugs as a means of detecting adulterations. For want of space, the reader is referred to articles in the *P. J. Tr.*, 1875, p. 966 (reprinted, *A. J. P.*, 1875, p. 305), and the *Phila. Med. Times*, 1875, p. 258.

FORMIATE OF AMMONIUM. *Ammonii Formias.* (NH_4CHO_2.) From the fact that formiate of ammonium is a chemical homologue of acetate of ammonium, the acid of the former being a derivative of methyl, as acetic acid is of ethyl, it has been suggested that they might resemble each other in their medicinal relations; but, though formic acid is irritant to the skin like acetic, it has not proved, upon trial, that the two salts have any strong resemblance. The formiate of ammonium has been employed by Dr. Ramskill, at the Hospital for the Epileptic and Paralytic, in London, who considers it useful in chronic paralytic disease with general torpor; especially in cases of reflex paralysis, and, in a less degree, in the paralytic condition arising from long disuse of the muscles. It is said to be equally applicable to palsy of sensation and motion. It is contraindicated by any remaining active irritation or inflammation of the nervous centres or about them, which may have been the original seat of the lesion. The inference is that formiate of ammonium is a stimulant with a special tendency to the nervous centres, and probably analogous to the carbonate. The dose is five grains; and a larger quantity than this is apt to vomit. Patients experience a glow in the region of the stomach when they swallow it.

FORMIC ACID. *Acidum Formicum.* ($HCHO_2$.) This acid, although deriving its name from having first been obtained from the ant (*Formica rufa*) is remarkable for the number of sources of its production. It can be made from some species of caterpillars, from the blood, urine, fluid of the spleen, and perspiration of human beings; it is found in the products of decomposition of a number of vegetable substances, in common oil of turpentine, as a decomposition product of tartaric acid contained in various fruits and in the juice of the stinging nettle. It may be produced artificially in many ways. The best method (Berthelot's) will only be given: (*Ann. Ch. Phys.*, 3, 46, 477.) Equal weights of oxalic acid and glycerin with 10 per cent. of water are gently heated, hardly over 100° C. (212° F.), in a capacious retort, carbonic acid gas and formic acid are produced, a little formic acid passing over into the distillate, the greater portion remaining in the retort, however, with the glycerin, from which it can be separated by adding an equal bulk of water, distilling slowly, and renewing the water in the retort as required, until the acid is all distilled off. Formic acid, in its most concentrated state, is a colorless liquid, sp. gr. 1·235, boiling at 98·5° C. (209° F.), fuming slightly upon exposure to the air, having a pungent sour taste, and, when applied to the soft skin, producing violent pain, and often ulceration. Diluted solutions are alone suitable for medicinal applications; equal parts of the strong acid and water have been used. *Spiritus Formicarum* of the German Pharmacopœia is made by macerating for two days, in a mixture of fifteen parts of alcohol and water, ten parts of bruised ants, recently gathered, and then distilling off twenty parts from the mixture. It is a clear, colorless liquid, which reddens blue test-paper. Twenty parts, mixed with one part of solution of subacetate of lead, should form a mixture almost entirely filled with feathery crystals.

Medical Properties. Formic acid, diluted with an equal measure of water, is said to be an excellent application to paralyzed limbs, exciting the circulation, and producing erythematous redness, with a pricking sensation as if stung with nettles. (*N. Y. Med. Journ.*, 1865, p. 80.)

FORMIC ETHER. A paper on the physiological action of this substance may be found in the *Journ. de Pharm.*, Juin, 1872, p. 453.

FRASERA. *American Columbo* (*Frasera Walteri*, Michaux; *F. Carolinensis*, Walter) is a most elegant representative of the family of Gentianaceæ. From the root, which is triennial, long, spindle-shaped, horizontal, fleshy, and yellow, a strong, succulent, solid, smooth stem rises, from five to ten feet in height. The leaves are sessile, entire, glabrous, of a deep green color, and disposed in whorls, which commence at the root, and ascend to the summit with successively diminishing intervals. The radical leaves, from five to twelve in number, are elliptical, obtuse, a foot or more in length by about four inches in breadth, and lie upon the ground in the form of a star. Those constituting the whorls are successively smaller as they ascend; the lowest oblong-lanceolate, the upper lanceolate and pointed. The flowers are numerous, large, yellowish white, and disposed in a beautiful terminal pyramidal panicle, from one to five feet long, the branches of which spring from the axils of the upper leaves. The segments of the calyx are lanceolate, acute, and somewhat shorter than those of the corolla. The filaments are inserted into the base of the corolla, between its segments, which they do not equal in length. The anthers are oblong and notched at the base. The germ is oblong-ovate, compressed, and gradually tapers into the style, which ends in a bifid stigma. The fruit is an oval, acuminate, compressed, two-valved, one-celled, yellow capsule, containing from eight to twelve flat elliptical seeds.

The Frasera flourishes in the southern and western portions of the United States, and in many situations is very abundant, especially in Arkansas and Missouri. It prefers rich woodlands and moist meadows. The period of flowering is from May to July; but the stems and flowers are produced only in the third year, the radical leaves being the only part of the plant which previously appears above ground. From this manner of growth, it is inferred that the roots, which were formerly included in the Secondary List of the U. S. Pharmacopœia, should be collected in the autumn of the second or the spring of the third year. Before being dried, it should be cut into transverse slices.

As formerly in the market, Frasera was in pieces irregularly circular, an eighth of an inch or more in thickness, about an inch in diameter, somewhat shrunk in the middle, consisting of a central medullary matter and an exterior cortical portion, of a yellowish color on the cut surfaces, with a light reddish-brown epidermis. In appearance these pieces somewhat resembled columbo, but were easily distinguishable by the greater uniformity of their internal structure, the absence of concentric and radiating lines, and their purer yellow color without a greenish tinge. A parcel of the root sliced longitudinally, so as to imitate gentian, has been noticed in the market. It would not be likely to be confounded with it by an experienced person. It was called *American gentian.* The taste of Frasera is bitterish and sweetish. Water and diluted alcohol extract its virtues; and the tincture lets fall a precipitate upon the addition of water, but is not disturbed by tincture of galls. The hot infusion is not precipitated by solution of gelatin, and gives with iodine no signs of starch. These reactions afford additional means of distinguishing the root from columbo. Mr. Higinbothom, of Bermuda, found in it gum, pectin, glucose, wax, resin, fatty matter, yellow coloring matter, bitter extractive, and an acid which was probably peculiar. (*A. J. P.*, Jan. 1862, p. 23.) Experiments by Mr. Frank W. Thomas have determined the entire absence from Frasera of berberina, one of the active principles of columbo. (*Ibid.*, July, 1868, p. 310.) G. W. Kennedy obtained *gentisic acid*, $C_{14}H_{10}O_5$, and *gentiopicrin*, $C_{20}H_{30}O_{12}$, the two chief constituents of gentian root, from which it differs chemically in the relative amounts of these constituents. (*Proc. A. P. A.*, 1873, p. 635.) Prof. J. U. Lloyd believes that the yellow coloring matter of several investigators was impure gentisic acid. (*A. J. P.*, 1880, p. 71.)

Medical Properties and Uses. Frasera is a mild tonic, calculated to meet the same indications with the other simple bitters. It has been thought to resemble columbo in medical properties as well as in appearance, and hence has received the popular name of *American columbo;* but experience has not confirmed the high estimate at one time formed of its virtues; and though, perhaps, still occasionally used in some places, it has failed to supplant the tonic of Mozambique. It may be given in powder or infusion. The dose of the former is from thirty grains to a drachm; that of an infusion, made in the proportion of an ounce of the bruised root to a pint of boiling water, is one or two fluidounces, to be repeated several times a day. The fresh root is said to operate as an emetic and cathartic, and has been given with a view to the latter effect.

FRAXINUS EXCELSIOR. The bark of the *Common European Ash* is bitter and astringent, and at one time was employed in the treatment of intermittent fever. Keller believed that he had found in the bark a peculiar crystallizable principle, which Buchner denominated *fraxinin;* but Rochleder and Schwartz have since shown that the crystals, formed along with the bitter substance obtained by the process of Keller, were nothing but mannite. (*Pharm. Centralblatt*, 1853, p. 312.) Since that period, a crystallizable bitter principle has been discovered by Salm-Horstmar, which has been named *fraxin* or *paviin.* It is obtained by precipitating the decoction with acetate of lead, washing the precipitate, decomposing it by sulphuretted hydrogen, and concentrating the solution, which deposits the fraxin in needle-shaped crystals. These are four-sided prisms, shining, white with a tinge of yellow, feebly bitter and astringent, inodorous, soluble with difficulty in cold but readily in hot water. These have the formula $C_{16}H_{18}O_{10}$. Fraxin is a glucoside, dilute acids decomposing it into *fraxetin*, $C_{10}H_8O_5$, and *glucose*, $C_6H_{12}O_6$. The concentrated warm solution has an acid reaction. When much diluted, it exhibits a clear blue fluorescence by daylight, especially if a trace of ammonia be present. Alkalies, alkaline earths, and the carbonates color it yellow; chloride of iron first colors it green, and then throws down a yellow precipitate. (*Chem. Centralblatt*, 1857, p. 452.) The *leaves* have been at different times recommended as an antidote to the poison of serpents, and as a remedy in scrofula, and in the treatment of gout and rheumatism. Drs. Pouget and Peyraud, of France, have spoken in the highest terms of their efficacy in rheumatic affections; and, upon the authority of the former, it is stated that they have been used for forty years by the peasants of Auvergne as a specific in gout. M. Garot has shown that they contain 16 per cent. of *malate of calcium*, to which it is thought their anti-arthritic virtues may be ascribed. (*Journ. de Pharm.*, 3e sér., xxiv. 311.) Prof. Gintl confirmed this (*Ibid.*, 4e sér., xii. 60). An ounce may be infused in half a pint of boiling water, and taken three times a day. (See *Am. Journ. of Med. Sci.*, N. S., xxv. 492.)

Fraxinus Americana. White Ash. The bark of the white ash has been used in the treatment of dysmenorrhœa, by Dr. Chas. P. Turner and others, of Philadelphia. A *wine of white ash bark* is proposed by Thos. S. Wiegand (*A. J. P.*, 1882), made by macerating eight troyounces of powdered bark for three days in one pint of sherry wine, then transferring to a percolator, pouring on sufficient menstruum to obtain two pints of percolate. The dose is a teaspoonful.

FRENCH CHALK. A compact, unctuous, indurated talc, of a greenish color, glossy, somewhat translucent, soft and easily scratched, and leaving a silvery line on paper; used chiefly for marking cloth, and for extracting grease-spots.

FRUIT ESSENCES, ARTIFICIAL. Several of the compound ethers have been found to possess the odor and flavor of certain fruits, a property which has led to their employment as flavoring materials for confectionery and desserts, under the name of fruit essences. The simple ethers present in these compounds, so far as they have become of commercial importance, are common ether or oxide of ethyl, which should be called ethylic ether, and oxide of amyl or amylic ether. Each of these ethers possesses basic properties, and has its alcohol; common or ethylic ether corresponding to common or ethylic alcohol, and amylic ether to amylic alcohol or fusel oil. These alcohols are hydrates of ethyl and amyl respectively. (See *Alcohol Amylicum*, and *Alcohol*, Part I.) Colored artificial essences are to be distinguished from the real by the following tests, founded upon the presence of anilin. Fuchsin dyes a woollen or silken thread a permanent rose color, the tint imparted by natural fruit-juice washes out (C. Puscher, *Journ. de Pharm.*, 4e sér., xlv. 395); dilute mineral acids redden natural fruit essences, turning yellow those containing an anilin dye; half a volume of nitric acid *instantly* turns an artificial syrup yellow; carbonate of potassium reddens artificial syrups, but has no effect on natural syrups; subacetate of lead precipitates red with fuchsin, green with natural fruit. (M. Vandeyvere, *Journ. de Pharm.*, 4e sér., x. 457; Dr. Hager, *A. J. P.*, xlv. 395.)

Butyrate of Ethyl. Butyric Ether. $C_4H_7(C_2H_5)O_2$. This ether is readily prepared by mixing 100 parts of butyric acid with 100 of alcohol and 50 of concentrated sulphuric acid, and agitating the mixture for a short time. The ether forms a layer on the surface, and may be purified by washing it with water and subjecting it to the action of chloride of calcium. Butyric ether is sparingly soluble in water, but very soluble in alcohol, and boils at 110° C. (230° F.). It is said to be much used to communicate a pine-apple flavor to rum. Dissolved in 8 or 10 parts of alcohol, it forms the *pine-apple essence.* From 20 to 25 drops of this essence, added to a pound of sugar containing a little citric acid, imparts to the mixture a strong taste of pine-apple. *Butyric acid*, $C_4H_8O_2$, is formed during what is called the butyric fermentation, which usually consumes two or three months before it is completed, and which is preceded by the lactic fermentation. To prepare it, a solution of grape sugar is mixed with half its weight of chalk, and with about one-tenth of its weight of cheese to act as a ferment, and the whole is kept at the temperature of 32·2° C. (90° F.). The sugar is first transformed into a viscous substance, and afterwards into lactic acid, which is gradually converted into butyric acid, with the disengagement of hydrogen and carbonic acid. At the end of the fermentation, the liquid contains principally a mixture of butyrate and lactate of calcium, from which the butyric acid may be obtained by precipitating the lime as a carbonate by carbonate of sodium, and decomposing the resulting butyrate of sodium with sulphuric acid. Butyric acid is a colorless liquid, having a very disagreeable odor and a rancid taste. It dissolves in all proportions in water and alcohol, boils at 157° C. (314·6° F.), and has the density 0·973.

Pelargonate of Ethyl. Ethyl Pelargonate. Pelargonic Ether. Œnanthic Ether. (C_2H_5, $C_9H_{17}O_2$.) A preliminary step in forming this ether is to prepare the *pelargonic acid.* This is most conveniently obtained, according to Dr. R. Wagner, by the action of nitric acid on oil of rue. Treat the oil with double its weight of very dilute nitric acid, and heat the mixture until it begins to boil. Two layers are formed in the liquid; the upper one being brownish, and the lower consisting of the products of the oxidation of the oil, with the excess of nitric acid. The lower layer, having been separated, is freed from the greater part of the nitric acid by evaporation in a chloride of zinc bath, and then filtered. The filtrate is a solution of pelargonic acid, and may be converted into pelargonic ether by a prolonged digestion, at a gentle heat, with alcohol. The ether as thus prepared has the agreeable odor of quince, and, when dissolved in alcohol in due proportion, forms the *quince essence.* (See *A. J. P.*, 1853, p. 320.) It is also obtained from wine lees, by adding sulphuric acid and water, and distilling in a current of steam. *Pure* pelargonic ether (œnanthic ether) is a colorless liquid, having a peculiar, vinous, stupefying odor, and a taste at first slight but afterwards acrid. Its sp. gr. is 0·872, and its boiling point, when constant, 222·7° C. (433° F.). (*Delffs.*) It is insoluble in water, but dissolves readily in alcohol and ether. Pelargonic acid, first obtained from *Pelargonium roseum*, or rose geranium, belongs to the fatty acid series, and has the formula $C_9H_{18}O_2$. Delffs's analysis of œnanthic acid gives it the same composition; and, accordingly, he considers the two acids as undoubtedly identical. (*Chem. Gaz.*, 1852, p. 144.)

Acetate of Amyl. Acetate of Pentyl. Amyl Acetate. (C_5H_{11},$C_2H_3O_2$.) This is prepared by distilling a mixture of one part of amylic alcohol (fusel oil), two of acetate of potassium, and one of concentrated sulphuric acid. The distilled liquid is purified from free acid by washing with a weak alkaline solution, and from water by distillation from chloride of calcium. It is a colorless, limpid liquid, lighter than water, boiling at 140° C. (284° F.), insoluble in water, but soluble in alcohol. It possesses the odor, in a remarkable degree, of the Jargonelle pear, and is manufactured on a large scale for flavoring syrups and confectionery. An alcoholic solution of this ether forms the *Jargonelle pear essence.* Fifteen parts of acetate of amylic ether, with half a part of acetic ether, dissolved in 100 parts of alcohol, form what may be called the *bergamot pear essence*, which, when employed to flavor sugar acidulated with a little citric acid, imparts the odor of the bergamot pear, and a fruity, refreshing taste. Acetate of amyl, mixed with butyric ether, forms another fruity compound, which recalls the odor of the banana, and forms, in alcoholic solution, the *banana essence.*

Valerianate of Amyl. (C_5H_{11},$C_5H_9O_2$.) *Amyl Valerate. Apple Oil.* This is made by carefully mixing four parts of pure amylic alcohol (fusel oil) with four of sulphuric acid, and adding the mixture, when cold, to five parts of valerianic acid. The whole is warmed for a few minutes in a water-bath, and then mixed with a little water, which causes the ether to separate. Lastly, it is purified by washing it with water and a weak solution of carbonate of sodium. An alcoholic solution of this ether, in the proportion of one part to six or eight of alcohol, forms a flavoring liquid under the name of *apple essence.* See *Acidum Valerianicum.*

Besides the essences here described, there are found in commerce the strawberry, raspberry, apricot, greengage, mulberry, and black currant essences, all of which may be viewed as various mixtures of the ethers of the ethyl and amyl series, modified by the addition of pure nitrous ether, tincture of orris, vanilla, volatile oils, etc., to bring about a resemblance to the fruit the odor and taste of which it is the object to imitate. In making these essences it is important that the materials should be pure, especially the fusel oil and alcohol. The alcohol used as a solvent should be rectified and deodorized.

The fruit essences are extensively employed for flavoring ices, jellies, lozenges, and drops, and for making fruit syrups and effervescent beverages.

M. Kletzinski prepared a table giving the ingredients, and their proportions, of a large number of fruit essences. This table has been carefully revised, as several important errors occurred in it. They are alcoholic solutions of different ethers, to which are sometimes added certain acid and natural essences. Glycerin is present in nearly all, being useful in blending and harmonizing the different flavors. The alcohol and other ingredients must be chemically pure. Each column represents the number of measures to be added to 100 measures of alcohol.

Names of the Essences.	Chloroform.	Nitrous Ether.	Aldehyd.	Acetic Ether.	Formic Ether.	Butyric Ether.	Valerianic Ether.	Benzoic Ether.	Œnanthylic Ether.	Oil of Persicot.	Sebacic Ether.	Methyl-Salicylic Ether.	Amylic Alcohol.	Amyl-Acetic Ether.	Amyl-Butyric Ether.	Amyl-Valerianic Ether.	Oil of Lemon.	Oil of Orange.	Alcoholic Solutions saturated in the cold of				Glycerin.
																			Tartaric Acid.	Oxalic Acid.	Succinic Acid.	Benzoic Acid.	
Pine-apple	1	...	1	...	...	5	...	...	...	...	...	...	...	...	10	...	...	...	...	...	...	...	3
Melon	...	—	2	..	1	4	5	...	...	...	10	...	...	...	...	...	...	...	...	...	...	...	3
Strawberry	...	1	...	5	1	5	...	...	...	...	...	1	...	3	2	...	...	...	...	...	...	...	2
Raspberry	...	1	1	5	1	1	...	1	1	...	1	1	...	1	1	...	...	...	5	...	1	...	4
Gooseberry	...	...	1	5	...	...	...	1	1	...	...	...	...	...	...	...	...	...	5	...	1	1	......
Grape	2	...	2	...	2	...	...	...	10	...	...	1	...	...	...	...	...	...	5	...	3	...	10
Apple	1	1	2	1	...	...	...	...	...	...	...	...	...	...	...	10	...	...	...	1	...	...	4
Orange	2	...	2	5	1	1	...	1	...	...	...	1	...	1	...	...	...	10	1	...	...	...	10
Pear	...	...	...	5	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	2
Lemon	1	1	2	10	...	...	...	...	...	...	...	...	...	...	...	...	10	...	10	...	1	...	5
Black Cherry	...	...	...	10	...	...	...	5	...	2	...	...	...	...	...	...	...	...	...	1	...	2	......
Cherry	...	...	...	5	...	...	...	5	1	...	...	...	...	...	...	...	...	...	...	...	...	1	3
Plum	...	...	5	5	1	2	...	...	...	4	...	...	...	...	...	...	...	...	...	...	...	...	8
Apricot	1	...	...	...	...	10	5	...	1	...	...	...	2	...	1	...	...	...	1	...	...	...	4
Peach	...	...	2	5	5	5	5	...	...	5	1	...	2	...	...	...	...	...	...	...	...	...	5
Currant	...	...	1	5	...	...	...	1	1	...	...	...	...	...	...	...	...	...	5	...	1	1	......

FUCUS VESICULOSUS. *Sea-wrack. Bladder-wrack.* This sea-weed is perennial, with the frond or leaf flat, smooth and glossy, from one to four feet long, from half an inch to an inch and a half broad, furnished with a midrib throughout its length, dichotomous, entire upon the margin, and of a dark olive-green color. Small spherical vesicles, filled with air, are immersed in the frond near the midrib. The air in these vesicles has not the exact composition of the atmosphere; consisting, according to the analysis of M. Ernest Baudrimont, in one instance of 28·4 per cent. of oxygen and 71·6 of nitrogen, in another of 26·5 of the former and 73·5 of the latter. (*Journ. de Pharm.*, 4e sér., ii. 446.) The fruit consists of roundish, compressed receptacles, at the ends of the branches, filled with a clear tasteless mucus. The plant grows upon the shores of Europe and of this continent, attaching itself to the rocks by its expanded woody root. On the coasts of Scotland and France, it is much used in the preparation of kelp. It is also employed as a manure, and is mixed with the fodder of cattle. It has a peculiar odor, and a nauseous saline taste. Several chemists have undertaken its analysis, but the results are not satisfactory. It contains much soda in saline combination, and iodine, according to Gaultier de Claubry, in the state of iodide of potassium. M. Convoy has found in it 0·21 per cent. of iodine. (*P. J. Tr.*, x. 434.) These ingredients remain in its ashes, and in the charcoal resulting from its exposure to heat in close vessels. *F. vesiculosus* is not always richer in iodine than certain other algæ, circumstances of growth having much influence in the matter. (See *Journ. de Pharm.*, 4e sér., ii. 276; *Proc. A. P. A.*, xxvii. 133.) On the coast of France about a dozen species of sea-weed are used with it in making kelp. M. Eugène Marchand has ascertained that, though the ashes of the *Fucus vesiculosus* contain iodine, yet this species is one of those poorest in this constituent; and those of *Fucus digitatus* contain seven or eight times more. Consequently, if it be for the iodine that these plants are chiefly valuable, the latter is greatly preferable to the former. (*Journ. de Pharm.*, 4e sér., ii. 276.)

The charcoal, which is sometimes called *Æthiops vegetabilis* or *vegetable ethiops*, has long had the reputation of a deobstruent, and been given in goitre and scrofulous swellings. The mucus contained in the vesicles was applied externally, with advantage, by Dr. Russell, as a resolvent in scrofulous tumors. M. Duchesne Duparc has obtained from it very good results in the treatment of morbid obesity. He employs the whole plant, either in substance in the form of pill, in decoction, or in extract. It is not till two or three weeks after beginning with the remedy that its effects in diminishing the obesity begin to be perceived, and one of the first signs of its favorable action in this respect is the increase of the urine, and the appearance of a black pellicle on its surface. Dr. Godsfrey confirms the statements of M. Duchesne. (*Journ. de Pharm.*, 1862, p. 65.) Dr. A. T. Carson affirms, however, that the *Fucus vesiculosus* is largely used in Ireland for fattening pigs; and it is doubtful whether its preparations are capable of reducing human obesity unless given in such doses as to interfere with digestion and injure the health. M. Dannecy prepares the extract from the plant, collected at the period of fructification about the end of June, in the neighborhood of Bordeaux, and rapidly dried in the sun. This mode of desiccation is important, as when dried by artificial heat the plant never becomes friable, and always retains its hygroscopic qualities. When sufficiently dry to be friable, he treats it, in the state of coarse powder, for three days, with four times its weight of alcohol of 86°, expresses at the end of this time, and subjects the residue twice successively to a similar treatment with alcohol of 54°. The tinctures are then mixed, the alcohol distilled off, and the remainder evaporated to the consistence of an extract. Of this extract, which is one-fifteenth of the plant, three pills, each containing 25 centigrammes (3·75 grains), may be taken daily in the beginning, and increased gradually to twenty-four pills, a quantity which has often been attained without the slightest derangement of the stomach. The commencing dose would be about equivalent to twenty grains of the powder three times a day. (*Journ. de Pharm.*, 1862, p. 434.) A syrup may be readily prepared by dissolving the extract in a little diluted alcohol, and mixing this with syrup, in such proportion that a teaspoonful of the syrup shall contain a dose of the extract.

Other species of Fucus are in all probability possessed of similar properties. Many of them contain a gelatinous matter, and a sweet principle analogous to mannite; and some are used as food in times of scarcity. Large quantities of a sea-weed, named in the East *agar-agar*, are gathered on the rocky coasts of the East India Islands, and sent to China, where it is valued for making jellies, and as a size for stiffening silks. The *Ceylon moss* is a delicate fucus (*Gigartina lichenoides*), growing on the coast of Ceylon, where it is gathered by the natives. It abounds in starch and vegetable jelly, which render it applicable to the same purposes as the carrageen or Irish moss. (*P. J. Tr.*, xiii. 355.) *F. Helminthocorton* (*Gigartina Helminthocorton* of Greville) has some reputation in Europe as an anthelmintic, and is said also to be febrifuge. It is an ingredient in the mixture of marine plants sold in Europe under the name of *Corsican moss* or *helminthocorton.* This is used in decoction, from four to six drachms being boiled in a pint of water, and a wineglassful given three times a day.

Attention has been called by Dr. Sloan, of Ayr, Scotland, to the *Laminaria digitata*, commonly called *sea-girdles* or *tangles*, which grows about the shores of Scotland, as supplying an admirable material for bougies. The stem is from two to twelve feet long, and an inch or more in breadth, is of great strength and tenacity, with the property of drying readily, and, in doing so, of shrinking much, and acquiring an elastic firmness, with a consistence, if the desiccation be arrested at the proper point, somewhat softer than horn. In this state the plant may be kept for years; and, if at any time exposed to moisture, will absorb it readily, and swell up to the original size. This last property renders it especially applicable for the formation of bougies or tents to be used in the dilatation of strictures and sinuses, for which purpose it was recommended by Dr. Sloan, and has been found useful by others. Mr. M. H. Collis, of the Meath Hospital, Dublin, commends it highly, in a paper on the subject communicated to the *Dublin Quarterly Journ. of Med. Sci.* (1864, p. 373), to which the reader is referred for further information on the subject.

FULIGOKALI. This preparation, proposed by M. Deschamps, is formed by boiling for an hour, 20 parts of caustic potassa, and 100 of shining soot, in powder, in a sufficient quantity of water. The solution, when cold, is diluted, filtered, and evaporated to dryness. Fuligokali is in the form of a black powder, or of scales, very soluble in water, and having an empyreumatic odor and mild alkaline taste. It is used in the same affections as *anthrakokali.* The dose is two or three grains, repeated several times a day. An ointment, containing from 16 to 32 grains to the ounce of lard, was found by Dr. Gibert, of Paris, to be detersive, resolvent, and gently stimulant. (*A. J. P.*, xiv. 284.)

FUMARINA OFFICINALIS. *Fumitory.* A small annual European plant, naturalized in this country, growing in cultivated grounds, and flowering from May to August. It was formerly considerably employed as a medicine, and is still used in Europe. The leaves are the officinal part. They are inodorous, have a bitter, saline taste, and are very succulent, yielding by expression a juice which has the sensible and medicinal properties of the plant. An extract, prepared by evaporating the expressed juice or a decoction of the leaves, throws out upon its surface a copious saline efflorescence. M. Hannon, of Belgium, ascribes the virtues of fumitory to an alkaloid, called *fumarine* (*fumarina*), which was first observed by Peschier. He obtained it by treating the pulp of the leaves with concentrated acetic acid, with the aid of heat, filtering, evaporating the liquid, treating the extract with boiling alcohol, filtering the alcoholic solution, and, finally, decolorizing, and evaporating so that crystals might form. The acetate thus procured was decomposed by the alkalies, and yielded the fumarine. Fumitory has been considered gently tonic, alterative, and, in large doses, laxative and diuretic. But M. Hannon considers it mainly sedative, and states that its prolonged use diminishes plethora, and may even produce anæmia. He has found fumarine, in the dose of about one-third or one-fourth of a grain, to be moderately excitant; in that of three grains, to be at first irritant and afterwards sedative. (*Ann. de Thérap.*, 1854, p. 78.) Both in ancient and modern times fumitory has been esteemed a valuable remedy in visceral obstructions, particularly those of the liver, in scorbutic affections, and in various troublesome eruptive diseases. Cullen speaks favorably of it in these last complaints. He gave two ounces of the expressed juice twice a day. Others have prescribed it in much larger quantities. The leaves, either fresh or dried, may be used in decoction or extract, without precise limitation as regards the dose. The inspissated juice has also been employed.

FUSTIC. A yellow dye-wood, obtained from *Morus tinctoria* (*Broussonetia tinctoria*, Kunth), a tree growing in the West Indies and South America. It is not used in medicine or pharmacy. According to Bancroft, two different woods bear in England the name of fustic, one the product of the tree just mentioned, distinguished as *old fustic*, probably from the greater magnitude of the billets in which it is imported; the other derived from the *Rhus Cotinus* or *Venice sumach*, and called *young fustic*, or sometimes *Hungarian fustic*. The wood of *M. tinctoria* owes its coloring properties to two principles, which have been isolated by R. Wagner; one denominated *morin* and the other *moritannic acid*, from its resemblance to tannin. (See *Chem. Gaz*, ix. 1, 21, and 241.) From the fustic of *Rhus Cotinus* or Hungarian fustic, M. Chevreul extracted a yellow coloring matter, in small crystalline needles when pure, which he called *fisetin* or *fisetic acid*, and a red substance, of which he was unable to say whether it pre-existed in the fustic, or was formed from the fisetin. (*Chem. News*, 1865, p. 126.) Koch, who has since prepared the pure fisetin, gives it the formula $C_{15}H_{10}O_6$, making it distinct from quercetin, to which it was thought to be closely related. (*Ber. Chem. Ges*, 1872, p. 235.)

GALANGAL. *Galanga. China Root. India Root.* Two varieties are described by authors, the *galanga major* and *galanga minor*, or *large* and *small galangal*. They are probably the roots of different plants. The large galangal is derived from *Maranta Galanga* of Linn. (*Alpinia Galanga* of Willd.) According to Dr. H. F. Hance, of Canton, the smaller galangal is the product of a distinct but closely allied plant, *Alpinia officinarum*, Hance. (*A. J. P.*, xliii. 408.) Both forms are brought from the East Indies. The *larger variety* is cylindrical, three or four inches long, as thick as the thumb or thicker, often forked, reddish brown externally, slightly striated longitudinally, marked with whitish circular rings, orange brown internally, rather hard and fibrous, difficultly pulverizable, of an agreeable aromatic odor, and a pungent, hot, spicy, permanent taste. The *small galangal* resembles the preceding in shape, but is smaller, not exceeding the little finger in thickness, of a darker color, and of a stronger taste and smell. According to Morin, galangal contains a volatile oil, an acrid resin, extractive, gum, bassorin, and lignin. A. Vogel, jun., found also starch and fixed oil. (*Pharm. Centralblatt*, 1844, p. 158.) R. Brandes discovered a peculiar crystallizable substance called *kempferid*. (*Annal. der Pharm.*, xxxii. 311.) The active principles are the volatile oil and acrid resin. The medical effects of galangal are those of a stimulant aromatic. It was known to the ancient Greeks and Arabians, and formerly entered into numerous compounds. (*A. J. P.*, xliii. 454.) At present it is seldom employed. Its dose is from fifteen to thirty grains in substance, and twice as much in infusion.

GALEGA OFFICINALIS. *Goat's Rue.* A perennial herb, growing in the south of Europe, and sometimes cultivated in gardens. It is without smell unless bruised, when it emits a disagreeable odor. Its taste is unpleasantly bitter and somewhat rough, and when chewed it stains the saliva yellowish brown. In former times it was much employed as a remedy in malignant fevers, the plague, the bites of serpents, worms, etc.; but it has fallen into merited neglect. It is affirmed to improve both the quality and quantity of the milk in nursing women. (*A. J. P.*, xliv. 106.) The roots of *Galega Virginiana*, a native of the United States, are said to be diaphoretic and powerfully anthelmintic. They are given in decoction.

GALIUM APARINE. *Cleavers. Goose-grass.* This is an annual, succulent plant, common to Europe and the United States, growing in cultivated grounds, and along fences and hedges. It is inodorous, and has a bitterish, herbaceous, somewhat acrid taste. Analyzed by Schwartz, it was found, besides chlorophyll, starch, and other principles common to all plants, to contain three distinct acids, viz., a variety of tannic acid, which he names *galitannic acid*, citric acid, and a peculiar acid, previously discovered by Schwartz and Rochleder, and named *rubichloric acid*. (*P. J. Tr.*, xii. 190.) The expressed juice is said to be aperient, diuretic, and antiscorbutic, and has been used in dropsy, congestion of the spleen, scrofula, scorbutic eruptions, and lepra. In the two last complaints it has been thought peculiarly useful. (*Med. Times and Gaz.*, 1854, p. 144.) Three ounces of the juice may be taken twice a day. Dr. Winn, of Truro, Cornwall, commends it in lepra. The fresh herb, in the form of ointment or decoction, has been applied externally to scrofulous swellings with supposed advantage.

GALIUM VERUM. *Yellow Ladies' Bedstraw. Cheese Rennet.* This species of Galium is perennial, and a native of Europe. The flowers, which are yellow, have a peculiar agreeable odor, and have been used as an antispasmodic. The herb is inodorous, but has an astringent, acidulous, bitterish taste. The property of coagulating milk was formerly ascribed to it, but is certainly not constant, as the experiment has been frequently tried without success. The bruised plant is sometimes used to color cheese yellow, being introduced into the milk before coagulation. It is also used for dyeing yellow. The roots of this and of most other species dye red; and the plant, eaten by animals, colors the bones like madder. Schwartz found the same principles in it as in *G. Aparine*. It was formerly highly esteemed as a remedy in epilepsy and hysteria, and was applied externally in cutaneous eruptions. It may be employed in the form either of the recently expressed juice, or of a decoction prepared from the fresh plant. Its medical properties, however, are feeble. Testimony has been given in France to the special efficacy of *Galium palustre* in epilepsy. (*Ann. de Thérap.*, 1863, p. 77.) Of the American species, *G. tinctorium* is closely allied in properties to *G. verum*. It is said to be useful in cutaneous diseases; and the root is employed by the Indians for staining their feathers and other ornaments red. *G. triflorum* contains coumarin, as pointed out by L. von Cotzhausen. (*A. J. P.*, 1876, p. 405.)

GARDENIA GRANDIFLORA. A Chinese tree, the fruit of which is employed in dyeing the yellow robes of the mandarins; and, according to Lorenz Mayer, contains *crocin*. In powder, it is of a bright red color, and is soluble in water and alcohol. By treatment with hydrochloric acid, it yields another coloring substance called *crocetin*, which is a true dye-stuff. (*Chem. Gaz.*, 1858, p. 331.) The fruit of another species, *G. campanulata*, growing in the forests of Chittagong, in India, is said to be used by the natives as a cathartic and anthelmintic. (Lindley, *Flor. Med.*, p. 434.)

GARRYA FREMONTII. *Skunk Bush.* This Californian plant has been analyzed by Mr. D. W. Ross, who asserts that he found in it a new alkaloid, *Garryine*. (*A. J. P.*, 1877, p. 585.)

GENISTA TINCTORIA. *Dyers' Broom. Dyers' Weed. Green Weed.* A low shrub, growing wild in Europe, and sometimes cultivated in this country in gardens. The flowering tops of the plant are employed to dye yellow, whence its name was derived. Both these and the seeds have been used in medicine. They are said to be purgative and even emetic, especially the seeds, which were formerly given as a cathartic in the dose of a drachm and a half. By some authors they are said to be diuretic, and to be useful in dropsy.

GERANIUM ROBERTIANUM. *Herb Robert.* This species of geranium grows wild both in Europe and the United States, but is rare in this country; and Pursh states that the American plant is destitute of the heavy smell by which the European is so well known, though the two agree in all other respects. The herb has a disagreeable, bitterish, astringent taste, and imparts its virtues to boiling water. It has been used internally in intermittent fever, consumption, hemorrhage, nephritic complaints, jaundice, etc., has been employed as a gargle in affections of the throat, and has been applied externally as a resolvent to swollen breasts and other tumors.

GEUM. *Water Avens.* Several species belonging to this genus have been medicinally employed; but two or three only are deserving of particular notice—*Geum rivale*, which once had a place in the U. S. secondary list, *G. urbanum*, formerly recognized by the Dublin College, and perhaps *G. Virginianum*, an indigenous species, the root of which has been recommended in dysentery by Dr. W. A. Gibson, of St. Louis. (*Med. Record*, 1868, p. 384; from the *St. Louis Med. Reporter*.)

Geum urbanum, or *avens*, is a native of Europe, where it grows wild in shady places. The root, which is the part used, consists of a short oblong body, from a quarter to half an inch in thickness, externally brown, internally white towards the circumference and reddish at the centre, and furnished with numerous long descending fibres. When quite dry it is nearly inodorous; but in the recent state has a smell like that of cloves, whence it is sometimes called *radix caryophyllatæ*. The taste is bitterish and astringent. It imparts its virtues to water and alcohol, which it tinges red. Distilled with water it yields a thick, greenish-yellow volatile oil, and gives a pleasant flavor to the liquid. It contains, besides, according to Trommsdorff, tannic acid, which is abundant, a tasteless resin, gum, bassorin, and lignin. It has been much used in Europe as a tonic and astringent, in chronic and passive hemorrhages, chronic dysentery and diarrhœa, leucorrhœa, intermittent fever, etc. The dose is from thirty grains to a drachm of the powder three or four times a day, or an equivalent quantity in decoction.

Geum rivale. Willd. *Sp. Plant.* ii. 1115; *Engl. Bot.* 106. *Water avens* has a perennial, horizontal, jointed, scaly, tapering root, about six inches long, of a reddish-brown color externally, white internally, and furnished with numerous descending yellowish fibres. One or more stems rise from the same root, which also sends up numerous leaves. The stems are about a foot and a half high, simple, erect, pubescent, and of a purplish color. The radical leaves are interruptedly pinnate, with large terminal leaflets, and long, hairy footstalks; those of the stem are petiolate, and divided into three serrate, pointed segments. The flowers are few, solitary, nodding, yellowish purple, and supported on axillary and terminal peduncles. The color of the stems and flowers gave rise to the name of *purple avens*, sometimes applied to the plant. The calyx is inferior, with ten lanceolate, pointed segments, of which the five alternate are smaller than the others. The petals are five, and as long as the calyx. The seeds are oval, with plumose awns, minutely uncinate, and nearly naked at the summit. This species of Geum is common to Europe and the United States; though the plant of this country has smaller flowers, with petals more rounded on the top, and leaves more deeply incised than the European. It delights in wet, boggy meadows, and extends from Canada into New England, New York, and Pennsylvania. Its flowers appear in June and July. The dried root is hard, brittle, easily pulverized, of a reddish or purplish color, without smell, and of an astringent, bitterish taste. Boiling water extracts its virtues.

Water avens is tonic and powerfully astringent. It may be used with advantage in chronic or passive hemorrhages, leucorrhœa, and diarrhœa; and is said to be beneficially employed in the Eastern States, as a popular remedy in the debility of phthisis pulmonalis, in simple dyspepsia, and in visceral diseases consequent on disorder of the stomach. In Europe it is sometimes substituted for the root of *common avens*, or *Geum urbanum* but is less esteemed. The dose of the powdered root is from a scruple to a drachm, to be repeated three times a day. The decoction, which is usually preferred, may be made by boiling an ounce of the root in a pint of water, and given in the quantity of one or two fluidounces. A weak decoction is sometimes used by invalids in New England as a substitute for tea and coffee.

GILLENIA. Under this name the U. S. Pharmacopœia formerly included in its secondary lists the roots of *G. trifoliata* and *G. stipulacea.*

Gillenia trifoliata, Bigelow, *Am. Med. Bot.* iii. 10; Barton, *Med. Bot.* i. 65; Carson, *Illust. of Med. Bot.* i. 40, pl. 34. This is an herbaceous plant, with a perennial root, consisting of many long, slender, brown branches, proceeding from a thick, tuberlike head. The stems, several of which usually rise from the same root, are two or three feet high, erect, slender, smooth, flexuose, branched, and commonly of a reddish color. The leaves are ternate, with very short petioles, and small linear-lanceolate stipules. The leaflets are ovate-lanceolate, sharply serrate, and acuminate. The flowers grow in a loose terminal nodding panicle, with long peduncles. The calyx is tubular campanulate, ventricose, and terminates in five-pointed segments. The corolla is composed of five linear-lanceolate, recurved petals, the two upper separated from the three lower, white, with a reddish tinge on their border, and of three times the length of the calyx. The stamens are twenty, the filaments short, the anthers small and yellow. Each flower is succeeded by five capsules, connate at the base, oblong, acuminate, gibbous without, acute within, two-valved, one-celled, opening inward, and containing each one or two oblong seeds.

This species of Gillenia grows throughout the United States, east of the Alleghany ridge, and, in Pennsylvania, may also be found abundantly west of these mountains. Pursh found it in Florida, and it extends as far north as Canada. It frequents light soils, in shady and moist situations, and flowers in June and July. The root should be gathered in September.

G. stipulacea. Barton, *Med. Bot.* i. 71. This species is also herbaceous and perennial, though much taller and more bushy than the preceding. The stems are brownish and branched. The upper leaves are ternate, lanceolate, serrate; the lower more deeply incised, becoming towards the root pinnatifid, and of a reddish-brown color at the margin. The stipules are ovate, acuminate, deeply serrate, resembling leaves, and marking the species at the first glance. The flowers are smaller than those of *G. trifoliata*, and grow on long slender peduncles in a lax corymb. In the valley of the Mississippi, this plant occupies the place of *G. trifoliata*, which is not found beyond the Muskingum. It grows as far north as the State of New York, extends through Ohio, Indiana, Illinois, and Missouri, and probably into the States south of the Ohio, as it has been found in Western Virginia. Its root is precisely similar to that of the Eastern species, and is reputed to possess the same properties.

The dried root of Gillenia (*Indian Physic, American Ipecacuanha*) is not thicker than a quill, wrinkled longitudinally with occasional transverse fissures, and, in the thicker pieces, presenting in some places an irregular, undulated, somewhat knotty appearance, arising from indentations on one side corresponding with prominences on the other. It is externally of a light brown color, and consists of a thick, somewhat reddish, brittle cortical portion, with an interior slender, tougher, whitish, ligneous cord. The bark, which is easily separable, has a bitter, not disagreeable taste; the wood is nearly insipid and comparatively inert, and should be rejected. The powder is of a light brownish color, and possesses a feeble odor, which is scarcely perceptible in the root. The bitterness is extracted by boiling water, which acquires the red color of wine. The root yields its bitterness also to alcohol. By various experimenters it has been shown to contain gum, starch, gallo-tannic acid, fatty matter, wax, resin, coloring matter, albumen, and lignin, besides salts. (*A. J. P.*, xxvi. 490.) The name of *gillenin* has been given, by Mr. W. B. Stanhope, to a substance obtained by first preparing an alcoholic extract, treating this with water, which took up various substances with a little of the active matter, then macerating the residue for ten days in water acidulated with sulphuric acid, saturating with magnesia, evaporating to dryness, and finally treating with alcohol, filtering, and allowing the alcoholic solution to evaporate spontaneously. The substance thus obtained was whitish, very bitter, slightly odorous, permanent in the air, soluble in water, alcohol, ether, and the dilute acids, and neutral to test-paper. Nitric acid rendered it blood-red, chromic acid green. Tannic acid produced no effect. It gave white precipitates with potassa, subacetate of lead, and tartar emetic. Half a grain of it produced nausea and retching. (*Ibid.*, xxviii. 202.)

Gillenia is a mild and efficient emetic, and, like most substances belonging to the same class, occasionally acts upon the bowels. In very small doses it has been thought to be tonic. It is much used by some practitioners in the country as a substitute for ipecacuanha, which it is said to resemble in its mode of operation. It was employed by the Indians, and became known as an emetic to the colonists at an early period. Linnæus was aware of its reputed virtues. The dose of the powdered root is from twenty to thirty grains, repeated at intervals of twenty minutes till it vomits.

GLASS OF ANTIMONY. *Vitrum Antimonii.* This is prepared from the tersulphide of antimony by a partial roasting and subsequent fusion. Glass of antimony is in thin irregular pieces, with a vitreous fracture, and a metallic steel-gray lustre. When well prepared, it is transparent, and, upon being held between the eye and the light, appears of a rich orange red or garnet color; but if of inferior quality it is black and opaque. It is hard and brittle, and rings when struck with a hard substance. It is insoluble in water, but soluble in acids and cream of tartar, with the exception of a few red flocculi. Its essential constituents are the teroxide and tersulphide, united in variable proportions. Sometimes *glass of lead* is sold for glass of antimony, a fraud readily detected by the difference between the two substances in specific gravity; glass of lead having a density of nearly seven, while that of glass of antimony is not quite five.

Medical Properties, etc. Glass of antimony is an active antimonial; but, owing to its variable composition and unequal operation, it is at present very seldom used. When the levigated powder is mixed with one-eighth of its weight of melted yellow wax, and the mixture roasted over a slow fire, with constant stirring, until it ceases to exhale vapors, a coal-like pulverizable mass is formed, which is the *cerated glass of antimony*, a preparation formerly included in the Edinburgh Pharmacopœia.

GLECHOMA HEDERACEA. *Nepeta Glechoma. Ground-ivy.* A small perennial, labiate herb, indigenous in Europe and the United States, and growing in shady, grassy places, as in orchards and along fences and hedges. The herb was formerly officinal, and still enjoys some credit as a domestic remedy. It has a peculiar disagreeable odor, and a bitterish, somewhat aromatic taste, and imparts its properties to boiling water. It is very prone to have galls developed on it, and to be infested with micromycetes. (*Journ. de Pharm.*, 1875, p. 127.) It is said to be gently stimulant and tonic, with, perhaps, a peculiar direction to the lungs and kidneys. It has also been considered aperient. It has been most used in chronic affections of the pulmonary and urinary organs, and at one time had considerable reputation as a remedy in consumption. A half drachm to a drachm was usually given in infusion as a dose.

GLOBULARIA ALYPUM. *Wild Senna of Europe.* This is a small shrub, growing on the European shores of the Mediterranean, the leaves of which have been occasionally used as a cathartic since the middle ages. Dr. Gustave Planchon, of Montpellier, France, states that the leaves of this species are a mild and efficient cathartic, without the griping properties of senna, and without leaving behind a tendency to constipate like rhubarb, which, however, it resembles in tonic power. One ounce is given for a dose in decoction. It is unknown in this country. (*P. J. Tr.*, xvi. 426.)

GLORIOSA SUPERBA. The roots, stalk, and leaves of this climbing liliaceous plant are said to be an acrid narcotic poison, and not infrequently used for suicidal purposes in India. Prof. C. J. H. Warden found in them two resins, and a very poisonous bitter principle, *superbine.* (*P. J. Tr.*, xi. 496.)

GLUE. An impure form of gelatin, obtained from various animal substances by boiling them in water, straining the solution, and evaporating it till upon cooling it assumes the consistence of jelly. The soft mass which results is then divided into thin slices, which are dried in the open air. Glue, when of good quality, is hard and brittle, of a color varying from light yellow to brown, and equally transparent throughout. It softens and swells very much in cold water, without dissolving; but is readily dissolved by hot water. It is soluble in a large proportion of glycerin, and with heat forms with it in smaller proportion a jelly. (Maisch, *A. J. P.*, xlii. 518.) It is employed chiefly for cementing pieces of wood, being generally too impure for the purpose of a test, or as an article of food. An *elastic and imputrescible preparation of glue*, useful for various purposes in the arts and in medicine, may be made by dissolving glue in water by means of a water-bath, concentrating the solution, then adding a weight of glycerin nearly equal to that of the glue employed, thoroughly mixing, evaporating the residue of the water, and finally pouring into moulds, or on a marble slab. It is especially applicable to the preparation of artificial anatomical specimens. (*Journ. de Pharm.*, 1857, p. 23.) The various *hectograph* compositions introduced within recent years for copying purposes are similar mixtures. One of the best copying masses is made by dissolving one part of glue or gelatin in a mixture of two parts of water and four parts of glycerin, with a few drops of carbolic acid, heating, straining, and adding three parts of sifted whiting or terra alba. (See *N. R.*, 1879, pp. 338, 364.) A good *liquid glue* may be made by rubbing up in two pints of rain-water, with the heat of a water-bath, 16 ounces of the best white glue and 4 ounces of dry white lead, until thoroughly mixed, then adding 4 fluidounces of alcohol, and continuing the heat and the agitation for a few minutes. The mixture is to be poured into bottles while still hot. (*Drug. Circular*, Oct. 1866.) A *liquid glue* may also be readily prepared by mixing in a stoppered bottle 38 parts of glue, properly divided, and 100 parts of acetic acid of commerce, the latter of which dissolves the glue as water dissolves gum. On exposure the acid evaporates, leaving the glue unchanged. (*Journ. de Pharm.*, 3e sér., xlvi. 35.) It is stated that an excellent *liquid glue* may be made by dissolving glue in sweet spirit of nitre. A mode of preparing *strong liquid glue*, recommended by M. Knaff, is to take three parts of good glue in small pieces, cover it with eight parts of water, and, after having allowed it to stand for some hours, add half a part of hydrochloric acid and three-fourths of a part of sulphate of zinc, and expose the whole for 10 or 12 hours to a heat from 8.1° C. (178° F.)–87.2° C. (189° F.). This does not gelatinize, and keeps well. (*A. J. P.*, 1868, p. 330; from *Journ. de Pharm.*) It is stated that a *water-proof* glue may be made by adding bichromate of potassium to the solution of glue just before using, in the proportion of one part to fifty of glue. (*A. J. P.*, xliii. 420.) *Chromatized gelatin*, obtained by the addition of one part of bichromate of potassium to five parts of a solution (5 or 10 per cent.) of gelatin, forms an excellent cement for glass. The surfaces to be united, after being smeared with the cement, are placed upon each other and exposed to the sun. After a few hours the adhesion is perfect and almost invisible, and boiling water itself has no action on the cement. (*Lond. Lancet*, Nov. 11, 1876; from *Journ. de Méd. de Bruxelles*, Juillet, 1876.) For other formulas for liquid glue, see *A. J. P.*, xliii. 421.

Capsules of Gelatin. Glue has within a few years been applied to an important practical purpose in pharmacy. Certain medicines are so offensive to the taste, and consequently so apt to sicken the stomach, that it is highly desirable to administer them in such a way as to prevent their contact with the tongue and palate. This object is fully accomplished, so far as regards many disagreeable liquid medicines, by the use of the *capsules of gelatin*. A polished bulb of iron, ivory, or bone, of the size and shape of the capsules required, and connected by a slender rod with a handle, is first greased by rubbing with an oiled cloth, and then dipped into a solution of gelatin made by heating six parts of pure gelatin with one of sweetened water. Upon being withdrawn, it is held for a short time so as to allow the excess of the solution to run off, and then fixed with the handle in a board, the coated bulb being upward, until the coating becomes cold and firm. The capsule is now removed by the fingers, and further dried by exposure on a tray. A number of capsules having been prepared, they are placed each in a small cell upon a board, with their mouths upward; and the liquid they are to contain is introduced by means of a syringe with a fine point. Their mouths are then closed with a drop of the solution of gelatin applied by means of a camel's-hair pencil, which is afterwards strengthened by an additional coating, given by dipping the mouth of the capsule into the solution diluted with a little water. (*Redwood's Supplement*, p. 664.) The capsules may be made of such a capacity as to contain from ten to fifteen grains of copaiba or other liquid. Capsules are now largely used for enclosing dry powders like quinine, etc. These are ovoid in shape, and after being filled with the powder by the pharmacist, are closed by putting upon the open end a rounded gelatin cap and pressing it down tightly. T. J. Whitfield, of Chicago, and F. E. Davenport have invented machines for filling the capsules.

Another application of gelatin has been proposed by Mr. A. F. Haselden; for the formation, namely, of capsules to the tops of bottles, as a substitute for sealing-wax or resin. For this purpose, to a pound of gelatin, after it has been melted with as little water as necessary, an ounce and a half of glycerin are to be added to give it pliability and toughness, and a little liquid cochineal to color it; the cork and neck of the bottle are then dipped into the liquid, which gives them a coating, which may be rendered as thick as required by repeating the immersion if necessary. These are the essentials of the operation, but various manipulations are necessary to meet all the demands of the case, for which we refer to Mr. Haselden's article in the *P. J. Tr.* (1866, p. 450).

GNAPHALIUM MARGARITACEUM. *Cudweed. Life-everlasting.* An indigenous herbaceous perennial, growing in fields and woods, and flowering in August. The herb of this species and of *G. polycephalum*, or *sweet-scented life-everlasting*, is sometimes used, in the form of tea, by the country people, in diseases of the chest and of the bowels, and in hemorrhagic affections, and externally, in the way of fomentation, in bruises, languid tumors, and other local complaints; but it probably possesses little medical virtue. Shoepf says that it is anodyne. In Europe different species of Gnaphalium are also occasionally employed for similar purposes. (See *Antennaria margaritacea.*)

GOLD. *Aurum.* The preparations of this metal were introduced to the notice of physicians by Dr. Chrestien, of Montpellier, in 1810. They are employed both internally and by friction on the tongue and gums. The principal affections in which they have been recommended are secondary syphilis, syphilitic ulcerations, scrofula, and inveterate eruptions, particularly those of a leprous character. The chief preparations which have been employed, up to the present time, are metallic gold in a finely divided state, the oxide (teroxide or auric acid), the chloride (terchloride), the iodide, the double chloride of gold and sodium, now officinal, the chloroaurate of ammonium (a compound of terchloride of gold and chloride of ammonium), and the cyanide (tercyanide) of gold. *Gold in powder* may be obtained by rubbing up gold-leaf with 10 or 12 times its weight of sulphate of potassium until brilliant particles are no longer visible, and then washing away the sulphate with boiling water. The *oxide* may be procured by treating the nitrohydrochloric solution of gold with an excess of magnesia, and washing the precipitate, first with water, and afterwards with dilute nitric acid. This process being tedious, M. L. Figuier prefers to obtain the oxide by precipitating the cold solution of chloride of gold, rendered strongly alkaline by caustic potassa, with a solution of chloride of barium. The precipitate, consisting of aurate of barium, is then treated with dilute nitric acid, which dissolves the barium and leaves the oxide of gold pure. Ten parts of gold, thus treated, produced 11·75 parts of oxide; while the same quantity of gold by the magnesia process yielded only 9 parts. (*Journ. de Pharm.*, Dec. 1847.) The *chloride* is obtained by dissolving pure gold in three times its weight of nitrohydrochloric acid, with the aid of a moderate heat. The solution is evaporated by a gentle heat nearly to dryness, being at the same time stirred with a glass rod. It is in the form of a crystalline mass of a deep red color. Its solution has a fine yellow tint. Being deliquescent, it requires to be kept in ground-stoppered bottles. (See *Auri et Sodii Chloridum.*) The *iodide* may be made by precipitating a solution of terchloride of gold by one of iodide of potassium, and washing the precipitate with alcohol to remove the excess of iodine. It is of a greenish-yellow color, and, when heated in a porcelain crucible, is resolved into iodine vapors and a residue of pure gold. The *chloraurate of ammonium* is formed by dissolving one part of the terchloride of gold and two parts of chloride of ammonium in distilled water, assisted by a few drops of nitrohydrochloric acid, and evaporating the solution to dryness by a gentle heat. The *cyanide* is best obtained, according to M. Oscar Figuier, as follows. Prepare the chloride of gold as neutral as possible by repeated solutions and crystallizations; and to the solution of this salt add, very cautiously, avoiding any excess, a solution of *pure* cyanide of potassium, so long as any precipitate falls. (See *Potassii Cyanidum.*) The precipitate, consisting of cyanide of gold, is to be washed with pure water, and dried in the dark. Gold in powder, and the oxide, chloride, iodide, sodio-chloride, and cyanide, are officinal in the French Codex.

The preparations of gold are decidedly poisonous, though in different degrees. The chloride is most virulent, and, according to Dr. Chrestien, is even more active than corrosive sublimate. In an overdose, it produces pain, inflammation, and even ulceration of the stomach and bowels, and otherwise acts as a corrosive poison. The general effect of these preparations, in moderate doses, is to produce increased fulness and frequency of the pulse, and to augment the urine and insensible perspiration, without interfering with the appetite to the regular action of the bowels; but, if the dose be pushed too far, general irritation is apt to be produced, inflammation seizes upon some organ, according to the predisposition of the individual, and fever is developed.

Gold in powder, the oxide, chloride, and *iodide* are not as much used as the double chloride of gold and sodium. The oxide may be given in the form of pill, containing the tenth of a grain, in scrofula and lymphatic swellings, beginning with one pill daily, and afterwards gradually increasing to seven or eight in twenty-four hours. The chloride has been used with advantage as a caustic in lupus, and in syphilitic tubercles and ulcers, by M. Chavannes. The iodide may be given in the same cases with the other preparations. The dose is from the fifteenth to the tenth of a grain.

Chloroaurate of ammonium has been recommended by Bouchardat in amenorrhœa and dysmenorrhœa in debilitated subjects, in the dose of about the tenth of a grain. A grain may be dissolved in five teaspoonfuls of alcohol and five of water. and a teaspoonful given morning and evening, mixed with sweetened water.

Cyanide of gold is employed, like the chloride of gold and sodium, mixed with inert powders by friction, and in the form of pill. The fifteenth of a grain may be rubbed into the gums daily for fifteen days, next the fourteenth of a grain for fourteen days, and so on, increasing until the dose amounts to the ninth or eighth of a grain. The dose for internal exhibition is the eighteenth of a grain, gradually increased to the eighth. Cyanide of gold has been found useful in the treatment of syphilis and scrofula by M. Pourché, and is said to be less exciting than the double chloride, when used in those diseases.

The different medicinal compounds of gold should not be prepared in pill, powder, or otherwise, until they are wanted for use; as they are liable to undergo decomposition when kept. They should be carefully secluded from the light.

GRASS-TREE GUM. An Australian product, said to be obtained by exudation from different species of Xanthorrhœa, especially *X. hastilis.* As described by Mr. P. L. Simmonds, it is of a resinous character, usually as found in the markets in the state of small fragments or coarse powder, resulting from the breaking up of the larger brittle masses in which it first occurs. It is of a deep reddish yellow color in mass, but greenish yellow in powder. It does not dissolve in the mouth when chewed, nor adhere to the teeth, but has a slightly astringent and aromatic flavor. It melts with heat, and at a higher temperature takes fire in the air, burning with a smoky flame, and emitting a fragrant odor not unlike that of balsam of Tolu. It yields picric acid largely under the action of nitric acid. It is recommended as a source of gas for illumination. The natives and early settlers are said to have used it as a medicine in diarrhœa. It is obtainable in inexhaustible quantities, as the plants producing it are abundant throughout almost the whole of Australia. (*A. J. P.*, 1866, p. 465.)

GRATIOLA OFFICINALIS. *Hedge-hyssop.* This is a perennial herb, indigenous in the south of Europe, where it flourishes in meadows and other moist grounds. The whole herb is used. It is nearly inodorous, but has a bitter nauseous taste. Both water and alcohol extract its active properties. Its chemical constitution has been investigated by Dr. F. G. Walz, who found the following constituents: 1. *gratiolin*, 2. *gratiosolin*, 3. *gratiolacrin*, 4. fixed oil, 5. a brown resin, 6. tannic acid, and 7. a volatile acid, the *antirrhinic* acid, which exists in many of the Scrophularineæ. These results are some what doubtful, however, and need further confirmation. (See *Chem. Centralblatt*, Oct. 1858, p. 689; also *A. J. P.*, July, 1859.) Hedge-hyssop is a drastic cathartic and emetic, possessing also diuretic properties, and is employed on the continent of Europe in dropsy, jaundice, worms, chronic hepatic affections, scrofula, and various other complaints. With us it is almost unknown as a remedy. The dose of the powdered herb is from fifteen to thirty grains; of the infusion, made in the proportion of half an ounce to the pint of boiling water, half a fluidounce.

GROUND NUTS. *Pea Nuts.* The fruit of *Arachis hypogæa*, a leguminous, annual plant, indigenous probably in Africa and South America, and abundantly cultivated in our Southern States, China, etc. Thirty thousand tons are said to be produced annually in Senegal, and the crop of 1876 in the United States was valued at $3,000,000. A remarkable property of the plant is that its fruit ripens under the surface of the ground, into which the pods penetrate in the progress of their growth. The seeds constitute the well-known ground nuts of our markets, which consist of a dry, brittle envelope, and a yellowish-white kernel. When roasted, ground nuts constitute for many a very agreeable article of food, and in the South are said to be much used as a substitute for coffee. They are, however, chiefly valuable on account of their richness in a fixed oil, which amounts to more than twenty per cent. It is obtained by expression; the nuts being ground into a paste, and moderately heated before being submitted to pressure. The oil consists of the glycerides of four different fatty acids. The chief of these is *oleic acid*, $C_{18}H_{34}O_2$, with which is associated *hypogæic acid*, $C_{16}H_{30}O_2$, *palmitic acid*, $C_{16}H_{32}O_2$, and *arachic acid*, $C_{20}H_{40}O_2$. As described by Mr. Jonas Winter, the oil has a bright yellow color, the characteristic odor of the fruit, and a mild not unpleasant taste. It is soluble in all proportions in ether, chloroform, and benzin, but insoluble in alcohol. Its sp. gr. is 0·918 at 15·5° C. (60° F.). At 3·3° C. (38° F.) it thickens, at 0° C. (32° F.) congeals imperfectly, and at 326·6° C. (620° F.) is decomposed, giving out spontaneously inflammable vapors. Mr. Winter made experiments to ascertain how far it might be employed with advantage in pharmacy, and found that it answered well in the preparation of cerates and ointments, but would not serve as a substitute for olive oil in the preparation of lead-plaster. It is a non-drying oil, and will not therefore answer for painting; but it is enormously used for adulteration and for various purposes in the arts, as for lubricating machinery, and in the manufacture of woollen cloths; in lamps it gives even a better light than sperm oil. (*A. J. P.*, 1860, p. 292.)

GUACO. This name is given in Central and South America, and the West Indies, to various plants having supposed alexipharmic properties, and belonging to the genera Mikania and Aristolochia; but it is to the different species of the former genus that the appellative properly belongs, especially to *Mikania Guaco*, described by Humboldt and Bonpland. (*Pl. Æq.* ii. 84.) The plants are closely allied to the Eupatoria. For their generic character, see *Lindley's Flora Medica*, and *Griffith's Medical Botany*. *Mikania Guaco* is described as having twining stems, with round, sulcate, and hairy branches; ovate, subacuminate, remotely dentate leaves, somewhat narrowed at the base, rough above, and hairy beneath; and flowers in opposite axillary corymbs. The plant is a native of intertropical America, and has been introduced into the West India Islands from the continent. The leaves are the part used. In the recent state they have a bitter taste, and a strong disagreeable odor; but their sensible properties and medical virtues are impaired by drying.

This and other plants have long been employed by the natives as a preventive and cure of the bites of poisonous serpents. This application of them was first made known by Mutis; and his account was confirmed by Humboldt and Bonpland. Very naturally the guaco came afterwards to be considered as antisyphilitic. The medicine has also been employed as a febrifuge and anthelmintic, and a few years since attracted considerable attention for its supposed prophylactic and remedial powers in epidemic cholera and chronic diarrhœa. According to Guibourt, however, the medicine used in France, under the name of guaco, was composed almost entirely of three or four species of Aristolochia, which, as before stated, are used in some parts of Mexico, as antidotes for snake poison, under the name of guaco. The medicine has, moreover, been recommended in chronic rheumatism, both internally and locally, and as an application to bites of insects, bruises and sprains, and atonic deafness. The probability is that, like eupatorium, it has simply the virtues of a mild tonic, and gentle stimulant to the secretions. It is best employed in the recent state. The natives, when employing it as a counterpoison, apply the bruised leaves and expressed juice to the bite, and at the same time drink of the infusion. It is highly recommended by Dr. E. W. Pritchard in the gouty paroxysm, in which he has seldom known it to fail giving more or less relief. He gives from half a drachm to a drachm of the tincture every four hours, and applies it locally at the same time. (*P. J. Tr.*, 1861, p. 288.) The preparations recommended for internal use are chiefly an infusion and tincture, the former made in the proportion of an ounce of the leaves to a pint of boiling water, the latter of about a pound to the gallon of proof spirit. The dose may be about the same as that of analogous preparations of eupatorium. (See *Lond. Med. Times and Gaz.*, 1852, p. 651; and *Journ. de Pharm.*, 3e sér., xx. 357.) The result of a long and close investigation into the natural history of guaco by the distinguished Guibourt is, that the *Mikania Guaco*, instead of possessing, as has been asserted, a strong, penetrating, and nauseous odor, is in fact inodorous, and destitute of all active properties; and that the strongly aromatic plants which have been employed under the name of guaco all belong to the genus Aristolochia, especially *A. cymbifera* of Martius, growing in Brazil, after this *A. maxima* (De Cand.), and in less degree *A. geminiflora* of Kunth. (*Journ. de Pharm.*, 1867, p. 99.)

GUANO. *Bird-manure.* This is a valuable manure, consisting of the decomposed excrement of countless aquatic birds, which has accumulated for ages on certain barren and uninhabited islets of the western coasts of South America, and in other localities throughout the world. The best comes from Peru, and will be here described. It is a coarse dry powder of a brown color. Exposed to the air it absorbs moisture, and becomes somewhat sticky. Its smell is offensive, and slightly ammoniacal. With the powder are intermingled friable lumps, which exhibit in their inside whitish specks, and which, when exposed to the air, fall to powder, exhaling an ammoniacal smell. It is soluble in great part in water, and the solution formed contains chiefly oxalate of ammonium. When exposed to heat it blackens, burns with a slight flame, exhales the smell of ammonia, and leaves a whitish ash, varying in amount from 27 to 35 per cent. The guanos of commerce vary very much in composition, from the best Peruvian to the inferior sorts, which have scarcely any value as fertilizers. A good specimen of guano, analyzed by Fownes, consisted of about two-thirds oxalate of ammonium, and one-third earthy and alkaline phosphates, etc. The source of oxalate of ammonium is undoubtedly the uric acid, originally in the excrement, and which is often found undecomposed in the guano. The value of guano as a fertilizer depends chiefly upon the proportion of the organic ingredients; the phosphates being of secondary importance. M. E. Baudrimont infers, from the analysis of seventeen samples of Peruvian guano, that the proportion of nitrogen may be obtained approximately by dividing the amount of the organic matters by five. The samples varied greatly in value. (*Journ. de Pharm.*, Oct. 1857.) Crystals of carbonate of ammonium have been observed in guano. Colombian guano was found by Dr. C. Morfit, of Baltimore, to be rich in phosphoric acid and lime. (*Chem. Gaz.*, Dec. 1, 1855.) Unger obtained from Peruvian guano, in 1845, a peculiar substance, called *guanine*, $C_5H_5N_5O$. (See *Journ. de Pharm.*, 4e sér., xvii. 328.) By the action of nitrous acid upon guanine there is produced the base *xanthine*, $C_5H_4N_4O_2$, and Emil Fischer has recently shown that *theobromine* and *caffeine* are capable of being produced from xanthine, and are, in fact, dimethyl- and trimethyl-xanthine respectively. (*A. J. P.*, 1882, p. 218.)

In South America, guano has been used with benefit, internally and externally, as a remedy in the different forms of lepra. The late Prof. Horner, of Philadelphia, employed it as a cataplasm, mixed with an equal quantity of potters' clay, in a case of chronic inflammation of the knee-joint. In this proportion it blistered the surface; and cataplasms were afterwards adopted, containing one-third and one-fourth of guano. (*Med. Exam.*, 1852, p. 69.) Prof. Horner attributed the revulsive effect of guano to urate of ammonium; but the best authorities state that oxalate of ammonium is the characteristic salt of this substance. Since 1852, guano has been a good deal used in cutaneous diseases, especially in ecthyma, eczema, and tinea capitis. It is employed in the form of bath, lotion, and ointment. Récamier prescribed baths in these diseases, each bath containing sixteen ounces of guano; and the practice has been imitated with success by M. Desmartis, and by M. Van der Abeele, of Belgium. The lotion may be made by exhausting an ounce of guano with a pint of boiling water, and filtering the solution. The ointment is formed of various strengths, from one to five parts of guano to fifteen of lard. M. C. Girardin prepares an extract of guano by exhausting it with alcohol, diluted with twice its bulk of water, and evaporating the solution to dryness. Of this extract he makes an ointment, useful in eruptions, by mixing it with three parts of lard, and also a syrup, flavored with vanilla, of which the dose is a fluidrachm, containing a grain of the extract, to be given in scrofula. The variable composition of guano must always form a serious objection to its therapeutic use.

GYNOCARDIA ODORATA. *Chaulmoogra.* This is an East India plant, the fruit of which has been employed, with asserted benefit, in elephantiasis or the leprosy of the East. The fruit is a succulent indehiscent pericarp, which yields a fixed oil by expression. Chaulmoogra oil, as it occurs in commerce, is solid at 17° C. (62·6° F.), of a whitish color, sometimes tinged with brown, and is usually prepared by expressing the kernels of the seed. It is sometimes prepared by boiling the crushed seeds with water and separating the oil. It has an acid reaction to litmus-paper, melts at 42° C. (107·6° F.), and at this temperature its sp. gr. is ·930. Alcohol dissolves a considerable portion of it, whilst ether, chloroform, bisulphide of carbon, and benzin dissolve it freely. John Moss (*P. J. Tr.*, x. 251) found in chaulmoogra oil, *gynocardic acid* 11·7, *palmitic acid* 6·3, *hypogœic acid* 4, *cocinic acid* 2·3 per cent. in combination with glyceryl as fats, whilst gynocardic and palmitic acids were also found in the free state; the activity of the oil he believes to be due to gynocardic acid, and states that the green coloration produced by treating the oil with sulphuric acid (Dymock's test) can also be obtained by treating palm oil in the same manner, yet purified gynocardic acid gives the same green color. Dr. John D. Hillis has used chaulmoogra oil with success in true leprosy. He gives it internally, in doses commencing with ten minims, emulsionized with milk; and one part of the oil with fifteen of olive oil, applied externally. (*N. Y. Med. Abstract*, 1881.) The seeds are used internally, and the oil applied to the ulcers. Dr. Mouat has used it advantageously in leprosy, ichthyosis, scrofulous enlargements, and constitutional syphilis. He gave the seeds in the dose of six grains three times a day. (*Am. Journ. of Med. Sci.*, N. S., xxx. 493; from *Association Med. Journ.*, Aug. 17, 1855.) Mr. Cottle uses the oil, commencing with doses of 4 drops and increasing to a drachm. (*Brit. Med. Jour.*, 1879, i. 968.)

HAMAMELIS VIRGINICA. *Witch-hazel.* An indigenous shrub, from five to fifteen feet high, growing in almost all sections of the United States, usually on hills or in stony places, and often on the banks of streams. It is remarkable for the late appearance of its yellow flowers, which expand in September or October, and continue till the weather becomes very cold in winter. The fruit, which is a nut-like capsule not unlike the hazel-nut, ripens in the following autumn, and is often mingled on the same plant with the new blossoms. The bark has a bitter, astringent, somewhat sweetish, and pungent taste. It probably first attracted notice as a remedy of the Indians, who are said to have used it as a sedative and discutient in painful tumors, and other cases of external inflammation. It is used in the shape of poultice, or as a wash in the form of decoction, in hemorrhoidal affections and ophthalmia. A distilled extract of witch-hazel has been largely used as a nostrum in this country. Quite as marvellous results have been claimed from the use of a similar extract made by distilling 10 parts of the bark with a mixture of 10 parts of alcohol and 90 of water. The leaves are said to possess similar properties, and, in the state of infusion, to be given internally in bowel complaints and hemorrhages. Dr. James Fountain, of Peekskill, N. Y., speaks in strong terms of the efficacy of the bark in hemorrhage of the lungs and stomach, and also highly recommends, as one of the best applications in external piles, an ointment prepared from lard and a decoction of equal parts of this bark, white-oak bark, and that of the apple-tree. He believes the witch-hazel to possess anodyne properties. (*N. Y. Journ. of Med.*, x. 208.) Dr. N. S. Davis agrees with Dr. Fountain in his estimate of this remedy, which he has employed usefully in incipient phthisis. He gives it in decoction, made with an ounce of the bark to a pint of water, of which the dose is a wineglassful every three, six, or eight hours. (*Transact. of Am. Med. Assoc.*, i. 350.) Still another use of the remedy is for the prevention of abortion, for which purpose it is recommended by Dr. W. W. Durham, who states that he has employed it very successfully in obviating the effects of the cotton root in bringing on miscarriage. (*Med. and Surg. Reporter*, 1867, p. 101; from *Atlanta Med. and Surg. Journ.*) The seeds are black and shining externally, white, oily, and farinaceous within, and edible like the hazelnut.

HARTSHORN. *Cornu.* Lond., Ed. This ancient medicine was the horn of *Cervus Elaphus*, the stag or hart. This species of deer inhabits Europe, Asia, and the North of Africa. The horns of our own common deer, *Cervus Virginianus*, though employed in the arts, were not officinal. Hartshorn has been usually imported into this country from Germany, in the form of shavings. These are without smell and taste, pliable, and of an ivory yellow color. According to M. Merat-Guillot, they contain in 100 parts, 27 of gelatin, 57·5 of phosphate of calcium, 1 of carbonate of calcium, and 14·5 of water including the loss. Boiling water extracts their gelatin, forming a transparent, colorless jelly, which may be rendered palatable by the addition of sugar, lemon or orange juice, and a little wine. To prepare it, two pints of water are boiled with four ounces of the shavings to a pint, and the residue strained while hot. The liquid gelatinizes upon cooling. By destructive distillation, the shavings yield an impure solution of carbonate of ammonium, which was formerly called *spirit of hartshorn;* and the same name has been applied to similar ammoniacal solutions from other sources.

Cornu Ustum. (Lond.) *Burnt Hartshorn.* The directions formerly given by the London College for the preparation of this substance were to "burn pieces of Hartshorn in an open vessel until they are thoroughly white; then powder them, and prepare them in the manner directed for Chalk." The horn must not only be heated, but also burnt. Burnt hartshorn consists of bone-phosphate of calcium, with about 1 per cent. of free lime, derived from the carbonate contained in the horns. Calcined bone is usually sold in the shops for burnt hartshorn. For the chemical characters of bone-phosphate of calcium, see *Calcii Phosphas Præcipitata.*

The opinion formerly entertained, that burnt hartshorn was antacid, has been abandoned since the discovery of its chemical nature. It is a useless, barbarous remedy.

HEDERA HELIX. *Ivy.* This well-known evergreen creeper is a native of Europe. The fresh *leaves* have a balsamic odor, especially when rubbed, and a bitterish, harsh, unpleasant taste. They are used for dressing issues, and, in the form of decoction, have been recommended in sanious ulcers and cutaneous eruptions, particularly tetter and the itch. Dried and powdered, they have been employed in the atrophy of children, and in complaints of the lungs, in the dose of a scruple or more. The *berries*, which have an acidulous, resinous, somewhat pungent taste, are said to be purgative and even emetic. MM. Vandamme and Chevallier discovered in ivy seeds a peculiar alkaline principle, which they called *hederine* (*hederia*). It is very bitter, and appears to be closely allied to quinine in febrifuge properties. It is obtained by treating the seeds with hydrate of lime, dissolving the precipitated alkaloid in boiling alcohol, and evaporating the alcoholic solution. (*A. J. P.*, xiii. 172.) Prof. Posselt has discovered two acids in the seeds, one of which has their taste in a high degree, and was named by him *hederic acid*, the other he did not obtain quite pure. (See *Chem. Gaz.*, 1849, p. 93.) The seeds were also found to contain a variety of tannic acid, turning ferric salts dark green, to which Posselt gave the name of *hedera-tannic acid.* (*Ann. Ch. und Phar.*, 69, p. 62.) Dr. F. A. Hartsen has found in the leaves a crystalline glucoside allied to saponin. (*A. J. P.*, 1875, xlvii. 268.) Davies and Hutchinson confirmed the existence of Posselt's hederic acid, but with Kingzett they now believe that it is not an acid but a glucoside. (*Year-Book of Ph.*, 1877, p. 508.) From the trunks of old ivy plants, growing in the south of Europe and the north of Africa, a resinous substance exudes through incisions in the bark, which has been employed in medicine under the name of *ivy gum.* It is in pieces of various sizes, of a dark yellowish brown color, sometimes inclining to orange, more or less transparent, sometimes of a deep ruby red color internally, of a vitreous fracture, pulverizable, yielding a lively orange yellow powder, of a peculiar not disagreeable odor when heated or inflamed, and of a bitterish resinous taste. Its chief constituent is resin, though some pieces contain a considerable proportion of bassorin, and others large quantities of ligneous matter. It was formerly used as a stimulant and emmenagogue, but is now scarcely employed. Placed in the cavities of carious teeth, it is said to relieve toothache. The *wood* of the ivy, which is light and porous, is sometimes used for making *issue-peas.*

HELENIUM AUTUMNALE. *False Sunflower. Sneezewort.* An indigenous perennial, bitter, somewhat acrid herb. The leaves and flowers snuffed up in the state of powder produce violent sneezing, and have been used as an errhine. F. J. Koch (*A. J. P.*, 1874, p. 221) found in the plant a bitter principle believed to be a glucoside, malic acid, traces of tannic acid, albumen, volatile oil, etc.

HELENIUM TENUIFOLIUM. A common roadside weed in Mississippi and Louisiana, which is stated by Dr. Galloway to be very poisonous, producing in animals muscular twitchings, passing into violent convulsions, terminating in death. In four negroes it produced spasms, with more or less delirium and loss of consciousness. (*A. J. P.*, 1872, p. 309.)

HELIANTHEMUM. *Frostwort.* The herb of the *Helianthemum Canadense*, belonging to the natural order of Cistaceæ, was formerly included in the U. S. secondary list. The *frostwort*, *frost-weed*, or *rock rose*, as this plant is variously called, is an herbaceous perennial, from six to eighteen inches high, with a slender, rigid, pubescent stem, oblong, somewhat lanceolate leaves about an inch in length, and large yellow flowers, the calyx and peduncles of which, as well as the branches, are covered with a white down. The flowers which first appear are terminal, few or solitary, large, on short peduncles, with erosely emarginate petals about twice as long as the calyx. Later in the season, or on different plants, other flowers appear, very small, axillary, solitary or somewhat clustered, nearly sessile, sometimes destitute of petals, and usually wanting the two outer sepals of the calyx. The fruit is a capsule, smooth and shining, with brown, scabrous, punctate seeds. Frostwort grows in all parts of the United States, preferring dry sandy soils, and flowering in June in the Middle States. The herb of *H. corymbosum* has been examined by Fred. J. Kruell, who found in it *tannin* in large proportion, resin, glucose, gum, extractive, chlorophyll, and inorganic salts. He presumes that its virtues reside in the tannin and extractive. (*A. J. P.*, 1874, p. 358.)

Medical Properties and Uses. The herb has an astringent, slightly aromatic, and bitterish taste; and appears to possess tonic and astringent properties, and some years since was employed as a remedy in scrofulous diseases. (See *U. S. D.*, 14th ed.) In a pamphlet upon the frost-weed by Dr. D. A. Tyler, published at New Haven, 1846, it is stated that *H. corymbosum* possesses similar properties, and is indiscriminately employed with *H. Canadense.* He found both useful in scrofula, diarrhœa, and secondary syphilis, and locally as a gargle in scarlatina, and a wash in prurigo. The plant has been used in the forms of powder, decoction, fluid extract, tincture, and syrup; and may be given freely with impunity. Dr. Tyler, however, has known the strong decoction and the extract to produce vomiting. He considers two grains of the latter as a full dose for an adult.

HELIANTHUS ANNUUS. *Common Sunflower.* This very large composite is cultivated in this country, Europe, and especially in China, chiefly for the sake of the fixed oil yielded by the seed. This, when pure, is nearly free from flavor, and is said to make an excellent salad dressing, and to be one of the best burning oils known. The increase in cultivation is stated to be nearly a thousand-fold, 275 pounds of oil being a fair yield per acre. For particulars as to cultivation, see *A. J. P.*, 1875, p. 460; also *N. R.*, 1876, p. 165. The stalk, when treated as is flax, yields a long, fine fibre, which is said to be used in China for the adulteration of silk. The sunflower also enjoys the reputation of protecting against marsh miasmata. It is related that a malarial locality in Belgium on the Scheldt has by its planting been rendered healthy. (*N. Y. Med. Rec.*, 1868, p. 353.) M. Chardon has obtained a small quantity of a peculiar oleoresin from sunflowers grown in Algeria. (*P. J. Tr.*, 1873, p. 323.) The Pah Ute Indians are said to use very freely as food the seeds of two indigenous sunflowers, *H. petiolaris* and *H. lenticularis.* (*Proc. A. P. A.*, xxvii. 178.)

HELLEBORUS. *Black Hellebore.* (*Ellébore noire*, Fr.; *Schwarze Niesswurzel*, G.; *Elleboro nero*, It.; *Helebor negro*, Sp.) Until the recent revision, the U.S. Pharmacopœia has always recognized the black hellebore, a plant belonging to the Ranunculaceæ. *Helleborus niger*, Willd. The root or rhizome of the black hellebore is perennial, knotted, blackish on the outside, white within, and sends off numerous long, simple, depending fibres, which are brownish yellow when fresh, but become dark brown upon drying. The leaves are pedate, of a deep green color, and stand on long footstalks which spring immediately from the root. Each leaf is composed of five or more leaflets, one terminal, and two, three, or four on each side, supported on a single partial petiole. The leaflets are ovate-lanceolate, smooth, shining, coriaceous, and serrated above. The flower-stem, which also rises from the root, is six or eight inches high, round, tapering, and reddish towards the base, and bears one or two large, pendent, rose-like flowers, accompanied with floral leaves, which supply the place of the calyx. The petals, five in number, are large, roundish, concave, spreading, and of a white or pale rose-color, with occasionally a greenish tinge. There are two varieties of the plant—*humilifolius* and *altifolius*—in the former of which the leaves are shorter than the flower-stem, in the latter longer. It is a native of the mountainous regions of southern and temperate Europe, and is found in Greece, Austria, Italy, Switzerland, France, and Spain. It is cultivated in gardens for the beauty of its flowers, which expand in the middle of winter, and have thus given it the name of *Christmas rose.*

Till the publication of Tournefort's travels in the Levant, this plant was regarded as identical with the hellebore of the ancient Greeks and Romans. But in the island of Anticyra, and various parts of continental Greece, in which it appears from the testimony of ancient writers that the hellebore abounded, this traveller discovered a species entirely distinct from those before described, and particularly from *H. niger.* He called it *H. orientalis*, and reasonably inferred that it was the true hellebore of the ancients; and botanists at present generally coincide in this opinion. But, as *H. niger* is also found in some parts of Greece, it is not impossible that the two plants were indiscriminately used. It is, indeed, highly probable that they possess similar properties; and a third, *H. viridis*, which grows in the west of Europe, is said to be frequently substituted for *H. niger*, which it closely resembles, if it does not equal in medicinal power. The roots of various other plants, not belonging to the same genus, are said to be frequently substituted for the black hellebore. They may usually be readily distinguished by attending to the characters of the genuine root.*

The medicine of which we are treating is sometimes called *melampodium*, in honor of Melampus, an ancient shepherd or physician, who is said to have cured the daughters of King Prætus by giving them the milk of goats which had been fed on hellebore.

Though the whole root is kept in the shops, the fibres are the portion usually recommended. They are about as thick as a straw, when not broken from four inches to a foot in length, smooth, brittle, externally black or deep brown, internally white or yellowish white, with little smell, and a bitterish, nauseous, acrid taste. In their recent state they are extremely acrimonious, producing on the tongue a burning and benumbing impression, like that which results from taking hot liquids into the mouth. This acrimony is diminished by drying, and still further impaired by age. MM. Feneulle and Capron obtained from black hellebore a volatile oil, an acrid fixed oil, a resinous substance, wax, a volatile acid, bitter extractive, gum, albumen, gallate of potassium, acid gallate of calcium, a salt of ammonia, and woody fibre. Mr. William Bastick discovered a peculiar crystalline principle, which he proposed to call *helleborin.* It is in white, translucent crystals, of a bitter taste with a tingling effect on the tongue, not volatilizable, slightly soluble in water, more so in ether and alcohol, and more readily in these liquids hot than cold. (*P. J. Tr.*, xii. 274.) Water and alcohol extract the virtues of the root, which are impaired by long boiling.

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* A root said to be not unfrequently substituted for or mixed with the genuine, and often to be met with in the shops of this country, is thought to be that of the *Actæa spicata* of Europe. This has been particularly described by Dr. Carson (*A. J. P.*, xx. 163). The points of difference upon which that writer especially insists are the diffuse, jointed, stem-like character of the caudex of the false root, the straggling, separated, and horizontal arrangement of the fibres, and their dense, woody structure, and reddish brown color, contrasted with the thickness, double-headed form, and sponginess of the genuine caudex, the close-set, perpendicular position of its fibres, and their wrinkled appearance, soft texture, and grayish brown color. The transverse section of the fibre of the Actæa presents the appearance of a cross, which is not obvious in that of the black hellebore, though the central point of this, if closely examined, will be found to present a somewhat stellate appearance. In the *P. J. Tr.* for Aug. 1861 (p. 112). Prof. Bentley states that solution of perchloride of iron produces little change of color and little or no precipitation with an infusion of black hellebore, while with a similar infusion of the Actæa root it causes a deep-blue or black color and a copious precipitate.

Some interesting results, chemical and physiological, in relation to both the black and green hellebore, which in these respects may be considered as one, have been obtained by Marmé and Husemann. A solution of an extract of the root, having been purified by precipitation with solution of subacetate of lead, and then freed from lead by sulphuretted hydrogen, yielded with phospho-molybdic acid a precipitate, which was found to have poisonous properties. They gave to this principle the name of *helleboreïn*, and found for it the formula $C_{26}H_{44}O_{15}$. They ascertained that it was a glucoside, separable by boiling with acid into glucose and a peculiar principle which they propose to call *helleboretin*, $C_{14}H_{20}O_3$, a compound of a fine violet color. The helleboreïn of these chemists exists both in the root and leaves. It has a taste at once sweet and bitter, is soluble in water and weak alcohol, and much less so in ether and absolute alcohol, and is crystallizable in rhomboidal prisms. It is precipitable by tannic acid and mercurous acetate. (*Journ. de Pharm. et de Chim.*, 4e sér., ii. 258.) Husemann and Marmé (*Ann. Ch. und Phar.*, 135, p. 61) also examined more thoroughly the *helleborin* of Bastick. They ascribe to it the formula $C_{36}H_{42}O_6$, and find that when boiled with dilute sulphuric acid, or better, zinc chloride, it is converted into sugar and *helleboresin*, $C_{30}H_{38}O_4$. They obtain this glucoside by treating with hot water the green fatty matter which is dissolved out of the root by boiling alcohol. Though both the principles referred to by the German chemists mentioned are poisonous, the products of their decomposition are said to be harmless. Neither of them is volatile. Helleboreïn is strongly irritant to the mucous membranes, causing, when applied to the conjunctiva, redness, swelling, and increased secretion with indirect enlargement of the pupil, and to the nasal membrane, sneezing, though in less degree than veratria. The salivary secretion appears to be stimulated not only by its application to the mouth, but also through the system. Small doses produce little effect on the stomach; but, repeated and accumulated, they cause anorexia, nausea even to vomiting, pain, increased secretion, and inflammation both of the stomach and bowels. The kidneys and generative organs in women are also stimulated. In very small doses, it lessens the frequency of the pulse; but in large doses, it accelerates the circulation, often even fatally. Gradual paralysis and convulsions are among its poisonous effects. The *helleborin* of Marmé and Husemann is a more active poison, though less irritant to the mucous membrane. It acts on the tongue like aconite. Its influence appears to be directed especially to the nervous system. In the lower animals it causes quickened breathing, restlessness, tension and trembling of the muscles, uncertainty of movement; then retardation of the breathing and pulse, irritability of the peripheral nerves, dilatation of the pupil, loss of hearing, and finally almost complete anæsthesia, with cerebral and spinal congestion, even to apoplexy.

Medical Properties and Uses. Black hellebore is a drastic hydragogue cathartic, possessed of emmenagogue powers, which by some are ascribed to a specific tendency to the uterus, by others are supposed to depend solely on the purgative property. In overdoses it produces inflammation of the gastric and intestinal mucous membrane, with violent vomiting, hypercatharsis, vertigo, cramp, and convulsions, which sometimes end in death. The fresh root applied to the skin produces inflammation and even vesication. The medicine was very highly esteemed by the ancients, who employed it in mania, melancholy, amenorrhœa, dropsy, epilepsy, various cutaneous affections, and verminose diseases. By the earlier modern physicians it was also much used. *Bacher's pills*, celebrated for the cure of dropsy, consisted chiefly of black hellebore. It is at present little employed. It may be given in substance, extract, decoction, or tincture. The dose of the powdered root is from ten to twenty grains as a drastic purge, two or three grains as an alterative. The decoction is prepared by boiling two drachms in a pint of water, of which a fluidounce may be given every four hours till it operates.

HELLEBORUS FŒTIDUS. *Bear's Foot.* This is a perennial European plant, growing in shady places, and flowering in March and April. It derived its specific name from its offensive odor. The leaves, which are the part used, have a bitterish, pungent, and acrid taste, and when chewed excoriate the mouth. The footstalks are still more acrid. Marmé and Husemann have discovered the same active principles in this as in the other species of Hellebore. (See *Helleborus.*) This species of hellebore is said by Allioni to be the most acrid and energetic of the plants belonging to the genus. It is powerfully emetic and cathartic, and in very large doses produces dangerous effects. It has long been used in Great Britain as a domestic remedy for worms, and was brought to the notice of the profession by Dr. Bissett, who found it an efficacious anthelmintic, and prescribed it also in asthma, hysteria, and hypochondriasis. M. Decerfs has known it to cause the expulsion of tænia. It is given in powder or decoction. The dose for a child from two to six years old is from five grains to a scruple of the dried leaves, or a fluidounce of the decoction, made by boiling a drachm of the dried leaves in half a pint of water. This quantity should be repeated, morning and night, for two or three days in succession. A syrup made from the juice of the green leaves is used in England.

HELONIAS DIOICA. *False Unicorn Plant. Starwort.* This is a small perennial herbaceous plant, growing in most parts of the United States, in shady and hilly situations. Pursh says that the bulbous root is used in colic. Dr. Braman has found it peculiarly efficacious, in doses of a drachm and a half three times a day, in atony of the generative organs, and has obtained great advantages from it in leucorrhœa. (*Bost. Med. and Surg. Journ.*, xl. 416.)

HEPATICA. *Liverwort.* Under this name was formerly included in the secondary list of the U. S. Pharmacopœia the leaves of *H. triloba*, Chaix. There are now two generally acknowledged species of the Ranunculaceous genus Hepatica growing in this country. Both have a perennial fibrous root, with three-lobed leaves, cordate at their base, coriaceous, nearly smooth, glaucous, and purplish beneath, and supported upon hairy footstalks from four to eight inches long, which spring directly from the root. The scapes or flower-stems are several in number, of the same length with the petioles, round, hairy, and terminating in a single white, bluish, or purplish flower. The calyx is at a little distance below the corolla, and is considered by some an involucre, while the corolla takes the name of the calyx. In *H. acutiloba* the leaves are cordate, with from three to five entire, acute lobes; and the leaflets of the calyx are acute. In *H. triloba* the leaves are cordate-reniform, with three entire, roundish, obtuse-lobes; and the leaflets of the calyx are obtuse. Both are indigenous, growing in woods upon the sides of hills and mountains; the former, according to Eaton, preferring the northern, the latter the southern exposure. The leaves resist the cold of the winter, and the flowers make their appearance early in spring. The whole plant is used. It is without smell, and has a mucilaginous, somewhat astringent, slightly bitterish taste. Water extracts all its active properties. Liverwort is a very mild, demulcent tonic and astringent, supposed by some to possess diuretic and deobstruent virtues. It was formerly used in Europe in various complaints, especially chronic hepatic affections, but has fallen into entire neglect. In this country some years since, it acquired considerable popular reputation, which, however, it has not maintained, as a remedy in hæmoptysis and chronic coughs. It may be used in infusion, and taken ad libitum. The term *liverwort* properly belongs to the cryptogamous genus *Marchantia.*

HERACLEUM LANATUM. (Michaux, *Flor. Boreal. Am.* i. 166.) *Masterwort.* This is one of our largest indigenous unbelliferous plants. The root is perennial, sending up annually a hollow pubescent stem, from three to five feet high, and often more than an inch thick. The leaves are ternate, downy beneath, and supported on downy footstalks; the leaflets petiolate, roundish-cordate, and lobed. The flowers are white, in large umbels, and followed by orbicular seeds. Like the European species, this is sometimes called *cow parsnep.* It grows in meadows and along fences and hedges, from Canada to Pennsylvania, and flowers in June. The root, which is the part used, bears some resemblance to that of common parsley. It has a strong disagreeable odor, and a very acrid taste. Both the leaves and root excite redness and inflammation when applied to the skin. Dr. Bigelow considers the plant poisonous, and advises caution in its use, especially when it is gathered from a damp situation. Masterwort appears to be somewhat stimulant and carminative, and was used successfully by Dr. Orne, of Salem, Massachusetts, in cases of epilepsy, attended with flatulence and gastric disorder. He directed two or three drachms of the pulverized root to be taken daily, for a long time, and a strong infusion of the leaves to be drunk at bedtime.

HERMODACTYLS. *Hermodactyli.* Under this name are sold in the shops of Europe the roots or bulbs of an uncertain plant, growing in the countries about the eastern extremity of the Mediterranean. By some botanists the plant is thought to be a *Colchicum;* and *C. variegatum*, a native of the south of Europe and the Levant, is particularly indicated by Fée, Geiger, and others; while by authors no less eminent, the roots are confidently referred to *Iris tuberosa.* They certainly bear a considerable resemblance to the bulb of *Colchicum autumnale*, being heart-shaped, channelled on one side, convex on the other, and from half an inch to an inch in length, by nearly as much in breadth. As found in the shops, they are destitute of the outer coat, of a dirty yellowish or brownish color externally, white and amylaceous within, inodorous and nearly tasteless, though sometimes slightly acrid. They are often worm-eaten. Their chief constituent is starch, and they contain no veratrine or colchicine. From this latter circumstance, and from their insipidity, it has been inferred that they are probably not derived from a species of Colchicum; but Geiger observes that they may have lost their acrimony by age. They are in fact almost without action upon the system, and are now seldom used; never, we believe, in this country. It is doubted whether they are the *hermodactyli* of the ancients, which were certainly a powerful medicine, operating very much in the same manner as our colchicum, and like it proving useful in gout and rheumatism. Pereira describes a bitter variety of hermodactyls, which was brought from India by Dr. Royle. The bulbs are smaller and darker than the others, and have externally a striped or reticulated appearance. From their bitter taste they are probably more active.

HERNIARIA GLABRA. M. Goblez has obtained from this plant a crystalline principle, which he calls *herniarine.* (*Journ. de Pharm.*, 4e sér., xx. 270.)

HEUCHERA. *Heuchera Americana. H. cortusa,* Michaux. *H. viscida,* Pursh, p. 187. The *alum-root* or *American sanicle* is a perennial, herbaceous plant, belonging to the Saxifragaceæ. The leaves are all radical, petiolate, cordate, with rounded lobes, furnished with obtuse mucronate teeth. There is no proper stem; but numerous scapes or flower-stems are sent up by the same root, from one to three feet in height, very hairy in their upper part, and terminating in long, loose, pyramidal, dichotomous panicles. The calyx is small, with obtuse segments; the petals lanceolate, rose-colored, and of the same length as the calyx; the filaments much longer, yellowish, and surmounted by small, red, globose anthers. The whole plant is covered with a viscid pubescence. It is found in shady, rocky situations, from New England to Carolina, and flowers in June and July. The root, which was formerly officinal, is horizontal, somewhat compressed, knotty, irregular, yellowish, and of a strongly styptic taste. Alum-root is powerfully astringent, and may be employed in similar cases with other medicines belonging to the same class. It has hitherto, however, been little used. Mr. Frederick Stearns (*Proc. A. P. A.*, 1858, p. 263) speaks of two other indigenous species, *H. caulescens* and *H. pubescens*, as having similar properties.

HIBISCUS ABELMOSCHUS. *Abelmoschus moschatus.* Wight and Arnott. An evergreen shrub, growing in Egypt, and in the East and West Indies, and yielding the seeds known under the names of *semen Abelmoschi*, *alceæ Ægyptiacæ*, and *grana moschata.* These are of about the same size as flaxseed, kidney-shaped, striated, of a grayish brown color, of an odor like that of musk, and of a warm somewhat spicy taste. They were formerly considered stimulant and antispasmodic, but are now used only in perfumery. The Arabs flavor their coffee with them. They are said to be employed in the adulteration of musk. Another species, *Hibiscus esculentus*, or *Abelmoschus esculentus*, of Wight and Arnott, is cultivated under the name of *okra*, *bendee*, or *gombo* in various parts of the world, for the sake of its fruit, which abounds in mucilage, to which the name of *gombine* has been given, and is used for thickening soup. The leaves are sometimes employed for preparing emollient poultices. The roots, which are a foot or two long, are said also to abound in mucilage, of which they yield twice as much as the althæa root from the same weight, free from any unpleasant odor. Their powder is perfectly white, and superior also to that of the marshmallow. The plant is largely cultivated near Constantinople, where it is much used as a demulcent. (*A. J. P.*, 1860, p. 224.) The bark is also used in making paper and cordage.

HIERACIUM VENOSUM. *Rattlesnake Weed.* (*Gray's Manual*, p. 237.) The rattlesnake weed has a smooth slender flower-stem, one or two feet high, either naked or furnished with but a single leaf, and dividing at top into a loose spreading corymb of yellow flowers. The plant is common, growing in dry places and open woods, in most of the eastern and northern parts of the United States. The leaves and root are thought to possess medical virtues, and, being deemed astringent, have been used in hemorrhagic diseases. The juice is supposed by some to have the power of removing warts. The medicine may be given in infusion, made in the proportion of two ounces to the pint, of which the dose is a wineglassful.

HOG-GUM. GUM-HOGG. Under the name of Gum-Hogg a peculiar gum is much used in marbling paper. A full discussion of it may be found in the 14th edition U. S. Dispensatory, but, as it appears to be only a variety of Bassora gum, we omit any further account of it here.

HURA BRASILIENSIS. *Assacou. Hura Brasiliensis* of Martius, is a Brazilian tree belonging to the family of Euphorbiaceæ, and known to the natives of the country it inhabits by the name of *assacou.* Another species of the same genus, *H. crepitans*, growing in the West Indies, and characterized by the tendency of its fruit to break when ripe with violence into several pieces, and thus scatter the seeds, has long been known as an acrid emeto-cathartic, capable in large doses of acting as a violent poison. The fresh juice, the seeds, and a decoction of the bark, all have these properties, which, in fact, belong in a greater or less degree to most of the Euphorbiaceæ; and, as in other members of the same family, an oil expressed from the seeds is actively purgative. It is highly probable that the *Hura Brasiliensis* is similar in all these respects to its congener. Martius states that the juice is anthelmintic, and employed to intoxicate fish. But attention has recently been especially attracted to the plant, in consequence of reports favorable to its efficacy in that terrible scourge of Brazil, the elephantiasis or leprosy of the country. These reports were received by the Academy of Medicine, of Paris, from the French Consul in one of the towns of Para, of which province the natives are said to regard the remedy as a specific in the complaint referred to. Experiments have been made by the Brazilian physicians, and it is said with favorable results, though complete cures have not been obtained. The fact is that various acrid emeto-cathartic medicines, capable also of producing diaphoresis, have been more or less useful in elephantiasis, as the *Calotropis gigantea*, and one or more species of Ionidium; and it is probable that the assacou acts in a similar manner, and with similar results. The milky juice of the plant, and an infusion or decoction of the bark, are used. The juice is extremely acrid, producing on the skin, when applied to it, an erysipelatous redness and a pustular eruption; and the natives are said to employ it in the preparation of a poison. A grain of the juice made into a pill, or a scruple of the bark infused in a pint of water, is given every day, and gradually increased as the stomach and bowels will bear it. Every week an emetic preparation is administered, made by boiling half an ounce of the bark in a pint of water to half a pint, to which twelve drops of the juice are added. Every second or third day the patient takes a bath consisting of a saturated infusion of the bark. (*Journ. de Pharm.*, xiv. 424.)

HYDRANGEA ARBORESCENS. *Common Hydrangea. Seven Barks.* The root of our indigenous Hydrangea, which is the part used, consists of a caudex, from which proceed numerous radicles, from the thickness of a quill to that of a finger or more. For use it should be cut into transverse pieces when fresh, and then dried. The taste is aromatic, pungent, and not unpleasant. The root was analyzed by Mr. Laidley, of Richmond, Va., who found in it gum, albumen, starch, resin, and various salts, among which was a ferrous salt. (*A. J. P.*, xxiv. 20.) Attention was first called to it as a remedy in the *New Jersey Medical Reporter* for Oct. 1850 (p. 44), by Dr. S. W. Butler, whose father, Dr. E. Butler, long residing as a missionary among the Cherokee Indians, employed it with great apparent advantage in their calculous complaints. Reports of cases, tending to confirm the opinion of its utility in "sabulous or gravelly deposits" in the urine, have since been published by Drs. W. L. Atlee, D. Horsley, and John C. S. Monkur. (*Ibid.*, 1854, pp. 393-416, 426, and 1855, p. 115.) Dr. Butler used it in the form of decoction, or of a syrup made from the decoction with sugar or honey. A strong syrup may be given in the dose of a teaspoonful three times a day. In overdoses it occasions vertigo, oppression of the chest, etc.

HYDRIDES, ORGANIC. In the *Medical Times and Gaz.*, 1871, vol. ii. pp. 403, 490, Dr. B. W. Richardson published an elaborate research upon the physiological action of these bodies. For want of space we can here only refer to his paper.

HYDRIODIC ACID, DILUTE. *Acidum Hydriodicum Dilutum.* This preparation was introduced into the U. S. Pharmacopœia in 1860 and dismissed in 1870. (See *Syrupus Acidi Hydriodici*, Part I.) The officinal formula in 1860 was as follows. "Take of Iodine, in fine powder, *a troyounce;* Distilled Water *a sufficient quantity.* Mix thirty grains of Iodine with five fluidounces of Distilled Water in a tall glass-stoppered bottle, having the capacity of half a pint, and pass into the mixture hydrosulphuric acid gas until the color of the Iodine entirely disappears, and a turbid liquid remains. Detach the bottle from the apparatus employed for introducing the gas, and gradually add the remainder of the Iodine, stirring at the same time. Then reattach the bottle, and again pass the gas until the liquid becomes colorless. Decant the liquid into a small matrass which it is nearly sufficient to fill, boil it until it ceases to emit the odor of hydrosulphuric acid, and filter through paper. Then pass sufficient Distilled Water through the filter to bring the filtered liquid to the measure of six fluidounces. Lastly, keep the liquid in a well-stopped bottle. The hydrosulphuric acid gas, required in this process, may be obtained by mixing, in a suitable apparatus, *a troyounce and a half* of sulphide of iron, *two troyounces* of sulphuric acid, and *six fluidounces* of water." *U. S.*

The rationale of the process is extremely simple. The hydrogen of the sulphuretted hydrogen unites with the iodine to form hydriodic acid whilst sulphur is deposited, $2H_2S + 2I_2 = 4HI + S_2$. It is well to agitate the vessel slightly soon after the sulphuretted hydrogen is passed into the liquid, so that the excess of iodine may be taken up by the solution of hydriodic acid, iodine being quite soluble even in a dilute solution. Some difficulty may be experienced if this is not done, through the finely precipitated sulphur coating the iodine and preventing its easy conversion. We have found it an improvement to dissolve the iodine in just sufficient alcohol, and then add to the water; the greater part is thrown down as a fine precipitate which is much more easily acted on by the sulphuretted hydrogen.*

* Various processes have been proposed for making hydriodic acid. Dr. Buchanan used an extemporaneous formula, which consisted in dissolving 330 grains of iodide of potassium and 264 of tartaric acid, each in one and a half fluidounces of water, mixing the solutions, filtering to separate the bitartrate of potassium formed, and finally adding sufficient distilled water to make the solution measure fifty fluidrachms. Each fluidrachm of this preparation contained five grains of iodine. Beginning with a few drops, he gradually increased to a fluidrachm, and finally even half a fluidounce or a fluidounce three times a day. Mr. John A. Dunn's modification of Buchanan's process is as follows. Take of iodide of potassium 209¾ grains; tartaric acid, in crystals, 190¼ grains. Dissolve the iodide in three fluidrachms of distilled water, and the acid in the same quantity, and filter if necessary; mix the solutions, set the mixture in ice-cold water, and allow it to stand for one hour; then filter, and make up the measure to two fluidounces. Each fluidrachm represents 10 grains of iodine. (*A. J. P.*, 1869, p. 41.) Prof. H. Kolbe (*Journ. f. prakt. Chem.*, 1879, p. 172, and *A. J. P.*, June, 1877) adds phosphorus to iodine in a retort filled with carbonic acid gas. Heat is applied, and water added; on application of moderate heat, hydriodic acid gas free from iodine is produced. C. Winckler (*A. J. P.*, May, 1880; from *Jahresber. d. Phys Ver.*) dissolves iodine in carbon disulphide; adds sufficient water to form a layer on top of the solution of iodine; passes

The iodine is known to have been all combined by the disappearance of the color. An excess of sulphuretted hydrogen is of no disservice, as it is driven off by the boiling. By filtration the liberated sulphur is separated, and the clear diluted hydriodic acid remains. By taking fixed proportions of iodine and water, an acid of the desired strength is secured.

In its pure state hydriodic acid is in the form of a gas, which fumes in the air, is colorless, and has an odor not unlike that of hydrochloric acid. It has a strong affinity for water, which, when saturated with it, forms liquid hydriodic acid. This has the sp. gr. 1·7, boils at 127° C. (260° F.), and may be distilled.

The diluted acid, as prepared by the former U. S. process, is colorless when recently prepared, of a sour taste, and of the sp. gr. 1·112. The acid is precipitated yellowish white by test solution of nitrate of silver, and this precipitate is not perceptibly dissolved either by nitric acid or ammonia. When exposed to the air it gradually darkens, in consequence of the separation of iodine, of which it acquires the characteristic odor. It is more rapidly decomposed, with the same result, by chlorine, by nitric, sulphuric, iodic, and sulphurous acids, and by sulphate of iron. Mr. John A. Dunn has found that this change is prevented by the addition of one-third of a grain of crystallized hyposulphite of sodium to a fluidounce. (*A. J. P.*, 1869, p. 42.)

Medical Properties and Uses. Diluted hydriodic acid was introduced into use as a medicine by Dr. Andrew Buchanan, of Glasgow, under the impression that it is by passing into this form that iodine, when taken internally, is absorbed, and enters the circulation. He believed it capable of producing all the effects of that element on the system, while it is less unpleasant to the taste, and less apt to offend the stomach. The acid officinal in 1860 contains ten grains of iodine in each fluidrachm, and is therefore twice as strong as Dr. Buchanan's solution. There can be little doubt that hydriodic acid is capable of producing the alterative effects of iodine; and it may be given in all cases to which that medicine is applicable. The dose may be half a fluidrachm (1·9 C.c.) three times a day, diluted with water. When the solution becomes discolored it may be irritant through the liberated iodine; but this effect may be obviated by exhibiting it in any amylaceous liquid, as barley-water.

HYDROCOTYLE ASIATICA. *Thick-leaved Pennywort.* (*Bevilacqua.* Boileau.) This is a small umbelliferous plant, growing in Southern Africa and in India, where it has long been used as an alterative to purify the blood. M. Jules Lépine discovered in it a peculiar oleaginous substance which he calls *vellarine*, and in which he supposes the active properties to reside. It has a strong odor recalling that of the plant, and a bitter, pungent, and persistent taste. (*Journ. de Pharm.*, 1855, p. 49.)

The plant has been supposed to possess diuretic properties, and, according to Ainslie, is employed in infusion with fenugreek in fever and bowel complaints. But it has attracted some attention on account of the strong statements of its efficacy in elephantiasis Græcorum, made by Dr. Boileau, of the Island of Mauritius, and confirmed by M. Lépine, of Pondicherry. Dr. Boileau gives an ounce of the dried plant daily for several weeks, in infusion. He then exhibits a syrup, gradually increased until an ounce of the drug is taken daily. (*Journ. de Pharm.*, 3e sér., xxiv. 424; xxv. 153.) M. Lecocq denies any value to the drug in elephantiasis. (*Ann. de Thérap.*, 1859.) Drs. E. J. Waring and Hunter have found it of great service in syphilitic and scrofulous ulcers. (*P. J. Tr.*, 1860, p. 143.)

HYDROCYANIC ETHER. *Cyanide of Ethyl.* (C_3H_5N, or $C_2H_5.CN$.) This ether was discovered by Pelouze. It is formed by distilling a mixture of sulphovinate of barium and cyanide of potassium. It is a colorless liquid, of a penetrating garlicky odor, soluble in alcohol, ether, and water, boiling at 82° C. (179·6° F.), and having the sp. gr. 0·78. It is very poisonous, but less so than hydrocyanic acid, with which it agrees in therapeutic action and dose.

HYPERICUM PERFORATUM. *St. John's Wort.* A perennial herb, abundant both in Europe and in this country, often covering whole fields, and proving extremely troublesome to farmers. It is usually from one to two feet high, with leaves which, from the presence of numerous transparent vesicles, appear as if perforated, and have hence given origin to the botanical designation of the plant. The flowers, which are numerous and of a deep yellow color, appear during the summer from June to August. The flowering summits are the parts used, though the unripe capsules are possessed of the virtues of the plant in an equal degree, and the seeds are said to be even stronger. St. John's wort has a peculiar balsamic odor, which is rendered more sensible by rubbing or bruising the plant. Its taste is bitter, resinous, and somewhat astringent. It imparts a yellow color to cold water, and reddens alcohol and the fixed oils. Its chief constituents are volatile oil, a resinous substance, tannin, and coloring matter. This latter, known as *hypericum red*, is a reddish resin, smelling like the flowers, soluble in

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a stream of hydrogen sulphide through the mixture; when this has acquired a yellow color, the layers are separated, the aqueous hydriodic acid is boiled a few minutes to expel hydrogen sulphide, and it is then chemically pure.

alcohol, ether, ethereal and hot fatty oils, coloring the solution wine red to blood red. It is soluble in alkalies with green color, and gives yellow precipitates with the alkaline earths and metallic salts. As a medicine it was in high repute among the ancients, and the earlier modern physicians. Among the complaints for which it was used were hysteria, mania, intermittent fever, dysentery, gravel, hemorrhages, pectoral complaints, worms, and jaundice; but it was, perhaps, most highly esteemed as a remedy in wounds and bruises, for which it was employed both internally and externally. It is difficult to ascertain its exact value as a remedy; but, from its sensible properties, and from the character of the complaints in which it has been thought useful, it may be considered, independently of its astringency, as somewhat analogous in medical power to the turpentines. It formerly enjoyed great reputation for the cure of demoniacs; and the superstition still lingers among the vulgar in some countries. At present the plant is scarcely used except as a domestic remedy. The summits were given in the dose of two drachms or more. A preparation is used, under the name of *oleum hyperici*, made by macerating four ounces of the tops in a pint of olive oil. It is still used in many families as a sovereign remedy for bruises. It is commonly called *red oil.*

HYPOSULPHITE OF CALCIUM. (*Calcium Sulpho-sulphate* or *Thio-sulphate.*) *Calcii Hyposulphis.* ($CaS_2O_3 6H_2O$.) Hyposulphite of calcium possesses, with other hyposulphites, useful properties in the destruction of the lower forms of animal and vegetable life, by which the human system is often seriously infested; and the hope is even indulged that it may become a most useful agent in the prevention and relief of a class of diseases depending on infection of the blood. The following mode of preparing it is recommended by M. J. Laneau, of Paris. Take 1000 parts of sulphur, 400 of lime, and 4000 of rain-water; slake the lime with sufficient of the water, add the sulphur and the residue of the water, and boil for an hour and a half, adding water to keep up the measure; when cool filter the liquid through linen covered with filtering paper; and wash the residue with 1000 parts of water. A solution is thus obtained of polysulphide of calcium of the sp. gr. 1·141. Into this pass a current of washed sulphurous acid gas until the solution becomes colorless; separate the precipitated sulphur (which may be used for the officinal *Precipitated Sulphur*); and evaporate the clear solution at a heat not exceeding 60° C. (140° F.), until it begins to crystallize, when it is to be set aside. The product is 700 parts of hyposulphite of calcium. This is in six-sided crystals, which effloresce in a dry air. M. Laneau prepares a syrup of the hyposulphite by dissolving 10 parts of the crystallized salt in 20 parts of distilled water, and mixing with the solution 170 parts of syrup of orange flowers. (See *A. J. P.*, 1863, p. 223.) The dose of the salt is from ten to twenty grains three times a day, of the syrup from two to four fluidrachms.

Of the *hyposulphites*, generally, it may be said that they closely resemble the sulphites in medical properties, and may be employed as substitutes for those salts, over which they have the advantage of greater stability, passing less readily into sulphates on contact with the air. They may be prepared by boiling a sulphite or bisulphite for some time with sulphur. They are very soluble in water, and are recognized by the precipitation of sulphur when decomposed by an acid.

HYPOSULPHITE OF SODIUM AND SILVER. *Sodii et Argenti Hyposulphis.* This double salt may be prepared by dissolving freshly precipitated oxide of silver in a solution of hyposulphite of sodium, and evaporating the solution. It is in the form of minute crystals, very soluble in water, but insoluble in alcohol, and possessing a very sweet taste. Its solution, protected from the light, undergoes no change, and, when quite pure, does not discolor the skin or linen. M. Delioux, of Rochefort, has tried this salt externally only, and thinks it acts like nitrate of silver, but more mildly. He used it in urethral discharges, in the proportion of one or two parts in two hundred of water. (*B. and F. Medico-Chir. Rev.*, Am. ed., 1853, p. 447.)

HYRACEUM. This is the product of *Hyrax Capensis*, an animal of South Africa, about the size of a large rabbit. It is said to be collected in small pieces on the rugged sides of mountains, and is probably the excrement or the dried urine of the animal. It is rather hard, tenacious, of a blackish brown color, and in taste and smell not unlike castor. It is inflammable, and yields portions of its constituents to water and alcohol. Examined with the microscope, it has been found to contain vegetable tissues, animal hair, sand, and globular particles, either resinous or oily. Schrader has found it to contain stearin, a gum-resin soluble in absolute alcohol, an odorous yellow substance soluble in ordinary alcohol and in water, a brown substance soluble in water, and insoluble residue. (See *A. J. P.*, 1879, p. 363.) Dr. Pereira considered it worthless as a therapeutic agent, though in physiological effects it is said to resemble American castor. (*P. J. Tr.*, x. 123.) For an elaborate paper on this substance by M. J. Léon Soubeiran, see *Journ. de Pharm.*, xxix. 378. Prof. Cope states that a similar substance is found in fissures of the rocks in New Mexico, and is probably a fecal and renal deposit of the wild rat, *Neotoma.* (*Proc. Acad. Nat. Sci.*, 1876.)

HYSSOPUS OFFICINALIS. *Hyssop.* This is a European labiate plant, perennial, with numerous erect, quadrangular, somewhat branching stems, which are woody in their interior portion, about two feet high, and furnished with opposite, sessile, lanceolate-linear, pointed, punctate leaves. The flowers are violet-colored or blue, sometimes white, turned chiefly to one side, and arranged in half verticillated, terminal leafy spikes. The upper lip of the corolla is roundish and notched at the apex, the lower is divided into three segments, of which the undermost is obovate. The flowering summits and leaves are the parts used. They have an agreeable aromatic odor, and a warm, pungent, bitterish taste, due to the presence of a volatile oil. Hyssop is a warm, gently stimulant, aromatic, applicable to the same cases as the other labiate plants. Its infusion has been much employed in chronic catarrhs, especially in old people and those of a debilitated habit of body. It acts by facilitating the expectoration of mucus when too abundantly secreted.

IBERIS AMARA. *Bitter Candytuft.* A small European herbaceous plant. The leaves, stem, and root are said to possess medicinal properties; but the seeds are the most efficacious. The plant appears to have been employed by the ancients in rheumatism, gout, and other diseases. In large doses it is said to produce giddiness, nausea, and diarrhœa; but its virtues do not seem to be associated with any perceptible physiological effect. It is thought to exercise a happy influence over the excited actions of the heart, and is especially useful in hypertrophy. Much advantage is also said to have accrued from it in asthma, bronchitis, and dropsy. The dose of the seeds is from one to three grains. (*Prov. Med. and Surg. Journ.*, 1847.)

ICAYA. *M'Boundou.* This is an ordeal root of Gaboon, whose physiological action has been investigated by MM. Rabuteau and Peyre. They found it to be devoid of influence upon the muscles, but to act upon the spinal cord, producing violent convulsions. Nasal hemorrhages were observed in the dog, and are stated also to have been noticed among the Gaboonese. (*P. J. Tr.*, 1870, p. 187.)

ILEX. *Holly.* Several species of Ilex are employed in different parts of the world. The *I. Aquifolium*, or *common European Holly*, has attracted much attention in France. It is usually a shrub, but in some places attains the magnitude of a middling-sized tree. The viscid substance called *birdlime* is prepared from the inner bark. The leaves, which are of a bitter, somewhat austere taste, were formerly much esteemed as a diaphoretic, and in the form of infusion were employed in catarrh, pleurisy, smallpox, gout, etc. A few years since they gained a brief reputation in France as a cure for intermittents. They were used in powder, in the dose of a drachm two hours before the paroxysm; and this dose was sometimes repeated frequently during the apyrexia. Their febrifuge virtues are said to depend on a bitter principle, *ilicin.* M. Labourdais obtained this principle by boiling a filtered decoction of holly leaves with animal charcoal, allowing the charcoal to subside, washing it, then treating it with alcohol, filtering off the alcoholic solution, and evaporating it to a syrupy consistence. The liquid thus obtained was very bitter, and, on being allowed to evaporate spontaneously, yielded an amorphous substance, having the appearance of gelatin, which was the principle in question. (See *A. J. P.*, xxi. 89.) A yellow coloring substance called *ilexanthin*, and a peculiar acid, called *ilicic acid*, have been obtained by Dr. F. Moldenhauer. Ilexanthin is obtained in the following manner. The leaves are exhausted with alcohol, the alcohol is distilled off, and the residue set aside for several days. A sediment forms, which is separated from the mother-liquor, treated with ether to remove the chlorophyll, and then purified by repeated solution in alcohol and crystallization. The composition of ilexanthin is $C_{17}H_{22}O_{11}$. It crystallizes in yellow needles, which change color at 185° C. (365° F.), melt at 198° C. (388° F.), and at 214° C. (417° F.) boil with decomposition, and are not sublimable. It is insoluble in ether, but soluble in alcohol. In cold water it is almost insoluble; but hot water dissolves it freely, and deposits it in crystals on cooling. (*Chem. Centralblatt*, 1857, p. 766.) The *berries* are about the size of a pea, red and bitter, and are said to be purgative, emetic, and diuretic. Ten or twelve of them will usually act on the bowels, and sometimes vomit. Their expressed juice has been used in jaundice.

The *Ilex opaca*, or *American holly*, is a middling-sized evergreen tree, growing throughout the Atlantic section of the United States, and especially abundant in New Jersey. It is so similar to the European plant, that it is, by some writers, considered as the same species. The berries, examined by Mr. D. P. Pancoast, were found to contain tannin, pectin, two crystallizable organic principles, and salts of potassa, lime, and magnesia. One of the crystallizable principles was inodorous and tasteless, the other inodorous but intensely bitter. The latter was obtained by a treatment similar to that of M. Labourdais, above described; but, after the evaporation of the tincture to a syrupy consistence, the process was continued by adding carbonate of potassium and afterwards ether, and agitating briskly. The ethereal solution, rising to the surface on repose, was separated, and allowed to evaporate spontaneously. Crystals of the bitter principle were deposited. This is probably pure *ilicin.* (*A. J. P*, xxviii. 314.) This species is said to possess the same medical properties as *I. Aquifolium.*

Ilex Paraguaiensis, the *I. Maté* of St. Hilaire, yields the celebrated *Paraguay tea*, so extensively consumed as a beverage in the interior of South America. It is a small tree or shrub growing wild along the streams in Paraguay, and also cultivated for the sake of its leaves, which are the part used. These are stripped from each plant every two or three years. (Parodi, *Revista Farmaceutica de Buenos Aires*, Jan. 1861.) The period of their collection extends from December to August, sometimes beginning earlier but never continuing later. Companies are formed who penetrate far into the forest at a distance from the settlements, and devote a long time to the collection and preparation of the leaves. These are first dried by exposure to heat, and are then reduced to powder more or less fine, which is kept for several months protected from moisture, and then packed in sacks, and delivered to commerce. (A. Demersay, *Ann. de Thérap.*, 1868, p. 72.) They have a balsamic odor and bitter taste, and are usually at first disagreeable to the palate. They have a pleasant and corroborant effect upon the stomach; but, when very largely taken, are said to purge and vomit. They are used in the form of infusion, which is prepared from the entire leaves as we prepare tea; or, under the name of *cha maté*, a fine powder is put in a cup of hot water by the drinker, and after a moment's stirring, the fluid is sucked up by means of a tube expanded below, and pierced with fine holes, so as to strain out the powder. They contain, besides other substances, a peculiar tannin and the alkaloid caffeine. The latter appears to be in very variable amount. In the analysis of D. A. Strauch, the leaves yielded 0·450 of theine, 20·880 of caffeotannic acid, 2·830 of gum, 5·902 of resin, chlorophyll, and wax, 1·200 of starch, 9·361 of protein compounds, 22·148 of cellulose, 8·640 of apotheme, 3·896 of salts, 8·100 of water, with a trace of volatile oil, and some sand and extractive. (*A. J. P.*, 1868, p. 314; from *Wittstein's Vierteljahr.*, 1867, pp. 167–182.) Mr. Pizarro found the percentage of theine to vary from 0·48 to 1·15, and of tannic acid from 4·10 to 5·50. (*Journ. de Pharm.*, 4e sér., xx. 250.) Bialet obtained 1·3 per cent. of caffeine (Dragendorff, *Jahresbericht*, 1876, p. 193); Byarron, 1·85 per cent. (*Proc. A. P. A.*, xxvi. 299); Señor Arata, 1·3 per cent. (*N. R.*, 1876, p. 325); A. Robbins, 0·02 to 0·14 per cent. (*A. J. P.*, 1878, p. 272). In the year 1870 Brazil is stated to have exported 9,507,086 kilogrammes of maté.

The *Ilex vomitoria* of Aiton and Linn., the *I. Cassine* of Michaux, is a handsome evergreen shrub, growing in our Southern States, and especially abundant along the southern coast of Florida. It is the *cassine* of the Indians, who formerly employed a decoction made from the toasted leaves, called *black drink*, both as a medicine, and as a drink of etiquette at their councils. It acts as an emetic. The leaves of the *Ilex Dahoon* of Walter and Michaux have similar properties, and are also said to have entered into the composition of the black drink. The leaves of the *Ilex Cassine*, known as *Yaupon* by the Indians, yielded, in an analysis made by Mr. H. M. Smith, 0·011 per cent. of volatile oil, and 0·122 per cent. of caffeine. (*A. J. P.*, xliv. 217.)

ILLICIUM FLORIDANUM. *Florida Anise-tree.* This is an evergreen shrub or small tree, growing in Florida, along the coast which bounds the Gulf of Mexico. The bark, leaves, and probably also the seed-vessels, are endowed with a spicy odor and taste, analogous to those of anise. It is a question worthy of investigation, whether the capsules of this plant might not be substituted for those of the *Illicium anisatum* or *star aniseed*. (See *Anisum*.) Another species, *I. parviflorum*, a shrub found by Michaux in the hilly regions of Georgia and Carolina, has a flavor closely resembling that of sassafras root.

IMPATIENS FULVA AND IMPATIENS PALLIDA. *Touch-me-not. Jewel-weed. Balsam-weed.* These two species of Impatiens are indigenous, annual, succulent plants, from two to four feet high, growing in low moist grounds, and flowering in July and August. They may be known by their tender, juicy, almost transparent stems; by their yellow flowers, which in one species are pale and sparingly punctate, in the other are deeper colored and crowded with dark spots; and by their capsules, which burst elastically, and curl up with the slightest pressure. They probably possess properties similar to those of the *I. Noli-me-tangere* of Europe, which has an acrid burning taste, and, when taken internally, acts as an emetic, cathartic, and diuretic, though considered dangerous, and therefore little used. The late Dr. Ruan, of Philadelphia, employed with great advantage, in piles, an ointment made by boiling the American plants, in their recent state, in lard. The flowers may be used for dyeing yellow. The *I. Balsamina* or *balsam-weed*, *touch-me-not*, etc., of the gardens resembles the other species in its effects.

IMPERATORIA OSTRUTHIUM. *Masterwort.* An umbelliferous plant, indigenous in the south of Europe. The root has a strong odor, similar to that of angelica, and a pungent, biting, aromatic taste, attended with a flow of saliva, and followed by a glowing warmth which remains long in the mouth. E. M. Holmes (*P. J. Tr.*, March 17, 1877) noticed this root mixed with aconite in the London market, but this probably arose from carelessness, as masterwort is worth twice as much as aconite. A crystallizable, tasteless principle, called *imperatorin*, $C_{12}H_{12}O_3$, was extracted from the root by Wackenroder, by allowing the ethereal tincture to evaporate, and recrystallizing the residue from ether and alcohol. It was purified by combining it with lime, and decomposing the lime compound by acetic acid. R. Wagner has ascertained that this principle is identical with *peucedanin*, obtained from the root of *Peucedanum officinale*, which was formerly employed in medicine, but is now quite out of use. (*Chem. Gaz.*, 1854.) M. Gorup-Besanez has found in the root another principle, to which he has given the name of *ostruthine*. (*Journ.*

de Pharm., 1875, p. 175; also *A. J. P.*, 1877, p. 247.) Besides these two crystalline compounds, masterwort contains a volatile oil, composed of a hydrocarbon and an oxygenated compound, probably the aldehyd of angelic acid. (Wagner, *Jour. Pr. Chem.*, 62, p. 283.) The root of masterwort was formerly considered alexipharmic, stomachic, corroborant, emmenagogue, diuretic, and diaphoretic; and was used in a wide circle of complaints with so much supposed success as to have gained for it the title of *divinum remedium.* It is, however, merely a stimulant aromatic, analogous but inferior to angelica, which has nearly superseded it in European practice. In this country it is unknown as a remedy, and its vulgar name has been applied to another plant.

INDELIBLE INK. This is prepared by dissolving two drachms of nitrate of silver and a drachm of gum arabic in a fluidounce of distilled water, colored with a little Indian ink. It is used for writing with a pen on linen and muslin. The place to be marked is prepared by being moistened with a solution of two ounces of crystallized carbonate of sodium and two drachms of gum arabic in four fluidounces of water, and then dried. The alkaline solution decomposes the nitrate, and protects the cloth from the action of the free nitric acid. At the end of twenty-four hours the spot is to be washed.

Prof. Redwood, of London, proposes the following indelible ink, not requiring the use of a mordant. Dissolve an ounce of nitrate of silver, and an ounce and a half of crystallized carbonate of sodium, separately, in distilled water, and mix the solutions. Wash the precipitated carbonate of silver, and, having introduced it, still moist, into a Wedgwood mortar, rub it with eight scruples of tartaric acid, until effervescence ceases. Then add strong solution of ammonia, just sufficient to dissolve the tartrate of silver formed (about two fluidounces). Lastly, having mixed in half a fluidounce of archil, half an ounce of white sugar, and an ounce and a half of powdered gum arabic, add sufficient distilled water to make the whole measure six fluidounces. M. Soubeiran has given the following formula for indelible ink, which he considers simpler than Mr. Redwood's. Dissolve 8 parts of crystallized nitrate of silver, 3 of nitrate of copper, and 4 of carbonate of sodium, in 100 of water of ammonia, and add to the solution a little gum. The marks produced by nitrate of silver on linen or muslin may be completely removed by moistening them with a solution of corrosive sublimate or cyanide of potassium in distilled water, and afterwards washing them with ordinary water.

M. Jules Guiller has devised the three following formulas for marking-inks for linen. 1. Nitrate of silver 11 parts; distilled water 85; powdered gum arabic 20; carbonate of sodium 22; solution of ammonia 20. Dissolve the carbonate of sodium in the water, rubbing the solution with the gum, and the nitrate of silver in the ammonia. Mix the solutions, and gradually heat the mixture in a flask until it boils. This ink flows readily from a pen. 2. Nitrate of silver 5 parts; distilled water 12; powdered gum arabic 5; carbonate of sodium 7; solution of ammonia 10. The ingredients are treated as in the preceding formula, with the exception that the mixed solution is heated until it becomes of a very dark color, and is reduced about one-twentieth in volume by evaporation. This ink is suitable for marking on linen with stamps. 3. Nitrate of silver 17 parts; distilled water 85; powdered gum arabic 20; carbonate of sodium 22; solution of ammonia 42; sulphate of copper 33. Dissolve the nitrate of silver in the ammonia, the carbonate of sodium in 25 parts of the water, and the gum in the remaining 60. Then mix with the soda solution, first the gum solution, and afterwards the silver solution. Lastly, add the sulphate of copper. This ink has a blue, instead of the dark brown color of the others. (See *A. J. P.*, 1853, p. 33.)

Dr. Boettiger gives the following formula. 3·65 Gm. of anilin black are rubbed down in a porcelain mortar with 60 drops of concentrated hydrochloric acid, and 22 Gm. of alcohol. This solution is mixed with a hot solution of 1·82 Gm. of gum arabic in 85 Gm. of hot water. This ink does not attack steel pens, and is not acted upon either by strong mineral acids or by alkalies. If the anilin black solution is diluted with shellac solution (21 Gm. in 85 of alcohol) an anilin black lake is obtained, which is suited for coloring wood and leather.

Herberger recommends the following indelible ink for other purposes than marking linen. Dissolve wheat gluten, carefully freed from starch, in a little weak acetic acid, and dilute the solution with rain-water, so as to have about the strength of wine vinegar. For every four ounces of the solution, add ten grains of the best lampblack, two grains of indigo, and a little oil of cloves. This ink has a beautiful black color, and cannot be removed by chlorine or dilute acids. (*Chem. Gaz.*, No. 70, p. 394.)

Dr. Elsner states that an *indelible red ink* can be prepared as follows: Equal parts by weight of copperas and cinnabar, both in fine powder and sifted, are rubbed up with linseed oil with a muller, and finally squeezed through a cloth. The thick paste can be employed for writing or stamping woollen or cotton goods.

INDIAN RED. A purplish red pigment, brought from the island of Ormus in the Persian Gulf. It is a *red ochre*, and owes its color to the red oxide of iron.

INDIAN YELLOW. This is a pigment manufactured from a yellow substance from India, called *purree.* Purree occurs in commerce in balls, from three to four ounces in weight, which are dark brown externally, and deep orange within. It has a peculiar smell, closely resembling that of castor. This circumstance gave rise to the belief that it was of animal origin; but Dr. Stenhouse finds that it contains no nitrogen, and believes that it is a vegetable substance. Upon analysis he found it to consist of magnesia, united with a peculiar acid, which he names purreic (*euxanthic acid* of Erdmann), and which forms nearly one-half of the crude substance. *Purreic acid* is in small crystals of a light yellow color, dissolving sparingly in cold water, pretty readily in boiling water, and abundantly in hot alcohol. It has at first a sweetish and then a slightly bitter taste, and possesses, in appearance, considerable resemblance to berberine. When acted upon by boiling nitric acid, it is finally converted into a new acid, crystallizing in yellow needles, called by Erdmann, *oxypicric acid.* Purreic or euxanthic acid is monobasic, and has the formula $C_{21}H_{18}O_{11}$. Dr. Stenhouse concludes that purree is probably the juice of some plant, saturated with magnesia, and boiled down to a solid consistence. (*Philos. Mag.*, xxv. 321.) Other authorities conjecture that it is obtained from the deposit of camels' urine after the animals have eaten the fruit of *Mangostana mangifer.* (*Chem. Gaz.*, 1855, p. 134.)

INDIGO. This well-known and highly important dye-stuff is obtained from various species of Indigofera, especially *I. tinctoria*, *I. Anil*, and *I. Argentea;* and is said to be afforded also by other plants, such as *Wrightia tinctoria*, *Polygonum tinctorium*, *Galega tinctoria*, etc. It does not exist ready formed, but is generated, during fermentation, from another principle existing in the plant. This principle appears to have been isolated from *Isatis tinctoria* by Ed. Schunck, who has named it *indican.* Through the agency of the mineral acids, it is resolved into indigo and sugar; and perhaps the same result may take place in fermentation. Indican is yellow, amorphous, of a nauseous bitter taste, with an acid reaction, and readily soluble in water, alcohol, and ether. It contains nitrogen. (*P. J. Tr.*, xv. 166.) In the process of preparing indigo, the plant is macerated in water; fermentation takes place; the liquor becomes of a greenish color, and in due time is decanted; the coloring principle dissolved by the water absorbs oxygen from the air, and assumes a blue color, becoming at the same time insoluble; a gradual precipitation takes place, favored by the addition of lime-water or an alkaline solution; and finally the precipitated matter, having been washed upon linen filters, is dried, shaped usually into cubical masses, and sent into market. Most of the indigo consumed in dyeing is brought from the East Indies, though considerable quantities are imported also from Guatemala, and the northern coast of South America. It was formerly produced in our Southern States, especially Florida, where the plant grows luxuriantly; and it still appears to be prepared there for local use. (See *A. J.* P., xxvii. 473.) It is of an intensely blue color, but assumes a coppery or bronze hue when rubbed by a smooth hard body, as the nail. Heated to 287·7° C. (550° F.), it emits a reddish violet vapor, which condenses in minute crystals. It is insoluble in water or alcohol, but is readily dissolved by sulphuric acid, which, without destroying its blue color, so far alters its nature as to render it freely soluble in water, and thus affords a convenient method of applying it to the purposes of dyeing. It is also soluble in nitro-benzol. (For other solvents, see *American Chemist*, i. 472, and *A. J. P.*, xliii. 562.) The solution in sulphuric acid is kept in the shops under the name of *sulphate of indigo.* According to Berzelius, indigo contains, among other ingredients, four distinct principles: 1, a substance resembling gluten; 2, a brown coloring substance; 3, a red coloring substance; and 4, a blue coloring substance, which is the principle upon which its value as a material for dyeing depends, and which seldom constitutes so much as one-half of the indigo of commerce. This blue coloring matter is called *indigotin.* According to C. Mehu, if dissolved in a boiling mixture of carbolic acid with a little alcohol or 15 per cent. of camphor, on cooling it is deposited in crystals. (*A. J. P.*, xliv. 71.) By deoxidizing agents it is deprived of its blue color, which it recovers by exposure to the air, in consequence of the absorption of oxygen. Such is the case with the acid sulphites, and in a less degree with sulphurous acid. Certain volatile oils are said to have the same effect when boiled with tincture of indigo, as the oil of turpentine, peppermint, lavender, juniper, savine, or sage. (*Journ. de Pharm.*, 1859, p. 399.) Chlorine also destroys the blue color. M. Preisser has concluded, from an elaborate examination of the *coloring principles* of plants, 1, that these principles are colorless in the young plants; 2, that they acquire color by combination with oxygen; 3, that all the coloring matters, extracted from any one plant, are produced by the oxidation in different degrees of a single principle; 4, that they are deprived of color by substances having a strong affinity for oxygen, and reacquire it by contact with oxidizing bodies; and 5, that these coloring principles are acids, and the lakes which they form genuine salts. (*Journ. de Pharm.*, 3e sér., v. 263.) For modes of testing the value of any specimen of indigo, see *Chemical Gazette*, vii. 463, viii. 443, and x. 159; *Chem. News*, 1862, p. 284; and *A. J. P.*, xxv. 223. Those methods which are based on the effect of oxidizing agents, by which the coloring matter is destroyed, as chlorate or bichromate of potassium, are asserted by Erdmann to be defective, as it is not only the proper indigo blue that is destroyed, but other principles which are always present in the best indigo of commerce, especially the indigo brown, and a substance like gelatin usually found in the drug. (*Journ. de Pharm.*, 4e sér., ii. 261.) For the value of these tests and the use of indigo in the estimation of nitric acid, see *Journ.*

de Pharm., 4e sér., xx. 415.) M. Lowenthal proposes the amount of ash yielded, as a test of the purity of indigo; a pure article should give about 4·5 per cent. (*A. J. P.*, xliv. 354.) This test will detect the not rare adulteration of indigo with lime and other inorganic salts.

The artificial production of indigo has been the subject of much investigation and effort in recent years. The problem has been successfully solved by Prof. A. Baeyer, of Munich, who has proposed several methods capable of utilization on a commercial scale.

The first is to start with *benzylchloride*, C_6H_5,CH_2Cl, prepared from *toluol*, C_6H_5,CH_3, and by changing this successively into *benzylcyanide*, C_6H_5,CH_2CN, *phenylacetic acid*, $C_6H_5,CH_2,COOH$, *oxindol*, $C_{16}H_{14}N_2O_2$, *isatin*, $C_{16}H_{10}N_2O_4$, he prepares *indigo blue*, $C_{16}H_{10}N_2O_2$.

The second method, and that at present carried out on a large scale by the Baden Anilin and Soda Co., at Ludwigshafen, is to start with *cinnamic acid*, $C_9H_8O_2$, which is changed into *ortho-nitro-cinnamic acid*, $C_9H_7NO_4$, and this by the intervention of the di-bromine derivative into *ortho-nitro-phenylpropiolic acid*, $C_9H_5NO_4$, and this by the action of alkalies in the presence of reducing agents like grape sugar is converted directly into *indigo blue* $(C_8H_5NO)_2$.

For the present the cost of the artificial indigo is such as to make it only in a limited degree a competitor of the natural color.

Indigo has been proposed by E. Mulder as a test for glucose and fruit sugar, which have the property of changing the blue color of indigo to white in the presence of the alkalies. To the solution to be examined he adds sulphate of indigo, previously treated with an excess of carbonate of potassium or sodium. The addition of the carbonated alkali to the sulphate of indigo scarcely affects the blue color even at a boiling heat; but if the solution contain glucose or fruit sugar, the blue color disappears even in the cold, but more rapidly with heat. Common sugar has no such effect. (*Journ. de Pharm.*, 1860, p. 179; from *Archiv der Pharm.*, clv. 268.)

Indigo has been introduced to the notice of the profession as a remedial agent. It was at first employed chiefly by the German physicians, from whose statements our knowledge of its physiological action and therapeutical application was derived. Though without odor and taste, it is said, in most individuals, to produce nausea and vomiting, frequently to operate upon the bowels, giving a bluish-black color to the stools, to render the urine of a dark violet or dark green color, without increasing its quantity, and sometimes to stimulate the secretory function of the uterus. From these statements it would appear to act as an irritant to the alimentary mucous membrane. The character of its general influence upon the system has not been well ascertained. In some instances, it is asserted to have been given in very large doses without any obvious effect. (*Chem. Gaz.*, 1854, p. 267.) The complaints in which indigo has been employed, with supposed advantage, are epilepsy, infantile convulsions, chorea, hysteria, and amenorrhœa. It is given, usually in connection with some aromatic powder, in the dose of a scruple three times a day, which may be increased to a drachm or more; and from half an ounce to an ounce has been employed daily for months together without disadvantage. (See *Am. Journ. of Med. Sci.*, xx. 487.) The general failure of indigo to produce the desired effects in epilepsy, in which it had at one time considerable credit as a remedy, has been ascribed to the use of too small doses. M. Ideler, of Berlin, began with about two drachms daily, and increased gradually to two ounces; but there was great difficulty in reconciling the patient to such doses, on account of the intense nausea produced. (*B. and F. Med.-Chir. Rev.*, Am. ed., 1856, p. 198.)

INÉE. *Onaye. Poison of Pahouins.* This exceedingly violent poison is obtained from the seeds of the *Strophantus hispidus*, an apocynaceous plant of Gaboon. Hardy and Gallois have found in it a crystalline neutral principle, *steophantin*, which does not give alkaloid reactions, and has no nitrogen in it. (*Bulletin de Thérap.*, xcii. 499.) Inée appears to kill by paralyzing the heart, and is said to act especially upon the muscles, destroying their contractility. (Consult *Ann. de Thérap.*, 1874, 19; *Compt.-Rend. Soc. Biolog.*, iv. 69.)

INKS, COLORED. The following recipes are stated by the *Boston Journal of Chemistry* to be preferable to the solutions of anilin dyes, which are now so extensively used as colored inks.

Green. Two parts acetate of copper, one part carbonate of potassium, and eight parts water. Boil till half is evaporated, and filter.

Blue. Three parts Prussian blue, one part oxalic acid, and thirty parts water. When dissolved, add one part gum arabic.

Yellow. One part fine orpiment, well rubbed up with four parts thick gum-water.

Red. With the aid of a gentle heat dissolve four grains of carmine in one ounce water of ammonia, and add six grains of gum arabic.

Gold. Rub gold leaf, such as is used by book-binders, with honey till it forms a uniform mixture. When the honey has been washed out with water, the gold powder will settle at the bottom, and must be mixed with gum-water in sufficient quantity.

Silver. Silver leaf treated in precisely the same manner gives a silver ink. Both these inks may, when dry, be polished with ivory.

Black. Three ounces crushed gallnut, two ounces crystallized sulphate of iron, two ounces gum arabic, and twenty-four ounces water.

White. Fine French zinc white or white lead, rubbed up with gum-water to a proper consistency.

INSECT POWDER. *Persian* or *Caucasian Insect Powder*, or *Guirila*, consists of the flowers of *Pyrethrum carneum* and *P. roseum*, growing upon the Caucasian mountains, at an elevation of about a mile. *Dalmatian Insect Powder* is the product of *P. Cinerariæfolium*, and it is more powerful than the Caucasian powder. *Insect Powder* is a coarse powder, of a greenish-yellow color and pungent odor. It does not appear to be poisonous to man, though it is said to cause some confusion of head in those who sleep in close apartments where much of it is used. Upon the insects, however, which are apt to infest the person of man and animals, as well as bedding and sleeping apartments, it acts very destructively, first stupefying and then killing them. It is scattered over the person, upon the beds, about apartments, etc., and is even employed as a dressing for ulcers and wounds to prevent the formation of maggots. It also answers to preserve dried insects and plants in cabinet collections. The demand for the powder having much increased of late, it is said to be adulterated with the leaves and stems of the plant. (Noodt, *Buchner's Neues Repert.*, vii. 562.) The powder, exhausted by alcohol, is harmless to insects; its activity is therefore dependent upon some principle whose nature has not been positively determined. M. Trapp, and also Ivanel de Bellesme, claim that it is an alkaloid, whilst M. Rother denies that it is of such nature. (*A. J. P.*, xxv. 1857; Dragendorff, *Jahresbericht*, 1876, p. 121.) Mr. Texton has found it to be a soft resin. (*A. J. P.*, 1881, p. 491.) In a series of experiments, Prof. Riley has found that the fumes of the burning powder are very poisonous to insects, and for certain purposes afford a ready mode of application, but that generally a watery infusion is the best and cheapest preparation. It is also used now in the form of cones made by making a mass with mucilage of gum, with the addition of a small quantity of nitrate of potassium. After drying, these are ignited like a pastile. Twenty-five grains stirred up in two quarts of water were sufficient to kill young cotton worms. The infusion soon spoils. The tincture and the alcoholic extract are both efficient preparations. The tincture (one part to four) has been especially recommended, diluted with ten times its bulk of water, by F. Jager, to keep off vermin from the human body. According to Prof. Maisch (*A. J. P.*, 1869, p. 128), it is capable of causing a vesicular eruption like that produced by the poison ivy.

IODAL. This substance, prepared by the action of iodine upon a mixture of alcohol and nitric acid, is decomposed by an alkali into iodoform and formic acid. M. Rabuteau found it to resemble chloral in its actions on animals. (*Ann. de Thérap.*, 1870, p. 98.)

IODATE OF CALCIUM. ($Ca(IO_3)_2 5H_2O$.) This salt has been brought forward by E. Sonstadt as a valuable antiseptic, to be used in the preservation of food. (*Chem. News*, xxviii. 297.) Mr. S. W. Moore has employed it in doses of two to four grains three times a day internally in febrile cases, and found it to lower the temperature and improve the appetite. (*Am. Journ. Med. Sci.*, lxx. 190.) It exists in sea-water, but may be prepared by acting upon iodine with chlorinated lime. (*A. J. P.*, 1874, p. 558.)

IODATE OF IRON. *Ferric Iodate. Iodate of Sesquioxide of Iron.* ($2Fe_2(IO_3)_6, Fe_2O_3, 24H_2O$.) This has been proposed as a substitute for the iodide by Prof. Cameron. (*Dublin Quarterly*, 1869, p. 354.) It is prepared by precipitating five fluidrachms of the stronger solution of perchloride of iron in four fluidounces of water with a solution of one ounce of the iodate of potassium in ten ounces of water. It has the advantage of being nearly tasteless, and not injuring the teeth. The dose is two to five grains.

IODATE OF POTASSIUM. This salt has been proposed as a substitute for the chlorate of potassium. MM. Demarquay and Custin propose the following mode of preparation, which is followed by the British Pharmacopœia in making its test solution. Take of iodine and chlorate of potassium, each, one part, and mix them with five or six parts of water, previously acidulated with a few drops of nitric acid, and heated to ebullition. As soon as chlorine ceases to escape, treat the liquid with a concentrated solution of chloride of barium. Wash with distilled water, and decompose with dilute sulphuric acid the iodate of barium precipitated; filter to separate the sulphate of barium; and slowly evaporate the solution. Wash with distilled water the crystals of iodic acid that are formed, dissolve them in boiling distilled water, and saturate with bicarbonate of potassium. On cooling, the iodate is deposited in small crystals. M. Stas prepares it by heating moderately, equal equivalents of iodide and chlorate of potassium, dissolving out the chloride formed with cold water, and repeatedly crystallizing the iodate from hot water. (*A. J. P.*, 1870, p. 217.) M. Egidio Pollacci has found that phosphorus affords a very delicate test for the iodate, as does also the iodate for phosphorus, free iodine being liberated. (*Journ. de Pharm.*, 4e sér., xx. 104.) The authors first mentioned have employed the iodate of potassium in all those cases of ulcerated and otherwise diseased mucous membrane of the mouth and fauces, in which the chlorate is usually prescribed, and have found it to produce the same curative effects more quickly, more energetically, and in smaller dose. In the healthy state, it acts remarkably on the pharyngeal and buccal mucous membrane, producing, in the quantity of 20 or 30 grains, a peculiar sense of constriction, and appearing considerably to diminish the mucous secretion. The diseases in which they have found it specially beneficial are diphtheria, mercurial affection of the mouth, and gangrenous stomatitis. The dose used by them was from four to eight grains. (*Dorvault's Rev. Pharm.*, 1858, p. 25.)

IODIC ACID. (HIO_3.) This is obtained by decomposing the iodate of calcium with sulphuric acid (*A. J. P.*, xlvi. 558), or by heating iodine with nitric acid (sp. gr. 1·5), and allowing the crystals of iodic acid to separate on cooling. It has been proposed by M. Lutton as a remedy in chronic glandular enlargements and goitre, half a drachm of a two per cent. solution being injected into the affected part. (*Ann. de Thérap.*, 1874, p. 192.)

IODIDE OF ANTIMONY. *Antimonii Iodidum. Teriodide of Antimony.* (SbI_3.) According to Mr. W. Copney, of London, this iodide may be conveniently prepared by gently heating, in a Florence flask, metallic antimony and iodine, in the proportion of one at. to three. The elements combine with sudden heat and liquefaction, and, upon the withdrawal of the heat, the iodide formed solidifies, and is removed from the flask by breaking it. Iodide of antimony, as thus prepared, forms a somewhat crystalline, foliated mass, which, when pulverized, yields a deep orange-red powder. By the action of water it is decomposed. It has been tried as an alterative in a dose varying from a quarter of a grain to a grain, given in the form of pill.

IODIDE OF BARIUM. *Barii Iodidum.* (BaI_2.) This compound may be formed by double decomposition, by adding native carbonate of barium in powder to a boiling solution of iodide of iron. M. Henry, jun., obtained it by decomposing a solution of sulphide of barium by a concentrated alcoholic solution of iodine. Sulphur is precipitated, which is separated by filtration, and iodide of barium formed in solution, from which it is obtained in the solid state by rapid evaporation to dryness. Iodide of barium crystallizes in small, colorless needles, which deliquesce slightly, and are very soluble in water. The solution promptly undergoes decomposition by exposure to the air, carbonate of barium being precipitated, and iodine set free, which colors the solution. It has been used with advantage by Jahn, as an alterative, in scrofulous affections and morbid growths. Lugol employed it in scrofulous enlargements. The dose is the eighth of a grain three times a day, gradually increased to three grains. Biett applied it to scrofulous swellings in the form of ointment, made with four grains of the iodide to an ounce of lard.

IODIDE OF BISMUTH AND POTASSIUM. This salt has been proposed as a test for the alkaloids, but, as it seems to offer no advantages, the reader is referred to the *A. J. P.*, xlvii. 374, for the method of its preparation and use.

IODIDE OF CALCIUM. *Calcii Iodidum.* (CaI_2.) This has been brought into notice by M. Malem, in a memoir published in the *Bulletin Thérapeutique* (Avril 30, 1868), as preferable to any other iodic compound in phthisis. He prepares it in the following manner. Treat a solution of iodide of iron with milk of lime. The liquor thus obtained, being filtered, and evaporated, yields crystals of iodide of calcium. It may also be made by dissolving lime or its carbonate in hydriodic acid. Pure iodide of calcium is white, and crystallizes in large plates of a pearly lustre. Procured as recommended, it is yellowish, probably in consequence of the presence of iodine in excess. It is deliquescent, and very soluble in water, and its solution is capable of dissolving iodine added to it. Iodide of calcium is much more unstable than iodide of potassium. When taken, it is rapidly decomposed into hydriodic acid and salts of lime, which are almost immediately absorbed. Most patients bear it very well; and M. Malem had administered it without inconvenience for a year or more. It is especially in scrofulo-tuberculous phthisis that he uses it. After the first dose the appetite is often improved, digestion becomes regular, the respiration deeper and more easy, the cough diminishes, and the expectoration is favorably modified. The muscular system is invigorated, the night-sweats diminish, and the patient increases in weight. Its long-continued use has in general only induced a little constipation, which often disappears upon a diminution of the dose, or suspension of the medicine. From excessive doses M. Malem has seen symptoms of active irritation induced, as increase of the cough, a deep color of the urine, uneasiness in its discharge, and pain with a sense of fulness in the region of the kidneys. But these symptoms are fugitive, and easily guarded against by a proper regulation of the dose. From one to three or four grains may be given after each meal. (*Ann. de Thérap.*, 1869, p. 194). To make the syrup of iodide of calcium the following formula has been proposed by Mr. O. Eberbach (*P. J. Tr.*, 3d ser., i. 364). Take of iodine 4 oz.; iron (in form of wire) 7½ dr.; distilled water q.s.; milk of lime (fresh) q.s.; sugar 28 oz.; simple syrup q.s.; mix 3 oz. of the iodine with the iron and 4 oz. of water, in a thin flask with long neck; shake occasionally until the reaction has ceased and the solution assumes a pale green color;

filter the solution and add the remainder of the iodine; heat to the boiling point, and add milk of lime until all of the iron is precipitated. Filter, and wash the precipitate with hot water until all the iodide is washed out, and then bring the whole to the measure of 20 fl.oz.; add the sugar, and dissolve by a gentle heat; to the solution add enough simple syrup to make it measure 40 fl.oz.; mix thoroughly, and fill into 2 oz. bottles well corked. Stanislaus Martin prepares the syrup by triturating 5 parts of calcium hydrate in a mortar with 30 parts of sugar, adding 100 parts of water in small portions at a time, allowing it to stand several hours; filtering, adding 2 parts of iodine, and when this is dissolved, 170 parts more of sugar, and flavoring with orange flower water. (*P. J. Tr.*, 1875, p. 299.)

IODIDE OF ETHYL. *Hydriodic Ether. Ethyl Iodide.* (C_2H_5I.) This ether may be obtained by gradually and cautiously mixing five parts of alcohol, ten of iodine, and one of phosphorus, and distilling. The residue of the distillation, as ascertained by D. K. Tuttle, is phosphovinic acid. The best mode of proceeding, in order to avoid danger, according to Soubeiran, is to melt the phosphorus with a gentle heat under the alcohol, contained in a wide-mouthed matrass, and to add the iodine gradually through a tube, sealed at the lower end, but perforated at the same end with a number of small holes. The tube is made to pass through a grooved cork, to give exit to the vapors, and is so adjusted as to reach nearly to the surface of the melted phosphorus. The matter in the matrass is distilled to the extent of four-fifths, the distillate is washed with water to separate alcohol, and the decanted ether is dried by the addition of a few pieces of chloride of calcium. Dr. de Vrij recommends the following method for procuring this ether on a large scale. Absolute alcohol is to be saturated with dry hydrochloric acid gas, the liquid being kept well cooled; and the amount of the acid is to be determined by a sample. The liquid thus saturated is to be put into a retort with as much iodide of potassium as may be necessary to form chloride of potassium; the mixture is to stand for a day; and is then to be submitted to distillation. Finally, the ether which comes over is to be washed and rectified. (See *A. J. P.*, 1859, p. 170.) Personne (*Comptes-Rendus*, 51, 468) proposed to use amorphous phosphorus instead of the ordinary kind, thus avoiding danger. Reith and Beilstein (*Ann. Chem. Pharm.*, 126, 250) propose the following process. Mix 10 parts amorphous phosphorus with 50 parts alcohol of sp. gr. 0·83; add 100 parts dry iodine in small portions. The mixture should be allowed to stand twenty-four hours before distillation, and the distillation decolorized by a solution of soda, and deprived of water by redistilling in contact with chloride of calcium. Hydriodic ether is a colorless non-inflammable liquid, insoluble in water, with a penetrating ethereal odor and pungent taste. Its density is 1·92, and boiling point 71°–72° C. (160°–161·6° F.). Exposed to the air it becomes red from the liberation of iodine; the change in color is prevented by adding to the bottle containing it a globule of mercury. M. Huette has proposed this ether as a medicine, to be used by inhalation, placed under a layer of water. Fifteen or twenty inspirations suffice to impregnate the system with iodine. Its physiological effects appear to be those of an antispasmodic and general stimulant. It acts also as a powerful anæsthetic, when sufficiently long inhaled. It increases the appetite, renders the pulse fuller, and gives vivacity to the feelings and activity to the intellect. M. Huette considers it a suitable preparation for bringing the system rapidly under the influence of iodine, and by any desired dose. (See *A. J. P.*, xxiii. 156.) Since the therapeutic trials of M. Huette were made, Mr. James Turnbull, of Liverpool, and Dr. Henry Fisher, of New York, have used this ether by inhalation in chronic pulmonary diseases with satisfactory results. Dr. Fisher specifies chronic bronchitis and phthisis as the diseases in which he has found it useful. The dose is 15 drops, three or four times a day, inhaled from a handkerchief. Hydriodic ether often has an unpleasant smell from the presence of foreign substances, which renders it offensive to patients. Phosphorus is a common and injurious impurity.

IODO-CHLORIDES OF MERCURY. *Iodides of Calomel. Sel de Boutigny.* These compounds, called subiodide and protiodide of calomel, were brought forward as remedies by M. Boutigny in 1847. They are now rarely used. (For an account of their preparation and use, see 14th ed. U. S. Dispensatory.)

IODOHYDRARGYRATE OF POTASSIUM. It has been found by chemists that mercuric iodide, HgI_2, unites with the more positive metallic iodides forming a series of double salts, sometimes called *iodohydrargyrates*. These have been particularly studied by Boullay (*Ann. Ch. Phys.* [2], 34, p. 345), who finds that a concentrated solution of potassium iodide will dissolve mercuric iodide in the ratio of 3 mols. of the mercuric salt for every two of the potassium salt. When the solution is cooled, one mol. of red mercuric iodide crystallizes out, and then from the mother-liquor deposits yellow prisms, having the composition $2(HgI_2,KI) + 3H_2O$. This substance was presented to the notice of the profession, as a new remedy of remarkable powers, in Feb. 1834, by Dr. William Channing, of New York. (*Am. Journ. of Med. Sci.*, xiii. 388.)

Dr. Channing attributes to this preparation the effects of diffusing excitement, and equalizing the circulation. In the different cases in which he tried it, he thought he saw evidence of its favorable influence on the lungs, in allaying cough and improving expectoration; on the alimentary canal, in restoring the healthy secretions; on the kidneys, in reviving their activity; on the skin and cellular tissue, in cicatrizing superficial ulcerations; and on the absorbent and exhalant systems, in causing the disappearance of effused fluid. The principal diseases in which he found it useful were chronic bronchitis, hooping-cough, tonsillitis, chronic gastro-enteritis, dyspepsia, ascites, anasarca, amenorrhœa, leucorrhœa, eruptions, and scrofula. In some cases of phthisis, it mitigated the symptoms, and appeared to prolong life. Dr. Hildreth, of Ohio, has tried the preparation, and reports favorably of its effects in functional dyspepsia, enlargement of the spleen, amenorrhœa, dysmenorrhœa, leucorrhœa, scrofulous affections, ascites, and general dropsy. (*Am. Journ. of Med. Sci.*, xxvi. 312.)

The average dose of the remedy may be stated at the twelfth of a grain three times a day; but in peculiar constitutions, not more than the forty-eighth, the ninety-sixth, or the two-hundredth of a grain daily can be borne. For the convenience of physicians who may wish to make trial of the remedy, we give the following formula, deduced from the statements in Dr. Channing's paper. Take of iodide of potassium three and a half grains; red iodide of mercury four and a half grains; distilled water a fluidounce. Dissolve first the iodide of potassium and then the red iodide of mercury in the water. The compound salt in this solution may be assumed to amount to eight grains, though there is a small excess of the iodide of potassium. Of this solution from two to five drops, containing from the thirtieth to the twelfth of a grain, may be given three times a day. It may be administered in the compound syrup of sarsaparilla, which does not decompose it.

The iodohydrargyrate of potassium was suggested by F. L. Winckler as a qualitative test of the organic alkaloids, with which it produces insoluble precipitates; and subsequently it was used by Prof. F. F. Mayer, of New York, for determining the quantity of these alkaloids in any mixture containing them. Prof. Mayer employed, for volumetric analysis, a solution made with 13·546 grammes of corrosive sublimate, 49·8 grammes of iodide of potassium, and a litre of distilled water. For the value, in our own weights and measures, of the gramme and litre, the reader is referred to tables in Part III. of this work. Of the solution thus made one cubic centimetre precipitates, of

Aconitine......	0·0267 gram.	Conine........	0·00416 gram.	Quinidine......	0·0120 gram.
Atropine	0·0145 “	Morphine....	0·0200 “	Quinine.........	0·0108 “
Brucine.........	0·0233 “	Narcotine....	0·0213 “	Strychnine.....	0·0167 “
Cinchonine....	0·0102 “	Nicotine	0·00405 “	Veratrine.......	0·0269 “

The resulting precipitates are hydriodates of the alkaloids, respectively, with iodide of mercury. They may be produced in acid, neutral, and feebly alkaline liquids, except in the presence of alcohol and acetic acid, by which they are dissolved. For those who may not possess the requisite instruments, Prof. Mayer gave the following table, having reference to ordinary officinal weights. The solution was made with 16·25 grains of corrosive sublimate, 100 grains of iodide of potassium, and enough distilled water to make altogether 12·5 troyounces, or 6000 grains. Of this solution 10 grains will precipitate of

Aconitine.........	0·0534 grs.	Conine	0·0083 grs.	Quinine............	0·0216 grs.
Atropine...........	0·0289 “	Morphine.........	0·0400 “	Sulphate of quinine	0·0296 “
Sulphate of atropine......	0·0389 “	Sulphate of morphine...	0·0500 “	Strychnine........	0·0334 “
Brucine	0·0466 “	Nicotine	0·0081 “	Veratrine...........	0·0538 “
Cinchonine	0·0204 “	Quinidine	0·0240 “		
Sulphate of cinchonine...	0·0250 “	Sulphate of quinidine...	0·0284 “		

For further observations upon Mayer's method of effecting the assay of the alkaloids, see *A. J. P.*, 1863, p. 20. (See *Test Solution of Iodide of Mercury and Potassium*, Part III.)

IONIDIUM MARCUCCI. This name has been conferred by Dr. Bancroft upon a South American plant supposed to be the source of a medicine used with great asserted advantage in Maracaibo and elsewhere, in elephantiasis and other cutaneous affections. A specimen, however, received from Dr. Bancroft, was found by Sir W. Hooker to be identical with the *Ionidium parviflorum* of Ventinat. The medicine is called by the Indians *cuichunchulli*, and grows in the neighborhood of Riobamba, a small town at the foot of the great mountain of Chimborazo. It is said to be diaphoretic, diuretic, occasionally sialagogue, and in large doses emetic and cathartic. The root is the part used. For further knowledge on the subject, see *A. J. P.*, iii. 125.

ISATIS TINCTORIA. *Woad. Pastel.* A biennial plant, indigenous and cultivated in Europe. The leaves have a fugitive pungent odor, and an acrid very durable taste; they have been used in scorbutic affections, jaundice, and other complaints, but are only valuable for making a blue dye-stuff, *woad*, which has been long employed in Europe, though at present nearly superseded by indigo. The leaves are prepared by grinding them to a paste, which is made into balls, placed in heaps, and allowed to ferment. When the fermentation is at an end, the mass falls into a coarse powder, which is the dye-stuff in question.

ISOPYRUM THALICTROIDES. F. A. Harsten believes he has found two alkaloids, *isopyrine* and *pseudoisopyrine*, in the root of this plant. (*A. J. P.*, xliv. 453.)

JEFFERSONIA DIPHYLLA. *Twin-leaf.* This is a small, indigenous, herbaceous, perennial plant, one of the Berberidaceæ. From a knotty rhizome, having long radicles, arises a naked one-flowered scape about a foot in height, and leaves which stand in pairs on long footstalks. The flower is white, with a four-leaved colored calyx, and eight petals; and the fruit is a one-celled, obovate, substipitate capsule, dehiscent near the top, with many oblong seeds, united at the base. The plant grows in the Middle and Western States. The rhizome, which, with the rootlets attached, is the part used, has a brownish yellow color, and a bitter, acrid taste, which resides in its cortical part, the inner portion being nearly tasteless. It was analyzed by Prof. E. S. Wayne, of Cincinnati, and found to contain albumen, gum, tannic acid, starch, pectin, a fatty resin, hard resin, sugar, lignin, and a peculiar acrid principle, having acid properties and resembling polygalic acid, in which it is supposed that the virtues of the root reside. The root is said to be emetic in large doses, tonic and expectorant in smaller doses, and not unlike seneka, as a substitute for which it is sometimes used. (*A. J. P.*, xxvii. 1.) According to Prof. Mayer, of New York, the rhizome of this plant contains a small quantity of berberine, and a second white alkaloid. The pectin of Mr. Wayne he considers to be saponin. (*Ibid.*, 1863, p. 99.)

JELLIES. The form of Jelly is sometimes a convenient method of administering medicines, especially the fixed oils, as cod-liver oil, castor oil, resinous juices, etc. The following is a formula recommended by Prof. Parrish and William C. Bakes. "Take of the fixed oil or liquid resin a *troyounce;* honey, syrup, each, *half a troyounce;* gum arabic, in powder, *two drachms;* Russian isinglass, *forty grains;* orange-flower water, *six fluidrachms.* Dissolve the isinglass, with the aid of heat, in half a fluidounce of the orange-flower water, replacing the water as it evaporates. Triturate the other ingredients, with the remainder of the orange-flower water, into a homogeneous mass in a warmed mortar, then add the hot solution of isinglass, stir the mixture as it cools, and set it aside to gelatinize." (*A. J. P.*, 1861, p. 4.) Any other aromatic water may be substituted for that of the orange-flower, and cinnamon-water diluted with an equal measure of pure water would probably better cover the offensive taste. In reference to cod-liver oil, the bitter-almond or cherry-laurel water would be still more effectual; care, however, being taken in this case, that the water is duly diluted, lest too large a dose of it be administered.

JUNIPERUS VIRGINIANA. *Red Cedar.* The tops of this plant were formerly included in the secondary list of the U. S. Pharmacopœia. The tree is an evergreen of slow growth, seldom very large, though sometimes attaining a height of forty or fifty feet, with a stem more than a foot in diameter. It has numerous and close branches, which, in the young tree, spread out horizontally near the ground; but as the tree advances, the lower branches slowly decay, leaving the trunk irregular with knots and crevices. The leaves are very small, fleshy, ovate, concave, pointed, glandular on their outer surface, ternate or in pairs, and closely imbricated. Those of the young shoots are often much longer and spreading. The leaves closely invest the extreme twigs, increasing with their growth, till ultimately lost in the encroachments of the bark. The red cedar grows in all latitudes of the United States, from Burlington, in Vermont, to the Gulf of Mexico; but it is most abundant and vigorous in the southern section. The interior wood is of a reddish color, and highly valuable on account of its great durability. Small excrescences, which are sometimes found on the branches of the tree, are popularly used as an anthelmintic, under the name of *cedar apples*, in the dose of from ten to twenty grains three times a day. The tops have a peculiar not unpleasant odor, and a strong, bitterish, somewhat pungent taste. These properties reside chiefly in a volatile oil, and are readily imparted to alcohol. The leaves, analyzed by Mr. Wm. J. Jenks, were found to contain volatile oil, gum, tannic acid, albumen, bitter extractive, resin, chlorophyll, fixed oil, lime, and lignin. (*A. J. P.*, xiv. 235.) They bear a close resemblance to the leaves of *Juniperus Sabina*, from which they can be certainly distinguished only by the difference of odor. The *oil of red cedar* is now an article of commerce: it is used principally in perfumery, and is one of the principal constituents of the popular extract of white rose. (*A. J. P.*, 1877, p. 186.) It possesses, in a marked degree, the well-known agreeable odor of the red cedar wood. *Cedren camphor*, $C_{15}H_{26}O = C_{15}H_{24} + H_2O$, may be obtained by cooling the oil until coagulated, and separating the crystalline portion by expression; the expressed liquid is *cedren*, $C_{15}H_{24}$, which, after rectification and distillation, has the sp. gr. 0·984 at 15° C. (59° F.), boiling at 248° C. (478·4° F.).

Uses. The resemblance of red cedar to savine is said also to extend to its medical properties. It is, however, much less energetic, and has not acquired the confidence of the profession generally. Externally applied it acts as an irritant; and an ointment, prepared by boiling the fresh leaves for a short time in twice their weight of lard, with the addition of a little wax, is employed as a substitute for savine cerate in maintaining a purulent discharge from blistered surfaces. Sometimes the dried leaves in powder are mixed with six times their weight of resin cerate, and used for a similar purpose. But neither of these preparations is as effectual as the analogous preparation of savine. The volatile oil acts probably like oil of savine; and in the *Boston Med. and Surg. Journ.*, xl.

469, several cases of poisoning are recorded by Dr. S. C. Watt, of Gouverneur, New York. It appears that this oil has the reputation of producing abortion, and was taken, in three of the cases described, with a view to that effect. In one instance a fluidrachm was taken, in another a fluidounce, and in both of these cases recovery took place. Two of the cases were fatal. The symptoms were burning in the stomach, sometimes vomiting, violent convulsions, coma, and a very slow pulse. The operation of the poison was mainly on the brain. No abortive effect was experienced in either case. The stomach, on examination after death, showed marks of inflammation, but not violent.

KALMIA LATIFOLIA. *Laurel. Mountain Laurel. Broad-leafed Laurel. Calico-bush.* This well-known evergreen inhabits all sections of the United States, being especially abundant on the sides of hills and mountains, which it adorns in summer with its elegant flowers. It is from three to ten feet in height. The leaves, which are possessed of poisonous, narcotic properties, have been found by Mr. Charles Bullock to contain gum, tannic acid, resin, chlorophyll, fatty matter, a substance resembling mannite, an acrid principle, wax, extractive, albumen, yellow coloring matter, lignin, and salts of potassium, calcium, and iron. (*A. J. P.*, xx. 264.) Mr. George W. Kennedy detected the alkaloid arbutin in them. (*Ibid.*, xlvii. 5.) They are said to prove fatal to sheep and some other animals, but are eaten with impunity by deer, goats, and partridges. Dr. Barton states, in his "Collections," that the Indians sometimes use a decoction of the leaves to destroy themselves. It is said that death has been occasioned by eating the flesh of partridges and pheasants which have fed upon them during winter. Dr. N. Shoemaker published, in the *North American Med. and Surg. Journ.*, two cases of poisoning which resulted from eating a pheasant, in the craw of which laurel leaves were found. The symptoms were nausea, temporary blindness, pain in the head, dyspnœa, pallid countenance, cold extremities, and a very feeble pulse, which in one case was for some time absent at the wrist, in the other beat only forty strokes in the minute. In both cases relief was afforded by vomiting, produced by a tablespoonful of flour of mustard mixed with warm water. A case of similar poisoning is related in the *Edinburgh Med. Journ.*, 1856, p. 1014, in which epigastric tension and uneasiness, glowing heat of the head, loss of sight, coldness of the extremities, general prostration, and twitchings of the muscles were the prominent symptoms, followed by nausea and full vomiting, which afforded some relief. But feelings of formication and weakness of the limbs, with great prostration of the circulation, remained for several hours, requiring the use of stimulants. Dr. Barton was informed that the powdered leaves were employed by an empiric with success in certain stages of fever; and Dr. Thomas, in an inaugural dissertation, published at Philadelphia, in 1802, states that an obstinate case of diarrhœa was cured by a decoction, made by boiling an ounce of the leaves in eight ounces of water down to four ounces. Thirty drops were given six times a day; but this quantity produced vertigo, and the dose was afterwards repeated only four times daily. The leaves are said to have been used advantageously in syphilis. Externally applied, in the shape of ointment or decoction, they have been found useful in tinea capitis, psora, and other cutaneous affections; but caution is necessary in their application, as, according to Dr. Barton, nervous symptoms have resulted from the external use of the decoction. Dr. Bigelow has seen the recently powdered leaves given in doses of from ten to twenty grains, without perceptible effect.

It is probable that other species of Kalmia, as *K. angustifolia*, or *sheep-laurel*, and *K. glauca*, or *swamp-laurel*, have properties identical with those of *K. latifolia.* A decoction of the leaves of *K. angustifolia* is used by the negroes of North Carolina as a wash for an ulcerative affection between the toes.

KAURI GUM. This is an amber-like substance, varying from a soft cream-white to an amber color, dug in large quantities from the soil in New Zealand. It is an exudation from the *Dammara australis*, but as it first exudes and is found on the surface of the ground, it is not esteemed. For a full account of it, see *P. J. Tr.*, ix. 715. It yields on distillation an oil almost entirely composed of a terpene. (*A. J. P.*, 1881, p. 419.)

KOMBÉ POISON. This is an African poison, prepared from the seeds of an apocynaceous plant, *Stropanthus Kombé*, Oliver. Dr. T. R. Fraser has found it to act primarily on the heart, producing paralysis with permanent contraction. It exaggerates the susceptibility of the voluntary muscles, and finally causes rigidity with acid reaction. The reflex function, but not the motor conductivity, of the cord is suspended soon after the cardiac paralysis. For further details, see Dr. Fraser's paper in the *Proc. Roy. Soc. Edinb.* 1869–70; abstracted, *Journal of Anatomy*, vol. vii.

KOSSALA. This is an Abyssinian remedy against tape-worm. (See *Proc. A. P. A.*, xxvi. p. 171.)

KOUMYS. *Kumys.* This is a liquor originally prepared by the Tartars from the milk of mares, but recently imitated with cow's milk to a great extent. It is said to be prepared in Tartary by putting the mare's milk in tall vessels whilst warm, adding koumys, one part for every ten of milk, stirring thoroughly every few minutes, and in three or four hours taking out and bottling in champagne bottles. (*Journ. de Pharm.*, 1875, p. 59.) For an account of the method employed in Russia, see *A. J. P.*, 1875, p. 261. The milk of the mares of the Steppes is stated to resemble that of women, being much richer than cow's milk in sugar and poorer in casein. (For analysis, see *Journ. de Pharm.*, 1875, p. 62.) Accordingly, in preparing the substitute for true koumys, H. and N. Schulze, of Berlin, add sugar of milk to cow's milk, and ferment with brewer's yeast in open tanks, stirring frequently, skimming off the casein and butter which rise to the surface, and bottling whilst fermentation is very active. (*Phila. Med. Times*, Jan. 1874.) (For a method of making a very fictitious koumys out of condensed milk, see *Ibid.*) Mr. Wilckens adds to every litre of cow's milk 30 grains of milk sugar and twice that weight of beer yeast, and then fills champagne bottles to within about a half-inch of the top, corking securely. This koumys is said to be good from the fifth to the twentieth day. (*Journ. de Pharm.*, 1875.) . The true koumys does not keep long, and therefore must be drunk at the place of production. For particulars as to the varieties of it, etc., see *Ibid.*, Janv. 1875; also, Truckenmiller, *A. J. P.*, 1880, p. 292. Dr. L. Wolff (*A. J. P.*, 1880, p. 291) has furnished, probably, the best formula for koumys: "Grape sugar, half an ounce. Dissolve it in four ounces of water. Dissolve twenty grains of Fleischmann's compressed yeast, or well washed and pressed out brewer's yeast, in two ounces of milk. Mix the two solutions in a quart champagne bottle, which is to be filled with good cow's milk to within two inches of the top. Cork well, secure the cork with wire, and place in a cellar or ice chest, where a temperature of 10° C. (50° F.) or less can be maintained, and agitate three times a day. In three or four days the koumys is ready for use, and should not be kept longer than four or five days; it should be drawn only with a champagne tap."

According to M. Stalberg, the composition of true koumys is as given below; other analyses may be found in the *Journ. de Pharm.*, 1875, p. 62. *Kumys of June.* In 100 parts, alcohol 1·65, fat 2·05, sugar of milk 2·20, lactic acid 1·15, casein 1·12, salts 0·28, carbonic acid 0·75. *Kumys of September.* Carbonic acid 1·86, alcohol 3·23, fat 1·05, lactic acid 2·92, casein and salts 1·21. M. Stalberg gives the following as the result of an analysis of Swiss kumys, made from skimmed cow's milk to which sugar had been added. Alcohol 3·622, lactic acid 0·256, sugar 2·376, albumen 2·099, butter 2·008, mineral salts 0·574, carbonic acid 1·997. Prof. Warnikiewicz found in kumys from cow's milk 6·32 per cent. of solid material, casein 3·08, butter 0·22, milk sugar 1·77, salts 0·33, lactic acid 0·62, alcohol 1·23 parts per hundred.

The taste of koumys is sweet but acidulous and peculiar. In small quantities it is said to increase the appetite, in large quantities to take the place of solid food, each quart of it containing, according to Dr. Victor Jagielsky, four ounces of solid food. (*N. R.*, i. 1.) In warm weather it is said to act as a diaphoretic, in cold weather as a diuretic. It is used especially in chronic constitutional diseases attended with emaciation, such as pulmonary phthisis, in chronic abdominal catarrhs, and in albuminuria. Jagielsky claims that it is a powerful diuretic. (*Br. Med. Journ.*, 1879, ii. 288.) In wasting diseases it is affirmed (*N. R.*, i. 4) that if no improvement in weight occur in ten days, the treatment should be discontinued. Usually the patient should at first take but a small quantity per day, but the ration should be rapidly increased until it constitutes almost all the food taken. Mr. Hourowicz states that in Russia "the cure" requires from twelve to fifteen pounds of milk daily (two mares), and that the koumys is taken in doses of a teacupful to a tumblerful every half-hour or hour early in the morning.

LABDANUM. *Ladanum.* A resinous substance, obtained from various species of Cistus, especially *C. Creticus*, *C. ladaniferus*, and *C. laurifolius*, small evergreen shrubs, inhabiting the islands of the Grecian Archipelago, and the different countries bordering on the Mediterranean. Upon the leaves and branches of these shrubs a juice exudes, which is collected by means of an instrument resembling a rake, with leather thongs instead of teeth, which is drawn over the plant. The juice adheres to the pieces of leather, and is afterwards separated. It is said that labdanum was formerly collected by combing the beards of goats which had been browsing upon the leaves of the cistus; and Landerer states that it is at the present time gathered in the same way in Cyprus from sheep and goats, whose fleeces become loaded with it while they are pasturing. (See *P. J. Tr.*, xi. 6.) It comes chiefly from the Grecian Islands. Two varieties exist in commerce. The *purest labdanum* is in masses of various sizes, sometimes weighing several pounds, enclosed in bladders, dark red almost black externally, grayish internally when first broken, of the consistence of a plaster, softening in the hand and becoming adhesive, of an agreeable balsamic odor like that of amber, and of a bitter, balsamic, somewhat acrid taste. It is very inflammable, burning with a clear flame. On exposure it becomes dry, porous, and brittle. Little of this variety is found in the markets. *Common labdanum* is in contorted or spiral pieces, light, porous, blackish gray, hard and brittle, not softening between the fingers, similar in odor and taste to the preceding variety, but less inflammable, and mixed with sand and other earthy matters, which are obvious to the sight. A specimen exhibited at the International Exhibition of 1862, at London, was in flattish pieces, an inch or more thick, with remains of leaves on one side, of a very dark greenish brown color, and a granular somewhat shining fracture. Guibourt found in 100 parts of the labdanum in masses, 86 parts of resin with a little volatile oil, 7 of wax, 1 of watery extract, and 6 of earthy substances and hair. In the contorted variety, Pelletier found 20 per cent. of resin, 3·6 of gum with malate of calcium, 0·6 of malic acid, 1·9 of wax, 1·9 of volatile oil including loss, and 72 of ferruginous sand. Labdanum is a stimulant expectorant, formerly given in catarrhal and dysenteric affections. At present it is employed in plasters, and but seldom even for that purpose. It is sometimes used in fumigation.

LAC. A resinous substance obtained from several trees growing in the East Indies, particularly from *Croton lacciferum*, two species of Ficus, *F. religiosa* and *F. Indica*, and, according to Valentine Ball, *Schlerchera trijuga*, *Butea frondosa*, and *Zizyphus jujuba*. Prof. Stillman states that *Acacia Greggii* and *Larrea Mexicana*, plants growing in Arizona, Colorado, and the Western territories, furnish both *shellac* and *lac dye*. (*A. J. P.*, 1880, p. 409.) It is found in the form of a crust, surrounding the twigs or extreme branches, and is generally supposed to be an exudation from the bark, owing to the puncture of an insect belonging to the genus Coccus, and denominated *C. Lacca*. By some it is thought to be an exudation from the bodies of the insects themselves, which collect in great numbers upon the twigs, and are embedded in the concreted juice, through which the young insects eat a passage and escape. Several varieties are known in commerce. The most common are *stick-lac*, *seed-lac*, and *shell-lac*.

Stick-lac is the resin as taken from the tree, still encrusting the small twigs around which it originally concreted. It is of a deep reddish brown color, of a shining fracture, translucent at the edges, inodorous, and of an astringent, slightly bitterish taste. Its external surface is perforated with numerous minute pores, as if made by a needle; and when broken it exhibits many oblong cells, often containing the dead insect. When chewed it colors the saliva beautifully red, and, when burnt, diffuses a strong, agreeable odor. It is in great measure soluble in alcohol.

Seed-lac consists of minute irregular fragments, broken from the twigs, and partially exhausted by water. It is of a light or dark brown color, inclining to red or yellow, feebly shining, almost tasteless, and capable of imparting to water less color than the stick-lac, sometimes scarcely coloring it at all. It is occasionally mixed with small fragments of the twigs.

Shell-lac is prepared by melting the *stick-lac* or *seed-lac*, previously deprived of its soluble coloring matter, straining it, and pouring it upon a flat smooth surface to harden. Valentine Ball ("Jungle Life in India," *N. R.*, June, 1880) states that the stick-lac is first placed between two powerful rollers, which, by a simple arrangement, admit of any degree of approximation. The lac is then crushed off and is separated from the woody portions by screening; it is next placed in large tubs half full of water and is washed by the coolies, male or female, who, standing in the tubs, and holding a bar above with their hands, stamp and pivot about on their heels and toes until, after a succession of changes, the resulting liquor comes off clear. The disposal of the liquor drawn off at the successive washings will be spoken of farther on. The lac, having been dried, is placed in long cylindrical bags of cotton cloth, of medium texture, and about ten feet long and two inches in diameter. These bags when filled have somewhat the appearance of an enormous Bologna sausage. They are taken to an apartment where there are a number of open charcoal-furnaces. Before each of these there is one principal operator and two assistants. The former grasps one end of the long sausage in his left hand, and slowly revolves it in front of the fire, and at the same time one of the assistants, seated as far off as the sausage is long, twists it in the opposite direction. The roasting before the glowing charcoal soon melts the lac in the portion of the bag nearest the operator's hand, and the twisting of the cloth causes it to drop into a trough placed below.

The troughs used are simply the leaves of the American aloe (*Agave Americana*). When a sufficient quantity in a molten condition is ready in the trough, the operator takes it up in a wooden spoon and places it in a wooden cylinder some eight or ten inches in diameter, the upper half of which is covered with sheet brass. The stand which supports this cylinder gives it a sloping direction away from the operator. The other assistant, generally a woman, now steps forward, holding a strip of the aloe between her hands, and with a rapid and dexterous draw of this the lac is spread out at once into a sheet of uniform thickness, which covers the upper portion of the cylinder. The operator now cuts off the upper edge with a pair of scissors, and the sheet is then lifted up by the assistant, who waves it about for a moment or two in the air till it becomes quite crisp. It is then held up to the light, and any impurities (technically called "grit") are simply punched out of the brittle sheet by the finger. The sheets are laid upon one another, and the tale at the end of the day is taken, and the chief operator paid accordingly. The sheets are placed in packing-cases, and when subjected to pressure break into numbers of fragments. The dark red liquor resulting from the washing above described is strained in order to remove all foreign materials. It is then passed into large vats, where it is allowed to settle. The sediment is subjected to various washings, and at last allowed to settle finally, the supernatant liquid being drawn off. The sediment when of proper consistency is placed in presses, from which it is taken out in the form of hard, dark purple cakes, with the manufacturer's trade-mark impressed upon them. This constitutes what is known in commerce as "lac dye." By the addition of mordants this dark purple substance yields the most brilliant scarlet dyes, which are not inferior to those produced by cochineal. Shell-lac is in thin fragments of various sizes, from half a line to a line thick, often somewhat curved, of a lighter or darker brown color, inclining more or less to red or yellow, shining, more or less transparent, hard and brittle, inodorous and insipid, insoluble in water, but easily and almost entirely soluble in alcohol, especially with the aid of heat. According to Oberdörffer, cold ether takes from shell-lac only about 5 per cent., consisting of wax; and adulteration with resins soluble in ether is thus readily detected. (See *A. J. P.*, 1861, p. 313.) An alcoholic solution of shell-lac usually needs clarification (due to suspended wax); by agitating the solution with 6 parts of powdered chalk, decanting and filtering, it becomes transparent.

A variety of lac is mentioned by writers in the form of cakes, called *cake-lac* or *lump-lac* (*lacca in placentis*); but this is at present rare in commerce.

According to John, lac consists of resin, coloring matter, a peculiar principle insoluble in alcohol, ether, or water, called *laccin*, a little wax, and various saline matters in small proportion. The resin, according to Unverdorben, consists of several distinct resinous principles differing in their solubility in alcohol and ether. The laccin is nearly or quite wanting in *shell-lac*, which also contains scarcely any of the coloring principle. Mr. Hatchett found in *stick-lac* 68 per cent. of resin, and 10 of coloring matter; in *seed-lac* 88·5 per cent. of resin, and 2·5 of coloring matter; in *shell-lac* 90·9 per cent. of resin, and 0·5 of coloring matter. The other constituents, according to this chemist, are wax and gluten, besides foreign matters. M. Schapringer gives a method of detecting lac in any mixture, through the property of its coloring matter, which he calls *coccine*, of being deep red in acid solutions, and becoming violet upon the neutralization of the acid by an alkali. To the suspected substance an excess of acetic or hydrochloric acid is added; the turbid liquid is heated till it becomes limpid and the resin has agglomerated; after which the liquid is decanted, and ammonia is added in excess. The red color, more or less violet, will soon become manifest if lac is present. A quarter of a grain of the lightest colored lac found in commerce may be thus revealed. (*Journ. de Pharm.*, 4e sér., v. 239.)

Lac in its crude state is slightly astringent, and was formerly used in medicine; but at present it is not employed. Shell-lac is wholly inert. Stick-lac and seed-lac are used on account of the coloring principle which they contain. Shell-lac, as well as the other varieties deprived of their coloring matter, is applied to numerous purposes in the arts. It is the chief constituent of *sealing wax*. The best *red sealing wax* is made by melting together, with a very gentle heat, 48 parts of shell-lac, 19 of Venice turpentine, and 1 of balsam of Peru, and mixing with the melted mass 32 parts of finely powdered cinnabar. But common resin is often substituted in part for the lac, and a mixture of red lead and chalk for the cinnabar. The best *black sealing wax* consists of 60 parts of lac, 10 of turpentine, and 30 of levigated bone-black; the best *yellow sealing wax*, of 60 parts of lac, 12 of turpentine, and 24 of chromate of lead. (*Berzelius.*) Lac is also used as a varnish, and forms an excellent cement for broken porcelain and earthenware. It may be dissolved in alcohol, oil of turpentine, benzin, or naphtha. For a method of preparing a colorless varnish from lac the reader is referred to *P. J. Tr.*, 1864, p. 338. Lac has been highly recommended as an adhesive material for the dressing of wounds, ulcers, etc. It is prepared for use by dissolving, with the aid of a gentle heat, in alcohol contained in a glass bottle, sufficient lac to give it a gelatinous consistence, and then closing the bottle. It is used by simply spreading it on the bandages.

LACTATE OF ZINC. *Zinci Lactas.* ($Zn(C_3H_5O_3)_2 3H_2O$.) This salt may be prepared by first obtaining lactate of potassium by double decomposition between lactate of calcium and carbonate of potassium, and then adding the solution of the alkaline lactate, filtered from the carbonate of calcium, to one of acetate of zinc. By a new double decomposition, lactate of zinc, on account of its sparing solubility in cold water, is deposited in crystals, and acetate of potassium remains in solution. The crystals may be purified by dissolving them in boiling water, and recrystallizing. This salt is in the form of white plates, soluble in sixty parts of cold water, and in six parts at the boiling temperature. It is insoluble in alcohol. Its taste is highly saccharine, with a styptic after-taste. Exposed to heat it bears a temperature of 200° C. (392° F.) without decomposition. Another lactate of zinc (zinc-paralactate), containing only two mols. of water, which crystallizes in needles, may be prepared by boiling carbonate of zinc with lactic acid.

Lactate of zinc was brought forward by M. Herpin as a remedy in epilepsy; and, after a trial of it for nearly two years, he concluded that it is at least as efficacious as the oxide, with the advantages of being better borne and more easily taken. The dose is two grains three times a day, given in pill, and gradually increased until it amounts to ten grains. The best time for taking it is about an hour after meals. In M. Herpin's cases it was continued for from five to twelve months. Dr. Hart has also found it useful in epilepsy; he combined it with belladonna. (*N. Y. Med. Journ.*, 1869, p. 77.)

LAKES. These paints are compounds of vegetable or animal coloring principles with alumina or other metallic oxide, and are usually obtained by adding alum or stannic chloride to the solution of the coloring matter in water, and precipitating by means of an alkali. The alumina or oxide of tin unites with the coloring matter at the moment of separation, and forms an insoluble compound. Lakes are obtained in this way from cochineal, madder, Brazil wood, seed-lac, French berries, etc.

LAPPA. Willd. Under this name the U. S. Pharmacopœia formerly included in its secondary list the root of *L. major* (*L. minor*, De Cand., *Arctium*). Burdock is biennial, composite, with a simple spindle-shaped root, a foot or more in length, brown externally, white and spongy within, furnished with thread-like fibres, and having withered scales near the summit. The stem is succulent, pubescent, branching, and three or four feet in height, bearing very large cordate, denticulate leaves, which are green on their upper surface, whitish and downy on the under, and stand on long footstalks. The flowers are purple, globose, and in terminal panicles. The calyx consists of imbricated scales, with hooked extremities, by which they adhere to cloth and the coats of animals. The seed-down is rough and prickly, and the seeds quadrangular. Although a native of Europe, burdock is abundant in the United States, where it grows on the roadsides, among rubbish, and in cultivated grounds. The root, which should be collected in spring, loses four-fifths of its weight by drying. The odor of the root is weak and unpleasant, the taste mucilaginous and sweetish, with a slight degree of bitterness and astringency. Among its constituents, inulin has been found by Guibourt, and sugar by Fée. The seeds are aromatic, bitterish, and somewhat acrid. The root is considered aperient, diaphoretic, and diuretic, without irritating properties; and has been recommended in gouty, scorbutic, venereal, rheumatic, scrofulous, leprous, and nephritic affections. Dr. J. Adolphus speaks of burdock in the strongest terms as a remedy in herpes, lepra, psoriasis, prurigo, lupus, obstinate acne, and other cutaneous diseases. (*Med. and Surg. Rep.*, 1868, p. 214.) To prove effectual its use must be long continued. It is administered in the form of decoction, which may be prepared by boiling two ounces of the recent bruised root in three pints of water to two, and given in the quantity of a pint during the day. A fluid extract and syrup have also been prepared from it. The seeds are diuretic, and have been used in the same complaints, in the form of emulsion, powder, and tincture. The dose is a drachm. The leaves have been employed both externally and internally in cutaneous eruptions and ulcerations.

LARKSPUR. (*Pied d'Alouette*, Fr.; *Feld Rittersporn*, G.) *Delphinium Consolida* is a showy annual plant, with an erect branched, slightly pubescent stem, belonging to the family of Ranunculaceæ. Its leaves are divided into linear segments, widely separated, and forked at the summit. The flowers are usually of a beautiful azure-blue color, and disposed in loose terminal racemes, with peduncles longer than the bracts. The nectary is one-leaved, with an ascending horn nearly equalling the corolla. The seeds are contained in smooth, solitary capsules. This species of larkspur has been introduced from Europe into the United States, where it has become naturalized, growing in the woods and fields, and flowering in June and July. The flowers are bitter and acrid, and, having formerly been supposed to possess the power of healing wounds, gave the name of *consolida* to the species. *Aconitic acid* has been obtained from the expressed juice by W. Wicke. (*Journ. de Pharm.*, 1854, p. 79.) The seeds were formerly in the U. S. secondary list. They were analyzed by Mr. Thomas C. Hopkins, of Baltimore, and found to contain *delphinine* ($C_{24}H_{35}NO_2$), volatile oil, fixed oil, gum, resin, chlorophyll, gallic acid, and salts of potassa, lime, and iron. (*A. J. P.*, xi. 8.) The flowers were formerly considered diuretic, emmenagogue, and vermifuge. The seeds are very acrid, are esteemed diuretic, and in large doses produce vomiting and purging. A tincture, prepared by macerating an ounce of them in a pint of diluted alcohol, has been found useful in spasmodic asthma and dropsy. The dose is ten drops (0·6 C.c.), to be gradually increased till some effect upon the system is noticed. The remedy has been employed both in America and England; and the seeds of an indigenous species, *D. exaltatum*, have been applied to a similar purpose. The root probably possesses the same properties as other parts of the plant. (See *Staphisagria.*)

LAURUS NOBILIS. *The Bay Tree. Laurus nobilis* is an evergreen tree, attaining in its native climate the height of twenty or thirty feet. Its leaves are alternate, on short petioles, oval-lanceolate, entire, sometimes wavy, veined, of a firm texture, smooth, shining, deep green upon their upper surface, paler beneath. The flowers are diœcious, of a yellowish white color, and placed in small clusters of three or four together, upon a common peduncle in the axils of the leaves. The corolla is divided into four oval segments. The fruit is an oval berry, of the size of a small cherry, and when ripe of a dark purple, nearly black color. The bay tree, so famous among the ancients, is a native of the countries bordering on the Mediterranean. Its leaves and fruit, and an oil expressed from the latter, are the parts used.

The *leaves* have a fragrant odor, especially when bruised, and a bitter, aromatic, somewhat astringent taste. They yield by distillation a greenish yellow volatile oil, upon which their properties chiefly depend. Water distilled from them has their peculiar odor. The *berries* when dried are black and wrinkled, and contain two oval fatty seeds within a thin, friable envelope; or they may be considered as drupes, with a kernel divisible into two lobes. They have the same aromatic odor and taste as the leaves, but are more pungent. Besides an essential oil, they contain a fixed oil, which may be separated by expression or decoction. The *expressed oil*, which is obtained from the fresh fruit, is concrete, of a greenish color, and retains a portion of the volatile oil, which renders it agreeably aromatic. Lard, impregnated with the odorous principle of the berries, and colored green, is said to be often substituted for the genuine expressed oil. The sophistication may be detected by means of boiling alcohol, which dissolves the laurel oil. The leaves, berries, and oil of the bay tree are excitant and narcotic, but at present are never used internally as medicines, and in this country are scarcely employed in any manner. Their chief use is to communicate a pleasant odor to external remedies. Dr. A. T. Thomson says that he has found an infusion of the berries useful in impetigo.

LAWSONIA INERMIS. *Henna Plant.* This is a shrub of the Salicariæ, growing in the Levant, Egypt, Persia, and India, and well known as the source of a dye-stuff denominated *henna*, much used throughout the Mohammedan countries of the East. It is largely cultivated in Egypt. *L. alba* also furnishes henna. The flowers have a strong pungent odor; and a distilled water is prepared from them, used by the women as a cosmetic. The fruit is thought to have emmenagogue properties. But the leaves constitute the henna of commerce. They are used very extensively by the females to give an orange color to their feet and hands, and a golden hue to their hair. They are also employed to stain common wood in imitation of mahogany. Henna is in the form of powder, which is strongly astringent. Abd-el-Aziz, of Cairo, Egypt, found in it a brown substance, of a resinoid fracture, having the chemical properties which characterize the tannins, and therefore named by him *henotannic acid.* (*Journ. de Pharm.*, 1863, p. 35.) Henna is used in medicine, both internally and locally, as a remedy in jaundice and leprosy and other affections of the skin. The fresh juice of the plant is said by Ainslie to be applied to the same purpose. (*Mérat and De Lens.*)

LEDUM PALUSTRE. *Marsh Tea. Rosmarinus Sylvestris.* A small evergreen shrub, growing in swamps and other wet places in the northern parts of Europe, Asia, and America, and in the mountainous regions of more southern latitudes. The leaves have a balsamic odor, and an aromatic, camphorous, bitter taste; and contain, among other ingredients, volatile oil and tannin. For the properties of the volatile oil, see *Journ. de Pharm.*, 4e sér., xx. 244; also *Proc. A. P. A.*, xxv. 154. It contains *ledum camphor*, a stearopten, together with valerianic and other volatile acids, and *ericinol*, $C_{10}H_{16}O$. The tannin has been named *leditannic acid*, $C_{14}H_{12}O_6$. The leaves are thought to possess narcotic properties, and have been employed in exanthematous diseases to allay irritation, in hooping-cough, in dysentery, and in various cutaneous affections, particularly leprosy and scabies. In complaints of the skin, they are used both internally and externally in the form of decoction. When placed among clothes they are said to prevent the attacks of moths. In Germany they are sometimes substituted for hops in the preparation of beer. *Ledum latifolium*, or *Labrador tea*, which is a larger plant than the preceding, is a native of North America, growing in damp places in Canada and the northern part of the United States. The leaves have an agreeable odor and taste, and are esteemed pectoral and tonic. They are said to have been used as a substitute for tea during the war for independence.

LEEK. *Porrum.* The bulb of *Allium Porrum.* The leek is a biennial bulbous plant, growing wild in Switzerland, and cultivated in the gardens of Europe and this country for culinary purposes. All parts of it have an offensive pungent odor, and an acrid taste, dependent on an essential oil, which is in a great measure dissipated by decoction, and may be obtained separate by distillation. The bulb, which is the medicinal portion, consists of concentric layers, like the onion, which it resembles in medical properties, though somewhat milder. It is generally stimulant, with a peculiar direction to the kidneys. The expressed juice may be given in the dose of a fluidrachm, mixed with syrup. This species of Allium is not used medicinally in the United States.

LEONURUS CARDIACA. *Common Motherwort.* A perennial labiate herb, thought to be of foreign origin, but growing wild in this country in waste places, around dwellings, etc. It has a peculiar aromatic odor and a bitterish somewhat pungent taste, and, in the form of infusion or decoction, is sometimes used in amenorrhœa, suppression of the lochia, and hysterical affections.

LIATRIS SPICATA. *Gay-feather. Devil's Bit. Colic Root. Button Snakeroot.* An indigenous perennial plant, growing in natural meadows and moist grounds throughout the Middle and Southern States. It has a tuberous root, and an erect annual stem, which terminates in a spike of beautiful, purple, compound flowers, appearing in August. The root is said by Schoepf to have a terebinthinate odor, and a warm, bitterish, terebinthinate taste; to be possessed of diuretic properties; and to be useful in gonorrhœa and sore throat, being employed internally in the shape of decoction in the former complaint, and as a gargle in the latter. The leaves of the *Liatris odoratissima* are very largely employed in the Southern United States to flavor tobacco, and to preserve clothing, etc., from moths. As a preservative, it is worthless. The agreeable odor is due to *coumarin*, $C_9H_6O_2$, which may be frequently noticed in crystals upon the surface of the smooth spatulate leaves. (*A. J. P.*, March, 1875; Sept. 1881; xlvii. 116; *N. R.*, 1882, p. 66.) Pursh informs us that *L. scariosa* and *L. squarrosa* are known in Virginia, Kentucky, and the Carolinas by the name of *rattlesnake's master;* and that their roots are employed to cure the bite of the rattlesnake, being bruised and applied directly to the wound, while their decoction in milk is taken internally. According to Dr. William P. C. Barton, all the tuberous-rooted species of Liatris are active plants, and appear to be diuretic. Dr. Goss (*Med. Record*, 1870, p. 492) attributes great value to *L. squarrosa* as a remedy in chronic bronchitis, and in inflammations of the urino-genital mucous membrane.

LIGUSTICUM LEVISTICUM. *Lovage.* An umbelliferous plant, growing wild in the south of Europe, and cultivated in gardens. *Levisticum officinale* is said to furnish lovage. (*Koch.*) The whole plant has a strong, sweetish, aromatic odor, and a warm, pungent taste. When wounded it emits a yellow, opaque juice, which concretes into a brownish resinous substance, not unlike opopanax. The roots, stems, leaves, and seeds have all been employed; but the last have the aromatic properties of the plant in the highest degree. They are small, ovate-oblong, somewhat flattened, curved, strongly ribbed, and of a yellowish brown color. The root is more frequently used. The medical properties of lovage are closely analogous to those of angelica. It is a stimulant aromatic, and has been employed as a carminative, diaphoretic, and emmenagogue. The best form for administration is that of infusion. The coloring principle has been isolated by M. J. Nicklès, who gives it the name of *ligulin*, and suggests an important application of it that may be made in testing drinking-water. If a drop of its alcoholic or aqueous solution is allowed to fall into distilled water, it imparts to the liquid its own fine crimson red color, which undergoes no change; but if limestone water be substituted, the red color disappears in a few seconds, and is followed by a beautiful blue. (*Journ. de Pharm.*, 1859, p. 329.)

LIGUSTRUM VULGARE. *Privet.* A shrub from four to ten feet in height, growing wild both in Europe and the United States, usually in hedges and by the roadside. The leaves, which have an astringent, bitter taste, and the flowers, which are small, snow-white, and of an agreeable odor, have been used in the form of decoction, in sore throat, and aphthous and scorbutic ulceration of the mouth. The berries are black, have a sweetish bitter taste, and are said to possess purgative properties, and to color the urine brown. They are sometimes used for dyeing. The case of a child, between two and three years old, is recorded by Mr. James Cheese in *P. J. Tr.* (2d ser., viii. 607), in which the eating of privet berries appeared to be the remote cause of death, having induced active purgation, and probably set on foot an inflammation of the bowels, which ultimately proved fatal. The bark was analyzed by M. G. Polex, who found a peculiar substance, which he denominated *ligustrin*, insoluble in ether and absolute alcohol, but soluble in water and diluted alcohol. Strong sulphuric acid gives with *ligustrin* a deep indigo-blue color. He found besides (see Kromayer, *Arch. Pharm.*, 2, ci. 281) mannite, sugar, muco-saccharine matter, starch, chlorophyll, bitter extractive, bitter resin, tannin, albumen, and salts. (*A. J. P.*, xii. 347.)

LILIUM CANDIDUM. *Common White Lily.* This well-known plant is a native of Syria and Asia Minor, but has been long cultivated in gardens. The bulb, which consists of imbricated fleshy scales, is without odor, but has a peculiar, disagreeable, somewhat bitter, and mucilaginous taste. It contains much mucilage, and a small proportion of an acrid principle, which is dissipated or destroyed by roasting or boiling. In the recent state, it is said to have been employed with advantage in dropsy. Boiled with water or milk, it forms a good emollient cataplasm, more used in popular than in regular practice. The flowers have an agreeable odor, which they impart to oil or lard; and an ointment or liniment is sometimes prepared from them, and used as a soothing application in external inflammations. A case is recorded by Dr. Jeffries Wyman, of Boston, in which a little girl appeared to have been poisoned by the pollen of the tiger lily (*Lilium bulbiferum?*), which the child had introduced into her nostrils and probably swallowed. She was affected with vomiting, purging, drowsiness, etc., from which, however, she recovered. (*Am. Journ. of Med. Sci.*, 1863, p. 271.)

LINDEN. M. Boussingault calls attention (*Journ. de Pharm.*, 4e sér., xv.) to a saccharine exudation which occurs upon the leaves of the European Linden, which he has found to have the same composition as manna of Mount Sinai.

LINT. As an object of great importance to the surgeon, and a necessary article of sale to the apothecary, this seems not only to admit, but to require, a brief notice in the present place. The term lint, strictly speaking, is applicable, as its name implies, to a substance prepared from linen. It is in fact linen made soft and somewhat fleecy by various mechanical processes, so as to render it suitable for the dressing of wounds. The qualities required in good lint are—1, perfect softness, to prevent mechanical irritation to the wound; 2, looseness of texture, to render it capable of absorbing the secretions from the surfaces to which it is applied; 3, a certain tenacity, so that it may receive unctuous dressings, yet with a facility of being torn in one direction; and, 4, sufficient firmness of fibre to prevent small portions from being easily separated and remaining as foreign bodies in the wound. As formerly and still frequently made for domestic purposes, it consists of old linen scraped by means of a knife with the hand, and thus brought into a soft flocculent state, almost destitute of visible fibres. It is obvious that, though this answers some of the above requisitions, it entirely fails to answer others, and is unfit for general surgical use. It will not readily admit of the application of cerates, and must very often leave portions of its substance in the wound, to serve as future sources of irritation. Much better is the old-fashioned lint, made by machines worked by the hand. This was formerly made in large quantities. Old linen was used for the purpose, such as shirts, sheets, table-cloths, etc., and generally in irregular pieces. This was first cleansed thoroughly by washing with soap and water, or by boiling with a weak ley of soda or pearlash. Sometimes, when colored, it was bleached before being washed. Thus prepared, it was operated on by a simple machine, in which the rag, wrapped round a cylinder, was submitted to the interrupted action of a knife made to descend upon it at intervals of one-eighth of an inch, so as to cut the thread in one direction. On being removed from the machine, the cut ends of the thread became untwisted and loose, giving a flossy character to the fabric. To render it smooth, it was passed through rollers, and its ragged edges were trimmed. Of course it had different degrees of fineness according to the character of the rags used; and this diversity rendered it fit for different purposes, the finer pieces being used merely as a dressing with unctuous matter to exclude the air, while the thicker were better adapted to the absorption of the liquid secretions.

In the progress of improvement, machines were invented and patented for manufacturing lint on the large scale. Thus made, it is distinguished in the shops as *patent lint.* This is generally prepared out of cloth manufactured for the purpose, and therefore has whatever advantage may be derived from uniformity of shape and consistence. In other respects, it is doubtful whether it has any superiority over the old-fashioned article; especially as, in consequence of competition, cotton, being the cheaper article, has frequently been in part or altogether substituted for linen. It is said that lint may be rapidly prepared by attaching a piece of linen to the toothed cylinder of the common carding machine. (*Med. and Surg. Reporter*, Oct. 4, 1862.)

Cotton is in several respects inferior to linen for the preparation of lint; and, unless its presence in any manufactured article sold by this name be made known, it should be looked on as a fraudulent substitution. Its fibre is less soft and therefore more likely to irritate; it has much less absorbing power; and it conveys heat less rapidly. The following are methods by which it may be distinguished (*Dr. Elsner*). 1. A linen thread when held erect, and set on fire, appears, after the flame is extinguished, in a smooth continuous form, while cotton thread similarly treated has a tufted aspect. 2. Under a microscope which magnifies 300 diameters, the linen fibre appears to be a straight nearly solid cylinder, with a slender central canal; the cotton, flattened as a piece of tape, with a wide canal, and often twisted like a corkscrew. 3. The potassa test, proposed by Böttger, consists in exposing the doubtful substance to the action of a boiling concentrated solution of potassa. If made of linen, it will in two minutes assume a deep yellow color; if of cotton, it will either remain colorless, or will become very faintly yellow; and if the texture be composed of both, it will exhibit a streaked or mottled aspect. The examination must be quickly made, as the yellow color of the potassa becomes faint with time. 4. Sulphuric acid dissolves the linen fibre, while it leaves that of cotton little changed. 5. Linen thoroughly oiled has the transparent appearance of oiled paper; cotton remains white and opaque. 6. Tinctures of all organic red dye-stuffs, as cochineal, madder, etc., give a much deeper color to linen than to cotton, and cause a mottled appearance when the two are mixed.

Tow, and hemp in the state of *oakum*, have been employed for dressing wounds; but they are only applicable as exterior dressings to absorb the pus, when the discharge of this is very copious. Dr. L. A. Sayre, Surgeon of Bellevue Hospital, N.Y., has found picked oakum preferable to lint as an immediate dressing to suppurating wounds, and ascribes its superiority to certain mechanical advantages as regards absorption. (*Bost. Med. and Surg. Journ.*, lxvii. 84.) Without adopting the theory, we may well admit the fact in certain cases; as few local applications are more efficient than tar properly used in promoting granulation in indolent supporting surfaces; and oakum consists of hemp saturated with tar. *Charpie*, so much used by French surgeons in dressing wounds from the bottom, generally consists of bundles of straight threads, each four or five inches long, made by unravelling old rather coarse linen. It is much inferior as a dressing for wounds to our best forms of lint. On the subject of lint, we would refer the reader to an article in *P. J. Tr.* (x. 241), and to another in *A. J. P.* (1861, p. 359).

LINUM CATHARTICUM. *Purging Flax.* Purging flax is a European annual plant, six or eight inches high, having erect, slender stems, dichotomous near the summit, furnished with opposite, obovate-lanceolate, entire leaves, and bearing minute white flowers, the petals of which are obovate and acute. The whole plant is very bitter, and somewhat acrid, and imparts its virtues to water, which acquires a yellow color. It appears to owe its activity to a peculiar drastic principle, which has received the name of *linin*, and which is afforded most largely by the plant after the flower has fallen. (*Pharm. Centralblatt*, 1844, p. 110.) Purging flax formerly enjoyed some reputation in Europe as a gentle cathartic, but fell into disuse. Attention has been again called to it as an excellent remedy in muscular rheumatism, catarrhal affections, and dropsy with disease of the liver. From four to eight grains of the extract, given twice or thrice daily, are said to operate as a purgative and diuretic, without inconvenience to the patient. (*Med. Times*, July, 1850.) A drachm of the powder, or an infusion containing the virtues of two or three drachms of the herb, may be taken for a dose.

LIQUIDAMBAR STYRACIFLUA. *Sweet Gum.* An indigenous tree, growing in different parts of the United States from New England to Louisiana, and flourishing also in Mexico, where, as well as in our Southern States, it sometimes attains a great magnitude. In warm latitudes a balsamic juice flows from its trunk when wounded. This has attracted some attention in Europe, where it is known by the name of *liquidambar*, or *copalm balsam*, and is sometimes, though erroneously, called *liquid storax.* It is not afforded by the trees which grow in the Middle Atlantic States, but is obtained in the Western States bordering on the Ohio, and in those farther south, as far as Mexico. It is a liquid of the consistence of thin honey, more or less transparent, of a yellowish color, of a peculiar, agreeable, balsamic odor, and a bitter, warm, and acrid taste. By cold it becomes thicker and less transparent. It concretes also by time, assuming a darker color. It is sometimes collected in the form of tears, produced by the spontaneous concretion of the exuded juice. According to M. Bonastre, it contains a colorless volatile oil, a semi-concrete substance which rises in distillation and is separated from the water by ether, a minute proportion of benzoic acid, a yellow coloring substance, an oleoresin, and a peculiar principle, insoluble in water and cold alcohol, for which M. Bonastre proposes the name of *styracin*. The styracin of M. Bonastre has since been found to be *cinnamyl cinnamate*, $C_9H_9,C_9H_7O_2$, which is found together with the *ethyl*, *benzyl*, and other ethers of cinnamic acid. The proportion of benzoic acid is very slight, and indeed it is questioned whether the acid present is not exclusively cinnamic. Examined by Mr. W. P. Creecy, of Mississippi, it was found, besides a volatile odorous principle, and 30 per cent. of a hard resin (according to W. von Miller *storesin*, $C_{36}H_{55}(OH)_3$), to contain cinnamic acid as the prominent acid ingredient, yet associated with a small proportion of benzoic acid. (*A. J. P.*, 1860, p. 199.) Prof. Procter, on a subsequent examination of the product, could not detect benzoic acid, and states that little if any of that acid exists in it, and that what had been taken for benzoic acid by the earlier examiners was really cinnamic. (*A. J. P.*, 1866, p. 38.) The volatile oil mentioned above contains a hydrocarbon, *styrol* or *cinnamene*, C_8H_8, which changes on heating into the polymeric *metastyrol*, a colorless transparent solid, identical in composition. A very careful examination of the liquidambar gum has been made by Mr. W. L. Harrison. His results have been confirmed by Prof. Maisch (*A. J. P.*, xlvi. 160, 165), and seem to prove that the American drug is identical with styrax, except in containing no water mechanically mixed with it.

Another product is said to be obtained from the same tree by boiling the young branches in water, and skimming off the fluid which rises to the surface. It is of a thicker consistence and darker color than the preceding, is nearly opaque, and abounds in impurities. This also has been confounded with liquid storax, which it resembles in properties, though derived from a different source. It is said to be used in Texas in coughs. (Gammage, *N. O. Med. and Surg. Journ.*, xii. 636.)

Liquidambar may be employed for the same purpose as storax, and is said to be used to a considerable extent in the Southern United States, but it is almost unknown in the shops of the Northern United States. The concrete juice is said to be chewed in the Western States in order to sweeten the breath. Dr. Gammage states that the juice is employed popularly in Texas as an addition to excitant ointments. According to C. W. Wright, of Louisville, Ky., the bark of the tree is used with great advantage in the Western States in the diarrhœa and dysentery of summer, especially in children. It is taken in the form of syrup, which may be prepared from the bark in the same manner as the syrup of wild-cherry bark, according to the U. S. Pharmacopœia. The dose is a fluidounce for an adult, repeated after each stool. (*Am. Journ. of Med. Sci.*, N. S., xxxii. 126.) The editor of the *Virginia Med. Journ.* (1856, p. 143) states that the use of a decoction of the bark in milk is common in many parts of Virginia, as a remedy in the diarrhœa of children. Prof. Procter states that the leaves and capsules of the tree have a somewhat aromatic odor when bruised, and are decidedly acid to the taste and to litmus, and thinks it probable that they contain gallic acid in considerable quantities; the tincture of the fresh leaves being decidedly acid and astringent, and giving a deep bluish black color with a persalt of iron, which is in great measure discharged by a heat of 100° C. (212° F.). (*A. J. P.*, 1866, p. 38.)

Liquidambar Altingia is said to exude a balsam in the Tenasserim provinces of India, somewhat resembling liquid storax. (See *P. J. Tr.*, viii. 243.)

LIQUOR MAGNESII BISULPHITIS. Mr. George Archibald, having found that the bisulphite of magnesium is capable of arresting the butyric acid fermentation, proposes a solution of it as a remedy in heartburn. He prepares it by treating the carbonate of magnesium with sulphurous acid, adding to an ounce of water sixteen grains of the sulphate thus formed, and passing sulphurous acid gas through the mixture till a clear solution is obtained. (*P. J. Tr.*, 3d series, ii. 502.)

LIRIODENDRON. *U. S.* 1870. *Tulip Tree Bark. American Poplar Tulip Tree.* This indigenous representative of the Magnoliaceæ attains in some situations a height of more than one hundred feet. The bark is of a brown or grayish brown color, except in the young branches, on which it is bluish or of a reddish tinge. The leaves, which stand on long footstalks, are alternate, somewhat fleshy, smooth, of a beautiful shining green color, and divided into three lobes, of which the upper one is truncated and notched at its summit, so as to present a two-lobed appearance, and the two lower are rounded at the base and usually pointed. In the larger leaves, the lateral lobes have each a tooth-like projection at some distance below their apex. This peculiar form of the leaf serves to distinguish the tree from all others inhabiting the American forests. On isolated trees the flowers are very numerous. They are large, beautifully variegated with different colors, among which yellow predominates, and in appearance bear some resemblance to the tulip, which has given a name to the species. Each flower stands on a distinct terminal peduncle. The calyx is double, the outer two-leaved and deciduous, the inner consisting of three large, oval, concave leaves, of a pale green color. The corolla is composed of six, seven, or more obtuse, concave petals. The stamens are numerous, with short filaments, and long linear anthers. The pistils are collected into the form of a cone, the upper part of which is covered with minute stigmas. The fruit consists of numerous long, narrow scales, attached to a common axis, imbricated in a conical form, and containing each two seeds, one or both of which are often abortive. The bark was the portion formerly officinal. It is taken for use indiscriminately from the root, trunk, and branches; though that of the root is thought to be the most active.

Deprived of the epidermis, it is yellowish white; the bark of the root being somewhat darker than that of the stem or branches. It is very light and brittle, of a feeble, rather disagreeable odor, strongest in the fresh bark, and of a bitter, pungent, and aromatic taste. These properties are weakened by age, and we have found specimens of the bark, long kept in the shops, almost insipid. The peculiar properties of liriodendron appear to reside in a volatile principle, which partially escapes during decoction. The late Professor Emmet, of the University of Virginia, believed that he had isolated this principle, and gave it the name of *liriodendrin.* As described by Professor Emmet, it is, in the pure state, solid, white, crystallizable, brittle, insoluble in water, soluble in alcohol and ether, fusible at 82·2° C. (180° F.), volatilizable and partly decomposed at 132·2° C. (270° F.), of a slightly aromatic odor, and a bitter, warm, pungent taste. It does not unite either with acids or with alkalies; and the latter precipitate it from the infusion of the bark by combining with the matter which renders it soluble in water. Water precipitates it from its alcoholic solution. It is obtained by macerating the root in alcohol, boiling the tincture with magnesia till it assumes an olive-green color, then filtering, concentrating by distillation till the liquid becomes turbid, and finally precipitating the liriodendrin by the addition of cold water. (*A. J. P.*, iii. 5.) The virtues of the bark are extracted by water and alcohol, but are injured by long boiling.

Liriodendron is a stimulant tonic, with diaphoretic properties. It has been used as a substitute for Peruvian bark in intermittent fevers, and has proved serviceable in chronic rheumatism, dyspepsia, and other complaints in which a gentle stimulant and tonic impression is desirable. The dose of the bark in powder is from half a drachm to two drachms. The infusion and decoction are also used, but are less efficient. They may be prepared in the proportion of an ounce of the bark to a pint of water, and given in the quantity of one or two fluidounces. The dose of the saturated tincture is a fluidrachm.

LITHOSPERMUM OFFICINALE. *Gromwell. Milium Solis.* A European perennial, the seeds of which are ovate, of a grayish white or pearl color, shining, rather larger than millet seeds, and of a stony hardness, from which the generic name of the plant originated. They were formerly used as stimulant diuretics in calculous and other allied affections, but are at present considered nearly inert, and are not employed.

LITMUS. LACMUS. Ed. *Turnsole. Tournesol, Orseille*, Fr. This is a peculiar coloring matter derived from *Roccella tinctoria* and other lichens. Three purple or blue coloring substances are known in commerce, obtained from lichenous plants. They are called severally *litmus*, *orchil*, and *cudbear.* The lichens employed are different species of *Roccella*, *Lecanora*, *Variolaria*, and others. They grow on alpine or maritime rocks, in various parts of the world, and for commercial purposes are collected chiefly upon the European and African coasts, and the neighboring islands, as the Azores, Madeira, Canaries, and Cape de Verde. The particular species most employed are probably *Le-*

canora tartarea or *Tartarean moss*, growing in the north of Europe, and *Roccella tinctoria* or *orchilla weed*, which abounds upon the African and insular coasts, and is called commercially, in common with other species of the same genus, *Angola weed*, *Canary weed*, etc., according to the place from which it has been brought.

The principles in these plants upon which their valuable properties depend are themselves colorless, and yield coloring substances by the reaction of water, air, and ammonia. They are generally acids or acid anhydrides, and are named *lecanoric*, *orsellic*, *erythric*, etc., according to their origin. Orsellic or lecanoric acid, $C_{16}H_{14}O_7$, the original constituent of most of these plants, when boiled with water or alkaline solutions, is changed into *orsellinic acid*, as follows: $C_{16}H_{14}O_7 + H_2O = (C_8H_8O_4)_2$. *Orsellinic acid* fuses at 176° C. (348·8° F.), and decomposes into *orcin*, $C_6H_3(CH_3)(OH)_2$, and CO_2. The same decomposition is readily effected by distillation with milk of lime. Orcin combines with ammonia gas to form $C_7H_8O_2,NH_3$, the solution of which exposed to the air becomes colored reddish, by the formation of *orcëin*, $C_7H_7NO_3$. This latter compound forms the basis of the commercial *orseille* extract (*orchil* or *archil*).

Kane (*Watt's Dictionary*, vol. iii. p. 731) has described a brownish red coloring principle, *azolitmin*, $C_7H_7NO_4$, but it was probably *orcëin.*

To test the value of the plants as dye-stuffs, they may be macerated in a weak solution of ammonia, or a solution of hypochlorite of calcium may be added to their alcoholic tincture. In the former case, a rich violet-red color is produced; in the latter, a deep blood-red color instantly appears, but soon fades.

Lacmus or *litmus* is prepared chiefly if not exclusively in Holland. The process consists in macerating the coarsely powdered lichens, in wooden vessels under shelter, for several weeks, with occasional agitation, in a mixture of urine, lime, and potash or soda. A fermentation ensues, and the mass, becoming first red and ultimately blue, is after the last change removed, mixed with calcareous or silicious matter to give it consistence, and with indigo to deepen the color, and then introduced into small moulds, where it hardens. It comes to us in rectangular cakes, from a quarter of an inch to an inch in length, light, friable, finely granular, of an indigo-blue or deep violet color, and scattered over with white saline points. It has the combined odor of indigo and violets, tinges the saliva of a deep blue, and is somewhat pungent and saline to the taste. From most vegetable blues it differs in not being rendered green by alkalies. It is *reddened by acids*, and restored to its original blue color by *alkalies.*

Its chief use in medicine is as a test of acids and alkalies. For this purpose it is employed either in infusion, or in the form of litmus-paper. The infusion, usually called *tincture of litmus*, may be made in the proportion of one part of litmus to twenty of distilled water, and two parts of alcohol may be added to preserve it. *Litmus-paper* is prepared by first forming a strong clear infusion with one part of litmus to four of water, and dipping slips of white unsized paper into it, or applying it by a brush to one surface only of the paper. The paper should then be carefully dried, and kept in well-stopped vessels, from which the light is excluded. It should have a uniform blue or slightly purple color, neither very light nor very dark. As a test for alkalies the paper may be stained with an infusion of litmus previously reddened by an acid, care being taken to avoid all excess. By gas-light it is said that the change of color cannot be determined by the eye exactly, as the blue of litmus becomes mauve; but this may be obviated by watching the process through a green glass, by which the faintest trace of blue becomes discernible. (*P. J. Tr.*, 2d ser., vi. 479.)

Orchil or *archil*, as prepared in England, is in the form of a thickish liquid, of a deep reddish purple color, but varying in the tint, being in one variety redder than in another. The odor is ammoniacal. It is made by macerating lichens in a covered wooden vessel, with an ammoniacal liquor, either consisting of stale urine and lime, or prepared by distilling an impure salt of ammonia with lime and water. (*Pereira.*) For details as to the method of preparation, see *Chemical News*, 1874, p. 143. It is occasionally adulterated with the extracts of colored woods, as logwood, sappan-wood, etc. A mode of detecting these adulterations is given by Mr. F. Leeshing in the *Chem. Gaz.* of June 1, 1855, p. 219.

Cudbear is in the form of a purplish red powder. It is procured in the same manner as orchil; but the mixture, after the development of the color, is dried and pulverized.

The point in which the preparation of these coloring substances differs from that of litmus appears to be, that potash or soda is added, in the latter, to the ammoniacal liquid used. Orchil and cudbear are employed as dye-stuffs, and sometimes, in like manner, with litmus, as a test of acids and alkalies. For some practical applications, see H. M. Wilder's paper, *A. J. P.*, 1874.

LOCO PLANTS. *Crazy Weeds.* These are plants growing in the far-western States, the eating of which by horses and cattle produces loss of flesh, disordered vision, delirium, convulsive movements, or stupor and death. The exact plants are not known. The astragalus, to which the evil effects have been ascribed, has been tested by Dr. H. C. Wood upon rabbits and dogs, and found not to be poisonous. *Sophora sericea* contains an active alkaloid, whilst in regard to *Oxytropis multiflora* and *O. deflexa*, both reputed crazy weeds, we have no positive information. (*N. R.*, 1872, p. 232; 1881, p. 67.)

LOLIUM TEMULENTUM. *Darnel. Ivraie*, Fr. One of the Gramineæ or grasses, indigenous in the Old World, but introduced into the United States, and owing its chief importance to the circumstance that it is apt to grow among wheat and other grains, and thus sophisticate the product with its seeds. From ancient times, these have been supposed to be deleterious to the human system, producing symptoms analogous to intoxication from alcoholic drinks, whence the plant derived its specific name of *temulentum*, and the French name of *ivraie.* The seeds have a sweetish taste, and are said to contain gluten, starch, and sugar; and there is nothing in their sensible properties which would suggest the idea that they might be poisonous. Indeed, De Candolle states that they are often eaten in bread without inconvenience; and that a beer into which they enter as an ingredient is drunk with impunity. (*Mérat and De Lens*, iv. 141.) The testimony, however, to the fact that they have a narcotic effect on the system, evincing itself by vertigo, dizziness, headache, sleepiness, and a species of drunkenness, is too strong to be resisted; though very few instances, so far as we know, have been recorded of death from their use. MM. Rivière and Maizière have each recorded a fatal case, which occurred in peasants who had for several days lived upon bread consisting to the extent of two-thirds or five-sixths of darnel. (*Journ. de Pharm.*, 1863, p. 280.) Though thus acting on man, dogs, sheep, and horses, the seeds are said to be wholly innoxious to hogs, cows, and ducks; and poultry have even been fattened by them. The remedy, in case of poisoning, would be as soon as possible to evacuate the stomach. Lindley states that this is the only one of the grasses which has been satisfactorily proved to have deleterious properties. (*Med. and Economic Bot.*, p. 27.) Two analyses have been made of the seeds. One, by MM. Filhol and Baillett, gives as their constituents about 50 per cent. of starch; a thick, almost solid green oil, consisting of a portion saponifiable and another not so, the latter soft, orange colored, insoluble in water, very soluble in alcohol, ether, and bisulphide of carbon, producing tremulousness when swallowed, but without any symptoms of narcotism, and capable of causing death in animals; sugar; dextrin; albumen; and a substance hitherto observable only in the form of extractive, soluble in water and alcohol, and acting on animals as a narcotic. The second examination was made by Ludwig and Stahl, who, besides cellulose, gluten, and starch, found—1, a neutral fatty matter burning with smoke; 2, an oily acid, burning without smoke, and precipitated from its alcoholic solution by acetate of lead; 3, an acrid oil, burning with smoke and an odor of incense; 4, a fixed oil, acrid and bitter, saponifiable, and, after being saponified, yielding, by precipitation with hydrochloric acid, a white rancid matter, volatilizable with watery vapor; and a portion of this substance contained in the seeds as a soap soluble in water. All the above principles, in the free state, are soluble only in alcohol and ether. In addition, there were—5, a substance soluble in water, producing a viscid mass, of an acrid and bitter taste, and transformable into sugar and volatile acids by boiling in contact with dilute sulphuric acid; 6, uncrystallizable sugar; 7, tannic acid, producing a green color with the salts of iron, and yielding sugar with dilute sulphuric acid; 8, an acid resembling the metapectic; 9, sulphate of potassium; 10, resinous substances. The authors consider the activity of the seeds to reside in the acrid oils, and the bitter principle mentioned in No. 5. (*Ann. de Thérap.*, 1866, p. 64.)

LONICERA CAPRIFOLIUM. *Honeysuckle.* This ornament of our gardens is a native of the south of Europe. Its sweet-scented flowers are sometimes used in perfumery; and a syrup prepared from them has been given in asthma and other pectoral affections. The expressed juice of the plant has been recommended for the stings of bees, being rubbed directly on the injured spot The fruit of all the species of Lonicera is said to be emetic and cathartic (*Mérat and De Lens*), and that of *L. xylosteum* to have caused serious poisoning. .(*Journ. de Pharm.*, 4e sér., xviii. 65.)

LUPINUS ALBUS. *Lupin.* A plant belonging to the Leguminosæ, and a native of Europe and Western Asia, which is sometimes cultivated in our gardens. Other species are also met with, *L. hirsutus*, *L. luteus*, *L polyphyllus*, *L. densiflorus.* The last two are indigenous to the Pacific slope and the West. The bitter principle *lupinin*, $C_{29}H_{32}O_{16}$, is a glucoside, and its solution in alkalies is of a dark brownish yellow color. The bruised seeds of white lupin, after soaking in water, are sometimes used as an external application to ulcers, wounds, swollen glands, etc., and internally are said to be anthelmintic, diuretic, and emmenagogue. An instance has been recorded where a decoction used as an injection in the rectum caused symptoms which suggested a poisonous character for the drug.

LYCIUM BARBARUM. *Matrimony Vine.* The genus Lycium belongs to the Solanaceæ. Different species have been used in various parts of the world in reference to supposed medical virtues. *Lycium barbarum*, which is indigenous in the south of Europe and in Asia, is a thorny shrub, with long flexible branches, and is cultivated for hedges and arbors. Drs. Husemann and Marme found in the leaves and stem an alkaloid, *lycine*, $C_5H_{11}NO_2$. (*A. J. P.*, 1864, p. 226.) It is characterized by its strong affinity for water, which causes it to deliquesce in a few minutes after exposure, and renders it very soluble in that liquid. It is also readily soluble in alcohol, but nearly insoluble in ether. It is crystallizable, of a sharp but not bitter taste, and forms crystallizable salts with the acids. Prof. Aug. Husemann believes that lycine does not exist in the plant, but is formed during the process of extraction, and also that it is identical with betaine, the alkaloid obtained from beet-juice by Scheibler, and with the oxyneurine of Leibreich. (*A. J. P.*, xlvii. 209.) The young shoots of one of the species of Lycium are eaten in Spain as asparagus, and its leaves as salad; and the aborigines of Colombia used another species against erysipelas. The leaves of *L. barbarum*, as well as the fruit, are said to be used by the physicians of Japan. (*Mérat and De Lens.*)

LYCOCTONA. For a paper on its physiological action, see *Phila. Med. Times*, Oct. 1875.

LYCOPUS. *U. S.* 1870. *Lycopus Virginicus.* Michaux, *Flor. Boreal. Americ.*, i. 14; Rafinesque, *Med. Flor.*, vol. ii. The *bugle-weed* is an indigenous herb, with a perennial creeping root, which sends up an erect, nearly simple, obtusely quadrangular stem, from twelve to eighteen inches high, and furnished with opposite sessile leaves. These are broad-lanceolate, attenuated and entire at both extremities, remotely serrate in the middle, somewhat rough, purplish, and beset with glandular dots on their under surface. The flowers are minute, in small axillary whorls, with two small subulate bracts to each flower, and a white corolla. The seeds are longer than the calyx, which is spineless. This plant grows in shady and wet places throughout the greater part of the United States. Its flowering period is August. The whole herb is used. It has a peculiar odor and a nauseous slightly bitter taste, and imparts these properties, as well as its medical virtues, to boiling water.

Lycopus Europæus is said to be frequently collected and sold for *L. Virginicus.* The former may be distinguished by its acutely quadrangular stem, its narrow lanceolate leaves, of which the lower are somewhat pinnatifid, its more crowded flowers, and the acute segments of its calyx, armed with short spines. It has been employed in Europe as a substitute for quinine.

According to Dr. A. W. Ives, the bugle-weed is a very mild narcotic. It is said also to be astringent. Drs. Pendleton and Rogers, of New York, obtained favorable effects from it in incipient phthisis and pulmonary hemorrhage (*N. Y. Med. and Phys. Journ.*, i. 179), and its use has been extended to the hemorrhages generally. (*Trans. A. M. A.*, i. 347.) It is most conveniently employed in the form of infusion, which may be prepared by macerating an ounce of the herb in a pint of boiling water. From half a pint to a pint may be taken daily.

LYTHRUM SALICARIA. *Loosestrife. Purple Willow-herb.* This is an elegant perennial plant, native of Europe, but naturalized in the northeastern parts of the United States. The whole herbaceous part is medicinal, and is dried for use. In this state it is inodorous, and has an herbaceous, somewhat astringent taste. It renders boiling water very mucilaginous, and its decoction is blackened by the sulphate of iron. Loosestrife is demulcent and astringent, and may be advantageously given in diarrhœa and chronic dysentery, after due preparation by evacuating treatment. It has long been used in Ireland in these complaints, and is said to be a popular remedy in Sweden. The dose of the powdered herb is about a drachm two or three times a day. A decoction of the root, prepared by boiling an ounce in a pint of water, may be given in the dose of two fluidounces.

MACALLO OR YABA BARK. For an article on this Yucatan bark, see *A. J. P.*, 1879, p. 392.

MACLURA AURANTIACA. The bark of the root of this tree, which is indigenous in our Southern States, is said to be considerably used in making a yellow dye. Mr. Alex. King has found in it *moric* and *morintannic acids.* (*A. J. P.*, xlvi. 257.)

MALAMBO OR MATIAS BARK. A bark received from South America by Dr. Alex. Ure, under the name of *matias bark*, was found to have the characters of the *malambo bark*, which is held in high esteem in Colombia where it is produced, and has been long known to the French pharmacologists. It has been ascertained by H. Karston, of Berlin, to be derived from a hitherto undescribed species of Croton, which he names *Croton Malambo*, and which is described in his work entitled "*Floræ Colombiæ Terrarumque adjacentium Specimina Selecta.*" This is a small tree or shrub, growing on the coast of Venezuela and Colombia. (*P. J. Tr.*, 1859, p. 321.) The bark is described by Dr. Ure as being three or four lines thick, brittle though somewhat fibrous, of a brown color, and covered with an ash-colored tuberculous epidermis. It has an aromatic odor, and a bitter pungent taste, and yields these properties to water and alcohol. Its active ingredients appear to be a volatile oil, and a bitter extractive matter. According to Dr. Mackay, it has been used successfully in intermittents, convalescence from continued fever, hemicrania, dyspepsia, and other cases in which tonic remedies are useful, and also as an adjuvant to diuretics. It is probably nothing more than an aromatic tonic. Dr. Ure has administered it with good effect as a substitute for Peruvian bark. (*P. J. Tr.*, iii. 169.)

Under the name of *Winter's bark*, a considerable quantity of bark was some time since imported into the United States from South America, which Mr. E. S. Wayne, of Cincinnati, has identified with the malambo bark above described, having found it to correspond with that product both in sensible characters and composition. (*A. J. P.*, xxix. 1.) Dr. Geo. B. Wood confirmed this decision of Mr. Wayne; a specimen in his possession answered precisely to the description given by Dr. Ure. The malambo bark, analyzed by Cadet de Gassicourt, yielded volatile oil, bitter resin, and extractive; but no tannic or gallic acid, and no alkaloid; and the same was the case with the so-called Winter's bark examined by Mr. Wayne. (*Ibid.*) The same bark has been analyzed by Mr. F. B. Dancy, who found in it volatile oil, gum, starch, albumen, resin, extractive, fixed oil, wax, and several inorganic substances. (*Ibid.*, p. 219.)

MALVA SYLVESTRIS. *Common Mallow.* This is a perennial, herbaceous plant, with a round, hairy, branching, usually erect stem, from one to three feet high, bearing alternate, petiolate, cordate, roughish leaves, which are divided into five or seven crenate lobes, and on the upper part of the stem are almost palmate. The flowers are large, purplish, and placed, from three to five together, at the axils of the leaves, upon long slender peduncles, which, as well as the petioles, are pubescent. The petals are five, inversely cordate, and three times as long as the calyx. The capsules are disposed compactly in a circular form. This species of mallow is a native of Europe, growing abundantly on waste grounds and by the way-sides, and flowering from May to August. It is sometimes cultivated in our gardens. Almost all the species of the genus are possessed of the same properties. *M. rotundifolia*, one of the most common, may be substituted for *M. sylvestris*. The herb and flowers have a weak, herbaceous, slimy taste, without odor. They abound in mucilage, which they readily impart to water; and the solution is precipitated by acetate of lead. The infusion and tincture of the flowers are blue, and serve as a test of acids and alkalies, being reddened by the former, and rendered green by the latter. The roots and seeds also are mucilaginous. Common mallow is emollient and demulcent. The infusion and decoction are sometimes employed in catarrhal, dysenteric, and nephritic complaints; and are applicable to all other cases which call for the use of mucilaginous liquids. They are also used as an emollient injection; and the fresh plant forms a good suppurative or relaxing cataplasm in external inflammation. It was formerly among the culinary herbs.

MANDRAGORA OFFICINALIS. *Atropa Mandragora.* Linn. *Mandrake. Mandragora.* A perennial European plant, with spindle-shaped root, which is often forked beneath, and is therefore compared, in shape, to the human figure. In former times this root was supposed to possess magical virtues, and was used as an amulet to promote fecundity, etc.; and the superstition is still cherished by the vulgar in some parts of Europe. The plant is a poisonous narcotic, somewhat similar in its properties to belladonna, to which it is botanically allied. It was much used by the ancients with a view to its narcotic effects; and the root has been recommended by some eminent modern physicians, as an external application to scrofulous, scirrhous, and syphilitic tumors. It is said to have been used by the ancients as an anæsthetic agent before surgical operations. (*Journ. de Pharm.*, xv. 290.) Its physiological action has been partially investigated by Dr. B. W. Richardson (*B. and F. Med.-Chir. Rev.*, 1874, p. 242). It is unknown as a remedy in the United States.

MANGANESE. *Manganesium.* This metal and its compounds with oxygen have been already described. (See *Manganesii Oxidum Nigrum.*) Several of its combinations have been proposed as medicines, and the therapeutic trials thus far made with them place them alongside of those of iron as tonic and anti-anæmic remedies. It will be recollected that manganese as well as iron is always present, in minute proportion, in healthy blood, and has been detected in various solids and fluids of the body. (See page 918.) According to an analysis by M. Burin-Dubuisson, the amount of manganese in the blood-corpuscles is about one-twentieth that of the iron. It is stated, as an advantage of the preparations of manganese, that they may be prescribed in conjunction with tannic acid and the various astringent medicines, which are all incompatible with the preparations of iron. Of the oxides of manganese, the *monoxide* only is strongly salifiable; and this is the oxide present in the ordinary salts of the metal. It may be obtained by precipitation, as a white hydrate, from any of the soluble salts of manganese by the addition of a caustic alkali. This, according to M. Hannon, is a good medical preparation; but a strong objection to it is that it rapidly absorbs oxygen, and passes to the state of the brown hydrated sesquioxide. The officinal dioxide (native black oxide) is described at page 918, where its medical properties are also noticed.

Iodide of Manganese. (MnI_2.) This very deliquescent salt may be prepared by adding carbonate of manganese to aqueous hydriodic acid, filtering the solution and granulating, carefully regulating the heat. This iodide may be administered in syrup or pill. Professor Procter proposed the following formula for the *syrup*. Dissolve sixteen drachms of sulphate of manganese, and nineteen drachms of iodide of potassium, separately, in three fluidounces of water, each portion of water being previously sweetened with two drachms of syrup. Mix the solutions in a glass-stoppered bottle, and when the crystals of sulphate of potassium have ceased to precipitate, throw the liquor on a strainer of fine muslin, and allow it to filter into a pint bottle, containing twelve ounces of powdered sugar. When the solution has ceased to pass, wash the filter with a little sweetened water, and add sufficient of that liquid to make the whole measure a pint. Lastly, agitate the liquid until the sugar is dissolved. Prof. Procter stated that this syrup contained about a drachm of iodide of manganese in each fluidounce, and corresponded in strength to the officinal solution of iodide of iron. The small proportion of sulphate of potassium which remains dissolved in the syrup, does not interfere with its medicinal efficacy. The dose is from ten to thirty drops, repeated several times a day. (*A. J. P.*, Oct. 1850.) M. Hannon makes a *pill of iodide of manganese* by double decomposition between equal weights of iodide of potassium and crystallized sulphate of manganese. The salts are perfectly dried, accurately mixed in powder, and then rubbed up with honey, so as to reduce the whole to a pilular mass, which may be divided into four-grain pills. Assuming that the honey added compensates for the loss of water in drying, each pill will consist of about two grains of iodide of manganese, one of sulphate of potassium, and one of honey, and sulphate of manganese in excess. The dose is one pill daily, gradually increased to six. According to M. Hannon, iodide of manganese is particularly useful in the anæmia attendant on scrofula, phthisis, and cancer, and in syphilitic cachexy. Given in conjunction with cinchona, it rapidly removes the enlargement of the spleen often following protracted fevers.

Carbonate of Manganese. ($MnCO_3$.) This salt may be obtained by the following formula, which is that of M. Hannon. Dissolve seventeen ounces of crystallized sulphate of manganese, and nineteen ounces of carbonate of sodium, separately, in two pints of water, a fluidounce of syrup having been previously added to each pint; and, having mixed the solutions in a well-stoppered bottle, allow the precipitate to subside. Decant the supernatant liquid, wash the precipitate with sweetened water, allow it to drain from a cloth saturated with syrup, express, mix with ten ounces of honey, and evaporate rapidly to form a pilular mass, which is to be divided into four-grain pills. By a double decomposition between the sulphate of manganese and carbonate of sodium, carbonate of manganese is precipitated, and sulphate of sodium remains in solution. The sulphate is washed away, and the carbonate is brought to a pilular consistence with honey, which, together with the syrup, prevents the monoxide of manganese in the pill from rising to a higher stage of oxidation. The dose is from two to ten pills daily. Carbonate of manganese was tried by M. Hannon as a medicine on himself. After its use for fifteen days he found his appetite improved, and his pulse increased in force; and he experienced a feeling of sanguineous plethora. He afterwards exhibited the remedy in several anæmic cases, with the effect of exciting the functions to a more healthy action, increasing the strength and improving the blood.

Phosphate, tartrate, and *malate of manganese* have also been proposed by M. Hannon as useful remedies. The phosphate is prepared by double decomposition between sulphate of manganese and phosphate of sodium. A *syrup of phosphate of manganese* has been made by Mr. T. S. Wiegand, of this city. (See his formula in *A. J. P.* for July, 1854.) Dr. Simpson, of Edinburgh, informed Dr. Geo. B. Wood that a syrup made with two grains of phosphate of iron and one grain of phosphate of manganese in a fluidrachm of syrup, was much and advantageously used by himself and others in Edinburgh. This may be easily prepared by adding to the two ingredients mentioned five grains of glacial phosphoric acid for each grain of the phosphate of iron. (*P. J. Tr.*, 1859, p. 288.) *Lactate of manganese* has been given, associated with lactate of iron, in chlorosis, in the dose of a grain, increased to five grains.

Ferro-manganic Preparations. M. Hannon conceives that manganese is peculiarly suited to the treatment of anæmic cases in which iron has failed, or acts very slowly; but, instead of passing at once from the use of iron to that of manganese, he prefers to give intermediately a mixture of the two metals. For this purpose he recommends the following formula. Take of crystallized sulphate of iron six drachms and a half; crystallized sulphate of manganese two drachms; carbonate of sodium nine drachms; honey five drachms. Rub together, and with syrup make a mass, to be divided into four-grain pills. In this pill both the metals are present as carbonates; and, as the sulphate of sodium is not washed away, it contains that salt also. The dose is from two to ten pills daily. (See the paper of M. Hannon, *Journ. de Pharm.* 3e sér., xvi. 41 and 189; also a note of the favorable results obtained by M. Pétrequin, of Lyons, *Ibid.*, xvi. 381.) Further experience has confirmed the favorable opinion of M. Pétrequin in relation to the therapeutic value of the ferro-manganic preparations. A number of formulas have been devised by M. Burin-Dubuisson, of Lyons, for making them, containing the metals variously combined; but the most important of them is the *syrup of iodide of iron and manganese*, for the preparation of which the following formula has been devised by Prof. Procter. Take of iodide of potassium 1000 grains; sulphate of iron 630; sulphate of manganese 210; iron filings 100; sugar, in coarse powder, 4800. Powder the iodide and sulphates separately, and, having mixed them with the filings, add half a fluidounce of distilled water, and triturate to a uniform paste. Then add another half fluidounce of distilled water to the paste, and triturate again; and, after an interval of fifteen minutes, add a third half fluidounce, and mix. Next transfer the magma of salts to a moistened filter, supported on a funnel, and allow them to drain into a bottle, holding a little more than twelve fluidounces, and containing the sugar. After they have drained, add cold boiled water by small portions at a time, until the solution of the iodides has been displaced and washed from the crystalline magma of sulphate of potassium. Finally, add sufficient cold boiled water to make the whole measure twelve fluidounces. The object of the iron is to prevent the liberation of iodine. This syrup has a very pale straw color. It contains a little sulphate of potassium, which does not injure it as a therapeutic agent. If the salts have not been all decomposed during their reaction, it will be greenish. Each fluidounce contains 50 grains of the mixed iodides, in the proportion of 3 parts of iodide of iron to 1 of iodide of manganese. The dose is from ten drops to half a fluidrachm. (*A. J. P.*, 1853, p. 198.) Prof. J. U. Lloyd proposed a process (*A. J. P.*, 1874, p. 6) whereby a less amount of sulphate of potassium remained in the finished preparation. Sulphate of manganese 240 grs.; iodide of potassium 288 grs.; iodine 744 grs.; iron wire (small) 240 grs.; sugar 17 oz. av.; distilled water q. s. Place the iodine, three ounces of distilled water, and the iron wire in a glass flask, and agitate until the solution has acquired a clear, greenish color, without a tinge of yellow. Filter the solution into the sugar contained in a porcelain dish; wash the filter by pouring into it two ounces of distilled water, allowing the liquid to filter into the sugar. Dissolve the sulphate of manganese and iodide of potassium separately in half an ounce of cold distilled water by trituration in a mortar; mix the two solutions together, and allow the sulphate of potassium to separate; transfer the mixture to a wetted filter, and allow the solution of iodide of manganese to filter into the sugar; when well drained, wash the precipitate in the funnel with half an ounce of *ice-cold* distilled water, and finish by agitating the mixture until sugar is dissolved; add enough distilled water to make the whole measure twenty fluidounces; filter. Syrup of iodide of iron and manganese is considered by M. Pétrequin to be particularly suited to the treatment of anæmia resulting from obstinate intermittent fevers, prolonged suppuration, and scrofulous, syphilitic, and cancerous affections.

Dr. T. S. Speer, of Cheltenham, in imitation of the practice of M. Hannon and M. Pétrequin, has employed the combined carbonates of iron and manganese with excellent effects; but, instead of using the carbonate in pill, protected by honey and syrup, as M. Hannon has done, he prefers a saccharine carbonate of the two metals, in imitation of the London saccharine carbonate of iron, made by the following formula. Dissolve three ounces and one drachm of sulphate of iron, one ounce and one scruple of sulphate of manganese, and five ounces of carbonate of sodium, each, in thirty Imperial fluidounces of water, and thoroughly mix the solutions. Collect the precipitated carbonates on a cloth filter, and wash them immediately with cold water, to separate the sulphate of sodium. Then press out as much water as possible, and, without delay, triturate the pulp with two and a half ounces of finely powdered sugar. Lastly, dry the mixture at a temperature not exceeding 48·8° C. (120° F). The *saccharine carbonate of iron and manganese*, as thus prepared, is a reddish brown powder, devoid of all taste, except that imparted by the sugar. The dose is five grains, gradually increased to a scruple, three times a day, given with the meals, or immediately after them. (See *A. J. P.*, 1854, p. 127; from *Med. Times and Gaz.*)

MARANTA. Under this name the U. S. Pharmacopœia, 1870, recognized the fecula obtained from the root of *M. arundinacea.* (*Arrow-root*, F.; *Amerikanisches Starkmehl*, *Arrowmehl*, G.) The root (rhizome) of this plant is perennial, tuberous, fleshy, horizontal, nearly cylindrical, scaly, from six inches to a foot or more in length, and furnished with numerous long white fibres. It sends forth several tuberous, jointed, curved, white, scaly stoles, the points of which sometimes rise above the ground and become new plants. The stems, of which several proceed from the same root, are annual, slender, branched, jointed, leafy, and about three feet in height. The leaves are ovate-lanceolate, about four inches long, alternate, and supported solitarily, at the joints of the stem, upon long, sheathing footstalks. The flowers are in a long, loose, spreading, terminal panicle, at each ramification of which is a solitary linear bract. The calyx consists of three small lanceolate leaves. The corolla is white and monopetalous, with a tube longer than the calyx, and a double border, of which the three outermost segments are smallest, and the two inner obovate, and slightly emarginate.

The arrow-root plant is a native of the West Indies, where it is largely cultivated. It is cultivated also in the East Indies, Sierra Leone, the south of Africa, and formerly in our Southern States, especially Georgia and Florida. The plant is easily propagated by cuttings of the root. The fecula is prepared in the following manner. The roots are dug up when a year old, washed, and then beaten into a pulp, which is thrown into water, and agitated so as to separate the amylaceous from the fibrous portion. The fibres are removed by the hand, and the starch remains suspended in the water, to which it gives a milky color. The milky fluid is strained through coarse linen, and allowed to stand that the fecula may subside, which is then washed with a fresh portion of water, and afterwards dried in the sun. We obtain the officinal arrow-root chiefly through London from the West Indies. That from the Bermudas has in general been most highly esteemed.* The term Bermuda arrow-root is now applied commercially to any carefully prepared arrow-root, without reference to the place of its production. Jamaica arrow-root is an inferior article, which is to some extent imported directly. St. Vincent, one of the British West India Islands, furnishes a large amount of the arrowroot imported into this country.

Other plants contribute to furnish the arrow-root of commerce. Lindley states that it is procured in the West Indies from *Maranta Allouya* and *M. nobilis*, besides *M. arundinacea*. Under the name of *M. Indica*, Tussac describes a distinct species, which he says was originally brought from the East Indies, and is now cultivated in Jamaica. This, however, is generally considered as a mere variety of *M. arundinacea*, from which it differs chiefly in having leaves more elongated at the point, and smooth on both sides. Very fine arrow-root is obtained in the East Indies from the root of *Curcuma angustifolia* of Roxburgh, which is cultivated in Travancore. But the product is lighter than the Maranta arrow-root, and does not so quickly make a jelly. Ainslie states that *M. arundinacea* has been introduced from the West Indies into Ceylon, where good arrow-root is prepared from it. Cassava arrow-root is prepared in Brazil from the *Janipha Manihot*, and sometimes sold as arrow-root, or used to adulterate the true arrow-root. A variety of arrow-root has been imported from the Sandwich Islands. Mr. Nuttall, during a visit to these islands, found that it was obtained from a species of tacca, which he described by the name of *Tacca oceanica*. (*A. J. P.*, ix. 305.) It is said that a similar product is afforded by *Tacca pinnatifida*, growing in the East India province of Arracan. (*P. J. Tr.*, vi. 383.) Arrow-root has been brought from Florida, prepared near St. Augustine from the root of *Zamia integrifolia*, by a process similar to that employed for the fecula of the Maranta (Dr. J. Carson, *A. J. P.*, xiv. 22); but care must be taken not to confound this with the genuine maranta from the same State. The tuberous roots of different species of Alstrœmeria, growing in South America, yield a fecula used for the same purposes as the maranta; and a specimen, under the name of *Talcahuana arrow-root*, was sent from Chili by Dr. Ruschenberger to Prof. Carson, of this city, who ascertained it to be the product of the *Alstrœmeria ligtu*. (*Ibid.*, xxxii. 289.) In the West Indies, substitutes for arrow-root are furnished by the roots of *Dioscorea sativa* or *yam*, and of *Colocasia esculenta*, and by the fruit of *Artocarpus incisa* or bread-fruit tree.† Attempts have been made to substitute finely prepared potato starch for arrow-root; and there is no doubt that in nutritive properties it is quite equal; but patients complain of an unpleasant taste of the potato which it is apt to retain.

Arrow-root is in the form of a light white powder, or of small pulverulent masses, without smell or taste. It has a firm feel when pressed between the fingers, and produces a faint crackling sound when rubbed. It is a pure starch, corresponding in chemical properties with that of wheat and the potato. It is very apt to be musty, and should then be rejected. The odor and taste are the best criteria of its purity. It should be perfectly free from smell and unpleasant flavor. Prof. Procter rendered musty arrow-root sweet and fit for use by washing it thoroughly with two successive portions of cold water, and then drying it upon frames of muslin in a warm place. (*A. J. P.*, xiii. 188.) Arrow-root is said to be sometimes adulterated with common starch, and that of the potato. These may be detected by the aid of the microscope. Hydrochloric acid has been proposed as a test. A mixture of equal parts of that acid and of water, rubbed with about half its weight of potato or wheat starch, very quickly forms so thick a mucilage that the mortar in which the trituration is effected may be raised by the pestle; while the same result does not take place with rice flour or arrow-root under 25 or 30 minutes. So small a proportion as from 4 to 6 per cent. of the impurity may, it is asserted, be detected in this way. (*Journ. de Pharm.*, 3e sér., ii. 246.) The German Pharmacopœia test is as follows: "When arrow-root is shaken for ten minutes with ten parts of a mixture consisting of two parts of hydrochloric acid and one part of water, the greater part should separate unchanged, and it should not become mucilaginous nor yield an herbaceous odor similar to that of green unripe bean-pods." (*Lochman.*)

As the microscope offers the best means of distinguishing the different varieties of fecula sold as arrow-root, or used for its adulteration, it is proper to indicate the form of their granules as exhibited by this instrument. Those of the proper officinal or *Maranta arrow-root* are rarely oblong, somewhat ovate-oblong, or irregularly convex, with very fine rings, a circular hilum which cracks in a linear or stellate manner, and small mammillary processes occasionally projecting from them. (*Pereira.*) The largest are the 750th of an inch, but many not more than the 2000th of an inch long; and their breadth is generally two-thirds of their length. (*Christison.*) The granules of the *East India arrow-root* are, according to Pereira, of unequal size, ovate or oblong-ovate, flattened, and often furnished with a very short neck or nipple-like projection. The rings are numerous, close, and very fine; and the hilum, which is situated at the narrow extremity, is circular, small, and indistinct. The microscopic appearance of the *tapioca fecula* will be described under the head of *Tapioca.* The *Tacca fecula* from the South Sea Islands, examined by Pereira, consisted of circular, muller-shaped, or polyhedral granules, with few and not very distinct rings, and a small, circular hilum, which cracked in a linear or stellate manner. The *Florida* or *Zamia arrow-root* was found by Dr. Carson to consist of granules forming the half, third, or quarter of a solid sphere. The *potato starch* granules are of various shape and size, but generally ovate or elliptical, and from the 7000th to the 300th of an inch in length; the largest being inferior in size only to the largest of the canna starch or *tous-les-mois.* (See *Canna.*) They are strongly marked with concentric rings, and have a circular hilum, from which usually proceed the cracks observable in some of the larger grains. (*Pereira.*)

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* For an account of the preparation of arrow-root in Georgia, see *Proc. A. P. A.*, 1858, p. 332. Dr. Robert Battey states that arrow-root is still raised for home consumption in the Gulf counties of Georgia, but it no longer appears in the Philadelphia market.

† Specimens of these feculas were seen by Dr. G. B. Wood, in the *Palais d'Industrie* of Paris, among the French colonial products, in the autumn of 1860.

Medical Properties and Uses. Arrow-root is nutritious and demulcent, affording a light, very mild, and easily digested article of diet, well adapted for the sick and convalescent, and peculiarly suited, from its demulcent properties, to bowel complaints and diseases of the urinary passages. It is much used as food for infants after weaning, or when the mother's milk is insufficient. It is prepared by dissolving it in hot water, with which it forms a pearly gelatinous solution, and, if in sufficient quantity, a jelly-like mass on cooling. A tablespoonful will communicate sufficient consistence to a pint of water. It should first be formed into a paste with a little cold water, and the boiling water then gradually added with brisk agitation. The preparation may be rendered more palatable by lemon-juice and sugar, or in low forms of disease by wine and spices. For children, arrow-root is usually prepared with milk.

MATA. This name is given, in New Mexico, to an herb much used in that region as an addition to tobacco in smoking. It is said, when burning, to have an odor like that of the Tonka bean, and, when smoked with tobacco, to correct the extremely disagreeable smell imparted by this to the clothing and apartments. From imperfect specimens of the plant raised by Prof. E. S. Wayne from seeds which had come into his possession, and sent to Prof. Maisch, it is supposed to be a Eupatorium, probably the *E. incarnatum* of Walter, which is indigenous in Texas. (*A. J. P.*, 1868, p. 122.)

MEAT BISCUIT. (See *Extractum Carnis.*) This alimentary substance, containing much nutriment in a small bulk, is the invention of Mr. Gail Borden, jun., of Texas. It is made by mixing a concentrated fluid extract of flesh, strained through wire-cloth, and freed from fat, with good wheat flour, or other meal, and baking the dough into a biscuit, which must be preserved, in mass or coarse powder, free from moisture, in gutta-percha bags, or air-tight casks or cases. To make the dough, about two parts of the extract are mixed with three of the flour; and about 20 per cent. is lost in baking. The extract contains the soluble ingredients of the flesh, not coagulable by heat; namely, gelatin, kreatin, kreatinin, phosphoric, lactic, and inosinic acids, and certain salts. Of course, it contains no albumen or fibrin, unless in some altered state in which they are rendered soluble at a boiling temperature. In this nutritious biscuit, the absence of albumen and fibrin is supposed to be supplied by the gluten of the flour. To prepare a pint of palatable soup, an ounce of the powdered biscuit, first made into a thin paste with cold water, is added, with constant stirring, to sufficient boiling water, and the whole boiled for twenty minutes. Salt and pepper are then added to suit the taste. The meat biscuit forms an important resource in all cases in which food must be carried on long journeys for daily consumption.

Preserved Meat-juice is a nutritive liquid, prepared by Mr. Gillon, a manufacturer of preserved meats, at Leith, in Scotland. For the method of its preparation see 13th edition of the Dispensatory, or *Med. Examiner*, March, 1855. An excellent meat-juice is now prepared by M. S. Valentine, of Richmond, Va. (1882.)

Flour of Meat. Dr. A. H. Hassall, of London, has given this name to a preparation which concentrates the virtues of meat within a smaller space, and more completely represents them, than any other preparation of which we have seen an account. Of the different forms of extract and essence of meat, almost all have this great deficiency, that, while they contain the stimulating and effete constituents of the meat, they are destitute of the fibrin and albumen, which are probably its most nutritious ingredients; and absolutely all are without the fibrin. Hassall's method consists in drying the meat, at a temperature generally below that necessary for coagulating albumen, so as to deprive it of all its water, without removing any of its essential constituents, perhaps in vacuo, and then grinding it into a *very fine powder.* When made from beef, the powder is of a light brown color and very agreeable taste; and one pound represents four pounds of flesh, or six pounds of the leanest joints not deprived of bone and fat. In a few words, Dr. Hassall speaks of it as—1, useful for the speedy preparation of beef tea; 2, with vegetables and flavoring substances for quickly making soups; 3, in forming, when combined with farinaceous matter, a nutritious food, well adapted for children, dyspeptics, and invalids; 4, for making, by mixture with cocoa, a nutritious breakfast drink; and, 5, for forming meat biscuit. Dr. Hassall has here omitted to state what appears to us to be its highest recommendation, that it is an excellent article of diet for the old and toothless, who cannot sufficiently comminute meats for the purpose of easy digestion. (*Lancet*, 1866, p. 184.) In a subsequent communication to the same journal, Dr. Hassall recognizes this as among its useful applications. He speaks also of its being retained by the stomach when meat in its ordinary forms is rejected, of its applicability to cases in which it is necessary to inject nutritive food into the stomach or the rectum, and of its special usefulness as an article of food in dyspepsia, in diabetes, in the weakness following parturition, and in low forms of fever. Dr. Hassall says that it is finer even than wheat flour. (*Ibid.*, 1866, p. 469.)

Raw Meat has been recommended as an article of diet for consumptive patients, and especially for scrofulous children, and in other cachectic cases, and is asserted to have proved highly useful. It may also be employed with great advantage in dyspepsia and chronic diarrhœa, especially in children. It was brought into notice by M. Fuster, of Montpellier, France. The following formula is recommended by M. Reveil. Take of fillet of beef 100 grammes, deprive it carefully of all fatty and membranous matter, cut it up finely, beat it in a mortar, and add of powdered sugar 20 grammes, chloride of sodium 1·5 grammes, chloride of potassium half a gramme, and powdered black pepper one-fifth of a gramme. The mixture is to be taken in teaspoonful doses through the day. (*Ann. de Thérap.*, 1866, p. 145.) An excellent method of exhibiting raw meat is to *scrape* a thin steak and mix the pulp thus obtained with brandy. M. Ivon asserts that a very pleasant emulsion is afforded by the following formula (*A. J. P.*, 1874, p. 346). Take of raw meat 250 parts, of sweet almonds 75 parts, of bitter almonds 5 parts, of white sugar 80 parts. Blanch the almonds and beat the whole into a paste. In dissolving, milk may be used instead of water.

Pemmican is an alimentary substance, containing much nutriment in a small bulk, which is used by fur traders and others, as their exclusive food, on long journeys in the northwest of this continent. It is made, according to Dr. C. C. Keeney, U. S. Army, by mixing equal weights of buffalo meat and buffalo tallow. The meat, thoroughly dried in the sun, is reduced to powder, and the tallow in the melted state is added to it, and the whole well stirred. The melted mixture is then poured into sacks of untanned buffalo hide, capable of containing from twenty to forty pounds. No salt is used, and yet the mixture keeps perfectly well. (*Med. Statistics, U. S. Army*, p. 56.)

MEDEOLA VIRGINICA. *Gyromia Virginica.* Nuttall. *Indian Cucumber.* An indigenous perennial herb, growing in all parts of the United States. The root, which in shape and flavor bears a strong resemblance to a small cucumber, is said by Pursh to be eaten by the Indians, and by Prof. Barton to be useful as a diuretic in dropsies.

MEGARRHIZA CALIFORNICA. *Man-root.* Mr. J. P. Henry has obtained a substance from this root, which he believes to be a glucoside, and calls it *Megarrhizoretin.* It is said to be actively cathartic. (*A. J. P.*, 1876, p. 451.)

MELILOTUS OFFICINALIS. *Melilot.* An annual or biennial plant, indigenous in Europe, and growing also in this country. We have two varieties, one with yellow, the other with white flowers, which are considered by some as distinct species. The plant, when in flower, has a peculiar sweet odor, which, by drying, becomes stronger and more agreeable, somewhat like that of the Tonka bean. This similarity is accounted for by the fact that *coumarin*, $C_9H_6O_2$, the chief constituent of Tonka beans, is present in melilot, combined with *melilotic acid*, $C_9H_{10}O_3$, and *coumaric acid*, $C_9H_8O_3$, of which latter acid *coumarin* is the anhydride. The taste of melilot is slightly bitterish. It has little medical power, and, though formerly recommended in various diseases, is at present not employed.

MENYANTHES TRIFOLIATA. *Buckbean. Marsh Trefoil.* Willd. This gentianaceous plant has a perennial, long, round, jointed, horizontal, branching, dark-colored root or rhizome, about as thick as the finger, and sending out numerous fibres from its under surface. The leaves are ternate, and upon long stalks, which proceed from the end of the root, and are furnished at their base with sheathing stipules. The leaflets are obovate, obtuse, entire or bluntly denticulate, very smooth, beautifully green on their upper surface, and paler beneath. The flower-stalk is erect, round, smooth, from six to twelve inches high, longer than the leaves, and terminated by a conical raceme of whitish, somewhat rose-colored flowers. The calyx is five-parted; the corolla funnel-shaped, with a short tube, and a five-cleft, revolute border, covered on the upper side with numerous long, fleshy fibres. The anthers are red and sagittate; the germ ovate, supporting a slender style longer than the stamens, and terminating in a bifid stigma. The fruit is an ovate, two-valved, one-celled capsule, containing numerous seeds. This beautiful plant is a native both of Europe and North America, growing in boggy and marshy places, always moist, and occasionally overflowed with water. It prevails, in the United States, from the northern boundary to Virginia. In this country the flowers appear in May, in England not until June or July. All parts of it are efficacious, but the leaves only were officinal.

The taste of buckbean is intensely bitter and somewhat nauseous, the odor of the leaves faint and disagreeable. The plant has been examined by Trommsdorff, Brandes, Landerer, and Kromayer. Its virtues depend on a bitter principle denominated *menyanthin*, which may be obtained sufficiently pure for use by treating the spirituous extract of the plant with hydrated oxide of lead, removing the lead by hydrosulphuric acid, filtering and evaporating the liquor, exhausting the residue with alcohol, and again evaporating with a gentle heat. It has a pure bitter taste, is soluble in alcohol and water, but not in pure ether, and is chemically neutral. Kromayer (1865) assigns to it the formula $C_{30}H_{46}O_{14}$.

Medical Properties and Uses. With the ordinary properties of the bitter tonics, menyanthes unites a cathartic power, and in large doses is apt to vomit. It was formerly held in high esteem in Europe as a remedy in numerous complaints, among which were intermittents, rheumatism, scrofula, scurvy, dropsy, jaundice, and various cachectic and cutaneous affections. In most of these it was administered under a vague impression of its alterative powers. It is little employed in this country; but, as it is a native plant, and applicable to cases where a combined tonic and purgative effect is demanded, it is desirable that country practitioners should be aware of its properties. The dose of the powdered leaves or root as a tonic is from twenty to thirty grains; of an infusion, prepared with half an ounce to a pint of boiling water, from one to two fluidounces; and of the extract ten or fifteen grains, to be repeated three or four times a day. A drachm of the powder, or a gill of the strong decoction, generally purges, and often occasions vomiting.

MERCURIALIS ANNUA. An herbaceous European plant, of the family of Euphorbiaceæ, which has been employed, from the most ancient times, as a purgative and emmenagogue. It has also been considered by some as diuretic, and has been used in the treatment of syphilitic affections. When boiled, it loses its acridity, and in this condition has been used as an emollient. Another species, *M. perennis*, also a native of Europe, is poisonous. (*Mérat and De Lens.*) M. Reichardt has discovered in *M. annua* a volatile alkaloid, *mercurialine* (*mercurialia*), possessing the formula CH_5N, isomeric and possibly identical with methylamine. This is a liquid, of an oily appearance, narcotic odor, and alkaline reaction; boils at 140° C. (284° F.); forms salts with the acids; absorbs carbonic acid; has a strong affinity for water; on exposure to the air it is changed into a resin of a buttery consistence; and is very poisonous to man. For the mode of procuring it, see *Annuaire de Thérapeutique* (1864, p. 44) and *Neues Repertorium für Pharm.* (xviii. 296). The existence of a volatile alkaloid in the Mercurialis suggests that other Euphorbiaceæ may owe their acrid properties to a similar constituent.

MESEMBRYANTHEMUM CRYSTALLINUM. *Ice-plant.* A biennial plant, a native of the south of Europe. The stem and under surface of the leaves are covered with crystalline drops, which give the plant the appearance of being coated with ice. The herb is without smell, and has a saline somewhat nauseous taste. It is considered demulcent and diuretic, and has been commended as a remedy in various complaints, especially those of the mucous membrane of the lungs and urinary passages. It has also been used in dropsy. The expressed juice is the form in which it has been generally employed.

MESENNA. *Musenna. Bisenna.* Under these different names has been brought into notice, as a powerful tæniafuge, the bark of an Abyssinian tree, the botanical character of which has recently been determined by M. Brongniart from dried specimens brought to Paris by M. Courbon. The tree is leguminous, and belongs to the family of the Mimoseæ. M. Brongniart names it *Albizzia anthelmintica.* The bark is in flat pieces from five to ten inches long, smooth, slightly fissured, of a rusty-gray color exteriorly, and pale yellow and fibrous within. It consists of four layers, one of which contains very large cells, with thick coats, and is supposed to be the active part. MM. E. Caventou and Legendre have examined the bark, and found in it no alkaloid, but a peculiar, acid, resinous substance, having an acrid taste, analogous to that of the bark, of which it is probably the active principle. The *musennin* of Thiel is probably the same, although not as yet in a pure state. The Abyssinians employ the powdered bark, in the dose of about two ounces, which they take in various ways, suspended in water or other liquid, or mixed with flour in the form of bread, or made into a confection with honey, butter, etc. It is taken in the morning, three or four hours before breakfast, and no other precautions are used. It produces no pain nor any disturbance of the functions, not even purging actively. Fragments of the worm are voided the same evening, and the greater portion of it the next day. Successful trials of the remedy have been made elsewhere than in Abyssinia, though M. Rayer has collected cases which tend to discountenance the opinion of its vermifuge powers. But the bark may in these instances have been injured by time. (See *Ann. de Thérap.*, 1862, p. 161.)

MESQUITE GUM. *Gum Mesquite. Gum Mezquite.* This is the product of *Prosopis juliflora*, D. C. (*Algarobia glandulosa*, Torrey and Gray), a small thorny tree or shrub, belonging to the family of Mimoseæ, and growing in New Mexico, Texas, and other neighboring regions, where it covers vast extents of country. Captain R. B. Marcy, of the U. S. Army, who commanded an expedition sent by our government into that region, gives a particular account of the tree, in a letter to Messrs. Rushton & Co., of New York. He states that it was first described by Dr. Edwin James, who attended Colonel Long's exploring expedition to the Rocky Mountains many years since. The specimens collected by Dr. James were submitted to Dr. Torrey, by whom the botanical character of the plant was determined. According to Captain Marcy, the tree is found between 26° and 36° of N. latitude, and extends from 97° to 103° of longitude, over a region containing more than 500,000 square miles. In its botanical affinities and habits it is closely analogous to the Acaciæ, which yield gum arabic. The fruit is a long, compressed pod, filled with a sweet pulp, which is said to contain 30 per cent. of grape sugar, and is used very largely by the Indians as food for themselves and horses. A gum exudes from the stem and branches, especially when wounded, which hardens in the dry season, sometimes in masses as large as a hen's egg. Specimens of this gum were collected and sent for examination to various persons in the Atlantic cities by Dr. George G. Shumard, of the U. S. Army, who was attached to Captain Marcy's expedition. A portion received by Dr. Geo. B. Wood was in irregular, roundish pieces, of various sizes and of different hues, from colorless transparency to a dark amber-brown. Some of them had the fissured appearance of the best Turkey gum. Examined by Prof. Procter, the gum was found to resemble gum arabic in its solubilities, but to differ from it essentially in some of its chemical reactions. The most striking points of difference are that solution of gum mesquite is not precipitated by subacetate of lead, and a strong solution is not coagulated by borax. (*A. J. P.*, xxvii. 224.) Dr. Campbell Morfit, of Baltimore, found it to approximate very closely to gum arabic in ultimate composition, its constituents being carbon, hydrogen, and oxygen, with three per cent. of inorganic matter. He found also a very little bassorin (0·206 per cent.), which did not exist in the specimens examined by Prof. Procter. (*Am. Journ. of Sci. and Arts*, March, 1855, p. 264.) There can be little doubt that this gum has all the valuable medicinal properties of gum arabic, and might be substituted for it in all cases, with this considerable advantage, that it may be added to diluted solution of subacetate of lead, so as to communicate to that preparation demulcent properties, in addition to those of a sedative and astringent, for which it is so much used as a local application. Its high price has so far prevented its general employment, although as much as 24,000 pounds are said to have been gathered in 1872, and chiefly used by confectioners.

The beans of a second species of Prosopis (*P. pubescens*, Benth.) are largely employed as food by the Indians. The wood of both species is exceedingly hard and very valuable, both in the arts and as fuel.

METHYLIC ALCOHOL. SPIRITUS PYROXYILICUS RECTIFICATUS (*Br.* 1864). PYROLIGNEOUS SPIRIT. *Pyroxylic Spirit. Wood Spirit. Wood Alcohol. Wood Naphtha.* (CH_3,OH.) Methylic alcohol was discovered in 1812 by P. Taylor, and was afterwards examined by Macaire and Marcet, Liebig, Dumas and Peligot, Kane, and others. When wood is subjected to destructive distillation, there is formed, besides acetic acid, tar, and other products (see *Creasotum*), about 1 per cent. of an inflammable, volatile liquid, which, when separated and purified, constitutes pyroxylic spirit. The crude liquor, derived from the wood, separates on standing into two liquids; the lighter containing the tarry matters, and the heavier consisting of water, acetic acid, pyroxylic spirit, etc. The heavier liquid is saturated with lime, and subjected to distillation, whereby the impure pyroxylic spirit first comes over, mixed, however, with various compounds, among which are aldehyd and pyroacetic spirit (aceton). This, after having been redistilled and deprived of water by repeated rectifications from lime, forms the *pyroxylic spirit of commerce.* The spirit of commerce is purified by adding to it as much chloride of calcium as it can dissolve, and allowing the mixture to stand for a few days. The pyroxylic spirit unites with the chloride of calcium, and the compound formed is subjected to distillation to separate certain contaminating substances, which distil over. Finally, the pyroxylic spirit is separated from the chloride of calcium by the addition of water and a new distillation, and from water by rectification from dry lime. Methyl alcohol, like the other monatomic alcohols, can also be formed synthetically in a variety of ways, —from marsh-gas, from formic acid, and formaldehyd.

Properties. Pure anhydrous methyl alcohol is a mobile, colorless liquid, possessing a hot, pungent taste, and a peculiar aromatic smell, recalling that of acetic ether. It mixes in all proportions with water, alcohol, and ether, without having its transparency disturbed. It burns like alcohol, but with a less luminous flame. Its sp. gr. as a liquid is 0·8021 at 15·5° C. (59·9° F.). Its vapor is irritating to the eyes. It boils at 66° C. (150·8° F.), and during ebullition its vapor causes concussions, which render its distillation difficult, but may be prevented by placing in the bottom of the vessel a layer of mercury. As a solvent it resembles alcohol, all bodies soluble in that menstruum being likewise soluble in pyroxylic spirit. Methyl alcohol is the first of a series of organic hydrates known as *alcohols.* It may be considered as a molecule of water in which one hydrogen atom is replaced by the nomad group CH_3 (methyl), derived from marsh-gas (methane) by the withdrawal of one hydrogen atom. These organic hydrates are basic, and form, with both organic and inorganic acids, salts called *ethers.*

The officinal pyroxylic spirit was directed in the Br. Pharmacopœia to have a sp. gr. from 0·841 to 0·846. From the density thus recognized, it might be implied that not the pure but the commercial pyroxylic spirit was contemplated, which has a straw-yellow color and a powerful odor of wood smoke. But the Pharmacopœia also directed that the spirit should be without action on litmus-paper, free from smoky taste, and not rendered turbid by water. It therefore intended a purified spirit; and the greater density must be ascribed to the presence of the 10 per cent. of water allowed. According to Mr. Morson, of London, the impure commercial spirit, which is unfit for medical use, may be purified "by largely diluting it with water, when an oily substance separates, after the removal of which the spirit may be recovered by distillation." By passing the mixed liquids through animal charcoal, the purification is rendered more complete. Pyroxylic spirit has been confounded with pyroacetic spirit. They may be distinguished, according to Mr. Scanlan, by chloride of calcium, which is without action on the latter, but dissolves in the former. In applying the test, a drop or two of a *saturated* solution of chloride of calcium is added to the doubtful liquid in a test tube. This solution is immiscible with pyroacetic spirit, separating after agitation, but dissolves instantly in pyroxylic spirit. The liquid examined must be so pure as not to separate into two layers, nor to become milky with water.

It is sometimes desirable to be able to distinguish the presence of methylic alcohol in ordinary alcohol, and in ether or nitrous ether which may have been prepared from the methylated instead of the pure spirit. For this purpose Mr. W. Young proposes a solution of permanganate of potassium as a test. Dissolve a grain of the crystallized permanganate in a fluidounce of distilled water. If ten minims of this solution be added to four fluidrachms of pure alcohol in a test tube, the bright pink color of the former fluid will be retained at least ten minutes, after which it will gradually fade. If only 10 per cent. of methylated alcohol be contained in the alcohol, the solution, instead of retaining its color for some time, will almost instantly change to a pale brown tint. With a larger proportion of the methylic alcohol, the change will be even more striking. One part of methylic alcohol can be thus readily detected in 300 of proper alcohol. The same test will detect methylic alcohol in ether and sweet spirit of nitre; but in the latter case the spirit should be purified from acid by mixing it with an equal measure of solution of potassa twice as strong as the officinal, and, after the mixture has stood an hour, distilling off the original measure of the nitrous spirit. (See *A. J. P.*, 1866, p. 58; from *P. J. Tr.*, Nov. 1865.) The test of Dumas and Peligot converts the wood spirit into an oxalate of methyl; A. Riche and C. Bardy condemn this process, as not applicable when the proportion of ethylic alcohol is large, and propose a substitute founded upon the different colored products yielded by the oxidation of ethyl-anilin and methyl-anilin. For details of this process the reader is referred to *P. J. Tr.*, 1875, p. 1007. For a method of detecting methylic alcohol in any mixture, by Mr. John T. Miller, see *P. J. Tr.* (2d ser., vii. 318).

Medical Properties, etc. Pyroxylic spirit, under the incorrect name of naphtha, was introduced as a therapeutic agent, some years ago, by Dr. John Hastings, of London, who proposed it as a remedy for consumption. It exerts no curative power over this disease, but may be usefully employed to palliate the cough and lessen the febrile excitement which attend it. The therapeutic properties of pyroxylic spirit have not been fully investigated; but, so far as observation has gone, it may be ranked as a narcotic, sedative, and anti-emetic. In chronic vomiting, whether dependent on functional or organic disease, Dr. Christison has found it useful, having frequently seen the vomiting arrested or greatly mitigated by its use. Dr. D. W. Yandell speaks favorably of its efficacy in diarrhœa and dysentery. It is not improbable that the impurities in the commercial spirit may have some remedial efficacy; and the purified spirit directed by the Br. Pharmacopœia may be less efficacious than the impure. The dose is from ten to forty drops, three times a day, sufficiently diluted with water. At one time it was doubtful whether the substance used by Dr. Hastings under the name of naphtha was pyroxylic or pyroacetic spirit; but it is now decided to have been the former.

Crude pyroxylic spirit, varying in density from 0·846 to 0·890, is employed by hatters and varnish-makers for dissolving resinous substances, and by chemists for burning in lamps as a substitute for alcohol. For the latter purpose it is more economical than alcohol; giving out more heat for equal weights.

In Great Britain alcohol is subjected to a heavy duty, which, until lately, prevented it from being used in many manufactures; because the products of its use can be more cheaply obtained from abroad. The British parliament, wishing to encourage the use of alcohol in the arts, but not as a beverage, passed an act in 1855, allowing it to be used duty-free, provided it be mixed with at least one-ninth of its bulk of pyroxylic spirit, which renders it unfit for drinking, but does not spoil it for use in the arts. This mixture is called *methylated spirit*, and is now employed extensively in Great Britain by hatters, brass founders, and cabinet-makers for dissolving shell-lac and other resinous substances, and by manufacturing chemists for making ether, chloroform, and sweet spirit of nitre. From the purification of pyroxylic spirit already referred to, so as to deprive it of offensive taste, it has been supposed that the intended operation of the British revenue laws might be evaded; but, in opposition to this idea, it is asserted that the purifying process is too expensive, on the large scale, to render it available for the purpose. The use of this spirit, however purified, would be unjustifiable in medical preparations, unless officinally recognized.

METHYLIC ETHER. $(CH_3)_2O$. This substance was discovered by MM. Dumas and Peligot, but was first employed as an anæsthetic by Dr. B. W. Richardson in 1867. He prepares it by mixing one part of pure methylic alcohol with two of strong sulphuric acid, heating, and collecting and washing repeatedly with strong potassa solutions the methylic ether which passes over. It is a gas even at low temperature. Dr. Richardson saturates absolute ethylic ether, at 0° C. (32° F.), with it, and at once closely bottles the compound under the name of *methyl-ethylic ether.* (For a detailed description of the preparation of methylic ether and of its properties, see *Journ. de Pharm.*, 4e sér., xix. 438.) According to Dr. Richardson, methylic ether is a very rapid and a safe anæsthetic, producing great muscular relaxation with extreme quickness. (*A. J. P.*, Sept. 1870; *Dublin Quarterly*, Aug. 1870; *Lancet*, March, 1870.)

MIMORDICA BALSAMINA. *Balsam Apple. Balsamina.* An annual climbing East Indian plant, cultivated in our gardens for the sake of the fruit. This is ovate, attenuated towards each extremity, angular, warty, not unlike a cucumber in appearance, of a lively red or orange-yellow color, easily falling when touched, and spontaneously separating into several pieces. It was formerly highly esteemed as a vulnerary, and is still in use among the common people. A liniment formed by infusing the fruit, deprived of its seeds, in olive or almond oil, is applied to chapped hands, burns, old sores, piles, prolapsus ani, etc.; and the fruit itself is sometimes mashed, and used in the form of poultice. According to M. Descourtlitz, it is poisonous when taken internally, having proved fatal to a dog in the quantity of two or three drachms. An extract prepared from it is said to be useful in dropsy, in the dose of from six to fifteen grains.

MITCHELLA REPENS. (*Gray's Manual*, p. 172.) *Partridge-berry. Checkerberry. Winter Clover.* This is a small evergreen, trailing, indigenous plant, creeping about the roots of trees, with fragrant flowers, and a berry-like, edible fruit, of a scarlet color, which lasts through the winter. The whole plant is supposed to possess remedial properties, and is said to be employed, in decoction, by the Indian squaws, to facilitate parturition. It appears to be diuretic, tonic, and astringent, resembling in these respects the pipsissewa, for which it is often substituted.

MONARDA. *U. S.* 1870. *Horsemint. Monarda punctata.* Willd. *Sp. Plant.* i. 126; *Am. Med. Recorder*, vol. ii. p. 496. This is an indigenous perennial or biennial plant, with herbaceous, obtusely angled, downy, whitish, branching stems, rising one or two feet in height, and furnished with oblong lanceolate, remotely serrate, smooth punctate leaves. The flowers are yellow, spotted with red or brown, and disposed in numerous whorls, provided with lanceolate, colored bracts, longer than the whorl. The horsemint grows in light gravelly or sandy soils from New Jersey to Louisiana, and flowers from June to September. The whole herb is employed. It has an aromatic smell, and a warm, pungent, bitterish taste, and abounds in a volatile oil, which may be separated by distillation with water. A crystalline stearopten, *monardin*, often separates from the oil (Procter, *A. J. P.*, xvii. 86): its composition, according to Arrpe, is $C_{10}H_{14}O$; it is isomeric with thymol. Horsemint is stimulant and carminative, but is seldom used in regular practice. In the state of infusion it is occasionally employed in families as a remedy for flatulent colic and sick stomach, and for other purposes to which the aromatic herbs are applied. It was formerly introduced into the primary catalogue of the U. S. Pharmacopœia, on account of the volatile oil which it affords.

MONESIA. A South American vegetable extract, which is believed to be derived from the bark of *Chrysophyllum glycyphlœum*, a tree of middling size, growing in the forests near Rio Janeiro, and elsewhere in Brazil. (*Journ. de Pharm.*, 3e sér., vi. 63.) The bark, which has also entered commerce, is in pieces, some of which are three or four lines thick, is very compact and heavy, of a deep brown or chocolate color, contrasting strongly with the grayish color of the epidermis when this remains, and of smooth fracture. The extract was received from South America in cakes weighing rather more than a pound, from three-quarters of an inch to an inch in thickness, of a dark brown almost black color, very brittle, of a fracture neither very dull nor very shining, and of a taste at first sweet, then astringent, and ultimately acrid; the acrimony being very persistent, and especially felt in the fauces. It is entirely soluble in water. The bark was found by MM. Derosne, Henry, and Payen to contain, in 100 parts, 1·2 of stearin, chlorophyll, and wax, 1·4 of glycyrrhizin, 4·7 of an acrid principle analogous to saponin, called monesin, 7·5 of tannic acid, 9·2 of a red coloring substance, 1·3 of malic acid and malate of calcium, 3·0 of various salts, including silica and oxides of iron and manganese, and 71·7 of pectic acid or pectin and of lignin, including loss, besides traces of an aromatic principle and of gum. *Monesin*, which is now considered as identical with saponin, $C_{32}H_{54}O_{18}$, was obtained by treating the bark or extract with alcohol, adding to the tincture an excess of hydrate of lime in fine powder, filtering, evaporating the clear liquor to dryness, treating the residue with water and animal charcoal, filtering, and again evaporating to dryness. Thus procured it was in transparent yellowish scales, which were easily pulverized, forming a white powder. It was uncrystallizable, readily soluble in alcohol and water, to the latter of which it gave the property of frothing, and insoluble in ether. It had no power to saturate acids, was without odor, but had a slightly bitterish taste, followed by a decided and permanent acrimony in the posterior mouth and fauces. (*Journ. de Pharm.*, Jan. 1841.) Monesia owes its activity probably to this principle and to tannic acid.

The effects of this medicine upon the system appear to be those of a moderate stomachic excitant, a general alterative, and a feeble astringent. In overdoses it is said to produce heat in the epigastrium, with obstinate constipation and tenesmus. It has been used internally with asserted advantage in diarrhœa, hæmoptysis, menorrhagia, scrofula, scurvy, the chronic catarrh of old people, and dyspepsia. As a local remedy it has been found useful in leucorrhœa, ulcerations of the mouth and fauces, spongy and scorbutic gums, carious teeth, and obstinate scrofulous and otherwise unhealthy ulcers upon the surface. The extract may be given in pill or powder, in aqueous solution, in tincture or in syrup. The dose of it is from two to ten grains, repeated every hour, two, or three hours, or less frequently. From ten grains to a drachm may be given daily. In scrofulous affections, it must be used in large quantities, and persevered in for several weeks, in order to obtain its curative effects. Monesia is applied to ulcers either by being sprinkled in powder upon the surface, or in the form of ointment made with one part of the extract and seven parts of simple ointment. Monesin, or the acrid principle, has been given internally in the dose of about half a grain, and has also been applied to ulcers. It is said to be a powerful oxytoxic.

Mr. Dupuy, of New York, states that specimens of an extract sold as monesia, which have come under his notice, bear so close a resemblance to extract of logwood as to suggest the inquiry whether they might not really have been the product of the same plant. (*N. Y. Journ. of Pharm.*, i. 167.)

MONGUMO BARK. A Madagascar bark, an account of which, with analysis, may be found in *P. J. Tr.*, ix. 816.

MOXA. The term *moxa* is employed to designate small masses of combustible matter, intended, by being burnt in contact with the skin, to produce an eschar. They are of various forms, and made of different materials. The Chinese moxa is in small cones from eight to twelve lines in height, and is prepared from the leaves of one or more species of Artemisia. *A. Chinensis* and *A. Indica* were indicated by the Dublin College; but Lindley states that it is the *A. Moxa* of De Candolle which is employed. According to some authors, the part used is the down which covers the leaves and stems; but others, with greater probability, assert that it is a fine lanuginous substance, prepared from the leaves by beating them in a mortar. A coarser and a finer product are obtained, the former of which is used for tinder, the latter worked up into moxa. A similar moxa has been made in France, by a similar process, from the leaves of *A. vulgaris.* By M. Percy, the stem of the *Helianthus annuus*, or common sunflower, when perfectly mature, is cut into transverse sections about half an inch in thickness, which must be carefully dried, and kept in a perfectly dry place. They have this advantage, that, in consequence of the retention of the cortical portion, they may be held with impunity, while burning, between the fingers of the operator. They are, however, often defective from an insufficiency of nitre in the pith, or the unequal inflammability of different parts. Artificial moxas are best made from cotton impregnated with nitre. It is important that the impregnation should be uniform; as otherwise different parts of the cylinder, burning with different degrees of rapidity, would produce unequal effects upon the skin. The following process is recommended. One pound of cotton is introduced into a vessel containing two ounces of nitre dissolved in half a gallon of water, and a moderate heat applied till all the liquid is evaporated. The cotton, when perfectly dry, is formed into thin, narrow sheets, which are rolled round a central cord of linen, so as to form a cylinder from half an inch to an inch in diameter, and several inches long. This is enclosed in a covering of silk or linen sewed firmly around it; and, when used, may be cut by a razor into transverse slices a few lines in thickness. By leaving a hole in the centre of the cylinder, the combustion will be rendered more vigorous, and a deeper eschar produced. M. Robinet rolls cotton round a small central cylinder of pith and envelops the whole in a piece of muslin, which is more or less firmly applied, according to the degree of compactness required. The cylinders, thus made, burn without assistance, uniformly, and with a rapidity proportionate to their firmness. Lime, in the act of slaking, has been used as a substitute for the moxa. (*Dubl. Journ.*, Jan. 1842.)

Medical Uses. Cauterization by fire, in the treatment of disease, has been commonly practised among savage and half-civilized nations from the earliest periods of history, and has not been unknown as a remedy in the most polished communities. The ancient Egyptians and Greeks were acquainted with the use of moxa; and in China, Japan, and other countries of Asia, it appears to have been employed from time immemorial. From these countries the early Portuguese navigators introduced it into Europe; and the term *moxa* is said to have been derived from their language, though supposed by some to be of Chinese origin. The true Chinese name is said to be *kiew.* (*Percy and Laurent.*) Some years since, the remedy became very popular in France, and attracted some attention in this country. It acts on the principle of revulsion; relieving deep-seated inflammation, and local irritation whether vascular or nervous, by inviting the current of excitement to the skin. In some cases it may also operate advantageously by the propagation of a stimulant impression to neighboring parts.

As a general rule, it should be applied as near as possible to the seat of the disease; and, in neuralgic or paralytic cases, at the origin or over the course of the nerves proceeding to the part affected. Some advise that the cylinder be attached to the skin by some adhesive liquid; but a more general practice is to retain it in the proper position by a pair of forceps or other instrument. Larrey recommends that the skin around it be covered with a piece of moistened lint, having a hole in the centre to admit the base of the cylinder. The moxa should be set on fire at the summit, and the combustion sustained if necessary by the breath, the blow-pipe, or the bellows. The size of the cylinder should vary according to the effect desired, from half an inch to an inch or more in diameter, and from a few lines to an inch in height. Any degree of effect may be obtained, from a slight inflammation to the death of the skin, by regulating the time during which the moxa is allowed to burn. When a slough is required, it should be suffered to burn until consumed. The first sensation experienced is not disagreeable; but the operation becomes gradually more painful, and towards the close is for a short time very severe.

MUCUNA PRURIENS. De Cand. *Dolichos pruriens.* Willd. *Stizolobium pruriens.* Persoon. *Cowhage.* This is a leguminous perennial climbing plant, with an herbaceous branching stem, which twines round the trees in its vicinity, and rises to a considerable height. The leaves are pinnately trifoliate, and stand on long footstalks, placed alternately on the stem at the distance of a foot from each other. The leaflets are acuminate, smooth on their upper surface, and hairy beneath. The lateral leaflets are oblique at the base, the middle one somewhat rhomboidal. The flowers, which resemble those of the pea in form, are large, of a red or purplish color, usually placed in threes on short peduncles, and hang from the axils of the leaves in pendent spikes about a foot in length. The fruit is a coriaceous pod, shaped like the Italic letter *ƒ*, about four inches long, and covered with brown bristly hairs, which easily separate, and when handled stick in the fingers, producing an intense itching sensation. The plant is a native of the West Indies, and other parts of tropical America. It has been supposed to grow also in the East Indies; but the plant of that region is now considered a distinct species, and entitled *Mucuna prurita.* The part usually imported is the pod, of which the hairs were formerly officinal under the name of Mucuna (*Cowhage; Pois à gratter*, F.; *Kuhkrätze*, G.; *Dolico Scottante*, It.).

The spicula are said to possess powerful vermifuge properties, and act mechanically, by penetrating the worms. Neither the tincture nor the decoction is in the least degree anthelmintic. The medicine was first employed as a vermifuge in the West Indies, and thence passed into British practice. There can be no reasonable doubt of its efficiency; but it is an exceedingly disagreeable remedy, and has, therefore, passed out of vogue. It has been usually employed against the round worm. The usual mode of preparing it is to dip the pods into syrup or molasses, and scrape off the hairs with the liquid, which is in a proper state for administration when it has attained the consistency of thick honey. The dose of this preparation is a tablespoonful for an adult, a teaspoonful for a child three or four years old, to be given every morning for three days, and then followed by a brisk cathartic. M. Blatin has proposed to employ cowhage as an external irritant; seven grains being mixed with an ounce of lard, and seven or eight grains of the ointment rubbed for ten, fifteen, or twenty minutes on the skin. A stinging and burning sensation is produced, followed by white elevations, which soon disappear, leaving no unpleasant effect.

The root of *M. pruriens* is said by Ainslie to be employed in the East Indies in cholera; and both this part and the pods have been thought to possess diuretic properties.

MUREXIDE. ($C_8H_4(NH_4)N_5O_6 + H_2O$.) A fine purple dye-stuff, made by the reaction of nitric acid on uric acid. As resulting from the action of nitric acid on urine, it was supposed by Mr. Prout to consist of purpuric acid and ammonia, and hence was named *purpurate of ammonium*, which belief has been confirmed by further investigation. It is now made from guano. This is first treated with hydrochloric acid to remove foreign substances, and then with soda to dissolve the uric acid, which is separated by neutralizing the soda with hydrochloric acid. The uric acid is dissolved in nitric acid, the solution is heated, and after it cools ammonia or its carbonate is added, which develops the purple color. Murexide is obtained in crystals, which have a square form, and are of a rich green color by reflected, but of a purple red by transmitted light. They are slightly soluble in cold water, more so in boiling water, and insoluble in alcohol and ether. With potassa they form a rich purple solution. (*Brande and Taylor.*) See *P. J. Tr.*, xviii. 328.

MUSCULUS VENENOSUS. Dr. F. Crumpe has called attention to a mussel found in a dock near the town of Tralee, Ireland, which is exceedingly poisonous, producing collapse, with complete paralysis of the voluntary muscles. He treated successfully a woman with traumatic tetanus with three of the raw mussels. In a case of fatal poisoning, the stomach and intestines were excessively distended with gas. (*Dublin Quart. Journ. of Med. Sci.*, Oct. 1872.)

MUSHROOMS. *Fungi.* This extensive family of cryptogamous plants is interesting to the physician, from the consideration, that, while some of them are very largely consumed as food, others are deleterious in their nature, and capable, when eaten, of producing poisonous effects. Their substance is made up of a cellular tissue, which is usually of that soft consistence denominated fungous, but is sometimes corky, ligneous, or even gelatinous. Many of them have an agreeable odor and taste, while others are unpleasant or offensive both to the nostrils and palate. Their juice generally exhibits an acid reaction. For statement of chemical principles, see *Agaric.* Mushrooms are very largely cultivated in Europe for the table, and are indeed a valuable food. According to Mr. Theodore Husemann, they contain a larger percentage of protein compound than does beef. They require a rich soil; but the discovery is asserted to have been recently made, that they will flourish better, and attain a much greater size, in artificial beds of sulphate of calcium, in which the spores are buried mixed with powdered nitrate of potassium to the depth of about one-third or one-half of an inch; at least this is said to be true of a variety of the *Agaricus campestris*, called by the French "*l'agaric de couche.*" (*Journ. de Pharm.*, 1861, p. 196.)

It is highly important for those who employ mushrooms as food, to be able to distinguish those which are wholesome from the poisonous. The following general rules are given by M. Richard in the *Dictionnaire des Drogues.* Those should be rejected which have a narcotic or fetid odor, or an acrid, bitter, or very acid taste; which occasion a sense of constriction in the throat when swallowed; which are very soft, liquefying, changing color, and assuming a bluish tint upon being bruised; which exude a milky, acrid, and styptic juice; which grow in very moist places, and upon putrefying substances; in fine, all such as have a coriaceous, ligneous, or corky consistence. The last, however, are injurious in consequence rather of their indigestible than of their poisonous nature. Even mushrooms which are usually edible may prove poisonous if collected too late, or in places which are too moist. It is said, moreover, that the poisonous species sometimes become innocent when they grow under favorable circumstances. It is affirmed, for example, that mushrooms which prove poisonous in England are eaten with impunity in Russia. (*P. J. Tr.*, 1861, p. 387.) Dr. Alfred S. Taylor, the distinguished toxicologist, makes the following observations about the poisonous fungi. As a rule, he states, these fungi may be recognized by the pileus or cap having a peculiar conical or flattened shape, and by being colored yellow, brown, green, red, or orange-red; by the want of a pink or purple color in the gills, and by a very disagreeable odor when the plant is bruised. They generally grow under trees, in groves or woods, and are often attached to decayed animal matter. (*Guy's Hospital Reports*, 1865.) According to Mr. W. G. Smith, who is familiar with the mushroom as an article of food, nearly all the fungi with white spores or seeds are edible; and the seeds of the innocent kinds are for the most part roundish or oval, while those of the poisonous are generally angular, and in one instance are covered with spines. (*P. J. Tr.*, 1869, p. 433; from *Gardener's Chronicle.*) Immense quantities of mushrooms are eaten in France, Germany, Italy, and other parts of continental Europe; and they are said to constitute the chief food of the people in certain provinces.

Some experiments of M. Gerard would tend to show that poisonous mushrooms may be rendered innocent, by treating them with water slightly acidulated with vinegar, before cooking them. About a pound avoirdupois of poisonous mushrooms, cut into pieces, are to be macerated for two hours in a quart of water, acidulated with two or three spoonfuls of strong vinegar, and afterwards to be washed with a large quantity of water. Next day they are to be put into cold water, boiled for half an hour, then taken out, washed, and dried. They are now fit for food. (See *A. J. P.*, xxv. 274.) But subsequent experiments by MM. Demartis and Corne, of Bordeaux, have proved that this method is not always to be relied on; as certain mushrooms, after having been treated in the manner suggested, have nevertheless produced fatal effects on animals; and, as the same mushrooms may be poisonous at one season or in one situation, and innocent in another, the inference is that those experimented on by M. Gerard, though ordinarily poisonous, may not have been so in that particular instance. (*Journ. de Pharm.*, 3e sér., xxi. 468.)

The poisonous mushrooms of the genus Agaric, section Ammonites, owe their fatal effects to the same narcotic alkaloid (*muscarine*, $C_5H_{14}NO_2,OH$). The physiological action of muscarine has been elaborately studied, especially by O. Schmiedeberg and R. Koppe (*Das Muscarin, das giftige Alkaloid des Fliegenpilzes*, Leipzig, 1869). For a brief summary, see *Agaricus Muscarius.* Along with muscarine, Schmiedeberg and Warnack (*Archiv f. Exp. Phys.*, 6, p. 101) claim to have found a second alkaloid, *amanitine*, which is isomeric with choline, and is changed into muscarine by the action of nitric acid.

The symptoms produced by the poisonous mushrooms are anxiety, vertigo, nausea, faintness, vomiting, and, if they are not rejected from the stomach, somnolence, stupor, small and intermittent pulse, tension of the abdomen, cold extremities, livid skin, and death in thirty-six or forty-eight hours. Sometimes violent pains in the stomach and bowels are experienced; and occasionally severe vomiting and purging occur, and save the patient. Blackish or bloody dejections, with tenesmus, sometimes attend the action of the poison. In some instances the symptoms are said to be remarkably like those from alcoholic drinks. The symptoms are not generally experienced until several hours, usually from five to ten, after the mushrooms have been eaten, showing that their deleterious effects depend upon the entrance of the poisonous principle into the circulation. If the physician is called in time, emetics should always be administered, accompanied with the free use of warm drinks, and followed by cathartics. Atropia is a physiological antidote to muscarine, and its hypodermic use is strongly indicated in most cases of mushroom poisoning. The symptoms produced by the poison should be combated as they arise.

A species of Lycoperdon or puff-ball, *L. proteus*, was thought to have been proved by Dr. B. W. Richardson, of London, to have remarkable narcotic and anæsthetic properties. Having noticed that the smoke of this fungus was used in the country for stupefying bees, he experimented with the fumes upon various animals, which, when caused to inhale them, became insensible, and could be operated on without evincing any signs of pain. When carried far, they caused death. He had himself inhaled the fumes clarified by passing them through water, and experienced symptoms of intoxication and drowsiness. They were procured by burning the fungus. (*Lond. Med. Times and Gaz.*, 1853, p. 610.) Mr. Thornton Herapath, however, maintains, as the result of his experiments, that these anæsthetic effects are in reality not owing to any narcotic principle present in the fungus, but to the carbonic oxide gas generated during their combustion. (*Philosoph. Mag.*, July, 1855.) A tincture of *Lycoperdon bovista*, made in the proportion of four troyounces to a pint of alcoholic menstruum, has been used by Dr. Addinell Hewson, of Philadelphia, in nervous diseases, in the dose of a teaspoonful. (*A. J. P.*, 1867, p. 113.)

MUSK, ARTIFICIAL. *Moschus factitius.* This is prepared, according to M. Elsner, by adding, in small portions at a time, one part of rectified oil of amber to three parts of fuming nitric acid. The resulting resin is washed with water, to separate the acid, and brought to the consistence of a firm extract in a water-bath. Thus prepared it is a dark brownish red substance, having a burning, bitter, aromatic taste, and a musky odor. It is very soluble in alcohol, ether, and the volatile oils; and its alcoholic solution reddens litmus. Triturated with caustic potassa, it gives off ammonia. When set on fire, it burns with a very smoky flame, and leaves a shining porous charcoal. Its formula is $C_{15}H_{16}N_2O_2$. Comparing its composition with that of the oil of amber, the action of the nitric acid evidently consists in eliminating a portion of carbon and hydrogen, adding to the oxygen, and furnishing nitrogen. M. Elsner found oil of amber to consist of several oily principles, having different boiling points, one of which, resembling eupion, he calls *amber eupion*. As this substance yields artificial musk by the action of fuming nitric acid, he believes the property possessed by oil of amber of yielding the same substance to be due to its presence. (*Journ. de Pharm.*, 3e sér., ii. 144.) During the reaction of nitric acid with oil of amber, Dr. John T. Plummer, of Indiana, has observed that oxalic acid is generated.

Dr. S. W. Williams gives the following formula for the preparation of artificial musk. Add gradually, drop by drop, three drachms and a half of concentrated nitric acid to a drachm of rectified oil of amber, contained in a glass tumbler or very large wineglass. The mixture grows hot, and emits offensive fumes, which the operator must avoid. When the ordinary nitric acid is employed, which is not of full strength, the reaction must be assisted by heat; in which case Dr. Williams recommends that the vessel containing the mixed ingredients be placed in a plate before the fire, they being, meanwhile, continually stirred with a glass rod. After the mixture has remained at rest for twenty-four hours, it acquires a resinous appearance, and divides into two portions, an acid liquid below, and a yellow resin above, resembling musk in smell. This being thoroughly washed, first with cold and then with hot water, until all traces of acid are removed, is the artificial musk. (See *A. J. P.*, viii. 14.)

Artificial musk is an antispasmodic and nervine, and possesses the general therapeutic properties of the natural substance, though in a weaker degree. It is praised by Dr. Williams in the treatment of hooping-cough, typhoid states of fever, and nervous diseases generally. When combined with water of ammonia, compound spirit of lavender, or laudanum, he found no remedy so efficient in the sinking faintness occurring in the last stage of pulmonary consumption. The average dose for an adult is ten grains; for a child two years old, from half a grain to a grain, repeated, in each case, every two or three hours. It may be prepared as the musk mixture, or with almonds in the form of emulsion. According to Berzelius, *tincture of artificial musk* is formed by dissolving a drachm of the musk in an ounce of alcohol, equivalent to ten fluidrachms, of the sp. gr. 0·835. Of this the dose for an adult is a teaspoonful. This tincture has been employed by Prof. Hauner, chief physician of the Children's Hospital at Munich, in uncomplicated spasm of the glottis, with invariable success in more than thirty cases. Though artificial musk is not equal in power to the natural substance, when genuine, yet it is in all probability superior to the adulterated article, so frequently sold under the name of musk.

MYRICA CERIFERA. *Wax-myrtle. Bay-berry.* This is an indigenous shrub, growing in great abundance in the sandy soil along the sea-shore, and even on the shores of our northern lakes. It belongs to the natural order Myricaceæ. The genus is characterized by its sterile flowers in cylindrical, and its fertile in ovoidal closely imbricated catkins, without calyx or corolla, solitary under a scale-like bract with a pair of bractlets; the stamens 2 to 8, with filaments somewhat united below; the ovary with 3 scales at its base, and 2 thread-like stigmas; the fruit a small spherical nut. The leaves of the wax-myrtle are oblong-lanceolate, narrower at their base, entire or somewhat toothed near the apex, shining, with resinous dots on both sides, and very fragrant when rubbed. The fruit is covered with a coating of white wax, and sometimes continues on the plant for two years or more. The shrub is from three or four to ten feet high, often thickly crowded, and, under such circumstances, scenting the air with its spicy odor. The coating of wax upon the surface is collected, and known in commerce as *myrtle wax.* (See *Vegetable Wax.*) A volatile oil might probably be collected by distillation from the leaves. The bark of the stem and root is supposed to possess valuable remedial properties, and has been employed to a considerable extent. In the dried state it is in quilled pieces of variable length, covered with a thin epidermis of a grayish color somewhat mottled, and marked with slight circular fissures. Within the epidermis the color is reddish brown. The bark is brittle, and of a peculiar, astringent, bitterish and pungent taste, followed by a slight sense of acrimony. Its powder has a peculiar aromatic odor, and irritates the nostrils and throat when inhaled. It yields its virtues to water and alcohol. Mr. Geo. M. Hambright found in it volatile oil, starch, lignin, gum, albumen, extractive, a red coloring substance, tannic and gallic acids, an acrid resin soluble in alcohol and ether, an astringent resin soluble in alcohol and not in ether, and a peculiar acrid principle having acid properties. (*A. J. P.*, 1863, p. 193.) Moore (*Am. Jour. Sci.*, (2), 33, 113) found a large quantity of *palmitic* and a small quantity of *myristic acid*, for the most part in the free state, but to a smaller extent combined with glycerin. The bark appears to be moderately tonic and astringent, and in large doses emetic. It has been considerably used by the "eclectics," in diarrhœa, jaundice, scrofula, etc. Externally the powdered bark is used as a stimulant to indolent ulcers; and the decoction as a gargle and injection in chronic inflammation of the throat, leucorrhœa, etc. The dose of the powder is twenty or thirty grains, of a decoction made with an ounce to the pint of water, one or two fluidounces. An alcoholic extract, very inappropriately named *myricin*, is given in the medium dose of about five grains.

MYROBALANS. *Myrobalani.* These are the fruits of various East India trees, particularly of different species of Terminalia. They are noticed here partly on account of their ancient reputation, partly because they are still occasionally to be found in commerce, though seldom if ever used in medicine. Five varieties are distinguished by authors. 1. *Myrobalani bellirieæ.* These are obtained from *Terminalia Bellirica.* They are roundish or ovate, from the size of a hazel-nut to that of a walnut, of a grayish brown color, smooth, marked with five longitudinal ribs, and sometimes furnished with a short, thick footstalk. They consist of an exterior, firm, resinous, brown, fleshy portion, and an interior kernel, which is light brown, inodorous, and of a bitterish very astringent taste. 2. *Myrobalani chebulæ.* This variety is produced by *Terminalia Chebula.* The fruit is oblong, pointed at each extremity, from fifteen to eighteen lines in length, of a dark brown color, smooth and shining, with five longitudinal wrinkles but without footstalks. In their internal arrangement and their taste, they resemble the preceding. 3. *Myrobalani citrinæ* vel *flavæ.* These are from a variety of the same tree which affords the last-mentioned myrobalans, from which they differ only in being somewhat smaller, of a light brown or yellowish color, and of a taste rather more bitter. They were formerly sometimes sold in the shops of Philadelphia, under the name of *white galls*, to which, however, they bear no other resemblance than in taste. 4. *Myrobalani Indicæ* vel *nigræ.* These are thought to be the unripe fruit of *Terminalia Chebula*, or *T. Bellirica.* They are ovate-oblong, from four to eight lines long, and from two to three lines thick, of a blackish color, wrinkled longitudinally, and presenting, when broken, a thick brown mass, without kernel, but with a small cavity in the centre. They are sourish and very astringent. 5. *Myrobalani emblicæ.* This variety is wholly different from the preceding, and derived from a plant having no affinity to the Terminaliæ, namely, the *Phyllanthus Emblica* of Linnæus. It is often in segments, as kept in the shops. When the fruit is entire, it is blackish, spherical, depressed, of the size of a cherry, presenting six obtuse ribs with as many deep furrows, and separating into six valves, and has a strongly astringent and acidulous taste. These fruits were in high repute with the Arabians, and were long employed by European practitioners, as primarily laxative and secondarily astringent, in various complaints, particularly diarrhœa and dysentery. Their dose was from two drachms to an ounce. They are not now employed as medicines. We have been told that they have been used as a substitute for galls in the preparation of ink-powder. R. Hennig has found in them 45 per cent. of tannic acid, and recommends them as a good and cheap source of that principle. (*A. J. P.*, xlii. 318.)

MYRTUS CHEKAN. *Cheken, Chequen.* The leaves of this Chilian plant have recently entered commerce under the name of *Chekan leaves.* They are reported by Dr. W. Murrell to be useful in chronic bronchitis. For an account of them and their properties, see *P. J. Tr.*, ix. 653.

NAPHTHALIN. *Naphthalene.* ($C_{10}H_8$.) This may be obtained by subjecting coal tar to distillation, when it passes over after the coal naphtha. It is frequently produced during the dry distillation of organic bodies. For a method of preparing it pure, and on a large scale for commercial purposes, see a paper by Vohl, in the *Journ. de Pharm.* (1868, p. 399; from *Polyt. Journ.*). It is a white, shining, crystalline substance, fusible at 80° C. (176° F.), and boiling at 217·2° C. (423° F.). According to Kopp, its sp. gr. in the liquid state is 0·9774, according to Alluard, at 98·8° C. (210° F.), 0·9628. (*Journ. de Pharm.*, 1860, p. 318.) It is soluble in alcohol, ether, naphtha, and the oils, but insoluble in water. It has been proposed by Dupasquier as an expectorant, and has been found, on trial, to act decidedly as such. In the impending suffocation, sometimes occurring in the chronic pulmonary catarrh of old persons, and in humoral asthma, it facilitated expectoration in a remarkable degree. Being a stimulating remedy, it is not proper in acute bronchitis, or where pulmonary inflammation exists. The dose is from eight to thirty grains, given in emulsion or syrup, and repeated at intervals of a quarter of an hour, until an abundant expectoration takes place. (*Journ. de Pharm.*, 3e sér., ii. 513.) M. Rossignon considers naphthalin to act like camphor, and to be capable of replacing it on many occasions as a remedy. It produces excellent effects in verminous affections. It has been found useful by M. Emery, in the form of ointment, made by mixing a scruple of naphthalin with five drachms of lard, in dry tetter, psoriasis, and lepra vulgaris. (*Annuaire de Thérap.*, 1843, pp. 64 and 66.) In the Cambridge Museum of Natural History its superiority as a means of preventing the ravages of insects is said to have been completely established.

NAPLES YELLOW. A yellow pigment prepared by calcining a mixture of lead, sulphide of antimony, dried alum, and chloride of ammonium, or a mixture of carbonate of lead, diaphoretic antimony, dried alum, and chloride of ammonium. (*Gray.*)

NARCISSUS PSEUDO-NARCISSUS. *Daffodil.* Both the bulb and the bright yellow flowers of this common garden plant have been used in medicine. The flowers have a feeble peculiar odor, and both have a bitter mucilaginous taste. They are emetic, though uncertain in their operation. It is probable that the flowers of the wild European plant are more powerful than those of the cultivated. A. W. Gerrard examined the bulbs of daffodil, and obtained a crystalline neutral principle and an amorphous alkaloid, which he calls *pseudonarcissine.* The dose of the powder, to produce an emetic effect, varies, according to the statements of different physicians, from a scruple to two drachms; while the extract is said to vomit in the dose of two or three grains. The bulb is most powerful in the recent state. Dr. Geo. B. Wood, when a student of medicine, wishing to ascertain whether this root might not, like ipecacuanha, possess diaphoretic properties, took a dose of it suspended in some warm water at bedtime, and on awaking in the morning found himself bathed in a copious sweat, and freed, at the same time, from the symptoms of a severe attack of catarrh under which he was at the time laboring. The alkaloids discovered by Mr. Gerrard have been physiologically studied by Prof. Ruiger, who found that the one obtained from the bulb of the flowering plant dries the mouth, checks perspiration, dilates the pupil, especially when applied locally, quickens the pulse, and acts on the heart of the frog antagonistically to muscarine and pilocarpine. The alkaloid obtained from the bulb after flowering causes salivation and perspiration, internally taken contracts the pupil, and topically applied dilates it slightly. (*Journ. of Physiol.*, i. 436.) In France, narcissus flowers have been used as an antispasmodic in various convulsive functional disorders.

NARD. *Spikenard.* Several aromatic roots were known to the ancients under the name of *nardus*, distinguished, according to their origin or place of growth, by the names of *nardus Indica*, *nardus Celtica*, *nardus montana*, etc. They are supposed to have been derived from different species of Valeriana. Thus, the nardus Indica is referred to *V. Jatamensi* of Bengal, the nardus Celtica to *V. Celtica*, inhabiting the Alps, Apennines, etc., and the nardus montana to *V. tuberosa*, which grows in the mountains of the south of Europe. The Indian nard, or spikenard, sometimes also called Syrian nard, is still occasionally to be found in the shops. It is a small delicate root, from one to three inches long, beset with a tuft of soft, light brown, slender fibres, of an agreeable odor, and a bitter, aromatic taste. It was formerly very highly esteemed as a medicine, but is now almost out of use. Its properties are analogous to those of the officinal valerian.

NASTURTIUM OFFICINALE. R. Brown. *Sisymbrium Nasturtium.* Linn. *Watercress.* In sensible and medical properties water-cress bears some resemblance to scurvy grass, though milder, and on this account is preferred for the table. It is thought to be useful in scorbutic affections and visceral obstructions. The expressed juice is sometimes given in the dose of one or two ounces; but the herb is more frequently used in the form of a salad. It contains a volatile oil, which, according to A. W. Hoffman, is a mixed substance, chiefly composed of the nitrite of phenyl, propionic acid. (*A. J. P.*, 1874, p. 331.) Other species of Nasturtium, as *N. Palustre* or *marsh water-cress*, and *N. amphibium* or *water-radish*, grow in similar situations with the *N. officinale*, and possess similar virtues.

NEAT'S-FOOT OIL. *Oleum Bubulum.* This oil was formerly officinal. It is obtained by boiling in water for a long time the feet of the ox, previously deprived of their hoofs. The fat and oil which rise to the surface are removed, and introduced into a fresh portion of water heated nearly to the boiling point. The impurities having subsided, the oil is drawn off, and, if required to be very pure, is again introduced into water, which is kept for twenty-four hours sufficiently warm to enable the fat which is mixed with the oil to separate from it. The liquid being then allowed to cool, the fat concretes, and the oil is removed and strained, or filtered through layers of small fragments of charcoal free from powder. The oil is yellowish, and, when properly prepared, inodorous, and of a bland taste. It thickens or congeals with great difficulty, and is, therefore, very useful for greasing machinery in order to prevent friction. It has been used as a substitute for cod-liver oil in scrofulous diseases, and, according to Dr. C. R. Hall, of England, with happy effects, especially in cases in which the latter does not agree with the stomach. It is apt to be laxative, and in certain cases proves useful in this way. It is given in the same dose as cod-liver oil. (See *Am. Journ. of Med. Sci.*, N.S., xxiv. 498.)

NERIUM OLEANDER. A notice of the *oleander*, so well known as an ornamental shrub of our conservatories, is introduced here mainly on account of its presumed poisonous properties. The peasantry in the south of France, where the plant grows wild, employ the powdered bark as a poison for rats, and death is said to have occurred from eating food roasted by the oleander wood. (*Mérat and De Lens.*) The leaves, boiled in lard or oil, yield an ointment which is said to be very efficacious, rubbed on the skin, against insects that infest the person. A case has been recorded in which a man in Hindostan swallowed somewhat more than an ounce of the juice of *Nerium odorum*, with the effect of producing the most violent narcotic symptoms, as stupor, stertorous breathing, and convulsions, followed by great prostration, with involuntary evacuations, from which, however, after two days of danger, he recovered under the use of emetics, followed by supporting treatment. (*B. and F. Med.-Chir. Rev.*, Am. ed., 1860, p. 387.) M. Latour has made a careful chemical examination of oleander, from which he obtained the following results. 1. The poisonous principle exists in the leaves, bark, and flowers, but most largely in the bark. 2. This principle is of a resinous nature, and not volatile, and is found more largely in the wild than in the cultivated plant. 3. The solubility of this resin in water is much facilitated by alkaline salts, and hence it exists in the watery extract. 4. The distilled water of the bark and leaves possesses some activity, which it owes to a small portion of the resin carried over with the steam. (See *A. J. P.*, 1858, p. 172.) Prof. E. Pelikan, of St. Petersburg, has made experiments with this plant on frogs, from which he concludes that the poisonous properties reside in the yellow resin of M. Latour; and that the poison acts especially on the heart, the pulsations of which it at first accelerates, then retards, and finally causes to cease altogether. He thinks that the hydro-alcoholic extract closely resembles digitalis, and might be substituted for it in therapeutics. (*Journ. de Pharm.*, 4e sér., iii. 206.) Two alkaloids have been discovered in oleander by Leukowsky (*Journ. de Pharm.*, (3) 46, p. 397); one named *pseudocurarine;* the other named *oleandrine.* Both neutralize acids; the former dissolves in water and alcohol, but not in ether, and is neither volatile nor poisonous; the latter is yellow, amorphous, very bitter, very slightly soluble in water, but more freely in alcohol and ether, and poisonous in its action on the system. From *Nerium odorum* Mr. H. G. Greenish has isolated two substances, *neriodorein* and *neriodorin*, which are probably not pure proximate principles. (*A. J. P.*, 1881, p. 350.)

NIGELLA SATIVA. *Nutmeg-flower. Small Fennel-flower.* A small annual plant, growing wild in Syria and the south of Europe, and cultivated in various parts of the world. The seeds, which are sometimes kept in the shops under the name of *semen nigellæ*, are ovate, somewhat compressed, about a line long and half as broad, usually three-cornered, with two sides flat and one convex, black or brown externally, white and oleaginous within, of a strong, agreeable, aromatic odor, like that of nutmegs, and a spicy, pungent taste. Their chief constituents are a volatile and fixed oil, and a peculiar bitter principle denominated *nigellin*, which exists in the seeds in very minute proportion. (*Journ. de Pharm.*, 3e sér., ii. 128.) In India they are considered as stimulant, diaphoretic, and emmenagogue, and are believed to increase the secretion of milk. They are also used as a condiment, and as a corrigent or adjuvant of purgative and tonic medicines.

NITRATE OF SODIUM. *Cubic Nitre.* ($NaNO_3$.) This salt may be formed by treating carbonate of sodium with nitric acid. It is found naturally in the desert of Atacama and elsewhere in Peru, where it forms beds of vast extent. Attempts were made between 1820 and 1830 to export it to England and the United States; but the cargoes were unsalable. Soon afterwards, however, its value became known; so that at present millions of pounds are yearly exported from Peru, being consumed in the production of sulphuric and nitric acids, and in the manufacture of fertilizers. The salt has also been found largely in Brazil, in the province of Bahia, near the river San Francisco. (*A. J. P.*, 1861, p. 502.) During the first eleven months of 1881, 112,381,019 lbs. of nitrate of sodium, valued at $2,599,985, were imported into the United States.

The crude salt, as it comes from Peru, is in saline lumps, rather soft and friable, and damp on the surface. Its varieties are graded according to its color and state of aggregation, and are commercially known as *white compact*, *yellow*, *gray compact*, *gray crystalline*, and *white crystalline.* It varies very much in purity, containing from 85 to only 20 per cent. of the pure salt. Some of the varieties contain iodine. The impurities consist of common salt, sulphate and carbonate of sodium, and chloride of calcium. Occasionally borate of calcium, associated with borate of sodium, is found under the beds of the nitrate.

Nitrate of sodium, when pure, is a white salt, crystallizing in rhomboidal prisms, and having a sharp, cooling, and bitter taste. It attracts moisture slightly from the air, and dissolves in about twice its weight of water, at 15·5° C. (60° F.). It has been praised as a remedy in dysentery by two German physicians, Drs. Velsen and Meyer, given in the quantity of from half an ounce to an ounce in the course of the day, dissolved in gum-water, or other mucilaginous liquid. It has been used with success in the same disease by Dr. Rademacher, of Vienna, who recommends it in a number of other diseases having nothing in common. (*Ann. de Thérap.*, 1854.) Dr. J. B. Brown also bears very emphatic testimony to the value of nitrate of sodium as a speedy and safe remedy in dysentery and dysenteric diarrhœa. (*Charleston Med. Journ.*, 1854, p. 398; from *North-Western Med. and Surg. Journ.*)

As nitrate of sodium has been imposed upon our merchants for nitre, it may be useful to mention that the former salt may be distinguished by its giving rise to an orange-yellow flame, when thrown on burning coals, and by the rhomboidal shape of its crystals; those of nitre being long, six-sided prisms.

NITRITE OF ETHYL. *Nitrous Ether.* (C_2H_5,NO_2.) This compound is here introduced, in order that the reader may be made acquainted with the results obtained by Dr. B. W. Richardson in reference to its physiological action when inhaled. The mode of preparing it, its sensible and chemical properties, and its composition, have been already incidentally considered, under Spiritus Ætheris Nitrosi, of which it is the characteristic ingredient. The liquid in its pure state is so very volatile as to require an admixture of a proportion of ether (say from 10 to 50 per cent.), in order that it may be duly manipulated. Its action, according to Dr. Richardson, is closely analogous to that of nitrite of amyl. Inhaled in the quantity of a grain, it induces a sense of fulness in the head, rapid action of the heart, and some suffusion of the surface. Animals, made to inhale air containing fifteen minims of the fluid diffused through a cubic foot, die almost instantly from suspended action of the heart; retaining, however, sensibility and consciousness to the last. The nitrite is, therefore, in no degree anæsthetic. After death, the lungs appear bloodless, almost as if washed free from blood with water; an effect ascribed by Dr. Richardson to the rapid contraction of the pulmonary capillaries. The muscles are also blanched. The color of the blood is changed, the arterial having become very dark, and the venous of a deep chocolate tint; but coagulation takes place as usual. A curious effect on cold-blooded animals is that, after apparent death, the animal will sometimes recover spontaneously, even after an interval of nine days. If a young hot-blooded animal, a kitten, for example, be suddenly subjected to its influence, it will fall senseless, and apparently dead, without respiration, or any discoverable action of the heart; but, after a period of six or eight minutes, respiration and circulation are spontaneously renewed, and this condition may last so long as half an hour, when the animal again relapses into inertia, and positively dies. In the human subject, after inhalation, there are extreme suffusion of the face, a sense of fulness of the head, a tendency to fall forward, rapid and painful respiration, and excessive rapidity in the action of the heart. The effects soon cease when the agent is withdrawn; but it may be readily conceived that a little excess of this action would prove fatal. (*B. and F. Medico-Chir. Rev.*, 1867, p. 259.)

NITROGEN MONOXIDE, so called *Nitrous Oxide. Laughing Gas.* (N_2O.) These names have been given to a gaseous substance, discovered by Priestley in 1776, but first brought into general notice in 1800 by Sir Humphrey Davy, who discovered and made known the remarkable exhilarating properties which earned for it the name of laughing gas.

Preparation. In its preparation, pure fused nitrate of ammonium is submitted in a glass retort to a heat sufficient to decompose it, not exceeding 204·4° C. (400° F.); and the resulting gas and vapor are collected in a glass receiver over warm water, or a saturated aqueous solution of common salt. Warm water is preferred because cold water absorbs much of the gas, and would consequently occasion loss; and even warm water, though it takes up much less, is not entirely unobjectionable on this score; and the saline solution is therefore probably, on the whole, best adapted to the purpose. When nitrate of ammonium is heated to the point of decomposition, it is wholly resolved into watery vapor and nitrogen monoxide, according to the reaction: $NH_4,NO_3 = (H_2O)_2 + N_2O$. But it is necessary not to let the heat employed be too high, as otherwise, besides nitrous oxide, there will come over portions of nitric oxide, uncombined ammonia, and probably even nitric acid, which contaminate the product, and render it unfit for use. This may be avoided by arresting the process as soon as any white fumes appear in the retort. Peculiar care also must be taken that the nitrate of ammonium should be pure, and especially free from chloride of ammonium, which might cause an admixture of chlorine in the product. To insure against impurities of this kind, it is best in any case in the least doubtful, and perhaps it might be best in all cases, to cause the nitrous oxide, before it is used by inhalation, to pass successively through two solutions; one of ferrous sulphate, to remove any nitric oxide that might be present; the second, of caustic potassa or soda, to neutralize acid impurities and chlorine.

Properties. Nitrogen monoxide gas is colorless, nearly or quite inodorous, slightly sweetish to the taste, and of the sp. gr. 1·527. Cold water will absorb about three-fourths of its bulk of the gas, and, under pressure, much more; and, thus impregnated, has a slight, not unpleasant smell, and sweetish taste. By the joint influence of cold and pressure the gas may be condensed into a liquid, which is colorless, very mobile, and capable, under the ordinary atmospheric pressure, of remaining liquid at —12·7° C. (9° F.). The liquefaction was effected by M. Bianchi at 0° C. (32° F.), under a pressure of thirty atmospheres. (*A. J. P.*, 1865, p. 275.) Inflammable bodies will generally burn with increased vigor in nitrous oxide, which is capable also of supporting life for a time when respired, by giving oxygen to the blood. It consists of two atoms of nitrogen and one of oxygen, and its formula is N_2O.

For use it may be kept in two states, according as it is to be used by inhalation or by the stomach; the gaseous, namely, and the liquid. In the former state, it is best kept in gasometers, from which it may be readily transferred to bags when wanted for inhalation; though, even for this purpose, it may not be amiss to follow the plan, suggested by Dr. Ziegler, of compressing it in water, which may be made to absorb five times its bulk, and when the gas is needed, will readily give it up if heated. More will be said in a subsequent page of the liquid form in which it is kept for internal use.

Medical Uses. The anæsthetic property of nitrogen monoxide, as well as its exhilarating influence, was discovered by Sir Humphrey Davy, who even suggested that it might be used to prevent pain in surgical operations; but the first practical application of it to this purpose is due to the late Dr. Horace Wells, of Connecticut. Having occasion for the extraction of a tooth, Dr. Wells successfully tried, in his own person, the efficacy of the nitrogen monoxide in preventing the pain of the operation; and soon afterwards, as the result of his experiment, two surgical operations were performed under the same influence, and with the same success. The measure, however, so promising at the outset, was entirely neglected. No further attention was given to the subject for sixteen or more years, when Mr. G. L. Colton introduced the use of the gas as a practical anæsthetic in dentistry. It is distinguished among remedies of its class for the rapidity and brevity of its action.

For short minor surgical operations the gas is an excellent anæsthetic, but in severe operations it is not to be relied on, any interruption of the inhalation being followed by immediate return to consciousness. The apparatus required for its production, storage, exhibition, and administration is also so cumbrous that practically nitrous oxide is only employed by the dentist. It is certainly a very safe agent when used with due care, although it has caused death. The common mode of exhibition is by means of an air-tight bladder or bag, with a tube and mouth-piece attached. The patient, with his nostrils closed, inhales the air from the bag, into which the expired air returns; so that, when the administration is somewhat protracted, the air in the bag becomes contaminated, and at length insufficient to support life. In such cases, the bag should be removed; or an instrument may be resorted to, in which, by a proper arrangement of valves, the inspired air may come from the bag, and that expired be allowed to escape by a different outlet. The capacity of the bag is often not more than one or two gallons; but, to obviate, in some measure, the inconvenience alluded to, it may be made to contain several gallons, three or four, for example, or, according to Dr. Spear, six or eight gallons. The period at which the anæsthetic effect is produced varies greatly. It may occur at the end of two or three minutes, or may be postponed a good deal longer; much depending, in this respect, on the ability of the patient to take a full breath. The effect is said to have been produced after three deep and prolonged respirations; but sometimes twenty are required where any impediment may exist to a free expansion of the lungs. It is possible that the anæsthesia is not directly produced by the gas, but is the result of the shutting off of the oxygen from the system. (See H. C. Wood's *Therapeutics.*)

Nitrous Oxide Water. Water, impregnated by pressure with about five times its volume of nitrogen monoxide, forms the *nitrous oxide water*, known in England under the name of *Searle's patent oxygenous aërated water*, which has been used to some extent as an internal remedy. Sir H. Davy tried the aqueous solution, made without pressure, and thought it acted as a diuretic, and promoted digestion; and Sérullas used it in Asiatic cholera with apparent advantage. The patent water is asserted to be suited to the treatment of torpor, debility, depression of spirits, asthma, and dyspepsia; but to be contraindicated in inflammatory and plethoric states of the system. Dr. George J. Ziegler asserts that water charged with five times its volume of the gas possesses tonic, resolvent, exhilarant, and diuretic properties. He has observed, however, that its free and prolonged use is apt to produce emaciation.*

NITROGLYCERIN. *Glonoïn. Trinitrate of Glyceryl.* $C_3H_5(NO_3)_3$. When glycerin is gradually added in small portions at a time to a mixture of equal parts of strong nitric and sulphuric acids, and at a temperature kept below freezing, it is converted into a bright yellow liquid, which has remarkable explosive properties, and has received the name at the head of this article. Nitroglycerin was discovered in the year 1847 by Professor Sobrero, of Turin. It was afterwards made a subject of study by Dr. de Vrij, of the Netherlands, Dr. Gladstone, and Dr. Kopp; but did not attract general attention until after 1864, when its capacities as an explosive agent became known. It is a yellow liquid (said to be colorless or slightly yellowish when pure); of a sp. gr. from 1·525 to 1·6; inodorous; of a sweet, pungent, aromatic taste; very slightly soluble in water, but readily soluble in ether, alcohol, and methylated spirit; not freezing above —15·5° C. (4° F.) when quite pure, according to J. R. Wagner, but, as it occurs in commerce, solidifying by continued exposure to a temperature of 8° C. (46·4° F.), and assuming the form of long needles, which it is dangerous to handle, as they explode violently when gently broken. In the liquid state, it does not inflame or explode by the mere contact of flame; but by concussion, or by touching it with a red-hot iron, it explodes with great vehemence. Detonating mixtures, or exploding gunpowder, in its near vicinity, produce the same effect. By keeping it undergoes partial decomposition; and, in confined vessels, the pressure of the accumulated gases which result is sometimes so great as to cause its explosion upon the slightest concussion. Its explosive force greatly exceeds that of gunpowder. According to Nobel, one measure of the fluid yields on explosion 10,384 measures of gas, while one measure of gunpowder yields only 800 measures. It has, therefore, been much employed in exploding rocks, in mining, quarrying, road-making, etc.; and its economical advantages have kept it in extensive use, notwithstanding the danger. Important inferences from these facts are, that it should not be kept in large quantities, nor conveyed to any considerable distance; and the most fearful consequences have followed a neglect of these precautions. Practical operators recommend that it should be made extemporaneously where wanted as an explosive agent.

Nitroglycerin is formed by the introduction of the nitro-group (NO_2) in place of the three replaceable hydrogen atoms of the glycerin formula, according to the reaction: $C_3H_5(OH)_3 + 3(NO_2,OH) = C_3H_5,(NO_3)_3 + 3(HOH)$. M. E. Kopp gives the following as his method of preparing nitroglycerin on the spot where it is needed. First, fuming nitric acid, of the sp. gr. 1·51 to 1·53, is mixed with twice its weight of the strongest sulphuric acid. At the same time commercial glycerin, free from lead and lime, is evaporated in a pot to 30° or 31° Baumé, so that, on cooling, it shall have a syrupy consistence. Into 3300 grammes of the acid mixture, contained in a glass or porcelain capsule, placed in a trough of cold water, 500 grammes of the prepared glycerin are slowly poured with constant stirring; great care being taken to prevent any sensible heating of the mixture. The whole is then to be left for five or ten minutes, after which the mixture is to be poured into five or six times its volume of cold water to which a rotary motion has been given. The nitroglycerin precipitates rapidly in the form of a heavy liquid, which is separated by decantation, then washed with a little water which is decanted, and lastly is put into bottles. In this state it still contains a little acid and water; but these do not interfere with its use as an explosive agent. Latterly, it has also been prepared by taking a mixture of 3½ parts of sulphuric acid of 1·83 sp. gr. and 1 part of nitre, and cooling this, when potassium sulphate will crystallize out. The acid drained off from this is peculiarly adapted for the formation of nitroglycerin, which then takes place rapidly and without so much dangerous development of heat.

Effects on the System. The action of nitroglycerin upon the system is almost identical with that of nitrite of amyl, excepting that it does not depress the blood-pressure so powerfully, and its influence is felt for a much longer time. The dose required to affect the system is very small. Mr. J. M. Merrick experienced decided effects from one-fortieth of a drop; and, in a case recorded by Mr. Field, a temporary loss of consciousness and other alarming symptoms were produced by about the forty-fifth of a drop. Mr. B. Sepuchardt, of Hanover, is said (*A. J. P.*, 1867, p. 164), five minutes after taking a single drop, to have felt a great deal of giddiness, attended with weakened vision, headache with throbbing in the temples, a sense of weariness, sleepiness, a strong aromatic taste in the mouth, burning in the throat, and severe pain in the cardiac region. An hour afterwards, these symptoms having subsided, he was attempting to take another dose from a bottle of the nitroglycerin by means of a glass tube, when accidentally a large quantity entered the fauces; and, though he discharged most of it from the mouth, he swallowed as much as ten drops. (A very doubtful case.—H. C. W.) The previous symptoms returned so severely that he was compelled to lie down; and a half-unconscious condition came on, which lasted several hours, and left behind it a violent throbbing headache, sensitiveness to light, giddiness, and universal trembling. At first there was increased heat and frequency of pulse, afterwards a feeling of coldness, with a burning sensation in the region of the heart, and nausea, but no vomiting. There were no symptoms of a convulsive character. Inhalation of the vapor produces similar effects. Mr. Merrick experienced intense headache from this cause, with intolerance of light, and feelings of general distress, faintness, and exhaustion. (*A. J. P.*, 1863, p. 564.) The same symptoms have been experienced by workmen engaged in its preparation and use. A case has been legally decided in which death was criminally produced by the poison. The gastro-intestinal mucous membrane was found to be eroded. (*Journ. de Pharm.*, xxvi. 356.) It has recently been used to a considerable extent in London in the treatment of angina pectoris. It is kept in the drug-stores in the form of one per cent. alcoholic solution, which is said not to be explosive, and may be given in doses of one to two drops.

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* In a letter addressed to Dr. Geo. B. Wood by Mr. R. C. Clark, it is stated that the writer had been effectually cured of severe neuralgia by taking a fluidounce of the nitrous oxide water every six hours.

NITROPRUSSIDE OF SODIUM. ($Na_2Fe(CN)_5NO$.) This is the most interesting of a series of salts, discovered by Dr. Playfair, called *nitroprussides*, which are produced, for the most part, by saturating *nitroprussic acid*, formed by the action of nitric acid on ferrocyanide of potassium, with different bases. The sodium salt is best obtained by the process of A. Overbeck, as follows. Dissolve four parts of powdered ferrocyanide of potassium, contained in a flask, in five and a half parts of commercial nitric acid, diluted with an equal weight of water. After the action is completed, which generally occupies about ten minutes, and is accompanied by a copious evolution of gases, heat the resulting coffee-brown liquid in a water-bath, until a drop of it gives a dingy green instead of a blue precipitate with a solution of sulphate of iron. Then allow the liquid to cool; whereupon the larger part of the nitrate of potassium generated will be deposited in crystals. Pour off the green mother-liquor from these, and separate the remaining nitrate of potassium by repeated concentrations. Next neutralize the liquid, while heated in a water-bath, with carbonate of sodium, taking care to add the carbonate so long only as a pure blue precipitate is produced. Lastly, filter the solution, and set it aside for the formation of crystals, which must be washed with water, and dried between blotting-paper. (*Chem. Gaz.*, 1853, p. 271.) This salt is in the form of large, ruby-colored, prismatic crystals, very much resembling those of ferridcyanide of potassium (red prussiate of potassa). It is soluble in two and a half parts of cold water, and in a less quantity of hot water. Its solution, exposed to sunshine, is decomposed, with evolution of nitric oxide gas, and deposition of Prussian blue, at the same time acquiring a green color. Nitroprusside of sodium, as well as the other soluble nitroprussides, is a most delicate test for the alkaline sulphides, with which it strikes a beautiful violet color. Its formula, as given above, is Na_2FeCy_5NO, while the free nitroprussic acid is H_2FeCy_5NO.

NOCTILUCINE. For an account of this substance, to which is ascribed the phosphorescence of various animals, see *Journ. de Pharm.*, 4e sér., xvii. 117.

NYMPHÆA ODORATA. *Sweet-scented Water-lily.* The root of this well-known American plant is very astringent and bitter, and, according to Dr. Bigelow, contains much tannin and gallic acid. It is sometimes employed, in the form of poultice, as a discutient application. The root of the *Nymphæa alba*, or European *white water-lily*, was esteemed antaphrodisiac by the ancients, but has long lost this reputation.

OCHRES. These are native mixtures of argillaceous or calcareous earth and oxides of iron and manganese, employed in painting. They are prepared for use by agitating them with water, decanting the turbid liquor after the coarser particles have subsided, then allowing it to rest in order that the finer parts may be deposited, and, lastly, drying the sediment which forms. The color of the ochres varies with the state of oxidation of the iron, and with the proportion which the iron bears to the other ingredients, and is sometimes artificially modified by the agency of heat. Several varieties are known in commerce under different names, according to their color or place of origin. Such are the *brown ochre*, the *yellow ochre*, the *red ochre*, the *Roman ochre*, of a brownish yellow changing by heat to a purple red, the *Oxford ochre*, of a brownish yellow color less deep than the Roman, and the *French ochre*, which is yellow. The *Indian red* from the Persian Gulf, and the *Spanish brown*, may also be ranked in this class of pigments. Sometimes ochres come in a powdery state, and sometimes in hard masses known as *stone ochres*.

OCYMUM BASILICUM. *Basil.* An annual plant, a native of India and Persia, and cultivated in Europe and in this country in gardens. The whole plant has a strong, peculiar, agreeable, aromatic odor, which is improved by drying. The taste is aromatic, and somewhat cooling and saline. It yields by distillation a yellowish green volatile oil, lighter than water, which on being kept solidifies into a crystalline camphor, isomeric with turpentine-camphor. (*Gmelin's Handbook*, xiv. 359.) Basil has the ordinary properties of the aromatic plants, and is in some places considerably used as a condiment. The seeds are said by Ainslie to be used in India, in the form of infusion, as a remedy in gonorrhœa and nephritic affections.

ŒNANTHE CROCATA. *Hemlock. Water-dropwort.* A perennial, umbelliferous, aquatic European plant, exceedingly poisonous both to man and inferior animals. (*London Lancet*, 1873, p. 918.) The root, which has a sweetish not unpleasant taste, is sometimes eaten by mistake for other roots, with the most dangerous effects; and numerous instances of fatal results are on record. The symptoms produced are those of irritation of the stomach, besides failure of circulation, and great cerebral disturbance, indicated by giddiness, convulsions, and coma. (See *P. J. Tr.*, 1874, p. 202.) Externally applied, the root produces redness and irritation of the skin, with an eruptive affection. It is said to be sometimes used empirically as a local remedy in piles; and a case is recorded in which an obstinate leprosy was cured by the continued use of the juice of the plant. Other species of *Œnanthe* are poisonous, and the whole genus should be suspected. We have two or three indigenous species. In cases of poisoning, the stomach should be at once evacuated, and symptoms met as they arise. A peculiar resinoid principle, denominated *œnanthin*, has been found by Mr. Gerding in *Œnanthe fistulosa*, of which half a grain, given to an adult, produced long-continued irritation of the fauces, with hoarseness, and a grain occasional vomiting. (See *A. J. P.*, xxi. 68.)

ŒNANTHE PHELLANDRIUM. Sprengel. *Phellandrium aquaticum.* Linn. *Fine-leaved Water-hemlock.* A biennial or perennial, umbelliferous, European water-plant, the fresh leaves of which are said to be injurious to cattle, producing a kind of paralysis when eaten. By drying, they lose their deleterious properties. The *seeds* have been used in Europe to a considerable extent in the treatment of disease. They are from a line to a line and a half in length, ovate-oblong, narrow above, somewhat compressed, marked with ten delicate ribs, and crowned with the remains of the calyx, and with the erect or reverted styles. Their color is yellowish brown; their odor peculiar, strong, and disagreeable; their taste acrid and aromatic. Among their constituents is a volatile oil, upon which their aromatic flavor depends. By Mr. C. Fronefield it has been rendered probable that they contain a volatile alkaloid, analogous to conine, if it be not conine itself; for if the powdered seeds are rubbed with solution of potassa, the peculiar mouse-like odor of that alkaloid is exhaled. The powder was submitted to distillation with caustic potassa, the alkaline liquid obtained was neutralized with sulphuric acid and evaporated to a syrupy consistence, alcohol was added to precipitate the sulphate of ammonia, the liquid was then filtered, treated with caustic potassa, and again distilled. On the surface of the distillate a yellow oily fluid floated, which was only slightly soluble in water but readily so in ether and alcohol, evinced an alkaline reaction with turmeric paper, and neutralized the acids. (*A. J. P.*, May, 1860, p. 211.) In overdoses the seeds produce vertigo, intoxication, and other narcotic effects. They appear to have been used most successfully in chronic pectoral affections, such as bronchitis, pulmonary consumption, and asthma. They have been given also in dyspepsia, intermittent fever, obstinate ulcers, etc. The dose of the seeds, to commence with, is five or six grains, so repeated as to amount to a drachm in twenty-four hours. They should be given in powder. A tincture and alcoholic extract have been prepared, of which the former, containing the virtues of half a drachm of the seeds in a fluidounce, is given in a dose varying from half a fluidrachm to a fluidrachm, and the latter in that of three to five grains. (*P. J. Tr.*, xii. 591.)

ŒNOTHERA BIENNIS. *Tree Primrose.* The late Dr. R. E. Griffith found a strong decoction of the small branches, with the leaves and cortical part of the stem and larger branches of this indigenous biennial, to be very beneficial in eruptive complaints, especially tetter. He applied the decoction several times a day to the affected part. He believed the virtues of the plant to reside in the cortical part, which has a mucilaginous taste, and leaves a slight sensation of acrimony in the fauces.

ŒTHUSA CYNAPIUM. Poisonous properties are alternately attributed and denied to this British plant. (See *P. J. Tr.*, 1874, p. 202; Nov. 1880, p. 438.)

OIL OF ANDA. A fixed oil procured by expression from the seeds of *Anda Brasiliensis* (Radde), *Anda Gomesei* (Ad. Jussieu), *Johannesia princeps* (Vell), a tree of Brazil, belonging to the family of Euphorbiaceæ. The bark yields on being wounded a milky juice, which is said to be poisonous, and to be used for stupefying fish. The fruit, which is about as large as an apple, ash-colored, with two larger and two smaller angles, encloses a two-celled nut, containing two seeds, about the size of a chestnut. Like the seeds of other Euphorbiaceous plants, these are actively purgative; one seed, according to Martius, being the dose for a man. By expression these seeds yield a pale yellow, transparent oil, with little smell or taste, which is said to be used in Brazil for burning and painting. Mello Olliveira has found in it an alkaloid, *Johannesine*, but Dr. Couty affirms this to be inert. (*N. R.*, 1881, p. 260.) Dr. Norris, who tried the oil at the Pennsylvania Hospital, found it to operate on the bowels moderately in the dose of fifty drops, and copiously, when more largely given. (*Cyclopædia of Pract. Med. and Surg.*, i. 470.) Dr. Manoel de Castro, and other Brazilian physicians, claim that in doses of one to two teaspoonfuls it acts in a manner very similar to castor oil, over which it has the great advantage of not being nauseous to the taste.

OIL OF BEN. This is a fixed oil extracted from the seeds of the *Moringa pterygosperma* and *M. aptera* of Gærtner, and not to be confounded with oil of benne from Sesamum Indicum. *Hyperanthera Moringa* (Vahl) is a synonym of the former species. These are trees belonging to the family of Leguminosæ, inhabiting different parts of India, Arabia, Syria, etc., and introduced into the West Indies. Mr. James Macfadyen, in his *Flora of Jamaica* (i. 325), states that it is not the *M. pterygosperma* which yields the commercial oil of ben, but the *M. aptera*, which has not been introduced into Jamaica. He says, however, that an excellent and palatable oil may be obtained by expression from the seeds of *M. pterygosperma*, growing in that island. The leaves and other parts have an acrid property, which has probably given the name of *horse-radish tree* to *M. pterygosperma*. The oil of the seeds has long been known, though used rather in the arts than in medicine. It is prepared in Europe from the seeds brought from Egypt (*Mérat and De Lens*); and it would appear, from the statements of Mr. Macfadyen, that the idea generally prevailing that it is also extracted in the West Indies is incorrect. The oil is inodorous, clear, and nearly colorless, and keeps long without becoming rancid. It is employed for similar purposes with olive oil. Mérat and De Lens say that it is purgative; but most of the fixed oils are so in sufficient doses. According to Völcker, the oil contains palmitin, olein, and a peculiar fatty matter yielding an acid by saponification, which he names *benic* (or *behenic*) *acid.* (*Journ. de Pharm.*, xvi. 77.) Heintz considers benic acid as simply a mixture of palmitic and myristic acids. (*Pogg. Ann.*, 92, 601.)

OIL OF EUPHORBIA. A fixed oil, obtained from the seeds of *Euphorbia Lathyris*, a biennial plant growing wild in this country, though believed to have been introduced from Europe. It is often found near gardens and in cultivated fields, and is generally called *mole plant*, under the impression that moles avoid the grounds where it grows. (*Pursh.*) It is the *caper plant* of England. (*Loudon's Encyc. of Plants.*) Like the other species of Euphorbiaceæ, it contains a milky juice, which is extremely acrid; and the whole plant possesses the properties of a drastic purge; but the oil of the seeds is the only part used in regular practice. This may be extracted by expression, or by the agency of alcohol or ether. In the first case, the bruised seeds are pressed in a canvas or linen bag, and the oil which escapes is purified by decanting it from the whitish flocculent matter which it deposits upon standing, and by subsequent filtration. By the latter process, the bruised seeds are digested in alcohol, or macerated in ether, and the oil is obtained by filtering and evaporating the solution. According to Soubeiran, however, the oils obtained by these different processes are not identical. That procured by expression is probably the purest.

Oil of euphorbia is colorless, inodorous, and, when recent, nearly insipid; but it speedily becomes rancid, and acquires a dangerous acrimony. Soubeiran has ascertained that it has a complex composition, containing, besides the pure oil, four distinct proximate principles. (*Journ. de Pharm.*, xxi. 259.) From 40 to 44 parts are obtained by expression from 100 of the seed. It is a powerful purge, operating with much activity in a dose varying from five to ten drops. It was, some years since, much used by certain Italian and French physicians, who did not find it to produce inconvenient irritation of the stomach and bowels. Its want of taste, and the smallness of the dose, recommended it especially in the cases of infants. It was said to be less acrid and irritating than the croton oil, over which it also has the advantage of greater cheapness. Some trials made with it on this side of the Atlantic have not confirmed these favorable reports. It was found uncertain in its cathartic effect, and very liable to vomit. (Scattergood, *Journ. of the Phil. Col. of Pharm.*, iv. 124.) It may be given in pill with the crumb of bread, or in emulsion.

OIL OF JASMINE. This oil is obtained from the flowers of *Jasminum officinale* or *common white jasmine*, and from those also of *J. Sambac* and *J. grandiflorum*. Alternate layers of the fresh flowers, and of cotton saturated with the *oil of ben* (see above), or perhaps other fixed oil, are exposed in a covered vessel to the warmth of the sun; the flowers being occasionally renewed till the oil becomes impregnated with their odor, when it is separated from the cotton by pressure. This method is necessary, as the flowers do not yield their aroma by distillation. The oil is used only as a perfume.

Dr. W. H. Hall records (*Med. and Surg. Rep.*, Jan. 1861) the case of a child poisoned by eating the fruit of a species of jasmine, probably the common white jasmine above referred to. The symptoms were those of an energetic narcotic; as coma, largely-dilated pupil, and snoring respiration, with a cold pale surface, and slow and feeble pulse, followed by violent convulsions, with rigidity of the muscles about the head and throat. Under the use of the hot bath, with active emetics, the spasms relaxed, vomiting took place, and the patient ultimately recovered.

OLIBANUM. Olibanum, the *frankincense* of the ancients, was erroneously ascribed by Linnæus to *Juniperus Lycia.* There are two varieties, one coming to Europe from the Mediterranean, and the other directly from Calcutta. These varieties were formerly considered distinct, but recent researches indicate their common origin. In 1843, Captain Kempthorne, of the East India Company's Navy, saw the olibanum tree growing upon the mountains, on the African coast, between Bunder Maryah and Cape Guardafui. According to his statement, it grows on the bare marble rocks composing the hills of that region, without any soil or the slightest fissure to support it, adhering by means of a substance thrown out from the base of the stem. This rises forty feet, and sends forth near the summit short branches, covered with a bright green, singular foliage. The juice, which exudes through incisions made into the inner bark, has at first the color and consistence of milk, but hardens on exposure. (*P. J. Tr.*, iv. 37.) Sir Wm. J. Hooker says that the African olibanum is derived from *Plösslea floribunda* of Endlicher (*Boswellia*, Royle); but thinks it highly probable that it is furnished by more than one species. (*Ibid.*, 1859, p. 217.) Mr. Bennett, of the British Museum, has also identified Kemper's specimens as *P. floribunda.* But in 1847 Mr. Carter described very closely the olibanum district, and procured living specimens, the descendants of which appear still to flourish in the "old gardens" of the Bombay Agri-Horticultural Society. Dr. Birdwood, who is in charge of these gardens, has examined the subject with great care, and published a monograph in the Transactions of the Linnæan Society, xxvii. He asserts that no olibanum is obtained in India, all coming from a coast district of Arabia, and being the product of a new species of Boswellia, *B. Carteri*, Birdwood. The newly made-out district is precisely that described by Theophrastus as the locality from which olibanum was brought in his day. The various species of Boswellia are described in the monograph of Dr. Birdwood.

The Arabian or African frankincense is in the form of yellowish tears, and irregular reddish lumps or fragments. The tears are generally small, oblong or roundish, not very brittle, with a dull and waxy fracture, softening in the mouth, and bearing much resemblance to mastic, from which, however, they differ in their want of transparency. The reddish masses soften in the hand, have a stronger taste and smell than the tears, and are often mixed with fragments of bark, and small crystals of carbonate of lime.

The Indian frankincense, or olibanum, consists chiefly of yellowish, somewhat translucent, roundish tears, larger than those of the African, and generally covered with a whitish powder produced by friction. It has a balsamic resinous smell, and an acrid, bitterish, somewhat aromatic taste. When chewed it softens in the mouth, adheres to the teeth, and partially dissolves in the saliva, which it renders milky. It burns with a brilliant flame, and a fragrant odor. Triturated with water, it forms a milky imperfect solution. Alcohol dissolves nearly three-fourths of it, and the tincture is transparent. From 100 parts, Braconnot obtained 8 parts of volatile oil, 56 of resin, 30 of gum, and 5·2 of a glutinous matter insoluble in water or alcohol, with 0·8 loss. Various saline substances were found in its ashes. The oil may be separated by distillation, and resembles that of lemons in color and smell. According to Stenhouse, it is isomeric with oil of peppermint, and consists of an oxygenated and non-oxygenated oil. (*Gmelin's Handbook*, xiv. 390.) Kurbatow showed that the oil consists of *olibene*, $C_{10}H_{16}$, and a portion containing oxygen. Hlasiwetz found the resin to be a uniform substance of the composition $C_{20}H_{30}O_3$.

Dr. W. F. Daniell has described an odorous product, used as *frankincense* in Sierra Leone, and obtained from a large tree, growing in the mountainous districts of that region. The tree has been described by Mr. J. J. Bennett in *P. J. Tr.*, 1854, p. 251, as *Daniella thurifera.* According to Dr. Daniell, the juice exudes through openings made by an insect, and, concreting in connection with the woody particles resulting from the boring of the insect, falls at length to the ground, where it is collected by the negroes. (See *A. J. P.*, xxvii. 338.)

Olibanum is stimulant like the other gum-resins, but is now very seldom used internally. M. Delioux, of Toulon, however, is in the habit of using it for the same purposes as the balsams of Tolu and Peru, having satisfied himself by much experience that it produces similar effects, while it is less costly. He gives it, in the form of pill, in the medium dose of fifteen grains, which may be increased to a drachm or more. It appears to act more favorably when combined with a little soap. He has also obtained advantage from the inhalation of its fumes, when heated, in chronic bronchitis and laryngitis. (*Bull. Gén. de Thérap.*, Fév. 28, 1861.) It is chiefly employed for fumigation, and enters into the composition of some unofficinal plasters.

ONION. *Cepa.* The bulb of *Allium Cepa.* Fourcroy and Vauquelin obtained from the ordinary onion a white acrid volatile oil containing sulphur, albumen, much uncrystallizable sugar and mucilage, phosphoric acid both free and combined with lime, acetic acid, citrate of lime, and lignin. The expressed juice is susceptible of the vinous fermentation. The oil is essentially the same in chemical composition as the oil of *allium sativum*, and consists largely of allyl-sulphide, $(C_3H_5)_2S$.

The onion is stimulant, diuretic, expectorant, and rubefacient. Taken moderately it increases the appetite and promotes digestion, and is much used as a condiment; but in large quantities it is apt to cause flatulence, gastric uneasiness, and febrile excitement. The juice is occasionally given, made into syrup with sugar, in infantile catarrhs and croup in the absence of much inflammatory action. It is also recommended in dropsy and calculous disorders. Deprived of its essential oil by boiling, the onion becomes a mild esculent; and it is much more used as food than as medicine. Roasted and split, it is sometimes applied as an emollient cataplasm to suppurating tumors.

OPOPANAX. A concrete juice usually ascribed to *Pastinaca Opopanax* (Willd.), *Opopanax Chironium* (De Candolle). This species of parsnep, usually called *rough parsnep*, has a thick, yellow, fleshy, perennial root, which sends up annually a strong branching stem, rough near the base, about as thick as a man's thumb, and from four to eight feet in height. The leaves are variously pinnate, with long sheathing petioles, and large, oblong, serrate leaflets, of which the terminal one is cordate, others are deficient at their base upon the upper side, and the whole are hairy on their under surface. The flowers are small, yellow, and form large flat umbels at the termination of the branches. The plant is a native of the Levant, and grows wild in the south of France, Italy, and Greece. When the base of the stem is wounded, a juice exudes, which, when dried in the sun, constitutes the opopanax of commerce. Some authors state that it is obtained from the root. A warm climate appears necessary for the perfection of the juice; as that which has been collected from the plant in France, though similar to opopanax, is of inferior quality. The drug is brought from Turkey. It is said to come also from the East Indies; but Ainslie states that he never met with it in any Indian medicine bazaar. The method of its production is not known with any certainty.

It is sometimes in tears, but usually in irregular lumps or fragments, of a reddish yellow color, speckled with white on the outside, paler within, and, when broken, exhibiting white pieces intermingled with the mass. Its odor is strong, peculiar, and unpleasant, its taste bitter and acrid. Its sp. gr. is 1·622. It is inflammable, burning with a bright flame. In chemical constitution it is a gum-resin, with an admixture of other ingredients in small proportion. The results of its analysis by Pelletier were, from 100 parts, 33·4 of gum, 42 of resin, 4·2 of starch, 1·6 of extractive, 0·3 of wax, 2·8 of malic acid, 9·8 of lignin, 5·9 of volatile oil and loss, with traces of caoutchouc. Water by trituration dissolves about one-half of the gum-resin, forming an opaque milky emulsion, which deposits resinous matter on standing, and becomes yellowish. Both alcohol and water distilled from it retain its flavor; but only a very minute proportion of oil can be obtained in a separate state.

Opopanax was formerly employed, as an antispasmodic and deobstruent, in hypochondriasis, hysteria, asthma, and chronic visceral affections, and as an emmenagogue in suppression of the menses; but it is now generally regarded as a medicine of very feeble powers, and in this country is scarcely ever used. The dose is from ten to thirty grains.

ORANGE RED. *Orange Mineral. Sandix.* Red oxide of lead, prepared by calcining carbonate of lead. It is of a brighter color than *minium*, and is used as a pigment.

OREODAPHNE CALIFORNICA. The *California Bay Laurel* is an evergreen tree of considerable size, rather abundant throughout the State. Its wood is much prized on account of the beauty of its grain and its immunity from the attacks of insects. The leaves yield about 4 per cent. of a neutral, straw-colored, limpid volatile oil, which has a warm camphoraceous taste and a pungent aromatic odor, resembling somewhat that of a mixture of oils of nutmeg and cardamom. It is soluble in 1000 parts of water, and with alcohol and ether in all proportions. It is said, when inhaled, to cause dizziness and headache. Its chemical characters have been studied by Mr. John P. Heamy. (*A. J. P.*, 1875, p. 105.) He finds it to consist of a pure hydrocarbon, sp. gr. ·894, boiling at 175° C. (347° F.), and an oxygenated pungent portion, which boils at 210° C. (410° F.). This he calls *oreodaphnol*. *Oreodaphnene* was obtained by distilling oreodaphnol with glacial phosphoric acid. For the reactions of these principles want of space compels us to refer the reader to Mr. Heamy's paper.

ORIGANUM VULGARE. *Common Marjoram. Origanum.* This labiate was officinal in the former U. S. and Ed. Pharmacopœias; but as the volatile oil which was ascribed to it, and for which it was chiefly valued, has proved to be the oil of thyme, it has been omitted from the U. S. and Br. Pharmacopœias. Two species of the genus Origanum have been used in medicine, *O. Majorana*, or sweet marjoram, and *O. vulgare*, or common marjoram. The former grows wild in Portugal and Andalusia, and is cultivated as a garden herb in other parts of Europe, and in the United States. Some authors, however, consider *O. Majoranoides*, which is a native of Barbary, and closely allied to *O. Majorana*, as the type of the sweet marjoram of our gardens. *Sweet marjoram* has a pleasant odor, and a warm, aromatic, bitterish taste, which it imparts to water and alcohol. By distillation with water it yields a volatile oil, which was directed by the Edinburgh College among their preparations. It is tonic and gently excitant, but is used more as a condiment in cookery than as a medicine. In domestic practice, its infusion is much employed by the vulgar to hasten the tardy eruption in measles and other exanthematous diseases.

Origanum vulgare, or *common marjoram*, is a perennial herb, with erect, purplish, downy, four-sided, trichotomous stems, about eighteen inches high, and opposite, ovate, entire, somewhat hairy leaves, of a deep yellowish green color. The flowers are of a pinkish purple or rose color, disposed in roundish, panicled spikes, and accompanied with ovate reddish bracts, longer than the calyx. This is tubular and five-toothed, with nearly equal segments. The corolla is funnel-shaped, with the upper lip erect, bifid, and obtuse, the lower trifid, blunt, and spreading. The anthers are double, the stigma bifid and reflexed. The plant is a native of Europe and America. In this country it grows along the roadsides, and in dry stony fields and woods, from Pennsylvania to Virginia, and is in flower from June to October; but it is not very abundant, and is seldom collected for use. It has a peculiar, agreeable, aromatic odor, and a warm, pungent taste. These properties it owes to a volatile oil, which was formerly employed, but has been superseded in great measure, if not altogether, by the oil of thyme. The oil on long standing deposits a camphor, to which Kane (*Jour. Prakt. Chem.*, 15 157) gave the formula $C_{50}H_{80}O$. It may be separated by distillation with water. Origanum is gently tonic and excitant, and has been used in the form of infusion as a diaphoretic and emmenagogue, and externally as a fomentation; but it is at present little employed.

OROBANCHE VIRGINIANA. *Epifagus Americanus.* Nuttall. *Beech-drops. Cancer-root.* This is a parasitic, fleshy plant, with a tuberous, scaly root, and a smooth stem, branched from the base, from twelve to eighteen inches high, furnished with small ovate scales, of a yellowish or purplish color, and wholly destitute of verdure. It is found in all parts of North America, growing upon the roots of the beech tree, from which it obtained its popular name. It is in some places very abundant. The plant has a bitter, nauseous, astringent taste, which is said to be diminished by drying. It has been given internally in bowel affections; but its credit depends mainly upon the idea that it is useful in obstinate ulcers of a cancerous character, to which it is directly applied in the state of powder. The late Professor Barton conjectured that it was an ingredient of a secret remedy, at one time famous as *Martin's cancer powder*, of which, however, the most active constituent was arsenious acid.

Other species of Orobanche, growing in America and Europe, have been employed. They are all parasitic, fleshy plants, without verdure, and of a bitter, nauseous taste. In Europe they are called *broom-rape.* The *O. Americana* and *O. uniflora*, of this country, are said to be used for the same purposes as the species above noticed, and like it are called *cancer-root.*

ORPIMENT. *King's Yellow.* (As_2S_3.) A native trisulphide of arsenic. It is in masses of a brilliant lemon-yellow color, composed of flexible laminæ, and slightly translucent. It exists in various parts of the world, but is obtained for use from Persia and China. (*Guibourt.*) It is sometimes mixed with realgar, which gives it a reddish or orange hue. A similar sulphide may be made artificially by passing sulphuretted hydrogen through a solution of arsenious acid in hydrochloric acid. There is reason to believe that neither the native sulphide, nor the artificial, when prepared in the manner just mentioned and well washed, is poisonous, at least in a degree at all comparable to other arsenical compounds.

Artificial orpiment is prepared for use by fusing together equal parts of arsenious acid and sulphur. (*Turner.*) In Germany, according to Guibourt, it is prepared by subliming a mixture of these two substances. In this case, however, it retains a large portion of the acid undecomposed, and is therefore highly poisonous. Guibourt found a specimen which he examined to contain 94 per cent. of arsenious acid, and only 6 per cent. of the tersulphide.

Orpiment is an ingredient of certain depilatories. *Atkinson's depilatory* is said to consist of one part of orpiment and six parts of quicklime, with some flour and a yellow coloring matter. (*Ann. der Pharm.*, xxxiii. 348.) But this arsenical sulphide is chiefly used in fireworks, and as a pigment.

ORYZA SATIVA. *Rice.* This is an annual plant, originally, perhaps, derived from the East Indies, but now cultivated in all parts of the globe where the climate and soil are adapted to its growth. Barth says, in his Travels (Am. ed., 1857, ii. 345), that it grows wild in Central Africa. The rice of commerce consists of the seeds of the plant deprived of their husk. Carolina rice was found by Braconnot to contain 85·07 per cent. of starch, 3·60 of gluten, 0·71 of gum, 0·29 of uncrystallizable sugar, 0·13 of fixed oil, 4·80 of vegetable fibre, 5·00 of water, and 0·40 of saline substances. This grain is highly nutritious, and of easy digestion, and constitutes the almost exclusive diet of whole nations. Being entirely free from laxative properties, it is admirably adapted to cases of weak bowels, in which there is a strong tendency to diarrhœa. Care, however, should be taken that it be boiled till it becomes soft. A decoction of rice, usually called *rice-water*, is a good nutritive drink in fevers, and in inflammatory affections of the bowels, lungs, and kidneys. There appears to be no ground for the opinion, entertained by some, that a diet of rice is injurious to the eyes.

OSHA ROOT. This is the root of an unknown New Mexican umbellifer. Mr. H. Haupt found in it an acid, *oshaic acid*, closely resembling angelic acid. (*A. J. P.*, 1867, p. 202; 1868, p. 106; 1873, p. 347.)

OSMIC ACID. *Tetroxide of Osmium.* (OsO_4.) A volatile, very odorous, crystalline compound, produced by the action of nitrohydrochloric acid on osmium or either of its lower oxides. Its vapor is very pungent and poisonous. Claus recommends as an antidote to its action cautious inhalation of sulphuretted hydrogen. Osmic acid melts to a colorless liquid at 90° C. (194° F.), softening at a temperature of 35° C. (95° F.). It is slowly soluble in water; soluble in alcohol and ether; but these solutions are unstable, depositing black osmic hydrate, $Os(OH)_4$.

OXALIS ACETOSELLA. *Wood-sorrel. Acetosella.* The wood-sorrel is a small, perennial, herbaceous, stemless plant, with numerous radical leaves, which are all ternate, and supported upon slender hairy petioles. The leaflets are obcordate, entire, hairy, of a yellowish green color, but frequently purplish on their under surface. The scape or flower-stalk, which usually exceeds the petioles in length, is furnished with two scaly bracts near the middle, and terminates in a large white or flesh-colored flower, marked with red streaks. The styles are of the same length as the inner stamens. This plant is a native both of Europe and North America. It selects shady places, such as woods, groves, and hedges, and flowers in May. Other indigenous species of Oxalis possess similar properties to *O. Acetosella.* They all have ternate leaves with obcordate leaflets, and, with the single exception of *O. violacea*, bear yellow flowers. The whole herbaceous portion may be used.

Wood-sorrel is without smell, and has an agreeable sour taste. It owes its acidity to *acid-potassium oxalate* or *binoxalate of potassium* (C_2HKO_4), which is sometimes separated for use, and sold under the name of *salt of sorrel.* This is prepared in Switzerland and Germany, from different species of Oxalis and Rumex, by the following process. The plants, previously bruised, are macerated for some days in water, and then submitted to pressure. The liquid thus obtained is mixed with clay, and occasionally agitated for two days. At the end of this time, the clear liquor is decanted, and evaporated so that crystals may form when it cools. These are purified by solution and a new crystallization. Five hundred parts of the plant afford four parts of the acidulous salt. The same salt may be prepared by exactly neutralizing with potassa one part of oxalic acid in solution, then adding one part more of the acid, and evaporating the solution so that it may crystallize upon cooling. Acid potassium oxalate is in rhomboidal crystals, of a sour, pungent, bitterish taste, soluble in forty parts of cold and six parts of boiling water (*Kane*), and unalterable in the air. *Tetroxalate* or *quadroxalate of potassium* is often substituted for the binoxalate. It is prepared in the same manner, except that, instead of one part, three parts of the acid are added to the original proportion neutralized by potassa. Both salts are kept in the shops under the names of *salt of sorrel* and *essential salt of lemons*, and are employed for removing iron mould and ink stains from linen, and sometimes as a test for lime. Both are poisonous, though in a less degree than uncombined oxalic acid.

This and other species of sorrel are refrigerant; and their infusion, or a whey made by boiling them in milk, may be used as a pleasant drink in febrile and inflammatory affections. A solution of the binoxalate of potassium is used on the continent of Europe as a substitute for lemonade. It has recently been recommended by W. H. Taylor as extraordinarily efficacious in scurvy, having effected cures in that complaint after lemon-juice had failed. The salt used contained an excess of oxalic acid. It was probably the quadroxalate. Four grains were given three times a day. (*Lancet*, 1869, p. 777.) The fresh plant, eaten raw, is said to be useful in scurvy. *Oxalis crassicaulis*, a Peruvian species, yields an edible root, and, by expression from its leaves, a very sour and astringent juice, which is employed, in the form of syrup, in hemorrhages, chronic catarrh, bowel affections, and gonorrhœa, with asserted advantage.

OZOKERITE. This substance, which is brought from Austria and Turkey, and near the Caspian Sea, in its crude state, is a dirty, greenish solid. When purified by treatment with sulphuric acid and alkali and subsequent filtration while melted through bone-black or other filtering medium, it is a hard, white, spermaceti-like substance. (See *Ceresin.*) It is a mixture of natural paraffins. It is said to resemble tar in its therapeutic properties, and, mixed with glycerin or linseed oil, has been employed in skin diseases by Dr. Purdon as a substitute for that remedy. (*Brit. and For. Med.-Chir. Rev.*, 1872, p. 535. See also *Arch. Gén.*, Avril, 1873.)

PÆONIA OFFICINALIS. *Peony.* The *root* of the Garden Peony consists of a caudex about as thick as the thumb, which descends several inches into the ground, and sends off in all directions spindle-shaped tubers, which gradually taper into thread-like fibres, by which they hang together. It has a strong, peculiar, disagreeable odor, and a nauseous taste, which is at first sweetish, and afterwards bitter and somewhat acrid. The odor is lost, or much diminished, by drying. Peony root was in very great repute among the ancients, who used it both as a charm and as a medicine in numerous complaints, particularly epilepsy. Dr. A. Livezey, of Lumberville, Pa., states that in his neighborhood it is much used in the convulsions of children, and bears testimony to its possession of decided nervine powers. (*Bost. Med. and Surg. Journ.*, lv. 467.) The dose of the fresh root is from two drachms to an ounce, boiled in a pint of water down to half a pint, which should be taken daily. It is said to be less active when dried. The expressed juice of the recent root is recommended in the dose of an ounce. It is milky, of a strong odor and very disagreeable taste. The *seeds* are roundish-oval, about as large as a pea, externally smooth, shining, and nearly black, internally whitish, inodorous when dry, and of a mild, oleaginous taste. By some authors they are said to be emetic and purgative, by others antispasmodic. They may be given in the same dose as the root, but are not used in regular practice.

PALM OIL. This highly valuable fixed oil is the product of *Elais Guiniensis*, a palm growing on the western coast of Africa, and cultivated in the West Indies and South America. It is among the handsomest trees of its graceful family which flourish in the tropical regions of Africa. The oil is obtained by expression from the fruit. It is brought to this country chiefly from Liberia and other places on the African coast, though prepared also in the West Indies, Cayenne, and Brazil. It is not improbable that various species of Palmaceæ contribute to the supply of this article of commerce.

Palm oil has the consistence of butter, a rich, orange-yellow color, a sweetish taste, and an agreeable odor, compared by some to that of violets, by others to that of the Florentine orris. By age and exposure it becomes rancid and of a whitish color. It melts with the heat of the hand, and when perfectly fluid passes readily through blotting-paper. Highly rectified alcohol dissolves it at common temperatures, and in ether it is soluble in all proportions. Its constituents are tripalmitin and triolein, $C_3H_5(C_{16}H_{31}O_2)_3$ and $C_3H_5(C_{18}H_{33}O_2)_3$. The palmitin is converted into *palmitic acid* by saponification, with liberation of glycerin. It appears also that a considerable proportion of this acid, together with some glycerin, exists uncombined in the oil, as ascertained by MM. Pelouze and Boudet; so that the changes which are effected in oils, through the agency of alkalies, in the process of saponification, take place, to a certain extent, spontaneously in palm oil. (*Journ. de Pharm.*, xxiv. 389.) Hence it is more easily saponified than any other fixed oil. Preparatory to saponification, it may be bleached rapidly, according to J. J. Pohl, by heating it quickly to 240° C. (464° F.) and keeping it for ten minutes at that temperature. It loses for a time its peculiar odor by the process, acquiring an empyreumatic smell; but this after a while ceases to be perceived, and the characteristic odor returns. (See *A. J. P.*, xxvii. 346.) Englehart bleaches it in the following manner. One thousand pounds of the oil are heated in a boiler to 62·2° C. (144° F.) and kept at that temperature until the next day, when it is decanted into a clean vessel, and cooled to a point between 36·6° C. (98° F.) and 40° C. (104° F.). In another vessel 15 lbs. of bichromate of potassium are dissolved in 45 lbs. of boiling water; and, when the solution is partially cooled, 60 lbs. of hydrochloric acid are added. This solution is then mixed with the oil, and briskly agitated. In five minutes the color changes to green, through the reduction of the chromic acid; and, with a continuation of the agitation, the oxide of chromium separates, and nothing more is necessary than washing with water to get the oil colorless. (*A. J. P.*, 1868, p. 333.) Palm oil is said to be frequently imitated by a mixture of lard and suet, colored with turmeric and scented with Florentine orris. It is much employed in the manufacture of a toilet soap, which retains its pleasant odor. Palm oil is emollient, and has sometimes been employed in friction or embrocation, though not superior for this purpose to many other oleaginous substances.

PANAX QUINQUEFOLIUM. Willd. (*Panax, U. S.* 1870; *Ginseng*, Fr., G., Sp.; *Ginsen*, It.) The *ginseng* has a perennial root, which sends up annually a smooth round stem, about a foot high, and divided at the summit into three leaf-stalks, each of which supports a compound leaf, consisting of five or more rarely of three or seven petiolate, oblong-obovate, acuminate, serrate leaflets. The flowers are small, greenish, and disposed in a simple umbel, supported by a peduncle which rises from the top of the stem in the centre of the petioles. The fruit is a kidney-shaped, scarlet berry, crowned with the styles and calyx, with two and sometimes three seeds. The plant is indigenous, growing in the hilly regions of the Northern, Middle, and Western States, and preferring the shelter of thick, shady woods. The root is the part employed. This is collected in considerable quantities in Ohio and Western Virginia, Minnesota, etc., for the purpose of exportation to China, where it is highly valued. Some suppose the ginseng plant of Chinese Tartary to be the same as ours; others believe it to be the *Panax Schinseng* of Nees von Esenbeck; while by others, again, though acknowledged to be a Panax, it is thought to be a different species from either of those mentioned. While supplied with this drug exclusively from their own country, which furnished the root only in small quantities, the Chinese entertained the most extravagant notions of its virtues, considering it as a remedy for all diseases, and as possessing almost miraculous powers in preserving health, invigorating the system, and prolonging life. It is said to have been worth its weight in gold at Pekin; and the first shipment from North America to Canton yielded enormous profits. For a very interesting account of the Chinese methods of using it, see *P. J. Tr.*, vi. 86. The Chinese ginseng is said to maintain its price, although the American article is but little esteemed.

The root is fleshy, somewhat spindle-shaped, from one to three inches long, about as thick as the little finger, and terminated by several slender fibres. Frequently there are two portions, sometimes three or more, connected at their upper extremity, and bearing a supposed, though very remote, resemblance to the human figure, from which circumstance it is said that the Chinese name *ginseng* originated. When dried, the root is yellowish white and wrinkled externally, and within consists usually of a hard central portion, surrounded by a soft whitish bark. It has a feeble odor, and a sweet, slightly aromatic taste, somewhat analogous to that of liquorice root. It has not been accurately analyzed, but is said to be rich in gum and starch, and contains albumen. Mr. S. S. Garrigues, of Philadelphia, obtained from it a peculiar substance, which he proposes to call *panaquilon*, and gives the formula, $C_{12}H_{25}O_9$. To prepare it he heats a cold infusion so as to separate the albumen, filters, concentrates to a syrupy consistence, precipitates by a concentrated solution of sulphate of sodium, washes the precipitate thoroughly with the saline solution, and then treats it with alcohol, which dissolves the principle in question, and yields it on evaporation. To purify it, he dissolves it in water, treats the solution with animal charcoal, again evaporates, and dissolves the residue in absolute alcohol, which is finally distilled off. Panaquilon is an amorphous yellow powder, soluble in water and alcohol, but not in ether, of a sweet bitterish taste, and has the characteristic property that, when treated with strong acids, it is converted into a white substance, insoluble in water, with the escape of carbonic acid and water. Mr. Garrigues proposes for this white substance the name of *panacon*, $C_{11}H_{19}O_4$. (*A. J. P.*, xxvi. 511.) The root is sometimes submitted, before being dried, to a process of clarification, which renders it translucent and horny, and enhances its value as an article of export. The extraordinary medical virtues formerly ascribed to ginseng had no other existence than in the imagination of the Chinese. It is little more than a demulcent, and in this country is not employed as a medicine. Some persons, however, are in the habit of chewing it, having acquired a relish for its taste; and it is chiefly to supply the wants of these that it is kept in the shops.

PANCREATIC EMULSION. As it is generally admitted that among the offices of the pancreatic juice is that of emulsionizing fatty matters that may pass through the stomach undigested, so as to facilitate their absorption, it would appear highly probable that this secretion might prove useful in cases in which fats are digested with difficulty if at all. Dr. Horace Dobell, physician to the "Royal Infirmary for Diseases of the Chest," having noticed that consumptive patients are very apt to have a dislike for fat, and thinking that this dislike might result from an inability to digest this kind of food, reasonably inferred that the pancreatic secretion might prove useful in these cases by supplying the wanted power. He was, therefore, induced to treat a series of consumptive cases of this kind with the pancreatic juice of the pig, which he gave in the form of emulsion with the fat of beef stirred in milk. His expectations were confirmed by the results. The great majority of cases were improved by the remedy, which he now confidently recommends. The preparations which he prefers are pancreatic emulsions of cod-liver and lard oils. In this connection, the pancreatic juice remains sound for a long time; though, unmixed with fat, the juice speedily undergoes decomposition. The emulsion with cod-liver oil, as prepared by Messrs. Savory and Moore, of London, has the appearance of a white paste, and the consistence of thick clotted cream. The dose is from one to three teaspoonfuls, once or twice daily, in a cup of milk, to which a little brandy may be added. (See *A. J. P.*, 1866, p. 143; from *The Chemist and Druggist*, Jan. 15, 1866.) The name of *pancreatine* has been conferred on the pancreatic juice itself, which was brought to the notice of medical men, by Dr. G. Harley, so early as 1858, "as uniting in itself the properties of all the digestive fluids." Mr. R. V. Mattison prepares a "*Saccharated pancreatine*" as follows. Macerate the cut-up pancreas in water acidulated with hydrochloric acid for 48 hours; filter till clear. Add a saturated solution of chloride of sodium, and allow to stand until pancreatine rises to the top; skim this, drain on a muslin filter, wash with a less concentrated solution of salt, and press until nearly dry; then rub up with sugar of milk, dry thoroughly, without heat, and dilute with sugar of milk until 10 grains just emulsify two drachms of cod-liver oil. Saccharated pancreatine is a white powder soluble in between five and six parts of water. Mr. Mattison also proposes an *elixir of pancreatine* prepared directly from the glands, by macerating in acidulated water, straining, adding glycerin, and flavoring with oil of orange. (*A. J. P.*, iii., iv.) Defresne claims to prepare a pancreatine composed of three very active ferments, *myopsine*, capable of digesting 104 times its weight of dry albumen, but not acting upon fat or starch; *steapsine*, able to break up 24 times its weight of fat, but not influencing starch or albumen; and *amylopsine*, which will convert into sugar 25 times its weight of starch. (*P. J. Tr.*, ix. 223.) Pancreatine has been used to a considerable extent as a substitute for pepsin, and in the same dose. It does not, however, rapidly advance in professional favor.

PAO-PEREIRA BARK. Under this name a bark is employed in Brazil as a febrifuge. It is supposed to be the product of *Geissospermum læve*, or of *G. Vellosii*. O. Hesse has found an alkaloid, *geissospermine*, in it (see *P. J. Tr.*, viii. 648), but he seems to have been preceded in this discovery by Santos. (*A. J. P.*, 1878, p. 184.)

PAPAYA. The *Carica papaya* (*Nat. Ord.* Passifloreæ) is an herbaceous tree, everywhere cultivated in tropical countries for the sake of its fruit, which ranks next to the banana in importance. The tree is both diœcious and hermaphrodite, reaches a height of about 20 feet, with a cylindrical stem 12 to 20 inches in diameter, a smooth gray bark, and a shield-like crown of leaves. The fruit in the best varieties attains a size larger than that of a man's head. According to M. Peckolt (*P. J. Tr.*, Nov. 1879), the milky juice is contained in all parts of the tree, but in such small quantity, save in the unripe fruit, that it is always procured from the latter. One fruit will yield about 33 Gm., which is obtained by scratching through the skin in various places; the process does not interfere with the ripening of the fruit, but it is said that the seeds will not germinate. The milk has an acid reaction, an astringent bitterish taste, a sp. gr. of 1·023. Upon standing for a few minutes it separates into two parts, a watery liquid, and a white, as it were coagulated, pulpy mass. In the watery portion is an albuminous substance, to which the name of *papäin* has been given. It is precipitated by alcohol, and, according to M. Wurtz, has not a definite constitution (*Comptes-Rendus*, Aug. 1879), but contains as much as 10·6 per cent. of nitrogen. In Dr. T. Peckolt's analysis, 100 parts of juice yielded 5·303 parts of papäin, 4·5 parts of caoutchouc-like substance, besides two resins, fatty materials, malic acid, extractive matter, etc. Various carnivorous plants, such as our ordinary Sarracenia, have the power of dissolving animal flesh, by virtue, apparently, of their secreting a pepsin-like ferment. Papäin is undoubtedly of this nature. M. Wurtz found that, purified by repeated precipitation from its watery solution, 0·1 Gm. of papäin in alkaline solution at a temperature of 40° C. dissolved in twenty-four hours 17·5 Gm. of moist fibrin. By further study M. Wurtz proved that the fibrin was formed into a peptone. It is noteworthy that the fibrin is dissolved, whether the solvent solution be of an alkaline or an acid reaction.

Papaya juice has a tendency to spoil by undergoing a butyric fermentation, but M. Wurtz found that the addition of glycerin to it preserved it without interfering with its digestive power. Imported in this form, it was a thick milky liquid, which first coagulated milk and then dissolved the casein, and attacked rapidly meat, false membranes, ascarides, etc. M. Peckolt affirms that juice to which glycerin has been added yields a pure and more abundant precipitate of the ferment. It is stated that from time immemorial the fresh leaves of the plant have been used by the Indians to wrap meat in to make it tender, and as a dressing to foul wounds. M. Peckolt says that, taken internally, the juice is reputed to cause intestinal inflammation, so that it is yet doubtful whether the ferment is capable of being used in practical medicine as a substitute for pepsin, since it is possible that its digestive powers may be exerted upon the mucous membrane as well as upon the contents of the gastro-intestinal tract.

PARIETARIA OFFICINALIS. *Wall Pellitory.* A perennial European herb, growing on old walls and heaps of rubbish. It is inodorous, has an herbaceous, somewhat rough and saline taste, and contains nitre derived from the walls where it flourishes. It is diuretic and refrigerant, and is said also, but without good reason, to be demulcent and emollient. The ancients employed it in various complaints, and it is still considerably used on the Continent of Europe, especially in domestic practice. It is given in complaints of the urinary passages, dropsy, and febrile affections, usually in the form of decoction. The expressed juice is also used, and the fresh plant is applied in the shape of a cataplasm to painful tumors.

PARTHENIUM INTEGRIFOLIUM. *Prairie Dock.* This is an herbaceous perennial, growing abundantly in the prairies of our Southwestern States. Two ounces of the intensely bitter flowering tops, given in the form of infusion, are thought by Dr. M. Houlton to be equivalent to twenty grains of sulphate of quinine as an antiperiodic.

PATENT YELLOW. *Mineral Yellow.* A pigment, consisting of chloride combined with monoxide of lead. It is prepared by mixing common salt and litharge with a sufficient quantity of water, allowing the mixture to stand for some time, then washing out the liberated soda, and exposing the white residue to heat.

PEACH LEAVES. *Leaves of Amygdalus Persica.* (Willd. *Sp. Plant.* ii. 982. *Persica vulgaris.* Miller, Lamarck.) The peach-tree is supposed to have been originally brought from Persia, but flourishes everywhere in the warm temperate zone. Peaches are among the most grateful and wholesome of our summer fruits. They abound in saccharine matter, which renders their juices susceptible of the vinous fermentation, and a distilled liquor prepared from them has been much used, in some parts of the country, under the name of *peach brandy.* The kernels of the fruit resemble, physically and chemically, bitter almonds, for which they are frequently, and without inconvenience, substituted in our shops. The flowers, leaves, and bark also have the peculiar odor and taste of bitter almonds, and yield hydrocyanic acid. The leaves afford a volatile oil by distillation. The distilled water prepared from them was found in one instance to contain 1·407 parts of hydrocyanic acid in 1000, and in another only 0·437 parts in the same quantity. From some experiments it is inferred that the proportion of acid is greatest where there is least fruit. (*A. J. P.*, xxiv. 172.)

Medical Properties. Peach leaves are said to be laxative; and they probably exert, to a moderate extent, a sedative influence over the nervous system. They have been used as an anthelmintic with great reported success. More recently their infusion has been recommended in irritability of the bladder, in sick stomach, and in hooping-cough. Half an ounce of the dried leaves may be infused in a pint of boiling water, and half a fluid-ounce given for a dose three times a day, or more frequently. Dr. Dougos gives, in hooping-cough, a pint of the strong infusion, in small doses, in the course of the day. (*Journ. de Pharm.*, xxiii. 356.) The flowers are also laxative; and a syrup prepared from them is considerably used, in infantile cases, upon the Continent of Europe. Woodville states that a drachm of the dried flowers, or half an ounce in their recent state, given in infusion, is the dose as a vermifuge. Cases of fatal poisoning from their use in children are on record. The kernels have more of the peculiar powers of hydrocyanic acid, and therefore require to be used with some caution. Blanched, and rubbed up with cold water, they form an emulsion well adapted to coughs depending on or associated with nervous irritation. The bruised leaves, flowers, or kernels are sometimes used by pharmacists for cleansing vessels from disagreeable odors. The dried fruit, stewed with sugar, is an excellent laxative article of diet, suitable to cases of convalescence attended with torpid bowels.

PEARL WHITE. *Pearl Powder.* This is subnitrate of bismuth, prepared for cosmetic use.

PELARGONIUM ODORATISSIMUM. *Rose Geranium.* This well-known plant, so much a favorite for its odor in our dwellings and conservatories, is a native of the Cape of Good Hope, but is said to be cultivated extensively in the south of France and in Turkey for the sake of its volatile oil, which is much employed for the adulteration of the oil of roses. According to Guibourt, three species of Pelargonium yield a volatile oil by distillation, closely analogous in smell to that of the rose; the species above named, and *P. capitatum* and *P. roseum.* (*Hist. Nat. des Drogues*, 4e ed., iii. 52.) The oil is obtained from the leaves. M. Recluz obtained from 35 ounces of *P. odoratissimum* two drachms of a volatile, crystallizable oil. (Méret and De Lens, *Dict. de Mat. Méd.*, iii. 368.) According to Septimus Piesse, 1 cwt. yields about two ounces. (See *A. J. P.*, xxvi. 368.) The oil which occurs in commerce, purporting to be the oil of *P. odoratissimum*, is perfectly fluid at ordinary temperatures, of a pale brownish yellow color, and the characteristic smell of the plant, recalling merely that of the rose. Pelargonic acid, $C_9H_{18}O_2$, was first obtained from the oil of *P. roseum*, which is probably the same as that under consideration, by Pless (*Ann. Ch. und Phar.*, 5, 54). This oil is now much used in perfumery, and, dissolved in alcohol in the proportion of three ounces to the gallon, forms the preparation called "*extract of rose-leaf geranium.*" Mr. Piesse states that, as this oil is used to adulterate that of roses, so is it in its turn adulterated with the cheaper oil of *Andropagon nardus*, cultivated in the Moluccas. (*A. J. P.*, xxvi. 368.) Jaillard states that the true oil of rose geranium from *P. roseum* is freely soluble in 70 per cent. alcohol. The oils likely to be used to adulterate it are insoluble in this liquid. If, therefore, six drops of the suspected oil is mixed with five C.c. of 70 per cent. alcohol, there should be no separation. (*A. J. P.*, 1878, p. 260; from *Journ. de Pharm. et de Chim*)

PERCHLORATE OF POTASSIUM. *Hyperchlorate of Potassium.* ($KClO_4$.) This salt is prepared by fusing chlorate of potassium until it begins to assume a pasty condition. The cooled mass consists of perchlorate and chloride of potassium. The absence of undecomposed chlorate may be known by a sample failing to communicate a yellow color to hydrochloric acid. The mass must be dissolved in the smallest possible quantity of boiling water, when perchlorate crystallizes out. It is sparingly soluble in water, and insoluble in alcohol. It has been examined remedially by M. Rabuteau. The following are his conclusions. 1. Introduced into the system in the quantity of five grammes (77 grains), it is eliminated in 36 or 48 hours, without having undergone any change of composition. Its effects are wholly different from those of the chlorate of potassium. 2. It appears to be useful in intermittents, and, if it prove in fact to have antiperiodic powers, it will be preferable to quinine in pernicious fever, from the rapidity of its action. 3. Arsenic diminishes the urea discharged much more than has been supposed; neither sulphate of quinine nor perchlorate of potassium has this effect unless long administered. 4. From the properties it possesses, M. Rabuteau thinks it applicable to all diseases in which quinine and nitre are used for their sedative or diuretic properties. (*Ann. de Thérap.*, 1869, p. 141.)

PEROXIDE OF HYDROGEN. *Oxygenized Water.* (H_2O_2.) This substance, though long known to chemists, has but recently been brought into notice as a remedy. It consists of water in which, by the presenting to it of oxygen in a nascent state, an additional atom of this element has combined with the hydrogen, forming the dioxide, $(HO)_2$ or H_2O_2. It was discovered by Thenard in 1818. To prepare it, peroxide of barium, BaO_2, is rubbed with distilled water so as to form a liquid paste, which is added gradually, with constant stirring, to distilled water acidulated with one-third of its weight of hydrochloric acid, contained in a vessel immersed in a freezing mixture, when the following reaction takes place: $BaO_2 + 2HCl = BaCl_2 + H_2O_2$. When the hydrochloric acid is saturated, a fresh quantity of the acid in a concentrated state is added, and then more of the peroxide of barium; and the operation is repeated till the solution will hold no more chloride of barium. It is then immersed in a mixture of ice and salt, and the greater part of the chloride of barium is deposited. The portion remaining in solution may be got rid of by the cautious addition of sulphate of silver, which precipitates sulphate of barium and chloride of silver. The liquid, being now filtered, is concentrated by exposing it in vacuo in a shallow vessel placed over another containing sulphuric acid. The water rises in vapor which is absorbed by the acid, and at last the peroxide of hydrogen is left nearly pure. (*Regnault.*) Thus procured, it is a colorless liquid of a fluid consistence, of the sp. gr. 1·452, remaining liquid at zero, beginning to give out oxygen when heated above 15·5° C. (60° F.), and at a higher heat rapidly and sometimes explosively resolved into water and oxygen. But when diluted with water, with which it unites in all proportions, it is not decomposed under 37·7° C. (100° F.). The great facility with which it parts with oxygen renders it a powerful oxidizer; and the simple contact with various substances, as platinum, gold, and silver, causes it to be resolved into oxygen and water. On the contrary, certain other substances, even though ordinarily evincing a strong affinity for oxygen, as phosphorus, for example, are unaffected by it, and there are a large number of bodies, as ammonia, hydrocyanic acid, tobacco, aconite, and most other narcotic substances, which have the property not only of being unaffected by it, but of restraining its oxidizing influence on other bodies. Its relations to ozone are peculiar; and at one time it was conjectured that ozone was nothing else than peroxide of hydrogen. At present the oxygen in it is considered by some as in the positive state and called *antozone*, while *ozone* itself is oxygen in the negative state, and the two mixing produce oxygen in its ordinary state, or neutral oxygen. When this neutral condition of oxygen is disturbed, giving rise to the phenomena of ozone, antozone is also liberated. Hence, according to Schönbein, whenever, upon the contact of phosphorus with water, ozone appears, the water is found to contain peroxide of hydrogen. These facts may at some future time prove to have an important bearing on peroxide of oxygen as a physiological or remedial agent; but at present they may be left out of view in treating of it medicinally. It has been detected by M. Struvé, of St. Petersburg, in minute proportion, in the air of the atmosphere in Southern Russia. (*Chem. News*, July 2, 1869, p. 23.) Schönbein has made the same discovery in the vicinity of Basel, in Switzerland. In both instances it was found in the rain-water. (*Neues Repertorium*, 1869, xviii. 364.)

The profession is indebted to Dr. B. W. Richardson, of London, for most of what is known of the physiological operation and therapeutical effects of peroxide of hydrogen. In relation to its influence on organic bodies, Dr. Richardson found that to venous blood, deprived of its fibrin, it imparts oxygen, with an increase of heat, and a change of the color to red. Fibrin and cellular tissues cause it to evolve oxygen. Sugar and starch are decomposed by it, giving out carbonic acid. Albumen, gelatin, urea, and cutaneous tissue have no effect on it. Injected into the left cavities of the heart of an animal, it restores the irritability of that organ, but has an opposite effect in the right cavities. Thrown into the arteries, immediately after death, it restores for a time the contractile power of the muscles, and suspends cadaveric rigidity, while it counteracts the influence of various medicinal substances that cause muscular spasm. Dr. Richardson inferred from his experiments that the peroxide might be found useful as an antidote to the narcotic poisons, as a local application to gangrenous ulcers, and as an internal remedy in low forms of fever. Subsequently, from numerous therapeutical trials of the remedy, he came to the conclusion that it is of great value in chronic and subacute rheumatism; acts in the removal of scrofulous tumors like iodine; relieves the paroxysms of hooping-cough, and cuts short the disease more effectually than any other medicine; affords great relief in chronic bronchitis with dyspnœa; and, in phthisis, operates favorably in the early stage by improving digestion and giving increased activity to chalybeate remedies, while in the advanced stages it afforded great relief to the dyspnœa and oppression, acting, indeed, in this respect like opium, without its narcotic effects. In general, it seemed to him to improve digestion, and therefore to be useful in cases complicated with dyspepsia. Sometimes, when freely employed, it produced profuse salivation, suggesting the idea that it might in other respects resemble mercury, and possibly be found capable of replacing this remedy to a certain extent in the treatment of disease. Dr. Richardson recommends that a solution of the peroxide should be used charged with ten volumes of oxygen, the dose of which may be from one to four fluidrachms, freely diluted with water. There are so many substances which decompose the peroxide, that, as a general rule, it is best given without addition; at least nothing should be allowed to remain long in contact with it. There can be no difficulty in obtaining the desired strength of ten volumes of oxygen to one of the solution, by estimating the quantity of oxygen contained in the peroxide of barium employed in the process. (See *Lancet*, Oct. 20, 1860, and April 12, 1862.)

Ozonic ether is a name proposed for a solution of peroxide of hydrogen in ether, which was first noticed by Dr. Richardson. Ether will take a portion of the peroxide from its watery solution, forming a compound of considerable stability, as it has borne a voyage to Australia without change. Dr. Richardson recommends it for diffusion in the state of spray in the sick chamber, as it has great purifying power. Care, however, must be taken to guard against the consequences of its extreme inflammability. (See *A. J. P.*, 1869, p. 156.) But ozonic ether owes the reputation which it has so suddenly acquired to its supposed efficacy in the treatment of diabetes. In a letter by Dr. John Day, dated Australia, August, 1867, and published in the *Lancet* (Jan. 11, 1868), an account is given of an apparently quite desperate case of that disease, in which he was induced to give the ethereal solution of the peroxide of hydrogen, by the hope of oxidizing the sugar in the circulation, and thus causing its elimination through the lungs instead of the kidneys. He gave half a drachm of the solution, mixed with an ounce of distilled water, three times a day. The effect was most striking. The quantity of urine discharged rapidly decreased to the normal standard, its sp. gr. diminished at the same time, the thirst disappeared, and the patient, who was a woman, appeared to have been snatched from the brink of the grave. In less than a month, she had so far improved that she considered herself quite well, though there was probably still sugar in the urine. The case of a man was afterwards described, in a letter from Mr. S. J. Bayfield of London, to the *Med. Times and Gaz.* (1868, p. 404), in which a cure was effected under the use of the medicine as employed in the case of Dr. Day. Experience thus far would seem to be greatly in favor of the remedy; but among the first therapeutic experiments of Dr. Richardson with peroxide of hydrogen had been its use in diabetes, in which, though it appeared to have considerable effect in diminishing the discharge of urine and the secretion of sugar, it had shown no power of arresting the course of the disease, which, so far as traced to its results, had proved uniformly fatal. (*Med. Times and Gaz.*, 1868, p. 662.) Dr. Pavy, also, who tried it in a few cases, failed to get any advantage from its use. (*On Diabetes*, 2d ed., p. 268.) Dr. John Day believes that the efficacy of iodide of potassium in chronic syphilis is much increased by the exhibition of peroxide of hydrogen shortly after each dose of the iodide. He thinks that the iodide is in this way liberated in the blood. (*Med. Times and Gaz.*, 1871, p. 569.)

Locally employed, peroxide of hydrogen sometimes acts very beneficially, especially in feeble, flabby, or ill-conditioned ulcers, in chancre and diphtheritic sores, in all of which it operates, not as a corrosive substance, but probably by imparting oxygen to the diseased tissues, and thus destroying them.

PETROLEUM. *Rock Oil.* This was recognized by the late London and Edinburgh Colleges, but has been omitted in the British Pharmacopœia, and, as it holds no place in that of the United States, takes rank among the extra-officinal medicines. Petroleum is a native mixture of hydrocarbons with very small amounts of oxidation or alteration products admixed. The hydrocarbons may be gaseous, liquid, or solid, and in crude oil, fresh from the wells, all three classes are present. The hydrocarbons belong to several of the homologous series known to organic chemistry. The researches of Pelouze and Cahours, of Warren, and more especially of Schorlemmer, have established the presence of the paraffin series, CnH_2n+_2, beginning at marsh-gas and continuing through the liquid members, which constitute the bulk of the oil, to the solid hydrocarbons known commercially as "paraffin"; of the olefine series, CnH_2n; and of the benzol series, CnH_2n-_6. After the oil has been heated, as in distillation, pyrogenic products form, so that in the residues of petroleum distillation naphthalene, anthracene, and other higher hydrocarbons have been detected. In Caucasian petroleum, Beilstein and Kurbatow (*A. J. P.*, 1880, p. 612) have also found another homologous series of hydrocarbons, *hexahydrobenzol*, C_6H_{12}, and its homologues.

Pennsylvania petroleum consists, however, chiefly of paraffins, and the individual hydrocarbon making the bulk of illuminating oil is *heptane*, C_7H_{16}. The oxidation products accompanying petroleum constitute only a small fraction of one per cent. usually, and have not been studied chemically. Prolonged atmospheric exposure may, however, cause a petroleum to thicken, at least superficially. In this way the semi-solid deposits of California are explained, as well as Rangoon tar and Trinidad pitch or bitumen. When the bitumen is in the solid state it is called *asphaltum*. This is black, dry, friable, and soluble in water or alcohol. Not unfrequently asphaltum exists in nature mixed with more or less of the liquid substance; and this semi-solid mixture is distinguished by the name of *maltha* or *mineral tar*.

Petroleum has been known from the earliest historical period. Herodotus refers to wells of it existing in Zante, and from time immemorial it has been known in Persia, where it was probably connected with the origin and ceremonies of fire-worship. Until the discoveries of Pennsylvania petroleum, the best-known sources of it were the borders of the Caspian Sea in Persia, at Amiano in Italy, at Gabian in France, the island of Trinidad in the West Indies, and in the Burman Empire near Rangoon, where vast quantities have been annually raised for many centuries, without any apparent exhaustion of the wells from which it is drawn. Within the limits of the United States it has long been known to exist in a few localities. On the borders of Seneca Lake in the State of New York, small quantities of it were collected, and to some extent used in medicine under the name of Seneca oil. In Western Pennsylvania, on Duck Creek in Ohio, near Scottsville in Kentucky, and on the Kanawha in Virginia, it attracted local attention; and a certain locality in Western Canada had acquired some notoriety by its burning spring. But little attention was paid to it until about twenty-three years since; when, the preparation of oil for burning, distilled from bituminous shales, having proved very profitable, and a strong resemblance having been proved to exist between this and petroleum, enterprise was directed towards some of the known sources of the latter liquid, and, being greatly stimulated by success, soon led to further and astonishing discoveries. Hitherto the most productive locality of petroleum has been in Western Pennsylvania; but it has been found to exist in great quantities elsewhere, and in fact occupies large portions of a region commencing in Western Canada, and extending, through New York and Pennsylvania, westward into Ohio and Kentucky, and far southward into Western Virginia. From later accounts it appears that petroleum exists also abundantly in California, although, as before stated, of a thicker quality.

In the early days of the petroleum discovery the oil was gathered as it floated on the surface of the water in springs or small streams. In 1859 the first oil well, the *Drake* well, was sunk near Titusville, Pa., and the oil-bearing strata were reached at a depth of 71 feet, with the result of some 8 barrels per day. In 1861 and 1862 the first large flowing wells were struck in drilling for oil. The explanation of these flowing wells is simply that in new territory the gaseous hydrocarbons have accumulated with the liquid oil in such amount that they exert an enormous pressure, causing a flow of oil at the rate of two, three, and in one case as high as five thousand barrels per day. At the present time, a fresh district has been opened in Warren Co., Pa., and four large flowing wells are together pouring forth some 6000 to 7000 barrels of oil daily. Often, however, the pent-up gas escapes with enormous force without any accompanying oil. These "gas wells," as they are termed, are well known throughout the oil regions. Prof. Sadtler has analyzed numerous samples of this natural gas, and finds it to consist chiefly of methane and its homologues, with traces of the olefines and of carbon monoxide. In one case free hydrogen was present. (*Proc. Amer. Philos. Soc.*, xvi. 585, 1877.) After a well has flowed oil for a time, it will continue to yield, on pumping. Indeed, many smaller wells never have flowed, and have to be pumped from the start. In some districts "torpedoing" with nitroglycerin has been largely resorted to after a well has begun to decline in power, in order to increase the flow. The explosion effects this by shattering the sandstone and pebble conglomerate which holds the oil, so that new channels are opened.

Oil wells are of various depths. The first or Drake well, as stated, was only 71 feet deep, while in Butler County the fourth sand-rock was reached only at a depth of from 1500 to 1800 feet.

There are two theories as to the origin of petroleum. According to one, it is simply a product of distillation from the bituminous shales which underlie almost the whole of this oil-producing country. The gas and the liquid oil are equally products of this distillation. According to the other it represents the decomposition of marine plants and possibly animal life which accumulated in these sand-rock formations. These decomposition products may have also been in part subjected to distillation.

Crude petroleum is occasionally of a clear color when taken from the earth, but is generally of a greenish color, appearing claret-red by transmitted light. The green color may, however, become so dark as to be almost black. In gravity it varies from 0·865 to 0·777, or from 32·5° to 52° Baumé.

The enormous production of crude petroleum in the last twenty-five years has had the effect of developing a variety of new industries connected with the working or shipping of it. The whole producing area of Western Pennsylvania is now covered with a network of wrought-iron pipes, for the conveyance of the oil; and these "pipe lines" have even extended to the sea-board in two cases, so that crude oil is pumped from the vicinity of the wells to the sea-board cities to be refined there or to be exported in bulk. The refining of crude oil, and the working up of the several liquid and solid products that are known commercially, are also immense industries. The following figures show the quantities of petroleum and petroleum products exported during the year 1881. This is, of course, independent of the amount used in home consumption. Crude oil exported, 40,430,108 gal.; value, $3,089,297; naphthas exported, 20,655,116 gal.; value, $1,981,197; illuminating oil exported, 444,655,615 gal.; value, $42,122,683; lubricating oils exported, 5,053,862 gal.; value, $1,165,605; residuum exported, 3,756,018 gal.; value, $197,321; total exported, 514,550,719 gal.; value, $48,556,103.

Barbadoes petroleum is a black, nearly opaque, inflammable liquid, of the consistence of molasses, unctuous to the touch, and possessing a bituminous taste, and a strong and tenacious odor. Its sp. gr. varies from 0·730 to 0·878. When subjected to distillation it yields naphtha, and leaves a solid residue of asphaltum. It is little affected by alcohol, acids, or alkalies, but dissolves in ether and in the fixed and volatile oils. It consists chiefly of carbon and hydrogen, associated with a little nitrogen and oxygen. *Rangoon petroleum*, also called *Rangoon tar* and *Burmese naphtha*, has a greenish brown color, a peculiar, rather fragrant odor, and the consistence of goose-fat. It is lighter than water. Heated to 32·2° C. (90° F.) it becomes a very mobile liquid. By distilling it in a current of steam, first at 100° C. (212° F.), and afterwards super-heated, Drs. W. de la Rue and H. Müller obtained 96 per cent. of volatile products, solid and liquid.

The solid product (*paraffin*) amounted to from 10 to 11 per cent. The liquid product, usually called naphtha, is separable by sulphuric and nitric acids into two series of hydrocarbons; one series removable by these acids, the other resisting their action. The former series contain fewer atoms of hydrogen than of carbon, and embrace, among other hydrocarbons, berzol and toluol. The latter, which form by far the larger portion of the liquid product, are perfectly colorless, almost inodorous, very mobile liquids, not congealable by intense cold. They belong to the paraffin series, and have the general formula $CnH_2n + {}_2$.

The method of purifying petroleum is analogous to that already described for purifying coal tar. The crude oil is put into large retorts of wrought iron and exposed to a heat rising gradually to between 315·5° C. (600° F.) and 426·6° C. (800° F.), by which all the volatile ingredients are distilled, leaving 10 or 12 per cent. of solid residue, constituting a sort of coke. The liquids thus obtained are comparatively colorless, though still retaining the strong odor of the crude oil. The several fractions are caught separately, and are of very different gravities and volatility, adapting them for different uses. An average result of distillation may be stated as follows: Gasoline 1½ per cent., refined naphtha 10 per cent., benzin 4 per cent., refined petroleum or kerosene 55 per cent., lubricating oil 17½ per cent., paraffin 2 per cent., loss, gas, and coke 10 per cent. A crude distillate, however, would not be adapted for the purposes of an illuminating oil, so the distillate must be treated with acid. It is placed in the treating tank or "agitator" and one or two per cent. of strong sulphuric acid is added, when by the aid of an air-blast introduced below the whole is violently agitated. The acid combines with the impurities of the oil and forms a tarry substance, called the "sludge acid," which settles to the bottom, and after the whole has subsided is removed. The oil is then washed with water and again agitated, the process being repeated once or twice. It is then treated with caustic soda solution and again washed. The oil is now clear and almost colorless. It is then placed in large tanks covered with glass frames, where it is "bleached" by the aid of sunlight. It is sometimes atomized or sprayed in these tanks, and is thus brought to the desired fire-test. In most States of the Union the legal fire-test for illuminating oils is 110° F.; that is, it must not evolve inflammable vapors under this temperature of 110° F. Many special brands of illuminating oil have a much higher fire-test, as high even as 300° F.

Lubricating oils, on the other hand, are valued according to their "cold-test;" that is, they must not congeal except at very low temperatures. A lubricating oil, therefore, consists of the heavy liquid hydrocarbons of the paraffin and olefine series, but is free from the solid paraffin.

Medical Properties and Uses. Petroleum is accounted a stimulating antispasmodic, expectorant, and diaphoretic. In large quantities it may prove poisonous, as shown by a case recorded in the *Journ. de Pharm.* (Mars, 1869, p. 227), in which, after swallowing by mistake a quantity of rectified petroleum, a workman was seized almost immediately with violent inflammation of the throat, with colicky pain, and a desire to vomit, followed in an instant by a fearful tetanic seizure, and a general rigidity, attended with the most frightful cries. After a relaxation of ten minutes the symptoms returned with still greater violence; and life was probably saved only through the prompt action of the powerful emeto-cathartic medicines administered. It is occasionally given in disorders of the chest, when not attended with inflammation. In Germany it has been extolled as a remedy for tape-worm. Schwartz's formula in such cases was a mixture of one part of petroleum with one and a half parts of tincture of assafetida, of which forty drops were given three times a day. Externally, petroleum is employed in chilblains, chronic rheumatism, affections of the joints, paralysis, and diseases of the skin, and is said to be very effectual in psora and prurigo. (See *Petrolatum*, Part I.) It also affords a good antiseptic dressing for wounds. (*Med. Times and Gaz.*, 1870, p. 101.) It is an ingredient in the popular remedy called *British oil.* (See *note*, p. 1048.) The dose of Barbadoes petroleum is from thirty drops to a small teaspoonful, given in any convenient vehicle. Rangoon petroleum is probably more active, and should be given in a smaller dose. Crude petroleum is used to a considerable extent as an external application in domestic practice. It is light-colored, thinner in consistence, and less sapid and odorous than the Barbadoes petroleum, and probably contains more naphtha. The finer kinds of petroleum, called naphtha, have been used with advantage in epidemic cholera by Dr. Andreosky, of the Russian army, by M. Cloquet, physician to the Shah of Persia, and by M. Moretin, of France. They gave from ten to twenty drops in half a glass of white wine or mint-water. It is affirmed that many cases of asthma are much benefited by inhaling petroleum vapors.

PHLORIZIN. *Phloridzin. Phlorrhizin.* ($C_{21}H_{24}O_{10}$.) This is a bitter principle, discovered by Dr. Konink, of Germany, in the bark of the apple, pear, cherry, and plum trees. It is most abundant in the bark of the root, and derived its name from this circumstance (from two Greek words *ϑλοιός*, bark, and *ῥίζα*, a root). It is light, white, crystallizable in silky needles, of a bitter taste, soluble in about 1000 parts of cold and in all proportions in boiling water, very soluble in alcohol and methylic alcohol, scarcely soluble in ether cold or hot, dissolved without change by solutions of the alkalies, deprived of its water of crystallization at 100° C. (212° F.), and fusible at a somewhat higher temperature. The ammoniacal solution becomes red on exposure to the air on account of the formation of phloridzëin, $C_{21}H_{30}N_2O_{13}$. It is without acid or alkaline reaction, and belongs to the class of glucosides. When heated with dilute hydrochloric or sulphuric acid, it is converted into sugar and a peculiar substance called *phloretin*, $C_{15}H_{14}O_5$. (See *Chem. Gaz.*, viii. 392.) To obtain it, the fresh bark of the root of the apple-tree should be selected, as the dried bark is said to contain it in much smaller proportion. The bark is to be boiled for an hour or two successively in two separate portions of water, each sufficient to cover it, and the decoction set aside. At the end of thirty hours they will have deposited a considerable quantity of colored phlorizin, which may be purified by boiling for a few minutes with distilled water and animal charcoal, filtering, repeating this process two or three times, and then allowing the solution to cool slowly. The phlorizin is deposited in the crystalline state. An additional quantity may be obtained by evaporating the decoction to one-fifth of its bulk, allowing it to cool, and purifying the substance deposited in the same manner as before. Rochleder states that the leaves contain a principle, *isophlorizin*, isomeric with phlorizin.

Phlorizin is said to possess the anti-intermittent property in a high degree, and to have proved successful where quinine had failed. It was employed by Dr. Konink in the dose of 10 or 15 grains, and effected cures in several cases of intermittent fever. Dr. De Ricci recommends it very strongly as a tonic in the dyspepsia of delicate females, in the debility of children requiring a supporting treatment, and in all cases in which quinine is indicated but is not well borne. He has never known it to disagree with patients in the dose of 10 grains three or four times a day. As a tonic, 5 grains of it may be given at a dose. Though nearly insoluble in water alone, it may be readily exhibited in solution by adding to the water a few drops of spirit of ammonia. (*Dub. Quart. Journ.*, Aug. 1862.)

PHOSPHATE OF POTASSIUM. *Potassii Phosphas.* (K_2HPO_4.) The phosphate of potassium, which has of late come into use as a medicine, is the dipotassic orthophosphate, having a composition precisely analogous to that of the medicinal phosphates of sodium and ammonium. It may be formed precisely as phosphate of sodium is prepared; or by saturating, by means of carbonate of potassium, common or orthophosphoric acid, H_3PO_4. The medicinal phosphate of potassium is a white, amorphous, deliquescent salt, crystallizing with difficulty. It has been given as an alterative in scrofula and phthisis, and in some other diseases, with supposed advantage. The dose is from ten to thirty grains three times a day, dissolved in a tablespoonful of water.

PHOSPHATE OF ZINC. *Zinci Phosphas.* ($Zn_3P_2O_8,2H_2O$.) Dr. Barnes, of London, has brought forward this salt of zinc as having special advantages over other salts of the same metal in the treatment of nervous diseases. The theoretical ground of preference is that in diseases of the brain there is apt to be a waste of phosphorus in the cerebral substance, and the phosphoric acid offers the means of supplying the deficiency. Phosphate of zinc, or trizincic orthophosphate, may be prepared by the mutual reaction of sulphate of zinc and an alkaline phosphate. It is a white powder, insoluble in water but soluble in acids. Dr. Barnes has found it peculiarly useful in the insanity occurring in the convalescence from fevers, in which he associates it with quinine, and in epilepsy attended with disorder of the uterine functions. He also uses it preferably to the sulphate of zinc in the sweats of phthisis. He finds it less liable to disturb the stomach than the sulphate. It may be given in pill. or dissolved in water acidulated with phosphoric acid, in the dose of from one to three grains.

PHYSALIS ALKEKENGI. *Alkekengi. Common Winter Cherry.* A perennial herbaceous plant, belonging to the Solanaceæ, growing wild in the south of Europe, and cultivated in our gardens. The fruit is a round red berry, about as large as a cherry, enclosed in the calyx, and containing numerous flat kidney-shaped seeds. All parts of the plant are bitter, especially the leaves and the capsules enveloping the fruit. The berries are very juicy, and have an acidulous, bitterish taste. By drying they shrink, and become of a brownish red color. The bitter principle has been isolated by MM. Dessaignes and Chautard, and named by them *physalin.* It is obtained by agitating an infusion of the plant with chloroform, which extracts the bitter principle, and yields it by evaporation. To purify it, dissolve it in hot alcohol, add a little animal charcoal, filter, precipitate by water, and wash the precipitate with the same liquid. It is a light powder, white with a shade of yellow, of a taste slight at first, but in the end permanently bitter, very slightly soluble in cold water, somewhat more soluble in boiling water, and very soluble in alcohol and chloroform, especially with the aid of heat. Its composition is $C_{14}H_{16}O_5$. (*Journ. de Pharm.*, 3e sér., xxi. 24.) The berries are said to be aperient and diuretic, and have been recommended in suppression of urine, gravel, and other complaints of the urinary passages. M. Gendron recommends them very highly as a febrifuge. He thinks they are most effective when allowed to ripen and begin to dry on the stem. He usually administers about three drachms daily in two doses. (*Arch. Gén.*, xxiii. 536.) A French physician has published a pamphlet on gout, in which he strongly recommends alkekengi as more efficacious even than colchicum.

He takes the flowers and unripe fruit, dries and powders them, makes the powder into a paste with water and a little slaked lime, treats the mixture with boiling alcohol, and finally filters and evaporates the alcoholic liquid. The residue is given in the form of pill, made with solution of silicate of sodium and powdered *Teucrium Chamædrys.* Five or six of the pills are taken daily. (*Braithwaite's Retrospect*, Am. ed., No. 46, p. 214.) From six to twelve berries, or an ounce of the expressed juice, may be taken for a dose; and much larger quantities are not injurious. They are consumed to a considerable extent in some parts of Europe as food. The berries of the *Physalis viscosa*, of this country, are said by Clayton to be remarkably diuretic.

PICHURIM BEANS. *Sassafras Nuts.* The seeds of an uncertain tree growing in Brazil, Guiana, Venezuela, and other parts of South America. The tree has been supposed to be the *Ocotea Pichurim* of Kunth (*Laurus Pichurim*, Richard, *Aydendron Laurel*, Nees); but its position in either of these genera is denied by F. Nees von Esenbeck; and the plant is now referred to the genus Nectandra with the specific name *Puchury.* There appear to be two varieties of *Nectandra Puchury*, one bearing larger and the other smaller fruit, and distinguished as the *major* and *minor.* Professor Carson, of the University of Pennsylvania, had specimens of the fruit and other parts of the tree sent him, sufficient to verify the ascription of the pichurim beans to this source. (*A. J. P.*, xxvii. 385.) The beans are the kernels of the fruit separated into halves. They are ovate-oblong or elliptical, flat on one side, convex on the other, of a grayish brown color externally, chocolate-colored within, of an aromatic odor between that of nutmegs and sassafras, and of a spicy pungent taste. There are two kinds, one about an inch and a half long by half an inch in breadth, the other little more than half as large, rounder, and of a dark brown color. The former were said by Dr. Carson to come from Brazil, the latter from Venezuela, and may be severally the product of the varieties of the tree above referred to. (*Ibid.*, p. 387.) Bonastre has found them to contain a concrete volatile oil, a fatty matter of the consistence of butter, stearin, resin, brown coloring matter, fecula, gum, sugar, and lignin. Their virtues depend on the volatile oil. The buttery portion, known as "pichurim fat," contains *laurostearin*, $C_3H_5(C_{12}H_{23}O_2)_3$, and *pichurim camphor*, which, according to Gerhardt, is identical with laurel camphor. In *A. J. P.*, 1851, p. 1, Prof. Procter describes a liquid product brought from South America, known as "*the native oil of laurel* or *sassafras*," or "*aceyte de sassafras*," said to be obtained by making incisions in the trunk of a tree growing on the Orinoco. As described by Prof. Procter, it is an oleoresin, of the sp. gr. 0·898, of a light auburn color, a peculiar penetrating odor, and an aromatic, bitterish, pungent, and somewhat camphorous taste. On distillation, almost the whole passes over in the shape of a colorless volatile oil; a small proportion only of resinous matter being left behind. This oleoresin is conjectured to be the same as that employed for adulterating the copaiba exported from Maracaibo. It may be distinguished from copaiba by its ready solubility in alcohol of 0·838, and by the fact that its volatile oil is acted on by potassium. It is believed to be the same product as the "native oil of laurel" described by Pereira, which was obtained from Demerara, and by incisions in a large tree. Prof. Carson, on comparing it with a specimen of oil presented to him as obtained from the same tree with the fruit above mentioned, had no hesitation in considering them as identical, and, therefore, in referring the so-called native oil of laurel to *Nectandra Puchury.* Müller, by distilling the oil in contact with sulphuric acid, obtained a greenish yellow oil possessing the peculiar odor of the beans. By fractional distillation he separated—1, a colorless oil, boiling at 150° C. (302° F.); 2, a colorless oil, boiling between 165° C. (329° F.) and 170° C. (338° F.); both of these oils consist principally of a hydrocarbon, $C_{10}H_{16}$; 3, a greenish yellow viscid oil, boiling between 235° C. (455° F.) and 240° C. (464° F.), and having the composition $C_{33}H_{58}O_2$; 4, a deep blue oil, having a faint odor, boiling between 260° C. (500° F.) and 265° C. (509° F.). In medical properties the pichurim beans resemble the common aromatics, and may be employed for the same purposes. In South America they are said to be used as a substitute for nutmeg, and have even been called by that name. They are rare in this country. The oil obtained from the tree is said to impart its odor to the perspiration and urine, and to be useful in rheumatism, gout, etc. The bark is sometimes employed as a tonic and febrifuge.

PICRIC ACID. *Carbazotic Acid. Trinitrophenic Acid. Trinitrophenol.* ($C_6H_3(NO_2)_3O$.) This acid is obtained by the action of nitric acid on indigo, silk, salicin, aloes, benzoin, phlorizin, Australian gum, and other substances, or, as the name indicates, from phenol (carbolic acid). It may be cheaply prepared by adding coal-tar creasote (impure carbolic acid) gradually to strong nitric acid and heating, when, on standing, the picric acid will crystallize out; but in practice it is now almost always made by dissolving crystallized carbolic acid in strong sulphuric acid, and adding either nitric acid or sodium nitrate to the resultant sulphophenic acid. (Allen, *Commerc. Org. Anal.*, p. 327.) It is in pale yellow shining scales, soluble in water, to which it gives a strong yellow color and very bitter taste. Its salts crystallize readily, and explode when heated. The potassa salt is so sparingly soluble, that an alcoholic solution of the acid may be used as a test for this alkali. It is largely used in dyeing, producing magnificent yellow colors, and, in connection with indigo or Prussian blue, different shades of green. The salts which picric acid forms with potassa and soda are yellow and bitter; and it is in this state that the acid is often used in dyeing. It should be understood, however, that these salts are capable of exploding violently, at elevated temperatures or from a severe blow; and very fatal consequences occurred from such an explosion of a large quantity of picrate of potassium, in one of the magazines of Paris, in March, 1869. (*Journ. de Pharm.*, 1869, p. 247.) According to Mr. Galippe, picric acid affords one of the most sensitive known tests for albumen. He uses a saturated aqueous solution, putting it first into a test tube and dropping in the suspected urine. If albumen be present, a white line forms at the junction. (*Edinb. Med. Journ.*, 1873, p. 178.)

In large doses picric acid is poisonous; 10 grains of it having been sufficient to kill a dog in less than two hours. (*Taylor on Poisons*, p. 793.) It was first used in intermittent fever by Dr. Bell, of Manchester, and several practitioners have since claimed for it decided antiperiodic properties. More recent studies have, however, shown that the remedy is entirely unreliable. Anthelmintic powers have also been assigned to it, but Erb has proven that it is of no value in cases of tape-worm or in trichiniasis. (*Das Pikrinsäure*, Würzburg, 1865.) The most eligible form for administration is the salt of ammonia (picrate of ammonia), given in pill, in doses of a quarter to half a grain, three times a day. Mr. Aspland began with a grain three times a day, and increased to 4 grains for a dose. A curious effect of these salts, first observed by Dr. Moffat, is to produce, in many cases, a temporary yellowness of the skin and conjunctiva, as in jaundice. The effect is generally induced when about 15 grains of the acid have been taken. The urine also becomes orange-colored. The color disappears in two or three weeks after ceasing to use the medicine.

Picrate of iron may be prepared by digesting pure crystallized picric acid with an excess of recently precipitated ferric oxide and water at a gentle heat, till the acid has disappeared, filtering, and evaporating the filtrate at a temperature not exceeding 100° C. (212° F.). Thus prepared it is amorphous, reddish brown in mass, lighter colored in powder, of an astringent and intensely bitter and persistent taste, and readily soluble in water. On account of its bitterness, it is best given in pill. (See *A. J. P.*, 1863, p. 169.)

PICRORHIZA KUERVA. Under the name of *kali-kutki* a root has long been in use in India, which is stated to be the product of *Picrorhiza kuerva.* It is said to be a very valuable tonic, but has not yet found its way into European commerce. For an account of its physical properties, see *P. J. Tr.*, Dec. 1870, p. 502.

PIMPINELLA SAXIFRAGA. *Small Burnet Saxifrage. Saxifraga.* A perennial umbelliferous European plant, growing on sunny hills, and in dry meadows and pastures. The root has a strong, aromatic, yet unpleasant odor, and a sweetish, pungent, biting, aromatic, bitterish taste. Its active constituents are volatile oil and an acrid resin. It is considered diaphoretic, diuretic, and stomachic, and has been used in chronic catarrh, asthma, dropsy, amenorrhœa, etc. The dose in substance is about half a drachm, and in infusion two drachms. The root is used also as a local stimulant in toothache, etc.

PINCKNEYA PUBENS. Michaux. A large shrub or small tree, growing in South Carolina, Georgia, and Florida, in low and moist places along the sea-coast. It is closely allied, in botanical characters, to the Cinchonas, with which it was formerly ranked by some botanists. The bark is bitter, and has been used with advantage in intermittent fever.

PISCIDIA ERYTHRINA. *Jamaica Dogwood.* This is a leguminous tree growing throughout the West Indies, and yielding to commerce a very valuable wood. From time immemorial the bark has been used for catching fish. The leaves, twigs, and root-bark are collected, macerated with the residue from the distillation of rum or with lime-water, then transferred into baskets, and the latter dragged up and down the water until the active principle has been extracted and the fish are stupefied.

In 1844, Dr. William Hamilton called the attention of the profession to the plant (*P. J. Tr.*, Aug. 1844) as a powerful narcotic, capable of producing sleep and relieving pain in an extraordinary manner, and stated that in toothache a saturated tincture is exceedingly efficacious, not only affording relief when taken internally, but uniformly curing the pain when introduced upon a dossil of cotton into the carious tooth. Notwithstanding these statements, no attention was given to the subject until the enterprise of Parke, Davis & Co. recently brought it before the notice of the profession. The bark of the root as it appears in commerce is described as follows.

"The bark of commerce appears in pieces of two to four inches in length, and from one to two inches wide, and about one-eighth of an inch in thickness. The outer surface of some of the pieces is of a dark gray brown, while others are of a yellow brown, with no shade of gray present. The bark is frequently studded with flattened protuberances of a lighter color than the surrounding cork. The central part of the bark is much lighter colored, and, when wet or freshly broken, is of a peculiar blue-green color. The inner part of the bark is of a dark brown color, and very fibrous. It has a strong disagreeable odor of opium when broken into pieces. It is strongly acrimonious, and produces a burning sensation in the mouth and pharynx."

In all probability the active principle is an alkaloid, but we are not aware that this has as yet been obtained in a pure state. A resinoid, yellowish powder, separated by Mr. Nagle, has received the name of *piscedin.*

The action of the drug upon the lower animals has been studied by Drs. J. Ott and A. C. Nagle with similar results. (*Jamaica Dogwood*, Parke, Davis & Co., 1881.) The conclusions reached are—1. It is narcotic to frogs, rabbits, and men. 2. It does not affect the irritability of the motor nerves. 3. It does not attack the peripheral ends of the sensory nerves. 4. It reduces reflex action by a stimulant action on the centres of Setschenow. 5. It produces a tetanoid state by a stimulant action on the spinal cord, and not by a paralysis of Setschenow's centres. 6. It dilates the pupil, which dilatation passes into a state of contraction upon the supervention of asphyxia. 7. It is a salivator. 8. It increases the secretion of the skin. 9. It reduces the frequency of the pulse. 10. It increases arterial tension by stimulation of the vaso-motor centre. 11. This increase of pressure is soon succeeded by a fall, due to a weakening of the heart itself.

The exact practical value of the drug has not been determined, nor are the results produced in man by doses approaching toxic, known. Dr. Hamilton took a drachm, when laboring under severe toothache, on going to bed. He first felt a violent sensation of heat internally, which gradually extended to the surface, and was followed by profuse perspiration, with profound sleep for twelve hours. On awaking, he was quite free from pain, and without the unpleasant sensations which follow a dose of opium.

Various practitioners have reported good results from its use as an anodyne in neuralgia, nervous insomnia, hooping-cough, etc., but in other hands it has failed to do good. Dr. H. C. Wood has found it in one case of neuralgia to produce great nausea and gastric distress without evincing the slightest narcotic effect. The dose of the fluid extract is a drachm, to be carefully increased.

PLANTAGO MAJOR. *Plantain.* The leaves are saline, bitterish, and austere to the taste; the root saline and sweetish. The common plantain weed was formerly considered refrigerant, diuretic, deobstruent, and somewhat astringent. The ancients esteemed it highly in hemorrhages, particularly from the lungs, consumption, dysentery, etc., but it is at present never used, except it be externally in domestic practice as a stimulant application to sores. The leaves are put on whole or bruised in the form of a poultice. *Plantago media* and *P. lancifolia*, or *rib-grass*, which are also indigenous, possess properties similar to those of *P. major*, and may be used for the same purposes.

Semen psyllii are the seeds of several species of European Plantago. The best are those of *Plantago Psyllium*, or *fleawort*, which grows in the south of Europe and in Barbary. They are small, about a line long by half a line in breadth, convex on one side, concave on the other, flea-colored, shining, inodorous, and nearly tasteless, but mucilaginous when chewed. They are demulcent and emollient, and may be used internally and externally in the same manner as flaxseed, which they closely resemble in medical properties.

PLATINUM. The most useful salt of Platinum is the chloride, $PtCl_4 5H_2O$, which may be obtained by mixing an aqueous solution of chloroplatinic acid, H_2PtCl_6, with a solution of nitrate of silver: a precipitate containing the silver, combined with some platinum and chlorine, separates, and the yellowish red solution yields on evaporation fine large red crystals of chloride of platinum. The compound usually called platinum chloride is said by Roscoe and Schorlemmer to be chloroplatinic acid, $H_2PtCl_6,6H_2O$, and is made by dissolving the metal in nitro-hydrochloric acid, and evaporating with hydrochloric acid until all of the nitric acid is removed. In 1826, Prof. Gmelin, of Tübingen, made experiments to determine the action of this metal on the economy. In 1841, Dr. Ferdinand Hoefer published some observations on the same subject. The latter experimented chiefly with the chloride, formerly called bichloride, and the double chloride of platinum and sodium. They are both poisonous; the chloride in the dose of 15 grains, the double chloride in that of 30 grains. When a concentrated solution of the chloride is applied to the skin, it produces violent itching, followed by an eruption. Administered internally it irritates the mucous membrane of the stomach and occasions headache. The double chloride has no action when externally applied, and, when given internally, operates on the system in a less sensible manner than the chloride. It possesses the power of augmenting the urine. Dr. Hoefer ranks the preparations of platinum with the alteratives, by the side of those of iodine, arsenic, and gold. He considers them particularly suited to the treatment of syphilitic diseases; the chloride to cases of long standing and inveterate, the double chloride to those which are recent. The dose of the chloride is from half a grain to two grains twice a day, given in pill. Eight grains may be made into sixteen pills, with a drachm of the extract of guaiacum wood of the French Codex, and sufficient powdered liquorice root. Of these, one, two, or three may be taken morning and evening. The double chloride may be prepared by dissolving five grains of the chloride and eight of pure chloride of sodium in seven fluidounces of gum-water; and the whole may be taken by tablespoonfuls in the course of twenty-four hours. For frictions on indolent ulcers, Dr. Hoefer used an ointment composed of sixteen grains of the chloride, thirty-two grains of extract of belladonna, and an ounce of lard. (*Journ. de Pharm.*, xxvii. 213.)

PLUMBAGO EUROPÆA. *Leadwort. Dentellaria.* A perennial, herbaceous plant, growing in the south of Europe. It has an acrid taste, and, when chewed, excites a flow of saliva. This is particularly the case with the root, which has been long used to relieve toothache. Hence the plant derived the name of *dentelaire* by which it is known in France. A decoction of the root in olive oil has been highly recommended for the cure of the itch. Writers differ much in their statements in relation to the activity of the plant, some speaking of it as a rubefacient, vesicatory, and caustic, and, when swallowed, as violently emetic, and liable to produce dangerous irritation of the alimentary canal; while others consider it nearly inert. Perhaps the difference may be ascribed in part to the use of the plant in the recent state in one case, and dried or long kept in the other. A crystallizable, acrid principle, called *plumbagin*, has been extracted from the root by Dulong. (*Journ. de Phar.*, (2) xiv. 441.)

POLYGALA RUBELLA. Willd. (*P. polygama.* Walter.) Bitter polygala is an indigenous, perennial plant, with a branching, somewhat fusiform root, which sends up annually numerous simple, smooth, and angular stems, from four to eight inches in height. The leaves are scattered, sessile, obovate or linear lanceolate, attenuated towards the base, obtuse, and mucronate. The flowers are purple, and in clongated terminal racemes. From the base of the stem proceed other racemes, which lie upon the ground, or are partially buried under it, and bear incomplete but fertile flowers, the calyx of which is without wings. This plant is found in many parts of the United States, preferring a dry sandy or gravelly soil, and flowering in June and July. The whole plant was formerly officinal. It has a strong and permanent bitter taste, which it yields to water and alcohol. In small doses bitter polygala is tonic, in larger, laxative and diaphoretic. The infusion of the dried plant has been usually employed to impart tone to the digestive organs. (*Bigelow.*) It appears to be closely analogous in medical virtues to *Polygala amara* of Europe, which is used for a similar purpose.

POLYPODIUM VULGARE. *Common Polypody.* A fern belonging both to the old and new continents, and growing in the clefts of old walls, rocks, and decayed trunks of trees. The root, which is the part considered medicinal, is rather long, about as thick as a goose-quill, somewhat contorted, covered with brown, easily separable scales, furnished with slender radicles, and marked by numerous small tubercles. As found in the shops, it is sometimes destitute of the scales and radicles. Its color is reddish brown with a tinge of yellow, its odor disagreeably oleaginous, its taste peculiar, sweetish, somewhat bitter, and nauseous. The root of the variety growing upon the oak has been preferred, though without good reason. It was deemed purgative by the ancients, who employed it for the evacuation of bile and pituitous humors in melancholic and maniacal cases. Modern physicians have used it in similar complaints, and as a pectoral in chronic catarrh and asthma. At present, however, it is scarcely ever employed, being considered nearly inert. It was given in doses varying from a drachm to an ounce, usually in connection with cathartics.

POLYTRICHUM JUNIPERINUM. *Hair-cap Moss. Robin's Rye.* This indigenous moss is stated by Dr. Wm. Wood to be a powerful diuretic, and very useful in dropsy. (*Am. Journ. Med. Sci.*, N. S. xxvii. 267.) He infuses a large handful of the whole plant in water, and allows the patient to drink freely of the tea, "the more the better." Dr. Ariel Hunter confirms these statements. (*N. J. Med. and Surg. Reporter*, ix. 417.)

POPULUS. *Poplar.* Several trees belonging to this genus have attracted some attention in a medical point of view. In most of them the leaf-buds are covered with a resinous exudation, which has a peculiar, agreeable, balsamic odor, and a bitterish, balsamic, somewhat pungent taste. This is abundant in the buds of *Populus nigra* or the *black poplar* of Europe, which are officinal in some parts of that continent. They contain resin and a peculiar volatile oil. The buds of *P. balsamifera*, growing in the northern parts of North America and Siberia, are also highly balsamic; and a resin is said to be furnished by the tree, which is sometimes, though erroneously, called *tacamahac*. The virtues of the *poplar buds* are probably analogous to those of the turpentines and balsams. They have been used in pectoral, nephritic, and rheumatic complaints, in the form of tincture; and a liniment, made by macerating them in oil, has been applied externally in local rheumatism. The *unguentum populeum* of European pharmacy is made, according to the directions of the French Codex, by bruising in a marble mortar, and boiling in 2000 parts of lard, with a gentle fire, till the moisture is dissipated, 250 parts, each, of the fresh leaves of the black poppy, deadly nightshade, henbane, and black nightshade; then adding of the dried buds of the black poplar, bruised, 400 parts; digesting for 24 hours; straining with strong expression; and finally allowing the ointment to cool after defecation. This is an anodyne ointment, occasionally employed in Europe in painful local affections. It has been ascertained that poplar buds are capable of imparting a principle to ointments which in a powerful degree obviates their tendency to rancidity.

The bark of certain species of poplar is possessed of tonic properties, and has been used in intermittent fever with advantage. Such is the case with that of *P. tremuloides* or *American aspen*, and of *P. tremula* or *European aspen*. In the bark of the latter Braconnot found *salicin*, $C_{13}H_{18}O_7$, and another crystallizable principle which he named *populin*, $C_{20}H_{22}O_8$. It is in these, probably, that the febrifuge properties of the bark reside. They may be obtained by precipitating a saturated decoction of the bark with solution of subacetate of lead, filtering, precipitating the excess of lead by sulphuric acid, again filtering, evaporating, adding animal charcoal towards the end of the evaporation, and filtering the liquor while hot. Salicin gradually separates, upon the cooling of the liquor, in the form of crystals. If, when this principle has ceased to crystallize, the excess of sulphuric acid in the liquid be saturated by a concentrated solution of carbonate of potassium, the populin will be precipitated. If this be pressed between folds of blotting-paper, and redissolved in boiling water, it will be deposited, upon the cooling of the liquid, in the crystalline state. The leaves also of *P. tremula* afford populin, and more largely even than the bark. It is probable that both principles exist in the bark of *P. tremuloides* and other species. Salicin is described under *Salix*. *Populin* is very light, purely white, and of a bitter, sweetish taste, analogous to that of liquorice. When heated it melts into a colorless and transparent liquid. It is soluble in 2000 parts of cold, and about 70 parts of boiling water; and is more soluble in boiling alcohol. Acetic acid and the diluted mineral acids dissolve it, and, upon the addition of an alkali, let it fall unchanged. Piria regards it as a complex body, consisting of benzoic acid, *saligenin*, $C_7H_8O_2$, and glucose. (See *A. J. P.*, xxiv. 240.) Of these principles saligenin and glucose have been found in salicin; and it was inferred that, by separating benzoic acid, populin might be converted into salicin. This has been effected by Piria. When populin is boiled with baryta-water or milk of lime, the benzoic acid precipitated by ferric chloride, the excess of iron removed by lime, and the excess of lime by carbonic acid, the remaining liquid yields salicin on evaporation. The same conversion may be effected by heating populin with an alcoholic solution of ammonia to 100° C. (212° F.). Populin is therefore simply *benzoyl-salicin*, $C_{13}H_{17}(C_7H_5O)O_7$. Piria obtained from populin 28·9 per cent. of benzoic acid. (*P. J. Tr.*, xv. 378.) Dr. T. L. Phipson, basing his experiments upon the results of Piria, has succeeded in preparing populin artificially by combining salicin and benzoic acid. Nothing more is necessary than to dissolve the two substances in alcohol, and to concentrate the solution. Crystals are formed having all the characters of populin, and consisting of salicin and benzoic acid combined in the proportion of their equivalents. (*Chem. News*, Dec. 6, 1862, p. 278.)

PORTULACA OLERACEA. *Garden Purslane.* An annual succulent weed of our gardens, which has an herbaceous, slightly saline taste, and is often used as greens, being boiled with meat, or with other vegetables. It is considered a cooling diuretic, and is recommended in scurvy, and affections of the urinary passages. The seeds have been thought to be anthelmintic; but they are tasteless and inert.

POTENTILLA REPTANS. *Cinquefoil.* A perennial, creeping, European herb, whose root has a bitterish, styptic, slightly sweetish taste, and was formerly used in diarrhœa, and other complaints for which astringents are usually prescribed.

POWDER OF ALGAROTH. *Pulvis Algarothi. Oxychloride of Antimony. Nitromuriatic Oxide of Antimony.* A powder rarely used now. For a description of its uses, properties, etc., see 14th edition U. S. Dispensatory.

PRENANTHES SERPENTARIA. *Lion's Foot.* This is a perennial herb, growing in the mountainous districts of Virginia and North Carolina. Dr. Darlington considers it a variety of *Prenanthes alba.* Pursh speaks of it as in great repute among the inhabitants of the regions it inhabits as a remedy for the bite of poisonous serpents, and relates a case in which he had seen it used effectively. The milky juice of the plant was taken internally, and the leaves steeped in water were applied to the wound and frequently changed. In October, 1849, Dr. Geo. B. Wood received a specimen of it from Dr. Newsom J. Pittman, of North Carolina, with the information that he had employed the decoction in ten or twelve cases of the bite of the rattlesnake with uniform success.

PRINOS VERTICILLATUS. The *black alder* is an indigenous shrub, with a stem six or eight feet high, furnished with alternate, spreading branches, and covered with a bluish gray bark. The leaves, which stand alternately or irregularly on short petioles, are oval, pointed, tapering at the base, acutely serrate, of a dark green color, smooth above, but downy on the veins beneath. The flowers are small, white, nearly sessile, and grow three or four together at the axils of the leaves. They are often diœcious. The calyx is persistent; the segments of the corolla obtuse; the stamens usually six, and furnished with oblong anthers; the germ large, green, and roundish, with a short style, terminating in an obtuse stigma. The fruit when ripe consists of glossy, scarlet, roundish berries, about the size of a pea, containing six cells and six seeds. Several of these berries are clustered, so as to form little bunches at irregular intervals on the stem. In the latter part of autumn, after the leaves have fallen, they still remain attached to the stem, and render the shrub a striking object in the midst of the general nakedness of vegetation. Hence the plant is often called *winterberry.*

It grows in all parts of the United States, from Canada to Florida, frequenting low wet places, such as swamps, and the borders of ponds, ditches, and streams. Its flowers appear in June. The berries, which have a bitter, sweetish, somewhat acrid taste, are sometimes used medicinally for the same purposes with the bark, which was formerly in the U. S. secondary list.

The dried bark is in slender pieces, more or less rolled, brittle, greenish white internally, and covered with a smooth epidermis, easily separable, and of a whitish ash color, alternating or mingled with brown. It has no smell, but a bitter and slightly astringent taste. Boiling water extracts its virtues. Mr. Thos. J. Lerch (*A. J. P.*, 1873, p. 251) has made a careful but unsuccessful search for berberina in the bark.

Black alder is usually considered tonic and astringent; and is among the remedies proposed as substitutes for Peruvian bark, with which, however, it has very little analogy. It has been recommended in intermittent fever, diarrhœa, and other diseases connected with debility, especially gangrene and mortification. It is a popular remedy in gangrenous or flabby and ill-conditioned ulcers, and in chronic cutaneous eruptions, in which it is given internally, and applied locally in the form of a wash or poultice. It may be used in substance or decoction. The dose of the powder is from thirty grains to a drachm, to be repeated several times a day. The decoction, which is usually preferred both for internal and external use, may be prepared by boiling two ounces of the bark with three pints of water to a quart, and given in the dose of two or three fluidounces. A saturated tincture, as well of the berries as of the bark, is sometimes employed.

PROPYLAMINE. *Propylamia. Trimethylamine. Secalia. Secalin.* Wertheim in 1850 prepared from narcotine a substance having the formula C_3H_9N, and gave it the name *metacetamine.* In the same year Anderson prepared from codeine, and Hofmann from methyl, substances having the same formula, giving respectively the names of propylamine and trimethylamine. Other chemists have obtained similarly constituted principles from cod-liver oil, ergot, herring-pickle, putrid calf's blood, codeine, etc., and have even found them in saline combination in the flowers of *Cratægus oxycantha*, *Sorbus aucuparia*, and of one or more species of Chenopodium. Under the names of propylamine some of these principles were introduced into medicine by Dr. Awenarius, of St. Petersburg, and met for a time with considerable favor; so that several processes for preparing propylamine were published before the 13th edition of the U. S. Dispensatory. Prominent among these was that of Prof. Procter (*A. J. P.*, 1859, p. 127), as follows. Herring-pickle procured from the dealers in salt fish, having been mixed with sufficient potassa to render the liquid strongly alkaline, is introduced into a retort or alembic, and heated. The vapors are condensed in a receiver containing distilled water duly refrigerated, and the heat is continued until the distillate, as it forms, ceases to have the odor of herrings. The condensed liquid, which contains the propylamine separated by the potassa from its saline combination in the pickle, is now neutralized with hydrochloric acid, and carefully evaporated to dryness. Ammonia, which comes over and is condensed with the propylamine, combines like it with the hydrochloric acid, and the dry salt obtained is a mixture of the hydrochlorates of both of these bases. This is exhausted with absolute alcohol, which dissolves the chloride of propylamine, and leaves the chloride of ammonium. If the alcoholic solution be treated with hydrate of lime, propylamine in vapor is given out abundantly with very little heat, and may be condensed in a receiver, which should be kept well cooled. The process may be simplified as suggested by Prof. Procter in a subsequent number of the journal (1859, p. 222), by acidulating the liquid in the receiver with hydrochloric acid, added gradually as the acid becomes neutralized, thus directly forming the hydrochlorate, which may be obtained crystallized by subsequent concentration, and, if necessary, freed from the accompanying chloride of ammonium in the manner already mentioned. Since the 13th edition of the U. S. Dispensatory it has been very clearly shown that these various substances, although containing the same number of atoms, have them differently arranged, are consequently possessed of diverse properties, and are hence only *isomeric.* The material obtained from herring-pickle and other sources and sold as propylamine is indeed not propylamine at all, but a more or less impure solution of trimethylamine; it is, in truth, doubtful whether propylamine has ever been procured from a natural source, or made in any other way than by treating iodide of propyl with ammonia. Both principles are derived ammonias or *amines*, but propylamine is a primary compound ammonia (monamine), and trimethylamine is a tertiary compound ammonia (triamine). In the first body the nitrogen is combined with two atoms of hydrogen and one propyl group, C_3H_7, in the second with three methyl groups $(CH_3)_3$.

$$\left.\begin{matrix}\text{Propyl, } C_3H_7\\ H\\ H\end{matrix}\right\} N = C_3H_9N\text{, Propylamine.}\qquad \left.\begin{matrix}\text{Methyl, } CH_3\\ CH_3\\ CH_3\end{matrix}\right\} N = C_3H_9N\text{, Trimethylamine.}$$

The physical differences are very marked. Thus, propylamine boils at 49° C. (120·2° F.), trimethylamine at 6° C. (42·8° F.). The commercial propylamine contains other ammonia compounds besides trimethylamine, the latter substance indeed being sometimes present in very small quantity.

M. E. Perret (*P. J. Tr.*, 1873, p. 884) states that a very pure preparation may be made by the following process. The digestive apparatus of cows, oxen, or sheep is to be cut up, washed, mixed with four to six times its weight of water, and one-fifteenth of carbonate of potassium or dry soda, and allowed to ferment at a temperature of from 59° to 64·5° F. during thirty-two to thirty-six hours. The liquid is then drained through a wire sieve, and to it is added half its weight of caustic soda (soap-maker lees at 40°), and the whole distilled very slowly. Gas very rapidly escapes, and the mass swells; the heat is then moderated. When this reaction is ended propylamine comes over, mixed very slightly with methylic and ammoniacal gases. It is contained in the earlier portions of the distillate. This should now be saturated with hydrochloric acid, filtered and evaporated to dryness. The dry hydrochlorate is pounded with three times its weight of caustic soda (lees at 40°), then distilled in a retort provided with a tube which reaches to near the bottom of distilled water placed in the recipient. The trimethylamine is absorbed by the water. So soon as this is saturated and the bubbles pass off at the surface, the contents of the receiver should be replaced by fresh water. Messrs. Ferris & Co., of Bristol, England, are said to produce the drug upon a large scale, as follows. Herring-brine is distilled with soda-lime, the alkaline distillate saturated with hydrochloric acid and evaporated; the residue treated with alcohol, the alcohol drawn off. What remains is distilled with caustic lime or potash, and the products, condensed in cold water, sold as "propylamine." If a purer article is desired, the distilled products are condensed in hydrochloric acid, this evaporated to dryness, the residue treated with absolute alcohol and again distilled with lime. This last process is repeated until a pure product is obtained.

The best form of trimethylamine for use is probably the hydrochlorate, which may be prepared in a state of purity as a very deliquescent salt, crystallizing in long needles. Mr. Frederick Wurtz makes it artificially by converting methylic alcohol into iodide of methyl, heating this under pressure with ammonia, washing the crystals of iodide of tetramethylammonium with distilled water, distilling this with chalk, receiving the gas of trimethylamine in hydrochloric acid, and freeing the chloride of trimethylamine by solution in absolute alcohol from chloride of ammonium, which is insoluble in such menstruum. (*Ann. de Thérap.*, 1874, p. 98.) To form the chloride naturally the distillatory products in M. Perret's process may be received into hydrochloric acid and separated from any chloride of ammonium by means of absolute alcohol. *Commercial propylamine, i.e.* impure solution of trimethylamine, is a colorless transparent liquid, of a characteristic odor, usually attended with some pungency, which may possibly be ascribed to the ammonia frequently mixed with it. It is soluble in water and alcohol, has a strong alkaline reaction, and forms crystallizable salts with the acids. If the end of a glass rod, previously dipped into hydrochloric acid, be held over the open mouth of a vial containing it, a white cloud of the chloride will be seen, as in the case of ammonia. *Pure propylamine* is said to be a perfectly clear, strongly refractive fluid, with the odor of ammonia; a boiling point of 49° C. (120·2° F.); a sp. gr. (at 20° C. (67° F.)) of 0·7186; inflammable; miscible with water. With hydrochloric acid it makes a deliquescent salt, soluble in alcohol, forming with chloride of platinum a double salt, which crystallizes in large, dark, golden-yellow clino-rhombic plates, somewhat soluble in hot water and alcohol. *Pure trimethylamine* is a gas at ordinary temperatures.

Dr. Awenarius, of St. Petersburg, Russia, first called attention to the use of commercial propylamine in rheumatism, for which he considered it a specific; so much so that a case of doubtful rheumatism might be diagnosticated by the successful use of this remedy in the course of a few days. Between March, 1854, and June, 1856, he treated in the Hospital Kalinkin, in St. Petersburg, 250 cases of rheumatism with success. Some of the cases were acute, some chronic, many metastatic, with pericardial, pleuritic, and meningeal complications; and hemiplegic and paraplegic cases were not wanting; but all recovered. In the acute cases the pain and fever disappeared in a day or two. He mixed 25 drops of propylamine with six fluidounces of distilled water, flavored if necessary with sugar and oil of peppermint, and gave a tablespoonful every two or three hours, taking care that the drug was pure and freshly prepared. (*Ann. de Thérap.*, 1859, p. 74.) In this city some years since the remedy was extensively employed by various practitioners both in hospital and private practice, and finally abandoned as not yielding as good results as the ordinary alkaline treatment. Whether the disrepute was caused by the impurity of the drug employed, by the insufficiency of the dose, or by the real want of power in the remedy, we do not know. Recently it has come largely into vogue in France and to a less extent in other European countries, and much testimony has been brought forward both as to its value and to its want of value, though on the whole the evidence as to its usefulness is in the ascendant.

Locally applied, trimethylamine acts as a powerful irritant or, if in sufficient concentration, even as a mild caustic. According to M. Laborde, in its physiological action it resembles the chloride or carbonate of ammonium, though differing in not causing convulsions in animals fatally poisoned with it. (*Med. Times and Gazette*, 1874, p. 241.) The chloride was found to act in the same way as the trimethylamine, but to be scarcely more than half as powerful. The irritant action of the drug is very apparent in man, so that doses of over half a drachm of the commercial propylamine, even if freely diluted, are almost sure to produce decided symptoms of gastro-intestinal irritation. In a case recorded by Dr. B. F. Eaton, after using it for about three days, the patient was seized with vomiting, accompanied with faintness, and excessive thirst; but whether these phenomena were the effects of the propylamine could not be determined. (See *A. J. P.*, 1862, p. 277.) Large doses are said in rheumatism to reduce the pulse very decidedly in force and frequency, and also the temperature and the elimination of urea. (*Ann. de Thérap.*, 1874, p. 104.) Hamdy and Dujardin-Beaumetz (*Ibid.*, pp. 104, 97) state that in animals the circulation is much depressed by it, but M. Laborde affirms (*Med. Times and Gaz.*, 1874, p. 246) that the drug, unless given in such doses as to endanger serious results from its local action, increases both in man and animals the force of the circulation. There is probably no better plan of administering the remedy than that recommended by Dr. Awenarius; namely, in watery solution. A solution of twenty-four to forty-eight drops of commercial propylamine in six fluidounces of peppermint-water, with two drachms of sugar, may be given in the dose of half a fluidounce, equivalent to two to four drops of the commercial solution, every two hours in the more acute cases. Or thirty-six grains of the chloride may be substituted in the mixture for the twenty-four drops, and six fluidrachms of the solution of potassa added. This would give, with each dose of the propylamine, three or four grains of chloride of potassium, which could have no material effect, and certainly none of an injurious character. In France the chloride of trimethylamine is preferred. The following is a favorite formula. Chloride of trimethylamine ten grammes, tincture of orange-peel twenty-eight grammes, syrup nine hundred and seventy grammes. A tablespoonful contains about three and a half grains. The dose of the chloride of trimethylamine is 7 to 15 grains.

PRUNELLA VULGARIS. *Self-heal. Heal-all.* A small perennial labiate plant, common both in Europe and the United States. It is inodorous, but has an austere bitterish taste. The herb in flower was formerly used, in the state of infusion or decoction, in hemorrhages and diarrhœa, and as a gargle in sore throat.

PSORALEA EGLANDULOSA. (*Elliot.*) P. MELILOTOIDES. (*Michaux.*) *Congo Root, Bob's Root. Samson's Snakeroot.* (See Psoralea melilotoides, *Gray's Manual of Botany.*) This leguminous plant, a foot or two high, which grows wild in Ohio westward to Illinois, and in Virginia southward, has been brought into notice as a remedy by Dr. John P. Mettauer, of Prince Edward's Court-House, Va. The root, according to Dr. Mettauer, is the most active part of the plant. Both root and leaves yield their virtues to water and to alcohol; but the latter is the most efficient menstruum. The season for collecting the plant is when it is in flower, which, in Virginia, is from the first of June to the middle of July.

Dr. Mettauer states that the psoralea is a gently stimulant tonic, with some influence over the nervous system analogous to that produced by tea. He considers it as peculiarly applicable to subacute irritations of the alimentary mucous membrane, especially when in some degree involving the mesenteric glands, and attended with diarrhœa. For further details see U. S. Dispensatory, 14th ed., or original article in *Bost. Med. and Surg. Journ.*, Oct. 1867.

PTELEA TRIFOLIATA. *Wafer-ash. Wingseed. Shrubby Trefoil. Hop-tree.* (See *Gray's Manual of Botany*, revised edition, p. 75.) This is a shrub, six or eight feet in height, growing in rocky places from Pennsylvania to Wisconsin, and southward. General attention has been called to it by Drs. O. F. Potter and Justus Steer. The bark of the root is the part used in medicine. When dried, it comes in cylindrical rolls or quills, one or two lines in diameter, and from one to several inches long, of a light brownish color, irregularly wrinkled, and covered with a thin epidermis. Internally it is yellowish white, but darkens by exposure. It has a peculiar somewhat aromatic smell, and a bitter, persistently pungent, and slightly acrid, yet not disagreeable taste. It yields its virtues to water, but more readily to alcohol. It is said to have been much employed of late, among the physicians of the Western States, in the treatment of dyspepsia, and generally in diseases requiring tonics, to which class the ptelea belongs. Dr. Potter considers it a valuable and reliable remedy. He has long used it in the debility following low fevers, and especially connected with gastro-intestinal irritation, to which it seems to be peculiarly applicable from its mild and unirritating qualities. It exercises a soothing influence on the stomach, which receives it when rejecting other tonics; while it promotes the appetite, invigorates digestion, and helps greatly to re-establish health in convalescence. Dr. Potter uses a tincture, made by macerating six ounces of the bark and half an ounce of ginger in two quarts of whisky, which he gives in the dose of one or two tablespoonfuls three times a day. (*N. Y. Med. Journ.*, ii. 184.) The bark has been examined chemically by Mr. Steer, who found it to contain, besides other ingredients, an oleoresin, of an acrid and bitter taste, and an odor recalling that of the bark, starch, albumen, a yellow coloring substance, and salts of lime, potassa, and iron. He also extracted from it the alkaloid berberine, which is probably the tonic principle, while the oleoresin may impart to the bark somewhat stimulant properties. (*A. J. P.*, 1867, p. 337.) See also a paper by Mr. G. M. Smyser, in the same journal (1862, p. 198).

PTOMAINES. Within the past few years a class of very interesting compounds have been described and are known under this name. They are alkaloid-like bases obtained from animal tissue after decomposition has commenced, hence sometimes called *cadaveric alkaloids.* Bence Jones and Dupré (*Pharm. Centralhalle*, 16, No. 10) first published a notice of the finding of an alkaloid-like base from a decomposing human liver. Its sulphate solution fluoresced, and in other ways resembled quinine, yielding precipitates also with the usual alkaloidal reagents, iodohydrargyrate of potassium, phosphopolybdic acid, gold and platinic chlorides. It appears, however, that Marquardt had isolated such bases even previous to this. The chief investigator of this class of alkaloids has been Leline, who has described several groups of them. From cadavers which had been buried 1, 3, 6, and 10 months in different cases, he obtained bases of strong alkaline reaction, all of which formed characteristic crystalline compounds, with a solution of hydrogen iodide containing dissolved iodine. Three were soluble in ether but not poisonous, one insoluble in ether but soluble in amyl alcohol was in the highest degree poisonous, producing in rabbits tetanus, strong dilatation of the pupil, paralysis of the heart, and death. All of these bodies give the general alkaloid reactions, but change rapidly when exposed to the air. Hager found an alkaloid of volatile character which he named *septicine;* Liebermann found one resembling conine in reactions, but without the characteristic odor of conine; Dragendorff obtained another resembling closely in its reactions morphine and narcine; and Leline, lastly, has quite recently described a number of these volatile bases containing arsenic, and derived from bodies in which poisoning by white arsenic had taken place. These arsines, as they may be termed, were very much more poisonous in their character than arsenious acid or any of its simple solutions.

The formation of these volatile and frequently actively poisonous bases in the cadaver would seem to make the task of the toxicologist very difficult when the search for poisonous bases has been delayed until decomposition has set in. Any reagent or reagents, therefore, which will enable the chemist to decide between vegetable bases and these ptomaïnes becomes very important. Brouardel and Bontury (*Comptes-Rendus*, 92, 1056) claim to have found such a decisive reagent in ferricyanide of potassium. This compound when treated with a solution of a pure vegetable alkaloid is unacted upon by it; while, under the same conditions, it is instantly reduced to the state of ferrocyanide by a ptomaïne, and thus becomes capable of forming Prussian blue with a ferric salt. Up to the present but two exceptions to this general rule have been found,—morphine, which readily reduces potassium ferricyanide, and veratrine, which gives traces of such reduction. It is possible, however, that in this last case the reducing action is due to certain impurities which the investigators were unable to remove completely from the veratrine employed by them.

Ptomaïnes are probably devoid of medical properties, but are of great interest to the toxicologist, not only from a chemical stand-point, but also from the fact that they are excessively fatal in their effects upon the animal economy. The well-known action of putrefactive flesh, the curious poisonings sometimes produced by lobsters and other animals which feed upon carrion, are in all probability caused by them. It is probable that different members of the class have different physiological effects, but at present we have no definite information, so that a most inviting field is opened to the investigator. In regard to treatment of poisoning by putrefactive animal matters, our present knowledge only justifies the immediate evacuation of the stomach and bowels, and the meeting of the various indications as they arise.

PULMONARIA OFFICINALIS. *Lungwort.* An herbaceous perennial, European plant, sometimes cultivated in this country in gardens. The leaves are inodorous, and have an herbaceous, somewhat mucilaginous, and feebly astringent taste. They have been considered pectoral and demulcent, and employed in catarrh, hæmoptysis, consumption, and other affections of the chest; but their virtues are doubtful, and they were probably used in pectoral complaints as much on account of the supposed resemblance of their speckled surface to that of the lungs, as from the possession of any positively useful properties.

PUMICE STONE. *Pumex. Obsidian.* A very light porous stone, found in the vicinity of active and extinct volcanoes, and believed to have been thrown up during their eruption. The spongy structure of pumice is believed to be due to the effects of aqueous vapor upon lava whilst in a fluid state. The pumice stone of commerce is said to be obtained chiefly from Lipari. It is used whole, in the manner of a file, for removing the outer surfaces of bodies, or for rubbing down inequalities, and, in the state of powder, for polishing glass, metals, stones, etc.; purposes to which it is adapted by the hardness of its particles.

PYRETHRUM PARTHENIUM. (Willd.) *Matricaria Parthenium.* (Linn.) *Chrysanthemum Parthenium.* (Persoon.) *Feverfew.* A perennial herbaceous plant, about two feet high, with an erect, branching stem, pinnate leaves, oblong, obtuse, gashed, and dentate leaflets, and compound flowers in a corymb upon branching peduncles. It is a native of Europe, but cultivated in our gardens. The whole herbaceous part is used. The plant has an odor and taste analogous to those of chamomile, which it resembles also in the appearance of its flowers, and in its medical virtues. According to Zeller, a pound of it yields 4·8 grains of volatile oil. (*Centralbatt*, 1855, p. 205.) The volatile oil is greenish, boils between 165° C. (329° F.) and 220° C. (428° F.), and separates on standing. *Pyrethrum camphor*, $C_{10}H_{16}O$, contains in addition a hydrocarbon and an oxidized oil. (Dessaignes and Chautard, *Journ. de Pharm.*, (3,) 13, 241.) Though little employed, it is undoubtedly possessed of useful tonic properties. The flowers of this and of a closely resembling species, *Matricaria parthenoides* (Desf.), are said to be used in France, to a considerable extent, indiscriminately with those of the true chamomile plant, *Anthemis nobilis*, which they closely resemble, especially when double. They may, however, be distinguished, in this state, by their peculiar odor, their smaller receptacle, which is, moreover, rounded and flattened above, instead of being conical and somewhat pointed as in the Anthemis, and by the tubular five-toothed central florets, which in the chamomile are small, few, and scarcely visible, but, in the two species of Pyrethrum, are large, very numerous, and very long.

PYROACETIC SPIRIT. *Pyroacetic Ether. Acetone.* (C_3H_6O.) This substance may be obtained by carefully distilling acetate of calcium, and rectifying the product by repeated distillations from quicklime in a water-bath, until the boiling point becomes stationary, whereby it is freed from water and empyreumatic oil. It may also be prepared by heating gum, citric and tartaric acids, sugar, and other vegetable substances in contact with lime. It is a colorless, volatile, inflammable liquid, having a peculiar penetrating smell, and a pungent taste like that of peppermint. Its sp. gr. is 0·792 at 18° C. (64·4° F.), and boiling point 56° C. (132·8° F.). As found in the shops, its density is not generally lower than 0·820. It is miscible in all proportions with water, ether, and alcohol, without disturbing its transparency. If it becomes turbid when mixed with water, the fact shows that it contains empyreumatic oil. It has been confounded with pyroxylic spirit, from which it is distinguished by its inability to dissolve a saturated solution of chloride of calcium, which is instantly dissolved in pyroxylic spirit. (*Scanlan.*) It was thought at one time that the substance brought to the notice of the profession by Dr. John Hastings, of London, under the name of naphtha, as a remedy for pulmonary consumption, was pyroacetic spirit; but it now appears to be settled that what he intended was pyroxylic spirit. (See *Methylic Alcohol*, page 1698.) There is no doubt that these spirits were used indiscriminately in the therapeutic trials which grew out of the publication of Dr. Hastings's book; but no exact experiments have been made, so far as we know, to determine the precise physiological action of pyroacetic spirit. In the arts, it is proposed to use acetone for the preparation of varnishes from mastic and sandarac; also in the restoration of oil paintings. (See *Chem. News*, March 17, 1865.)

PYROGALLIC ACID. *Pyrogallol. Galline* (Rosing). ($C_6H_6O_3$.) This substance has acquired great importance as an agent in photography. It is one of the results of the igneous decomposition of gallic acid, and may be obtained by submitting extract of galls to the same treatment as that used for preparing benzoic acid from benzoin, the reaction being $C_7H_6O_5 - C_6H_6O_3 + CO_2$. The vapors of pyrogallic acid rise, and condense on the upper surface of the paper diaphragm. The chief difficulty in the process is properly to regulate the heat; as at a high temperature this acid passes rapidly into metagallic acid, and thus the product is diminished. According to Löwig, it is best prepared by heating gallic acid, previously dried at 100° C. (212° F.), in a glass retort, by means of a chloride of zinc bath, to 210° C. (410° F.), when the pure acid sublimes. It is stated by MM. de Luynes and Espandieu that, in the ordinary method of obtaining pyrogallic acid, much of the acid is lost. According to Pelouze, the proportion of pyrogallic acid produced ought to be very nearly 75 per cent., but the processes in use yield only 25 per cent.; the pyrogallic acid itself undergoing rapid decomposition at an elevated temperature. MM. de Luynes and Espandieu have succeeded in preventing this loss by decomposing gallic acid in water under pressure, instead of dry sublimation. Gallic acid is introduced into a bronze boiler with twice or three times its weight of water; the temperature is raised to a point from 200° C. (392° F.) to 210° C. (410° F.), and maintained at that point for half an hour, when the liquid is allowed to cool. The boiler now contains a slightly colored solution of pyrogallic acid. This is heated with a little pure animal charcoal, filtered, evaporated sufficiently, and set aside to crystallize. The crystalline mass obtained is somewhat colored. To obtain it entirely white, nothing more is necessary than to distil in a vacuum. The product is quite 75 per cent. The carbonic acid escapes through the joinings of the apparatus, while the watery vapor is retained. (*A. J. P.*, 1866, p. 22.) Another equally satisfactory procedure is that of Thorpe, for details of which see *A. J. P.*, 1881, pp. 53, 236.

Pyrogallic acid is in white, shining scales, inodorous, very bitter, soluble in three and a half parts of water, readily dissolved by alcohol and ether, fusible at 115° C. (239° F.), and sublimable at 210° C. (410° F.) in irritating vapors. According to Rosing, of Christiania, it is always partially converted, when sublimed, into metagallic acid, to which probably it owes its acid reaction as generally found in commerce; for, when quite pure, it has no influence on litmus-paper. It is a triatomic phenol, $C_6H_3(OH)_3$, and is therefore, properly speaking, not an acid at all. One of its characteristic properties is its strong affinity for oxygen, in consequence of which it instantly undergoes change by contact with chlorine, iodine, bromine, and the acids which readily yield oxygen. Through the same property it rapidly reduces some of the metallic oxides; and its use in photography is based on this effect exercised on the salts of silver. Though unalterable in the air when quite dry, it is rapidly changed in solution by the absorption of oxygen, so that it may be used for ascertaining the proportion of this gas in a mixture of gases. M. J. Personne, believing that phosphorus acts as a poison on account of its affinity for oxygen, was led to make experiments with pyrogallic acid. (*Comptes-Rendus*, Oct. 1869.) He found that in doses of 30 grains it produced in dogs symptoms and post-mortem lesions similar to those caused by phosphorus.

QUEBRACHO BARK. *Quebracho Blanco.* The bark of the apocynaceous tree of Chili, *Aspidosperma quebracho*, is said to appear in European commerce in two varieties, the one coming from the province of Salta, of a lighter, clearer color, the other from the province of Cordoba, much darker. As we have seen the bark, it occurs in large pieces, half to three-quarters of an inch in thickness, covered on the outside with a very thick and rough corky layer, which is of a grayish brown color, and deeply divided by furrows and excavations. The inner side of the bark is grayish or yellowish, smooth or somewhat fibrous, often with small black spots. Upon section, the outer layer of the bark is red, with small yellowish spots; the inner, light grayish, and minutely marked by the ends of the bark fibres. The taste of the bark is intensely bitter. (For microscopical description of the bark, see *A. J. P.*, 1881, p. 238.) The wood of the tree is not met with in commerce, but is said to be very hard, distinctly marked with rings of growth, and of a bright chocolate-brown color, except the very young wood, which is yellowish or reddish. According to the experiments of Heise and Penzoldt, the wood is inactive, and contains no alkaloids; it is used for tanning purposes in South America.

In 1878, Fraude (*Ber. Deuts. Chem. Ges.*, 1878, p. 2189; 1879, p. 1560) discovered in the quebracho blanco an alkaloid, *aspidospermine*, $C_{22}H_{30}N_2O_2$; but a series of experiments have led Dr. F. Penzoldt to the conclusion that it does not represent the whole medical activity of the bark, and O. Hesse is said to have found four other alkaloids, one of which, *quebrachine* ($C_{21}H_{26}N_2O_3$), he has described. (*Ber. Deuts. Chem. Ges.*, xiii. 2308.) *Aspidospermine* is soluble in about 6000 parts of water at 15° C. (59° F.), and the solution has a decidedly bitter taste, soluble in about 48 parts of absolute alcohol, in 106 parts of ether, insoluble in glycerin; it dissolves readily in fats and fixed oils, cod-liver oil dissolving a larger proportion than it does of quinine. Its *sulphate* and *hydrochlorate* are very soluble. The citrate is crystallizable, and very soluble. The yield of aspidospermine is very small, 0·33 per cent. of the bark. Quebracho bark is said to be used as an antiperiodic in Chili, and has recently attracted attention and been highly lauded as a remedy in cardiac and asthmatic dyspnœa. (*Die Wirkungen Quebrachodrogin*, Dr. F. Penzoldt, Erlangen, 1881.) The alcoholic extract has been given in asthma, uræmic dyspnœa, fatty heart, etc., in doses of 5 grains, with asserted surprising advantage. (See *Berlin. Klin. Wochens.*, xvi., 1879; *Prag. Med. Wochenschrift*, 1879, iv.) In the lower animals large doses of the bark produce motor palsy, with dyspnœa, and finally death, apparently from asphyxia. The breathing early becomes slower in rate, but deeper; the blood-pressure is not until late much affected. Dr. F. Penzoldt (*loc. cit.*) believes that the relief of dyspnœa obtained clinically by the use of the drug is caused by its increasing the power of the blood to take oxygen, and the dyspnœa caused by poisonous doses he attributes to its preventing the blood yielding the oxygen to the tissues, but he does not clearly prove his theory.

Quebracho colorado and *Quebracho Gum* are respectively the wood and the dried juice or watery extract of the *Loxopterygium Lorentzii*, a large tree growing in the Argentine Republic. The wood is very heavy, hard, and of a reddish brown color. (See *A. J. P.*, 1879, p. 152; also, Penzoldt, *loc. cit.*; *P. J. Tr.*, xii.) Quebracho colorado has been used as a substitute for the true quebracho, but is essentially different from it, and probably is a simple astringent and gastro-intestinal stimulant, although Dr. Penzoldt claims that it is similar in its action, but much weaker than quebracho blanco. A *tincture of quebracho* has been made: 1 part to 5 parts of alcohol sp. gr. ·923. *Wine of quebracho*: 1 part quebracho bark, 2 parts alcohol sp. gr. ·923, white wine 16 parts.

QUINOA. The *Chenopodium quinoa* is largely cultivated in Southern Peru and Southern Chili, often above the height at which barley and rye will ripen, for the sake of its seeds. These are about the size of white mustard-seeds, but flatter, and afford a flour resembling somewhat oat-meal. The starch grains are very small, and constitute about 40 per cent. of the grain, which also contains 5 per cent. of sugar, 7½ of casein, and 11 of albumen and other protein compounds. One variety, the red quinoa, contains a bitter principle in the seed-husks, and is used to some extent as an emetic and antiperiodic. (*A. J. P.*, 1872, p. 559.)

RANUNCULUS. *Crowfoot.* Most of the plants belonging to the genus Ranunculus have similar acrid properties, and, from their close resemblance, are confounded under the common name of *buttercup.* *R. bulbosus* was formerly on the secondary list of the U. S. Pharmacopœia; but *R. sceleratus* had attracted more attention in Europe, and *R. acris* and *R. Flammula* were recognized by the Dublin College.

In May and June our pastures are everywhere adorned with the rich yellow flowers of *R. bulbosus,* which is distinguished by the bulb-like base of the stem, and the fact that the lateral divisions of its leaves are sessile, whilst the terminal are stalked and three-parted, all being wedge-shaped. Somewhat later *R. acris* and *R. repens* begin to bloom, and a succession of similar flowers is maintained till September. The two latter species prefer a moister ground, and are found most abundantly in meadows. *R. sceleratus* frequents ponds and ditches. In all these species, the whole plant is pervaded by a volatile acrid principle, which is dissipated by drying or by heat, and may be separated by distillation. Dr. Bigelow found that water distilled from the fresh plant had an acrid taste, and produced when swallowed a burning sensation in the stomach; and that it retained these properties for a long time if kept in closely-stopped bottles. Dr. Clarus discovered, in *R. sceleratus,* besides the acrid volatile oil, a nearly inert resin, and a narcotic principle called *anemonin* or anemone camphor, $C_{15}H_{12}O_6$. The volatile oil is soluble in ether, and is decomposed, on standing, into a white amorphous substance having acid properties (*anemonic acid*), $C_{15}H_{14}O_7$, and into anemonin. Other species of Ranunculus probably have the same constituents. (*B. and F. Med.-Chir. Rev.,* 1859, p. 181.) The plant itself, when chewed, excites violent irritation in the mouth and throat; inflaming and even excoriating the tongue and inside of the cheeks and lips, if not quickly discharged.

Medical Properties and Uses. Crowfoot, when swallowed in the fresh state, produces heat and pain in the stomach, and, if the quantity be considerable, may excite fatal inflammation. Dr. Clarus states that it has also narcotic properties, diminishing the frequency of the pulse and respiration, and producing palsy of the extremities. It is, however, never used internally. The property for which it has attracted the attention of physicians is that of inflaming and vesicating the skin; and, before the introduction of the Spanish fly into use, it was much employed for this purpose. But the uncertainty and occasional violence of its action have nearly banished it from regular practice. It probably varies in strength with the season, and in the dried state, or in decoction, is wholly inert.

REALGAR. (As_2S_2.) This is the disulphide of arsenic. It is found native in Saxony, Bohemia, Transylvania, and in various volcanic regions. Realgar is artificially made by melting arsenious acid with about half its weight of sulphur. (*Turner.*) Thus prepared, it is of a crystalline texture, of a beautiful ruby-red color, of a uniform conchoidal fracture, somewhat transparent in thin layers, and capable of being sublimed without change. Native realgar is said to be innocent when taken internally, while that artificially prepared is poisonous, in consequence, according to Guibourt, of containing a little arsenious acid. Realgar is used only as a pigment.

RED CHALK. *Reddle.* A mineral substance of a deep red color, of a compact texture, dry to the touch, adhering to the tongue, about as hard as chalk, soiling the fingers when handled, and leaving a lively red trace when drawn over paper. It consists of clay and oxide of iron, and is intermediate between *bole* and *red ochre,* containing more oxide of iron than the former, and less than the latter. It is used for drawing lines upon wood, etc., and is sometimes made into crayons by levigating and elutriating it, then forming it into a paste with mucilage of gum arabic, moulding this into cylinders, and drying it in the shade. It has been used internally as an absorbent and astringent.

REGIANINE. This is a principle obtained by Mr. Phipson from the nut of *Juglans regia.* It occurs in octohedral, prismatic, or feathery crystals, and gives with ammonia and other alkalies a reddish purple solution, from which hydrochloric acid precipitates an amorphous powder, *regianic acid.* It is probably identical with the *nucin* obtained from green walnut-shells.

RENNET. GASTRIC JUICE. For an account of the constitution of gastric juice and its properties the reader is referred to works upon physiology. The crude juice was used by Dr. P. S. Physick as a local application to cancerous and other foul ulcers, but is at present never employed externally or internally. Two preparations are, however, made from the stomach of lower animals, namely, rennet and pepsin; the latter being officinal. (See Part I.)

Rennet. This is an aqueous or vinous infusion of the dried stomach of the calf, though that of the sheep or other animal would probably answer the same purpose. It is much used, as every one knows, for curdling milk; a property which it owes to a portion of the gastric secretion, retained and dried in the mucous tissue of the stomach. To the same material it probably owes the property which it possesses of converting glucose into lactic acid; and there is little doubt that it is capable, in greater or less degree, of exercising the solvent property of gastric juice over albuminous and fibrinous food. The first of the properties just referred to suggested to Dr. James Gray, of

Glasgow, the use of rennet in diabetes, with the object of promoting the conversion of any sugar of grapes that might be formed in the stomach into lactic acid, and thus preventing its entrance into the circulation in its unchanged state. He met with considerable success in this use of the remedy; and it has since been employed by others, in the same disease, with supposed advantage. Dr. Gray gave a teaspoonful of the rennet after each meal. To be efficient it must be recently prepared, and of such strength that a teaspoonful will coagulate a pint of milk in five minutes. (*Ed. Monthly Journ. of Med. Sci.*, 1853, p. 31.) Rennet seems also to have been popularly employed for promoting defective digestion in the west of England. (*Med. Times and Gaz.*, 1857, p. 411.) It is highly probable that the preparation usually employed to curdle milk may contribute to the ready digestibility of the curds and whey, so favorite an article of diet among children in this country. Dr. Geo. Ellis gives the following method of preparing *rennet-wine*, from which he has obtained the most satisfactory results, when pepsin from inadequate preparation had failed him. Take the stomach of a calf immediately after death, cut off and reject about three inches of the upper or cardiac portion, slit the stomach longitudinally, wipe it gently with a dry napkin so as to remove as little of the clean mucus as possible, then cut it into small pieces, the smaller the better, put it into a common wine-bottle, fill the bottle with good sherry, and let it stand corked for three weeks. The dose is a teaspoonful, in a wineglassful of water, immediately after each meal. It is known to be good if a teaspoonful will coagulate half a pint of milk in two minutes at 100° F. (*Dub. Med. Press*, July 16, 1862.)

RESEDA LUTEOLA. *Weld. Dyer's Weed.* An annual European plant, naturalized in the United States. It is inodorous, and has a bitter taste, which is very adhesive. Volhard showed that sulphocyanide of allyl, C_3H_5, OSCN (oil of mustard), was present in the root, and Chevreul obtained from it by sublimation a peculiar yellow coloring matter, which he called *luteolin*. Rochleder and Brener (*Journ. Prakt. Chem.*, 99, 433) found that when fused with caustic potash it was decomposed into phloroglucin and protocatechuic acid with evolution of carbon dioxide. In medicine it has been employed as a diaphoretic and diuretic, and is used only for dyeing purposes in Europe.

RESORCIN. ($C_6H_6O_2$.) Hlasiwetz and Barth first obtained this organic body in 1864 from galbanum resin, by fusing it with potassa; it was subsequently obtained from *sagapenum*, *assafœtida*, *ammoniac*, and *gum acaroides*. According to Kopp, it is most easily and cheaply prepared by the destructive distillation of *brazilin*, or from the wash or mother-waters obtained in its manufacture from Brazil wood. It is now (1882) best prepared by fusing potassium benzoldisulphonate with caustic potassa. *Resorcin* is a diatomic phenol, isomeric with *pyrocatechin* and *hydroquinone*. It crystallizes in prismatic crystals of the rhombic system, melting at 104° C. (219·2° F.), distilling at 267° C. (512·6° F.), easily soluble in water, alcohol, and ether, insoluble in chloroform and carbon disulphide. A small quantity treated with fuming sulphuric acid is dissolved, with the production of, first, an orange-yellow, then a greenish blue, and finally a pure blue color. Bromine-water precipitates its aqueous solution, *tribromresorcin* separating in minute crystals. Several of the compounds of resorcin with phthalic acid have assumed great technical importance as dye colors, under the names of *fluoresceïn*, *eosin*, and *uranine*. (For a case of poisoning by resorcin, see *N. R.*, April, 1882.)

RHIGOLENE. This name was given by Dr. H. J. Bigelow, of Boston, to a very light, inflammable liquid, obtained by distilling petroleum, and separating the liquids of the lowest boiling point by redistillation, until one is obtained which boils at about 18° C. (64·4° F.). It is not pretended that this is a peculiar definite compound; on the contrary, it is simply a fluid more volatile than any one previously known, and capable, consequently, of producing a greater degree of cold by its evaporation. In this respect rhigolene probably exceeds all other substances, with the exception of *cymogene*, which boils at 0° C. (32° F.). A degree of cold —9° C. (15° F.) is, according to Dr. Bigelow, obtained through the evaporation of this liquid by means of the common atomizer or "spray-producer." This is the chief use of the liquid; which may be employed as a substitute for ether, and with still greater effect, in producing congelation of any part of the body preparatory to a surgical operation, or a great degree of cold for any other purpose. It should, when not in use, be kept in a cool place, in bottles tightly corked; as otherwise it will be rapidly evaporated. In a warm place it might break the bottles through its extreme volatility, unless the stopper should previously be driven out. It has been accused of being liable to explosion; but this is not true, unless the vapor should be mixed, in certain proportions, with atmospheric air, and then approached by a burning body.

RHODODENDRUM CHRYSANTHUM. *Yellow-flowered Rhododendron.* The leaves of this Siberian rhododendron, when fresh, have a feeble odor, said to resemble that of rhubarb. In the dried state, they are inodorous, but have an austere, astringent, bitterish taste. They yield their virtues to water and alcohol. They are stimulant, narcotic, and diaphoretic, producing, when first taken, increase of heat and arterial action, subsequently a diminished frequency of the pulse, and, in large doses, vomiting, purging, and delirium. They have been long employed in Siberia as a remedy in rheumatism; and their use has extended to various parts of Europe. Their action is said to be accompanied with a sensation of creeping or pricking in the affected part, which subsides in a few hours, leaving the part free from pain. They have been recommended also in gout, lues venerea, and palsy. In Siberia they are prepared by infusing two drachms of the dried leaves in about ten ounces of water, in a close vessel, and keeping the liquid near the boiling point during the night. The strained liquor is taken in the morning; and a repetition of the dose three or four days successively generally effects a cure. The remedy is not used in this country.

RIGA BALSAM. *Balsamum Carpaticum. Balsamum Libani.* This is usually stated to be a product of *Pinus Cembra*, a large tree growing in the mountainous regions and northern latitudes of Europe and Asia. The juice exudes from the extremities of the young twigs, and is collected in flasks suspended from them. It is a thin, white fluid, having an odor analogous to that of juniper, and possessing the ordinary terebinthinate properties. In this country it is very rare; but it is occasionally brought from Riga or Cronstadt in bottles. M. Keller, of Darmstadt, affirms that Riga Balsam is nothing but the product of the ordinary *Pinus palustris.* A similar product, called *Hungarian balsam*, is obtained in the same manner from *Pinus Pumilio*, growing on the mountains of Switzerland, Austria, and Hungary. It is scarcely known in the United States.

ROBINIA PSEUDACACIA. *Locust-tree.* This well-known indigenous tree has a place in the Materia Medica of the "eclectics." The bark of the root is the most active part, and is said to be tonic, and in large doses purgative and emetic.

Medical Properties. Zwenger and Dronke (*Ann. Chem. Pharm.*, Supp., i. 257) found a glucoside, *robinin*, $C_{25}H_{30}O_{16}$, which, treated with dilute acids, yielded *quercetin* and a sugar. Hlasiwetz also obtained *asparagin*, $C_4H_8N_2O_3$, from the root. Three cases of poisoning in children, who had eaten of the root by mistake, have been recorded. The symptoms were like those produced by an overdose of belladonna; but all the children recovered. One of them, who happened to be laboring under intermittent fever at the time, had no return of the paroxysms afterwards. (*Ann. de Thérap.*, 1860, p. 64.) These facts render caution advisable in the use of the root, yet are also well calculated to stimulate inquiry.

ROTTEN STONE. *Terra Cariosa.* An earthy mineral, occurring in light, dull, friable masses, dry to the touch, of a very fine grain, and of an ash-brown color. It is obtained from Derbyshire in England, and is used for polishing metals. A particular account of it may be found in *A. J. P.*, 1860, p. 463.

RUBIA. (*Garance*, Fr.; *Krappwurzel*, G.; *Robbia*, It.; *Rubia de tinctoreros*, *Granza*, Sp.) Under this name the U. S. P. formerly recognized *madder. Rubia tinctorum.* Willd. *Sp. Plant.* i. 603; Woodv. *Med. Bot.* p. 173, t. 67. The root of the *dyers' madder* is perennial, and consists of numerous long, succulent fibres, varying in thickness from the size of a quill to that of the little finger, and uniting at top in a common head, from which also proceed side-roots that run near the surface of the ground, and send up many annual stems. These are slender, quadrangular, jointed, procumbent, and furnished with short prickles, by which they adhere to the neighboring plants upon which they climb. The leaves are elliptical, pointed, rough, firm, about three inches long and nearly one inch broad, having rough points on their edges and midrib, and standing at the joints of the stem in whorls of four, five, or six together. The branches rise in pairs from the same joints, and bear small yellow flowers at the summit of each of their subdivisions. The fruit is a round, shining, black berry. The plant is a native of the south of Europe and the Levant, and is cultivated in Asia Minor, France, Holland, and the south of Italy. It is from Holland that commerce derives its chief supply. The root, which is the part used, is dug up in the third summer, and, having been deprived of its cuticle, is dried by artificial heat, and then reduced to a coarse powder. In this condition it is packed in barrels, and sent into the market. Madder from the Levant is in the state of the whole root; from the south of France, either whole or in powder. The plant is also cultivated in this country, in the States of Delaware and Ohio. The root consists of a reddish brown bark, and a ligneous portion within. The latter is yellow in the recent state, but becomes red when dried. The powder, as kept in the shops, is reddish brown. Madder has a weak peculiar odor, and a bitterish astringent taste; and imparts these properties, as well as a red color, to water and alcohol. It contains as its most important constituent *alizarin*, $C_{14}H_6(OH)_2O_2$, and with it as coloring matter of secondary importance *purpurin*, $C_{14}H_5(OH)_3O_2$. Besides these two technically important constituents there has been recognized *pseudopurpurin*, an orange dye-color, and a yellow one (*xanthopurpurin*). These coloring matters, however, are probably decomposition products from glucosides existing in the fresh plant. Thus, alizarin is known to result along with glucose from the treatment with dilute acids of *rubianic* or *ruberythric acid*, $C_{26}H_{28}O_{14}$, according to the reaction: $C_{26}H_{28}O_{14} + 2H_2O = C_{14}H_8O_4 + 2C_6H_{12}O_6$. The most interesting of the coloring substances is the *alizarin.* It may be obtained from the alcoholic extract by sublimation, in the method employed by Mohr in obtaining benzoic acid. (*Journ. de Pharm.*, 3e sér., xxxi. 267.)

It is orange red, inodorous, insipid, crystallizable, capable of being sublimed without change, scarcely soluble in cold water, soluble in boiling water, and very readily so in alcohol, ether, the fixed oils, and alkaline solutions. The alcoholic and watery solutions are rose-colored; the ethereal, golden yellow; the alkaline, violet and blue when concentrated, but violet red when sufficiently diluted. A beautiful rose-colored lake is produced by precipitating a mixture of the solutions of alizarin and alum. Alizarin was recognized by Graebe and Liebermann in 1868 as a derivative of anthracene, $C_{14}H_{10}$,—a hydrocarbon contained in coal-tar,—and in the same year they elaborated a method for preparing it commercially from anthracene. Upon this arose rapidly a great chemical industry, so that in 1878 the value of the artificial alizarin annually produced was nearly $7,500,000. Madder also contains sugar; and Döbereiner succeeded in obtaining alcohol from it by fermentation and distillation, without affecting its coloring properties. It is much used by dyers.

Madder was formerly thought to be emmenagogue and diuretic, and was used in amenorrhœa, dropsy, jaundice, and visceral obstructions. It is still occasionally prescribed in suppressed menstruation; but physicians generally have no confidence in its efficacy in this or any other complaint. When taken into the stomach it imparts a red color to the milk and urine, and to the bones of animals, without sensibly affecting any other tissue. The effect is observable most quickly in the bones of young animals, and in those nearest the heart. Under the impression that it might effect some change in the osseous system, it has been prescribed in rachitis, but without any favorable result. The dose is about half a drachm, repeated three or four times a day.

RUTA. Under this name the U. S. P. formerly recognized the *Ruta graveolens. Common rue* (*Rue odorante*, Fr.; *Garten-Raute*, G.; *Ruta*, It.; *Ruda*, Sp.) is a perennial plant, usually two or three feet high, with several shrubby branching stems, which, near the base, are woody and covered with a rough bark, but in their ultimate ramifications are smooth, green, and herbaceous. The leaves are doubly pinnate, glaucous, with obovate, sessile, obscurely crenate, somewhat thick and fleshy leaflets. The flowers are yellow, and disposed in a terminal branched corymb upon subdividing peduncles. The calyx is persistent, with four or five acute segments; the corolla consists of four or five concave petals, somewhat sinuate at the margin. There are usually ten stamens, but sometimes only eight. The plant is a native of the south of Europe, but cultivated in our gardens. It flowers from June to September. The whole herb is active; but the leaves are usually employed. These have a strong disagreeable odor, especially when rubbed. Their taste is bitter, hot, and acrid. When recent, and in full vigor, they have so much acrimony as to inflame and even blister the skin, if much handled; but the acrimony is diminished by drying. Their virtues depend chiefly on a volatile oil, which is very abundant, and is contained in glandular vesicles, apparent over the whole surface of the plant. (See *Oleum Rutæ.*) They contain, also, according to Mähl, chlorophyll, albumen, an azotized substance, extractive, gum, starch or inulin, malic acid, and lignin; and, according to Bornträger, a peculiar acid which he calls *rutinic acid*, $C_{25}H_{28}O_{15}$. (*Chem. Gazette*, 1845, p. 385.) Rutinic acid is the coloring principle of rue, and has been found in various other plants. It was thought, at one time, that it might be identical with quercitrin; but though, like that principle, yielding quercetin and sugar, it has been shown to be distinct. Like quercitrin, it seems to play an important part in the coloring of plants. (*Journ. de Pharm.*, 1862, p. 165.) Both alcohol and water extract their active properties.

Medical Properties and Uses. Rue is stimulant and antispasmodic, and, like most other substances which excite the circulation, occasionally increases the secretions, especially when deficient from debility. It appears to have a tendency to act upon the uterus; in moderate doses proving emmenagogue, and in larger, producing a degree of irritation in the organ which sometimes determines abortion. Taken very largely it acts as an acrid narcotic poison. Three cases are recorded by Dr. Hélie in which it was taken by pregnant women, with the effect of producing dangerous gastro-intestinal inflammation and cerebral derangement, which continued for several days, but ended at length in recovery. In each instance miscarriage resulted. Great depression and slowness of the pulse attended the narcotic action of the poison. In one of these cases, three fresh roots of the size of the finger were used in the form of decoction. (*Ann. d'Hyg. Pub. et de Méd. Lég.*, xx. 180.) A case is recorded by Dr. G. F. Cooper in the *Nashville Journ. of Med. and Surg.*, in which a man, convalescent from dysentery, having added some brandy to a handful of the bruised herb, expressed it, and took the whole of the liquor, with fatal effects. The prominent symptoms were vomiting, violent tormina, tenesmus with bloody stools, abdominal distention with tenderness, and severe strangury. (*Med. Exam.*, N. S., ix. 720.) Rue is sometimes used in hysterical affections, worms, flatulent colic, and amenorrhœa, particularly in the last complaint. It has also been highly recommended in uterine hemorrhage, especially when dependent on an atonic state of the organ. The ancients employed it as a condiment, and believed it to possess, besides other valuable properties, that of resisting the action of poisons. Its excitant and irritating properties require that it should be used with caution. The dose is from fifteen to thirty grains two or three times a day, preferably given in infusion.

SABBATIA ANGULARIS. Pursh. *Chironia angularis.* Linn. The *American centaury* is an annual or biennial herbaceous plant, with a fibrous root, and an erect, smooth, four-sided stem, winged at the angles, simple below, sending off opposite axillary branches above, and one or two feet in height. The leaves, which vary considerably in length and width, are ovate, entire, acute, nerved, smooth, opposite, and sessile, embracing half the circumference of the stem at their base. The flowers are numerous, growing on the ends of the branches, and forming together a large terminal corymb. The calyx is divided into five lanceolate segments, considerably shorter than the corolla. This is deeply five-parted, with obovate segments of a delicate rose-color, which are paler and almost white in the middle of their under surface. The anthers are yellow, and, after shedding their pollen, become revolute. The style, which is bent downward, and is longer than the stamens, terminates in two linear stigmas, which become spirally twisted together. The plant is widely diffused through the Middle and Southern States, growing in low meadow grounds, and, in wet seasons, upon uplands, in woods, and neglected fields. It flowers in July and August. In its general aspect as well as medical properties it bears a close resemblance to *Erythræa Centaurium*, or European centaury, for which it was mistaken by the earlier settlers. The whole herb is employed, and should be collected when in flower. It was formerly included in the U. S. secondary list.

All parts of it have a strongly bitter taste, without any admixture of astringency or other peculiar flavor. Both alcohol and water extract its bitterness, together with its medical virtues. It has been examined by Mr. John F. Huneker, who, in his inaugural essay, states that he has found in it a small proportion of *erythrocentaurin*, $C_{27}H_{24}O_8$, previously discovered by M. Méhu, a French chemist, in *Erythræa Centaurium* of Europe. Mr. Huneker also obtained from American centaury, resin, chlorophyll, fatty matter, gum, albumen, pectin, bitter extractive, traces of volatile oil, an organic acid, red coloring matter, and salts. (*A. J. P.*, 1871, p. 207.)

Medical Properties and Uses. American centaury has the tonic properties of the simple bitters, and is very analogous in its action to the other plants of the same natural family. It has long been popularly employed as a prophylactic and remedy in our autumnal intermittent and remittent fevers, and was formerly much esteemed by some physicians in the latter of these complaints. The condition to which it was considered applicable was that existing between the paroxysms, when the remission was such as to call for tonics, but was not deemed sufficient to justify a resort to the preparations of Peruvian bark. It is occasionally useful, during the progress of a slow convalescence, by promoting appetite and invigorating digestion, and may be employed for the same purpose in dyspepsia and diseases of debility. The most convenient form for administration is that of infusion. A pint of boiling water, poured on an ounce of the herb and allowed to cool, may be given in the dose of two fluidounces, repeated every hour or two during the remission of fevers, and less frequently in chronic affections. The dose of the powder is from thirty grains to a drachm. The decoction, extract, and tincture are also efficient preparations.

SACCHARATE OF IRON. The *Ferrum Oxydatum Saccharatum Solubile* of the German Pharmacopœia is of importance as an antidote to arsenic. (*Brit. and For. Med.-Chir. Rev.*, 1870, xlv. 558.) To twenty parts of a solution (43·5 per cent.) of the sesquichloride of iron are added 20 parts of simple syrup, and afterwards 40 parts of a solution of soda (30 per cent.). After twenty-four hours 300 parts of hot distilled water are added, and the precipitate washed by decantation and filtration; 90 parts of sugar are added, the whole dried in a water-bath, and enough sugar added to make the whole weigh 100 parts, containing the equivalent of 3 parts of metallic iron. E. Hoffmann has published a formula which he considers superior to the officinal. (See *Acidum Arseniosum*, Part I., and *A. J. P.*, xlvi. 559.)

SACCHARATE OF LEAD. PLUMBI SACCHARAS. *Oxyhydrate of Lead.* The saccharate of lead is made by saturating a solution of saccharic acid in water by freshly precipitated carbonate of lead gradually added. As the acid becomes saturated, the saccharate of lead falls in the form of a white powder, being insoluble in cold water, and but very sparingly soluble in that liquid boiling hot. From this Dr. E. Hoskins prepared his *nitro-saccharate of lead*, by dissolving the saccharate in dilute nitric acid, containing only one part of the acid in 20 parts of the mixture, filtering the solution, and gradually evaporating. The nitro-saccharate is deposited in yellow crystals of the form of regular six-sided plates or prisms. By dissolving one grain of this salt, with five drops of pure saccharic acid, in a fluidounce of distilled water, a solution was obtained, which, though slightly acid to test-paper, was perfectly bland. This solution, which is asserted to have the power of dissolving urinary calculi, was injected into the bladder and retained 50 minutes in several cases of phosphatic lithiasis without causing irritation, and with seeming advantage. (See Pereira's *Mat. Med.*, 3d ed., 755.)

SAGAPENUM. This gum-resin, formerly highly esteemed, but at present very rarely met with even in Eastern commerce, is the concrete juice of a well-known Persian plant. It is in irregular masses, composed of agglutinated fragments, slightly translucent, of a brownish yellow, olive, or reddish yellow color externally, paler internally, brittle, of a consistence somewhat resembling that of wax, and often mixed with impurities, especially with seeds more or less entire. An inferior variety is soft, tough, and of uniform consistence. It has an alliaceous odor less disagreeable than that of asafetida, and a hot, nauseous, bitterish taste. It softens and becomes tenacious by the heat of the hand. The effect of time and exposure is to harden and render it darker. It is inflammable, burning with a white flame and much smoke, and leaving a light spongy charcoal. Pure alcohol and water dissolve it partially, diluted alcohol almost entirely. Distilled with water it affords a small quantity of volatile oil; and the water is strongly impregnated with its flavor. According to Pelletier, it contains 54·26 per cent. of resin, 31·94 of gum, 1·0 of bassorin, 0·60 of a peculiar substance, 0·40 of acidulous malate of calcium, and 11·80 of volatile oil including loss. Brandes found 3·73 per cent. of volatile oil. This is pale yellow, very fluid, lighter than water, and of a disagreeable alliaceous odor. Flückiger found the oil devoid of sulphur, but to contain *umbelliferone*. (*Pharmacographia*, p. 324.)

Sagapenum was considered by the older physicians as midway in its medical properties between asafetida and galbanum, and was used in doses of from ten to thirty grains in amenorrhœa, hysteria, etc.; also externally in plaster form as a discutient.

SAGO. (*Sagou* Fr.; *Sago*, G., It.; *Sagu*, Sp.) Under this name the U. S. P. formerly recognized the starch obtained from the sago palms. Numerous trees, inhabiting the islands and coasts of the Indian Ocean, contain a farinaceous pith, which is applied to the purposes of nutriment by the natives. Such are *Sagus Rumphii*, *Sagus lævis*, *Sagus Ruffia*, *Saguerus Rumphii*, and *Phœnix farinifera*, belonging to the family of Palms; and *Cycas circinalis*, *Cycas revoluta*, and *Zamia lanuginosa*, belonging to the Cycadaceæ. Of these, *Sagus Rumphii*, *Sagus lævis*, and *Saguerus Rumphii* probably contribute to furnish the sago of commerce. Crawford, in his History of the Indian Archipelago, states that it is derived exclusively from *Metroxylon Sagu*, identical with *Sagus Rumphii;* but Roxburgh ascribes the granulated sago to *S. lævis*, and one of the finest kinds is said by Dr. Hamilton to be produced by the *Saguerus Rumphii* of Roxburgh. The farinaceous product of the different species of Cycas, sometimes called *Japan sago*, does not enter into general commerce.

Sagus Rumphii, Willd. *Sp. Plant.* iv. 404; Carson, *Illust. of Med. Bot.* ii. 44, pl. 88. *Metroxylon Sagu*, Roxb. (1783); *Bentley and Trimen*, 278. The *sago palm* is one of the smallest trees of its family. Its extreme height seldom exceeds thirty feet. The trunk is proportionately very thick, quite erect, cylindrical, covered with the remains of the old leafstalks, and surrounded by a beautiful crown of foliage, consisting of numerous, very large, pinnate leaves, extending in all directions from the summit, and curving gracefully downwards. From the bases of the leaves proceed long, divided and subdivided flower- and fruit-bearing spadices, having smooth branches. The fruit is a roundish nut, covered with a checkered imbricated coat, and containing a single seed.

The tree is a native of the East India islands, growing in the Peninsula of Malacca, Sumatra, Borneo, Celebes, the Moluccas, and a part of New Guinea. It flourishes best in low and moist situations. Before attaining maturity, the stem consists of a shell, usually about two inches thick, filled with an enormous volume of spongy medullary matter like that of elder. This is gradually absorbed after the appearance of fruit, and the stem ultimately becomes hollow. The greatest age of the tree is not more than thirty years. Large quantities of a kind of sugar called jaggary are produced from its juice. According to H. von Rosenberg (*Proc. A. P. A.*, xxvii. 140), the medullary matter contains most of starch when the large leaves have fallen off and the flowers are just taking their place. At this time the tree is felled, and the trunk cut into billets six or seven feet long, which are split in order to facilitate the extraction of the pith. This is obtained in the state of a coarse powder, which is mixed with water in a trough having a sieve at the end. The water, loaded with farina, passes through the sieve, and is received in convenient vessels, where it is allowed to stand till the insoluble matter has subsided. It is then strained off; and the farina which is left may be dried into a kind of meal, or moulded into whatever shape may be desired. For the consumption of the natives it is usually formed into cakes of various sizes, which are dried, and extensively sold in the islands. The commercial sago is prepared by forming the meal into a paste with water, and rubbing it into grains. It is produced in the greatest abundance in the Moluccas, but of the finest quality on the eastern coast of Sumatra. The Chinese of Malacca refine it so as to give the grains a fine pearly lustre. Malcolm states that it is also refined in large quantities at Singapore. In this state it is called *pearl sago*, and is in great repute. It is said that not less than five or six hundred pounds of sago are procured from a single tree. (*Crawford*.)

Pearl sago is that which is now generally used. It is in small grains, about the size of a pin's head, hard, whitish, of a light brown color, in some instances translucent, inodorous, and with little taste. It may be rendered perfectly white by a solution of chloride of lime. *Common sago* is in larger and browner grains, of more unequal size, of a duller aspect, and frequently mixed with more or less of a dirty-looking powder.

Sago meal is imported into England from the East Indies; but we have met with none in the markets of this country. It is in the form of a fine amylaceous powder, of a whitish color, with a yellowish or reddish tint, and of a faint but somewhat musty odor.

Common sago is insoluble in cold water, but by long boiling unites with that liquid, becoming at first soft and transparent, and ultimately forming a gelatinous solution. Pearl sago is partially dissolved by cold water, probably owing to the heat used in its preparation. Chemically considered, it has the characters of starch. Under the microscope the granules of sago meal appear oval or ovate, and often truncated so as to be more or less muller-shaped. Many of them are broken, and in most the surface is irregular or tuberculated. They exhibit upon their surface concentric rings, which are much less distinct than in potato starch. The hilum is circular when perfect, and cracks either with a single slit or a cross, or in a stellate manner. The granules of pearl sago are of the same form, but are all ruptured, and exhibit only indistinct traces of the annular lines, having been altered in the process employed in preparing them. Those of common sago are very similar to the particles of sago meal, except that they are perhaps rather less regular and more broken. (*Pereira.*)

Potato starch is sometimes prepared in Europe so as to resemble bleached pearl sago, for which it is sold. But, when examined under the microscope, it exhibits larger granules, which are also more regularly oval or ovate, smoother, less broken, and more distinctly marked with the annular rugæ than those of sago; and the hilum often cracks with two slightly diverging slits.

Sago is used exclusively as an article of diet. Being nutritive, easily digestible, and wholly destitute of irritating properties, it is frequently employed in febrile cases, and in convalescence from acute disorders, in the place of richer and less innocent food. It is given in the liquid state, and in its preparation care should be taken to boil it long in water, and stir it diligently, in order that the grains may be thoroughly dissolved. Should any portion remain undissolved, it should be separated by straining; as it might offend a delicate stomach. A tablespoonful to the pint of water is sufficient for ordinary purposes. The solution may be seasoned with sugar and nutmeg or other spice, and with wine, when these are not contraindicated.

SALEP. This name is given to the dried tubers of numerous species of the genus *Orchis*, and in India of the genus *Eulophia*. At present the salep of European commerce is prepared chiefly in the Levant, but to some extent in Germany and other parts of Europe. The German salep is said to be more translucent and more carefully dried than the Levant variety.

Salep is in small, oval, irregular, ovoid or oblong tubers, rarely palmate, hard, horny, semi-transparent, of a yellowish color, a feeble odor, and a mild mucilaginous taste. It is sometimes kept in the state of powder. In composition and relation to water it is closely analogous to tragacanth, consisting of a substance insoluble but swelling up in cold water (*bassorin*), of another in much smaller proportion, soluble in cold water, and of minute quantities of saline matters. It also occasionally contains a little starch. It is highly nutritive, and may be employed for the same purposes as tapioca, sago, etc. Its mediæval and Oriental reputation as an aphrodisiac is unfounded. On account of its hardness, salep, in its ordinary state, is of difficult pulverization; but the difficulty is removed by macerating it in cold water until it becomes soft, and then rapidly drying it.

SAMADERA BARK. This is the inner bark of a tree belonging to the family of Simarubaceæ, growing in Ceylon. It is intensely bitter, and probably contains quassin. For further particulars, see *P. J. Tr.*, 1872, p. 541.

SANDARACH. *Sandaraca.* This is a resinous substance obtained from the *Callitris quadrivalvis* (*Thuya articulata*), an evergreen tree growing in the north of Africa. It is in small, irregular, roundish-oblong grains or tears, of a pale yellow color, sometimes inclining to brown, more or less transparent, dry and brittle, breaking into powder under the teeth, of a faint, agreeable odor increased by warmth, and of a resinous, slightly acrid taste. It melts with heat, diffusing a strong balsamic odor, and easily inflames. It is almost entirely soluble in ordinary alcohol, and entirely so in that liquid when anhydrous, and in ether. Heated oil of turpentine also dissolves the greater part of it, but very slowly. According to Unverdorben, it consists of three resins, varying in their relations to alcohol, ether, and oil of turpentine. The *sandaracin* of Geise, which remains after sandarach has been exposed to the action of ordinary alcohol, is a mixture of two of these resins. Sandarach was formerly given internally, and entered into the composition of various ointments and plasters. At present it is used chiefly as a varnish, and as incense; its powder is rubbed upon paper to prevent ink from spreading, after letters have been scratched out, and is called *Pounce.*

SANICULA MARILANDICA. *Sanicle.* The root of this indigenous umbellifer is popularly known in some parts of the country by the name of *black snakeroot.* It is fibrous and of an aromatic taste, and has been used as a domestic remedy in intermittent fever. Dr. J. B. Zabriskie has found it highly effectual in chorea. He considers it most efficient in substance, and gives the powder to children eight or ten years old in the dose of half a drachm three times a day. (*Am. Journ. of Med. Sci.*, N. S., xii. 374.)

SANTALUM ALBUM ET CITRINUM. *Sandal wood. Saunders.* There are three kinds of wood known by the name of santalum or saunders;—1. *santalum rubrum*, or red saunders, from *Pterocarpus santalinus*, already described in this work under the officinal name of *Santalum;* 2. *santalum album*, or *white saunders*, from the *Santalum album* of Linnæus, growing in the East Indies, the South Pacific Islands, and South America; and 3. *santalum citrinum*, or *yellow saunders*, formerly supposed to be the inner wood of the tree of which the outer constituted white saunders, but now stated to be from a different species, *S. freycinetianum* of M. Gaudichaud, growing in the Sandwich Islands, the Feejee Islands, the Marquesas, on the coast of Malabar, etc. It is this species which supplies the sandal wood so highly valued by the Chinese. Both kinds have a very agreeable aromatic odor. The white is thought by the East India physicians to be refreshing, and useful in remittent fevers, gonorrhœa, and other complaints. It was formerly used in European pharmacy, and still enters into certain compound syrups, confections, etc. The Chinese employ the yellow saunders chiefly as a perfume, burning it in their temples, sick-chambers, etc., and obtain from it a volatile oil by distillation, which they mix with oil of roses. This variety was also formerly used in Europe, and praised as cordial and alexipharmic. The *three saunders* were not unfrequently combined in the same preparation. (*Mérat and De Lens.*) A *volatile oil*, obtained by distillation from a variety of yellow sandal wood, the product of *S. myrtifolium*, growing in continental India (Lindley, *Flor. Med.*, p. 323), was brought into notice by Dr. Thos. B. Henderson (*Med. Times and Gaz.*, 1865), as a remedy in the subacute stages of gonorrhœa. Experience has confirmed the first favorable reports, and the oil is now very much used in the complaint named. It is also of value in chronic bronchitis. It is agreeable to the palate and stomach in doses of 20 to 30 minims 4 or 5 times a day. Oil of cinnamon is often added to its emulsions.

SAPINDUS. Various tropical plants belonging to this genus contain saponin, and are largely used for cleansing purposes. Thus in India are employed the pulp of the fruit of the *Sapindus detergens*, the capsules of *S. emarginatus*, the berries of *S. laurifolius*, and in South America the oil and seed-vessels of *S. saponaria*. (*P. J. Tr.*, 1871, p. 585.) For the properties of saponin, see *Saponaria officinalis*, below.

SAPONARIA OFFICINALIS. *Soapwort.* A perennial herbaceous plant, growing wild in this country in the vicinity of cultivation, but probably introduced from Europe. It is commonly known by the vulgar name of *bouncing bet.* It is one or two feet high, with smooth, lanceolate leaves, and clusters of conspicuous whitish or slightly purplish flowers, which appear in July and August. The root and leaves are employed. They are inodorous, and of a taste at first bitterish and slightly sweetish, afterwards somewhat pungent, continuing long, and leaving a slight sense of numbness on the tongue. They impart to water the property of forming a lather when agitated, like a solution of soap, whence the name of the plant was derived. This property, as well as the medical virtues of the plant, resides in a proximate principle, obtained from the root by Bucholz, and called by him *saponin*, $C_{32}H_{54}O_{18}$. This principle constitutes, according to Bucholz, 34 per cent. of the dried root, which contains also a considerable quantity of gum and a little bassorin, resin, and altered extractive, besides lignin and water. Saponin is obtained, though not absolutely pure, by treating the watery extract with alcohol and evaporating. It is brown, somewhat translucent, hard and brittle, with a sweetish taste, followed by a sense of acrimony in the fauces. It is soluble in water and officinal alcohol, but is insoluble in anhydrous alcohol, ether, and the volatile oils. Although a glucoside, according to Lautenbach (*Journ. Nerv. and Ment. Dis.*, 1879, p. 433), it unites with sulphuric acid to form long and circular crystals. Its watery solution froths when agitated. It is decomposed by dilute acids, though with some difficulty, into *sapogenin*, $C_{14}H_{12}O_2$, and sugar. It has been found in various plants, as different species of Silene, Dianthus, Lychnis, and Anagallis, in *Acacia concinna*, *Vaccaria vulgaris*, *Agrostemma githago.* (*Journ. de Pharm.*, 3e sér., x. 339; also *P. J. Tr.*, 1871, p. 585.) Saponin is locally very irritant, and acts as such probably upon most tissues. In sufficient strength it soon kills by its local action either muscular or nervous tissue. Being a muscle poison, it is capable of producing cardiac palsy. After death from it the mucous membrane of the alimentary canal is usually much inflamed. As it exists in agrostemma seeds it has several times caused death in the human species. The symptoms have been headache, vertigo, vomiting, hot skin, rapid pulse, great difficulty in standing erect, and finally deep coma. Soapwort has been used in Germany as a remedy in venereal and scrofulous affections, cutaneous eruptions, and visceral obstructions. It appears to act as an alterative, like sarsaparilla, to which it has been deemed superior in efficacy by some physicians. The plant is given in the form of decoction and extract, which may be freely taken. From two to four pints of the decoction daily are recommended in lues. The inspissated juice, given in the quantity of half an ounce in the course of a day, is said by Andry generally to cure gonorrhœa in about two weeks, without any other remedy.

SARCOCOLLA. A peculiar vegetable product, exuding spontaneously from the *Penæa sarcocolla*, *P. mucronata*, and other species of Penæa, small shrubs growing at the Cape of Good Hope, in Ethiopia, Arabia, etc. It is in the form of small, roundish, irregular grains, sometimes agglutinated in masses, friable, opaque or semi-transparent, of a yellowish or brownish red color, inodorous unless heated, when they have an agreeable smell, and of a peculiar, bitter, sweetish, and acrid taste. Sarcocolla, according to Pelletier, consists of 65·3 per cent. of a peculiar substance, considered by Dr. Thomson as holding an intermediate place between gum and sugar, and called *sarcocollin*, $C_{13}H_{23}O_6$, or pure sarcocolla, 4·6 of gum, 3·3 of a gelatinous matter having some analogy with bassorin, and 26·8 of lignin, etc. It is said to be purgative, but at the same time to produce serious inconvenience by its acrid properties. The Arabian physicians used it internally; and by the ancients it was employed as an external application to wounds and ulcers, under the idea that it possessed the property of agglutinating the flesh, whence its name was derived. It is out of use.

SARRACENIA. *Side-saddle Plant. Fly-trap.* According to Dr. E. P. Porcher, the roots of *Sarracenia flava* and *variolaris* have long been used in the Southern United States in dyspepsia. In trying the remedy upon himself, Dr. Porcher found it to be bitter and astringent to the taste, and, in its effects on the system, stimulant to the stomach, the circulation, and in some degree to the brain, and at the same time to a certain extent diuretic, and disposed to operate mildly on the bowels. Prof. Sheppard found it to contain lignin, coloring matter, resin, an acid salt of lime, and a salt probably of an organic alkali. The value of *S. flava* in diarrhœa has recently been reasserted by Dr. J. D. Palmer. He makes a tincture by macerating, for fourteen days, four ounces of the root with two pints of alcohol, then expressing and filtering. The dose was a teaspoonful after each evacuation. (*A. J. P.*, 1869.) Not long since, wonderful virtues were claimed for *S. purpurea* in smallpox, but experience has shown the first statements to be unfounded. M. Stan. Martin claims that he has found in the root of this species—1, an alkaloid which he proposes to name *sarracenine;* 2, a resin; 3, a yellow coloring principle (probably identical with Schmidt's *sarracenic acid*); 4, extractive; 5, substances which constitute the framework of plants. Sarracenine (*sarracenia*) is white, soluble in alcohol and ether, combines with acids to form salts, and with sulphuric acid forms handsome needles, which are bitter, and communicate this taste to its menstrua. (*Ann. de Thérap.*, 1866, p. 73.) E. Schmidt, however, found no alkaloid, but discovered *sarracenic acid.* (*A. J. P.*, 1872, p. 213.)

SASSA GUM. This name has been applied by Guibourt to a gum, occasionally brought into market from the East, and answering so exactly to Bruce's description of the product of a tree which he calls *sassa*, that there is reason to believe in their identity. According to Guibourt's description, it is in mammillary masses, or in convoluted pieces resembling an ammonite, of a reddish color and somewhat shining surface, and more transparent than tragacanth. Its taste is like that of tragacanth, but slightly acrid. When introduced into water, it becomes white, softens, and swells to four or five times its original bulk; but it preserves its shape, neither like tragacanth forming a mucilage, nor like Bassora gum separating into distinct flocculi. It is rendered blue by iodine.

SASSY BARK. *Mancona Bark.* This bark is interesting chiefly from its employment by the natives of Western Africa as an ordeal in their trial for witchcraft or sorcery. Specimens sent to this country from Liberia were first examined by Mr. C. A. Santos, who published his observations in the *A. J. P.*, 1849, xxi. 97. Other specimens both of the bark and the plant producing it, afterwards came under the notice of Professor Procter, who was thus enabled to determine the chemical characters as well as the botanical source of the product. His papers on the subject are contained in the same journal (xxiii. 301, and xxiv. 195); and in the last is given a botanical description of the tree. To these papers the reader is referred for particular information on the subject. The bark was thought to be the product of a previously undescribed species of *Erythrophleum*, for which Prof. Procter proposed the name of *E. judiciale.* It appears, however, from a note of Prof. Lindley, published in the *P. J. Tr.*, 1857 (p. 373), that the tree had been previously described under two specific names, having been noted in Hooker's *Niger Flora* (p. 329) as the *Erythrophleum Guineense* of Don, and being also the *Fillæa suaveolius* of Guillemin and Perottet's Flora of Senegal; facts, of course, unknown to Prof. Procter, when his papers were written. It is a large tree with spreading branches, doubly pinnated leaves, flowers in spike-like racemes, and leguminous fruit. The bark is in pieces more or less curved, with or without epidermis, in the former case somewhat fissured externally, of a dull red color diversified by whitish spots, brittle, presenting when cut transversely numerous fawn-colored spots surrounded by reddish brown tissue, nearly inodorous, of an astringent taste, and, according to Mr. Santos, of the sp. gr. 1·054. Prof. Procter found it to contain tannic acid, insoluble apotheme analogous to that of rhatany, a red coloring matter formed by a combination of the two preceding constituents, gallic acid, gum, a little resin, fatty matter, various salts, and a peculiar substance precipitable by tannic acid, and soluble in alcohol and chloroform. He did not isolate the active principle. Gallois and Hardy obtained the poisonous principle *erythrophleine*, by making an alcoholic extract of the bark, exhausting this with water, evaporating, rendering this extract alkaline with ammonia, and treating with acetic ether. The alkaloid is a colorless, crystalline solid, soluble in water, acetic ether, alcohol, and amylic alcohol, insoluble in chloroform, benzin, and ether. In contact with sulphuric acid and black oxide of manganese, a violet color (less intense than that produced with strychnine) is developed. The bark yields its virtues to water. In reference to its effects on the system it has been considered as emetic and cathartic, with some influence over the cerebral functions; but little was certainly known. Professor Procter found three grains of the aqueous extract, given to a cat, to produce prostration, frothing at the mouth, dilatation of the pupils, and total loss of inclination to eat. Largely taken, the bark was known often to cause death. The powder snuffed up the nostrils occasions violent sneezing. Some experiments made with it by Drs. S. Weir Mitchell and W. A. Hammond have given us more precise knowledge in regard to its properties. From these it appears to be nauseating and emetic, narcotic, and astringent, but without any cathartic power. The same writers give the following as the result of the observations of Dr. Savage, made in Africa, and communicated to them. When the bark is chewed, it causes a feeling of constriction in the fauces, attended with prickling, and followed by numbness. A strong infusion or decoction occasions stricture across the brow, severe pain in the head, coma, and death. Independently of its use by the natives as an ordeal poison, it is sometimes employed by them as a remedy in dysentery, diarrhœa, and colic. Dr. Savage himself has known it to be successful in intermittent fever, dysentery, and diarrhœa. A grain of the watery extract was given for a dose every three hours. (*Charleston Med. Journ.*, 1859, p. 735.)

SATUREJA HORTENSIS. *Summer Savory.* S. MONTANA. *Winter Savory.* Annual labiate plants, resembling thyme in odor and flavor, growing spontaneously in the south of Europe, and cultivated in gardens as culinary herbs.

SAURURUS CERNUUS. *Lizard's Tail.* Dr. D. L. Phares, of Newtonia, Miss., speaks of this indigenous swamp plant as being much used in some parts of the country, both in regular and domestic practice, as a soothing, discutient cataplasm. He considers it "laxative, antispasmodic, sedative, and slightly astringent," and for many years has employed it largely, and with most satisfactory results, in irritation and inflammation of the kidneys, bladder, prostate, and urinary passages generally. He considers it peculiarly applicable to cases attended with strangury. It is generally acceptable to the stomach. Dr. Phares uses it both externally and internally. He gives it in strong infusion, made with the plant whether fresh or dried, of which from one to four ounces may be given every fifteen or thirty minutes, or three or four times a day, according to the urgency of the symptoms. (*A. J. P.*, 1867, p. 468; from *Atlanta Med. and Surg. Journ.*, July, 1867.)

SCOLOPENDRIUM OFFICINARUM. Smith. *Asplenium Scolopendrium.* Linn. *Harts-tongue.* The leaves of this fern, which is indigenous both in Europe and America, have a sweetish, mucilaginous, and slightly astringent taste, and, when rubbed, a disagreeable oily odor. They were used as a deobstruent in visceral affections, as an astringent in hemorrhages and fluxes, and as a demulcent in pectoral complaints; but have deservedly fallen into neglect.

SCROPHULARIA NODOSA. *Figwort.* This European plant has become abundantly naturalized in America. Its leaves have when fresh a rank fetid odor, and a bitter, somewhat acid taste; but these properties are diminished by drying. Water extracts their virtues, forming a reddish infusion, which is blackened by ferric sulphate. Walz has obtained from them two proximate principles, which he names respectively *scrophularin* and *scrophularosmin.* (Mayer, *A. J. P.*, 1863, p. 295.) Figwort leaves were formerly considered tonic, diuretic, diaphoretic, discutient, anthelmintic, etc., and were thought to be useful in scrofula. They are at present very little employed; but in Europe are sometimes applied, in the form of ointment or fomentation, to piles, painful tumors, ulcers, and cutaneous eruptions.

SECALE CEREALE. *Rye.* Syria, Armenia, and the southern provinces of Russia have been severally indicated as the native country of rye. The plant is now cultivated in all temperate latitudes. The *grains* consist, according to Einhof, of 24·2 per cent. of envelope, 65·6 of flour, and 10·2 of water. The *flour*, as an average of many analyses, consists of 14·24 per cent. water, 10·97 per cent. nitrogenous material, 1·95 per cent. fat, 3·88 per cent. sugar, 7·13 per cent. gum and dextrin, 58·73 per cent. starch, 1·62 per cent. woody fibre, and 1·48 per cent. ash. (König, *Nahrungs- und Genussmittel*, Berlin, 1880.) Rye flour has been much used, in the dry state, as an external application to erysipelatous inflammation, and other eruptive affections, the burning and unpleasant tingling of which it tends to allay, while it absorbs the irritating secretions. In the form of mush, it is an excellent laxative article of diet, and, mixed with molasses, it may be given with great advantage in hemorrhoids and prolapsus ani, connected with constipation. Rye carbonized by heat, with exclusion of the air, has been highly recommended as a tooth-powder.

SEDUM ACRE. *Biting Stone-crop. Small Houseleek.* This European plant has escaped to some extent from the gardens and grows wild in New England. Taken internally it vomits and purges, and applied to the skin produces inflammation and vesication. The fresh herb and the expressed juice have been used as an antiscorbutic, emetic, cathartic, and diuretic, and have been applied locally to old ulcers, warts, and other excrescences; but the plant is at present little employed. Other species are less acrid, and are even eaten as salad in some parts of Europe. Such are *Sedum rupestre* and *S. album*. *S. Telephium* was formerly employed externally to cicatrize wounds, and internally as an astringent in dysentery and hæmoptysis, and is still esteemed by the common people in France as a vulnerary. M. Ernst Mylius found in 100 parts of *Sedum acre* 2·2 parts of a soft, not acid resin, 12·80 parts of uncrystallizable sugar, and 12·40 parts of a soft acid resin, besides an alkaloid and inert substance. (*Journ. de Pharm.*, 4e sér., xvii. 81.)

SELINUM PALUSTRE. (*Linn.*) *Peucedanum montanum.* (Lindley, *Flor. Med.*) *Marsh Parsley. Persil de marais.* (Fr.) The root of this European umbellifer is, when dried, of a brown color externally, having a strong aromatic odor, and an acrid, pungent, aromatic taste. The powder is of a light grayish yellow color. Analyzed by Peschier, it was found to contain a volatile oil, a fixed oil soluble in ether and alcohol, gum, a yellow coloring substance, a nitrogenous, mucoso-saccharine principle, a peculiar acid which he calls *selinic*, phosphate of calcium, and lignin. The root of *Selinum palustre* has long been a popular remedy for epilepsy in the Russian province of Courland; and has been commended to the profession by Drs. Trinius (1818) and Herpin (1859). Dr. Herpin also uses it as an antispasmodic in hooping-cough, etc. He gives from 20 to 30 grains of it thrice daily, rapidly increased until four times the amount is taken. (*Journ. de Pharm.*, Juillet, 1859.)

SEMPERVIVUM TECTORUM. *Common Houseleek.* In Europe the leaves of this plant are employed in the recent state and bruised, as a cooling application to burns, stings of bees, hornets, etc., ulcers, and other external affections attended with inflammation. The juice is said to cure warts.

SENECIO VULGARIS. *Common Groundsel.* An annual European plant, introduced into this country, and growing in cultivated grounds. The whole herb is used, and should be gathered while in flower. It has, when rubbed, a peculiar rather unpleasant odor, and a disagreeable, herbaceous, bitterish, and saline taste, followed by a sense of acrimony. It is emetic in large doses, and has been given in convulsive affections, liver complaints, spitting of blood, etc., but is now very little used. The bruised herb is sometimes applied externally to painful swellings and ulcers. The plant is employed also as food for birds, which are fond of it. Other species of Senecio have been medicinally used; and an indigenous species, the *S. aureus* or *ragwort*, is said by Schoepf to be a favorite vulnerary with the Indians. The "eclectics" consider it emmenagogue, and use it not only to stimulate the function, but to regulate it when in excess or otherwise deranged. They also believe it to possess diuretic properties, and to be useful in disorders of the urinary organs. They give the name of *senecin* to a preparation made by precipitating the tincture with water; but this name should be reserved for the active principle when discovered. The whole plant is used in decoction or infusion, which may be taken freely.

SIENNA. *Terra di Sienna.* An argillaceous mineral, compact, of a fine texture, very light, smooth, and glossy, of a yellowish brown or coffee color, leaving a dull orange trace when moistened and drawn over paper. By calcination it assumes a reddish brown color, and is then called *burnt sienna.* In both the raw and burnt states it is used in painting. The best sienna is brought from Italy, but an inferior kind is found in England.

SILENE VIRGINICA. *Catchfly. Wild Pink.* The wild pink of West Virginia and the Carolinas is said to be considered by the Indians poisonous, and by Prof. Barton an anthelmintic.

SILEX, PULVERIZED. SILEX CONTRITUS. *Lond. Silicic Acid.* In operations of pharmacy, substances are sometimes employed whose action is exclusively mechanical. Thus, in the U. S. Pharmacopœia, formerly sand was used in preparing oil of amber and the fluid extract of rhubarb, and carbonate of magnesium in forming several of the medicated waters. The use of the same carbonate was also directed in the London Pharmacopœia of 1836, in alternative processes for preparing several of these waters. Mr. R. Warington objected to the use of this carbonate, as being dissolved to an injurious extent, and proposed to substitute porcelain clay, or pulverized silica, glass, or pumice stone. The London College, probably influenced by this objection, abandoned, in its Pharmacopœia of 1851, the use of carbonate of magnesium, and substituted finely pulverized silex, under the name of *Silex contritus.* This powder may be conveniently obtained from *colorless* quartz or rock-crystal. In order to render the mineral more easily pulverizable, it is advantageous to heat it to redness, and quench it in water. It may then be reduced to fine powder in a porphyry or agate mortar. The London College prepared all the medicated waters, except two, from the volatile oils of the plants, in addition to the method of distillation with water from the plants themselves. When the volatile oils were used, pulverized silex was directed as a mechanical agent. The oil was rubbed up first with the silex and then with the water, and the whole was filtered. The silex acted by minutely dividing the oil and diffusing it through water, and, by the subsequent filtration, was entirely removed.

Pulverized silex is a harsh, white, tasteless powder, insoluble in water and most other solvents. Its sp. gr. is 2·66. In composition it is a silicic oxide, SiO_2. *Silicon* is a non-metallic element, which has been obtained in three allotropic states, called amorphous, graphitoidal, and octohedral silicon; the first corresponding to charcoal, the second to graphite, and the third to diamond. The octohedral crystallizes like diamond with curved facets, is hard enough to scratch glass but not topaz, and has the sp. gr. 2·49. Pure *silica* is easily prepared by acidulating commercial solution of silicate of sodium with hydrochloric acid, heating and evaporating, and washing the precipitated silica.

SILICATE OF MAGNESIUM, HYDRATED. *Meerschaum.* ($2MgO,3SiO_2+2H_2O$.) A mineral used in France for the manufacture of smoking-pipes, which is known popularly by the name of meerschaum. It was brought into notice as a medicine by M. Garraud, a distinguished physician of Laval, who, struck with its resemblance to subnitrate of bismuth, being like it white, tasteless, and insoluble, was induced to use it as a substitute for that medicine in obstinate choleraic diarrhœa, and met with so much success as to induce him to make the remedy public. M. Trousseau employed it also with great success in numerous cases of diarrhœa. It is reduced to fine powder, and given in doses of from one to four drachms a day. It no doubt acts mechanically, either as an absorbent or a protective of the intestinal coats. (*Journ. de Pharm.*, 4e sér., iii. 385.)

SILICATE OF SODIUM. *Sodii Silicas. Soluble Glass.* (Na_2SiO_3.) Silicate of sodium is made by fusing one part of silica, fine sand or powdered flint, and two of dried carbonate of sodium, mixed in powder, in an earthenware crucible, and pouring out the fused mass on a stone slab to cool. This is pulverized, and treated with boiling water, to dissolve the soluble part. The solution is filtered and concentrated, so as to form crystals on cooling. These are then purified by dissolving them in water heated to 37·7° C. (100° F.), filtering the solution, and concentrating it so that it may recrystallize. The commercial *solution of silicate of sodium* usually contains about 20 per cent. of silica and 10 per cent. of soda.

Silicate of potassium, K_2SiO_3, also known as *soluble glass*, is prepared in the same way as the sodium salt. These salts have been used in rheumatism, gout, etc. (*A. J. P.*, 1857, p. 314; *Ann. de Thérap.*, 1865, p. 236), but are probably of no service. As suggested by Prof. Shun, they form excellent substitutes for starch, dextrin, and plaster of Paris, in the preparation of immovable dressings in the case of certain fractures of the limbs, and diseased joints. The solution is applied, of a syrupy consistence, by means of a brush, to the bandages, upon which it rapidly hardens, requiring only five or six hours for this result. The facility of removing them by means of hot water is another advantage which it possesses over the other dressings. (*Journ. de Pharm.*, 4e sér., iv. 52.)

SILPHIUM LACINIATUM. The *rosin weed*, or *compass plant*, of Ohio, yields an oleoresin, which is said to be gathered by children as a chewing gum. For further information, see *A. J. P.*, 1881, p. 487.

SIMARUBA. Under this name the U. S. P. formerly recognized the bark of the root of *S. officinalis.* (*Ecorce de simarouba*, Fr.; *Simarubarinde*, G.; *Corteccia di simaruba*, It.; *Corteza de simaruba*, Sp.) *Quassia Simaruba. Simaruba officinalis.* De Cand. *S. amara*, Aublet. As this plant is unisexual, it belongs to the genus Simaruba of De Candolle and Lindley, those only being placed by these botanists in the genus Quassia which are hermaphrodite. But, as the Linnæan arrangement was adhered to in the case of *Quassia excelsa*, we continue to adhere to it in relation to this plant. (See *Quassia.*) It is a tree of considerable height and thickness, having alternate branches, with a bark which in the old tree is black and somewhat furrowed, in the young is smooth, gray, and marked here and there with broad yellow spots. The leaves are alternate and abruptly pinnate, with a naked petiole, to which the leaflets are alternately attached by short footstalks. The leaflets are nearly elliptical, on the upper surface smooth and deep green, on the under whitish. The flowers are yellow, and in long axillary panicles. In some descriptions they are stated to be monœcious, in others diœcious. According to Dr. Wright, the female flowers are never found in Jamaica on the same tree with the male. The number of stamens is ten.

The tree is found in the West Indies and Guiana. In Jamaica it is called the *mountain damson. Simaruba amara* of Aublet, which grows in Guiana, and has generally been considered identical with *Q. Simaruba*, is believed by Hayne to be a distinct species; the Jamaica plant having diœcious, while this has monœcious flowers. The bark of the root is the part employed; the wood itself being nearly tasteless and inert.

Simaruba bark is in long pieces, some inches in breadth, folded lengthwise, light, flexible, tenacious, very fibrous, externally of a light brownish yellow color, rough, warty, and marked with transverse ridges, internally of a pale yellow. It is without smell, and of a bitter taste. It readily imparts its virtues, at ordinary temperatures, to water and alcohol. The infusion is at least equally bitter with the decoction, which becomes turbid as it cools. Its constituents, according to M. Morin, are a bitter principle identical with *quassin*, $C_{10}H_{12}O_3$, a resinous matter, a volatile oil having the odor of benzoin, malic acid, gallic acid in very minute proportion, an ammoniacal salt, malate and oxalate of calcium, some mineral salts, oxide of iron, silica, ulmin, and lignin.

Medical Properties and Uses. Simaruba possesses the same tonic properties as other simple bitters, and may be employed for the same purposes. In large doses it is said to purge and vomit. It was introduced into France in 1713 from Guiana, where it had previously been used as a remedy for dysentery. In the treatment of this disease and of obstinate diarrhœa, it afterwards obtained much credit in Europe; but Cullen was right in denying to it any specific control over these complaints. It operates simply as a tonic, and, though occasionally beneficial in relaxed and debilitated states of the alimentary canal, would do much harm if indiscriminately prescribed in dysenteric cases. On account of its difficult pulverization, it is seldom given in substance. The best mode of administration is by infusion. The dose is from a scruple to a drachm.

SISYMBRIUM OFFICINALE. Scopoli. *Erysimum officinale.* Linn. *Hedge Mustard.* This annual, growing in Europe and the United States, is said to be diuretic and expectorant, and has been recommended in chronic coughs, hoarseness, and ulceration of the mouth and fauces. The juice of the plant may be used mixed with honey or sugar, or the seeds may be taken in substance. *Sisymbrium Sophia*, or the *flax weed*, was formerly officinal. It is of a pungent odor when rubbed, and of an acrid biting taste. The herb has been used externally in indolent ulcers, and the seeds internally in worms, calculous complaints, etc. *Sisymbrium muralis* (*Ditoplaxis muralis*, P. Robert) has been used in France in scurvy, scrofula, and other cachectic affections, especially associated, in the form of syrup, with iodide of potassium. (*Ann. de Thérap.*, 1864, p. 126.)

SIUM NODIFLORUM. *Water-parsnep.* A perennial, umbelliferous, aquatic European plant, growing also in the southern section of the United States, where it is supposed to have been introduced. It is commonly considered poisonous; but the expressed juice, given by Withering in the dose of three or four ounces every morning, was not found to affect the head, stomach, or bowels. He found it, in this quantity, very advantageous in obstinate cutaneous diseases; and the plant has been usefully employed by others in similar complaints, and in scrofulous swellings of the lymphatic glands. It is considered diuretic. *Sium latifolium*, which grows in Europe and the United States, particularly along the water-courses of the valleys of the Pacific slope, and is the *common water-parsnep* of this country, is positively asserted to be poisonous, and madness and even death are said to have followed the use of the root. This plant has been examined by A. R. Porter and N. Rogers. (*A. J. P.*, 1876, pp. 348, 483.) The active principle seems to be a resinous body, which produced poisonous symptoms upon animals. *S. Sisarum*, or *skirret*, a plant of Chinese origin, cultivated in Europe, has a sweetish, somewhat aromatic root, which is employed as food in the form of salad, and is supposed to be a useful diet in complaints of the chest.

SMALT. *Azure.* When the impure oxide of cobalt, obtained by roasting the native arsenide of that metal, is heated with sand and potassa, the mixture melts, and a beautiful blue glass results, which, when reduced to powder, receives the name of smalt or azure. It is used chiefly in painting.

SODIUM ETHYLATE. *Ethylate of Sodium. Caustic Alcohol.* (C_2H_5NaO.) This preparation was introduced by Dr. B. W. Richardson, of England, as a caustic when specially indicated. He makes it by adding sodium in small pieces gradually, to absolute alcohol, kept at a temperature of 10° C. (50° F.); hydrogen is evolved, and when, owing to the formation of the ethylate, the reaction slackens, the liquid is to be carefully heated to 37·7° C. (100° F.). Sodium is now cautiously added until the reaction ceases; the liquid is now cooled to 10° C. (50° F.), and the same quantity of absolute alcohol added as was used in the beginning. (*P. J. Tr.*, 1878, p. 485.)

L. H. Smith (*N. R.*, 1882, p. 104) proposes a *solution of sodium ethylate* of definite strength (10 per cent.); the quantities used for this solution are 0·68 Gm. sodium and 20 C.c. absolute alcohol.

Ethylate of sodium is a white powder, frequently having a brownish tinge, dissolving in water with a hissing sound, having the property of splitting into alcohol and caustic soda upon contact with even a small quantity of water, or moist living tissue, $C_2H_5NaO + H_2O = C_2H_5HO + NaHO$.

Medical Properties. Sodium ethylate is only of medical value as a caustic; it is said to act with great vigor. There is no reason for believing that sodium ethylate will ever prove of any value as an internal remedy. When, however, it comes in contact with moist tissue, owing to the liberation of its sodium, it acts as a very speedy and powerful caustic. It should always be used in alcoholic solution, and applied by means of a glass rod. It is said to cause very little pain, and has been especially employed for the destruction of nævi. (*London Lancet*, Nov. 1878.) Dr. Richardson states that it should always be kept in glass-stoppered bottles in a cool place, as he has known it to explode when placed in warm situations.

SOLIDAGO. There are very numerous species of this composite genus in the United States. Of these *S. odora* was formerly officinal. *S. Virgaurea*, which is common to the United States and Europe, was formerly directed by the Dublin College. It is astringent, and has been supposed to possess lithontriptic virtues. For a study of the flowers of *S. bicolor* by Mr. Adam Conrath, see *A. J. P.*, 1873, p. 253.

Solidago odora. Sweet-scented golden-rod has a perennial creeping root, and a slender, erect, pubescent stem, two or three feet high. The leaves are sessile, linear-lanceolate, entire, acute, rough at the margin, elsewhere smooth, and covered with pellucid dots. The flowers are of a deep golden yellow color, and are arranged in a terminal, compound, panicled raceme, the branches of which spread almost horizontally, are each accompanied by a small leaf, and support the flowers on downy pedicels, which put forth from the upper side of the peduncle, and have small linear bracts at their base. The florets of the ray are ligulate, oblong, and obtuse; those of the disk, funnel-shaped, with acute segments. The plant grows in woods and fields throughout the United States, and is in flower from August to October. The leaves, which are the officinal portion, have a fragrant odor, and a warm, aromatic, agreeable taste. These properties depend on a volatile oil, which may be separated by distillation with water. It is of a pale greenish yellow color, and lighter than water.

Golden-rod is aromatic, moderately stimulant and carminative, and, like other substances of the same class, diaphoretic when given in warm infusion. It may be used to relieve pain arising from flatulence, to allay nausea, and to cover the taste or correct the operation of unpleasant or irritating medicines. For these purposes it may be given in infusion. The volatile oil dissolved in alcohol is employed in the Eastern States. The dried flowers and leaves are used as a pleasant and wholesome substitute for common tea.

SOLUBLE MERCURY OF HAHNEMANN. ($NH_2(Hg_2)NO_3$.) This is prepared by adding, drop by drop, a dilute solution of ammonia to an equally dilute solution of mercurous nitrate, until the precipitate begins to be paler than at first. It is a black powder. When it has a gray color, the fact shows that too much ammonia has been employed in its precipitation. In this case $NH_2(Hg_2)NO_3$ yields $NH_2(Hg)NO_3+Hg$. This preparation was included in the old French Codex. It has been used in syphilitic diseases.

SOOT. *Fuligo Ligni.* This well-known substance has a peculiar smell, and a bitter, empyreumatic, and disagreeable taste. Its composition is very complex. Reduced to powder, and treated with water, it affords an infusion of a deep yellow or brown color, which is deeper if heat be employed. The insoluble portion amounts to about 44 per cent. The soluble part consists chiefly, according to Berzelius, of a pyrogenous resin united with acetic acid (*acid pyretin*), saturated with potassa, lime, and magnesia. It also contains sulphate of calcium, chloride of potassium, acetate of ammonium, and traces of nitric acid. When the solution is evaporated to dryness, it furnishes a black extract. This forms with water a blackish brown solution, which, when treated with any free acid except the acetate, lets fall the acid pyretin, in the form of a black mass resembling pitch; while the acid employed remains in solution with the bases previously in combination with the pyretin. Braconnot thought he had discovered in pyretin a peculiar principle, which he named *asbolin;* but Berzelius believed he was mistaken. Besides these substances, Braconnot ascertained the existence in soot of an azotized extractive matter to the amount of 20 per cent. This matter, when submitted to dry distillation, afforded a considerable proportion of pyrogenous oil. Soot itself, when subjected to a similar distillation, furnishes one-fifth of its weight of empyreumatic oil. To the above ingredients of soot must be added creasote, to the presence of which it is supposed to owe its medicinal properties.

Soot was formerly officinal with the Edinburgh College, and the Scotch physicians were in the habit of frequently prescribing it as a tonic and antispasmodic in the form of tincture. At present it is very rarely, if ever, administered. It has been employed to some extent as an external remedy in skin diseases. (See *Revue Méd.*, June, 1834; *Bull. Gén. de Thérap.*, Mars, 1834; also, 14th ed. *U. S. D.*) An *infusion of hickory ashes and soot* is used in this city as a popular remedy for dyspepsia. It is made by infusing a pint of clean hickory ashes and a gill of soot in half a gallon of boiling water, allowing the liquor to stand for twenty-four hours, and then decanting. Of this a small wineglassful is taken three or four times a day. No doubt this infusion has been useful in acidity of stomach; but its indiscriminate use in the various gastric affections, popularly confounded under the name of dyspepsia, is calculated to do much harm. Soot has disinfecting power. A few shovelfuls of it, thrown into privies or drains, effectually destroy their foul exhalations.

SOPHORA SPECIOSA. From the poisonous seeds of this leguminous Texan tree Dr. H. C. Wood has obtained a volatile liquid alkaloid (*sophorine*) whose chloride is crystalline. The most characteristic test is its striking a deep red color with tincture of the chloride of iron. For method of preparation and other further information, see *A. J. P.*, 1878, pp. 33 and 283. In the seeds of the *S. sericea*, which grows in Colorado and Mexico, Mr. Parsons, of the United States Agricultural Department, has found a liquid alkaloid, which is probably sophoria. (*Rep. Commissioner of Agricult.*, 1879; also *N. R.*, 1881, p. 67.)

SORBUS AUCUPARIA. *Mountain Ash.* A small European tree, whose fruit contains a peculiar kind of sugar called *sorbin*, $C_6H_{12}O_6$, susceptible of the vinous fermentation; an alcoholic drink has been prepared from it. It seems to have been used for preparing malic acid; and Dr. Hofmann has discovered in it two new acids, which he designates as *sorbic* and *parasorbic acids.* (See *P. J. Tr.*, 1859, p. 573.) M. J. Boussingault has found in it a crystalline saccharine principle, *sorbite*, isomeric with mannite, melting, when anhydrous, at 110° to 111° C. (230° to 231·8° F.), when hydrated, at 102° C. (215·6° F.). Its formula is $C_6H_{14}O_6$. It does not undergo the vinous fermentation. (*P. J. Tr.*, 1872, p. 28.) It has been used in scurvy, and, in infusion, as a remedy in hemorrhoids and strangury. All parts of the tree are astringent, and may be employed in tanning, and dyeing black. *S. Americana*, or American Mountain Ash, probably has similar virtues to the European species.

SORGHUM SACCHARATUM. *Sorghum. Chinese Sugar-cane.* This valuable plant, indigenous in India, China, and other parts of the East, has within a few years been introduced into Europe and the United States. It was not till 1851 that the seeds were first sent to France from China; and so late as 1855 only a few acres were cultivated. In 1854 some seeds were brought to the United States by Mr. D. Jay Browne, for the Patent Office, from France, and were distributed to different persons through the country. (*H. S. Olcott.*) The sorghum is now very largely cultivated in this country and in France, and there has probably been no instance in which a plant has more rapidly grown into general favor, as an object of agriculture, than this. Barth, in his Travels in Africa (Am. ed., ii. 339), states that it is extensively cultivated in the interior of that continent. It has been extensively cultivated in the United States for the production of syrup, and there is every prospect of its being still more largely grown for sugar-making. Any one desirous of knowing the details as to the best modes of culture, varieties of the cane, percentage yield of sugar, etc., should consult the recent publications of the U. S. Agricultural Department, especially *Letter on Sorghum*, 1880, Report of Peter Collier, Chemist, on Sorghum and Cornstalks, 1881, Special Report, No. 33, Government Printing-Office, Washington, D.C.

SPARTIUM JUNCEUM. *Spanish Broom.* A small shrub, indigenous in the south of Europe, and cultivated in our gardens as an ornamental plant. The flowers are large, yellow, and of an agreeable odor. The seeds are in moderate doses diuretic and tonic, in large doses emetic and cathartic, and have been used advantageously in dropsy. The dose is from ten to fifteen grains three times a day in tincture.

SPILANTHES OLERACEA. A plant of India, used as a masticatory for the relief of toothache. It contains some acrid principle, and when chewed produces a copious flow of saliva. (*A. J. P.*, xliv. 323.)

SPIRÆA. *Spiræa Ulmaria*, *Queen of the Meadow*, or *Meadow-sweet*, which is a European plant, though introduced into this country, has been found by M. Tessier, of Lyons, to possess valuable diuretic properties, united with those of a moderate tonic and astringent. All parts of it are active. *Salicylic aldehyde* (salicylous acid), $C_7H_6O_2$, was recognized already in 1834 by Pagenstecher as occurring in the blossoms of *Spiræa Ulmaria.* It is a colorless oil, of aromatic odor, crystallizing at 20° C. (68° F.) and boiling at 196·5° C. (385° F.). It is inflammable, burning with luminous smoky flame. M. Tessier employed it in the form of decoction, of which he gave a quart daily. For more extended observations in relation to this medicine, see Bouchardat's *Annuaire de Thérapeutique* (1852, p. 119).

Spiræa tomentosa, or *Hardhack*, is an indigenous shrub, two or three feet high, with numerous simple, erect, round, downy, and purplish stems, furnished with alternate leaves, closely set upon very short footstalks. The leaves are ovate-lanceolate, unequally serrate, somewhat pointed at both ends, dark green on their upper surface, whitish and tomentose beneath. The flowers are a beautiful red or purple, and disposed in terminal, compound, crowded spikes or racemes.

The hardhack flourishes in low grounds, from New England to Carolina, but is most abundant in the Northern States. It flowers in July and August. All parts of it are medicinal. The root was formerly recognized in the U. S. Pharmacopœia, but, according to Dr. A. W. Ives, it is the least valuable portion. The taste of the plant is bitter and strongly astringent. Among its constituents are tannin, gallic acid, and bitter extractive. Water extracts its medicinal virtues.

Spiræa is tonic and astringent, and may be used in diarrhœa, cholera infantum, and other complaints in which astringents are indicated. It is said to have been employed by the aborigines; but was first brought to the notice of the medical profession by Dr. Cogswell, of Hartford, Connecticut.

The form in which it is best administered is that of an extract, prepared by evaporating the decoction of the leaves, stems, or root, or an infusion of the same parts made by percolation. The dose is from five to fifteen grains, repeated several times a day. A decoction, prepared by boiling an ounce of the plant in a pint of water, may be given in the dose of one or two fluidounces.

SPONGE. *Spongia. Spongia officinalis.* U.S. 1850. This, being no longer recognized in the Pharmacopœias, is transferred to this place. The sponge is now generally admitted to be an animal. It is characterized as "a flexile, fixed, torpid, polymorphous animal, composed either of reticulate fibres, or masses of small spires interwoven together, and clothed with a gelatinous flesh, full of small mouths on its surface, by which it absorbs and ejects water." More than two hundred and fifty species have been described by naturalists, of which several are probably employed, though *Spongia officinalis* is the only one that has been designated in the Pharmacopœias. Sponges inhabit the bottom of the sea, where they are fixed to rocks or other solid bodies, and are most abundant within the tropics. They are collected chiefly in the Mediterranean and Red Seas, and in those of the East and West Indies. In the Grecian Archipelago many persons derive their support altogether from diving for sponges. When collected they are enveloped in a gelatinous coating, which forms part of the animal, and is separated by first rubbing them with fine sand (*Landerer*), and then washing them with water. Large quantities of the coarser kinds are imported from the Bahamas, but the finest and most esteemed are brought from the Mediterranean, especially from the coasts of Syria. Recently the cultivation of sponges has been undertaken on an extensive scale. Small fragments are cut under water from the live sponge, and fixed upon a sandy bottom by means of skewers. In three years they will have grown sufficiently to be marketable.

Sponge, as found in commerce, is in yellowish brown masses of various shapes and sizes, light, porous, elastic, and composed of fine, flexible, tenacious fibres, interwoven in the form of cells and meshes. It usually contains numerous minute fragments of coral or stone, or small shells, from which it must be freed before it can be used for ordinary purposes. Sponge is prepared by macerating it for several days in cold water, beating it in order to break up the concretions which it contains, and dissolving what cannot thus be separated of the calcareous matter by hydrochloric acid diluted with thirty parts of water. By this process it is rendered perfectly soft, and fit for surgical use. It may be bleached by steeping it in water impregnated with sulphurous acid, or by exposure in a moist state to the action of chlorine. It is stated that sponges which have been soaked in pus and infectious matters will recover their primitive condition, even to the marine odor, by soaking in a 4 per cent. solution of permanganate of potassium, then in a 25 per cent. solution of sulphurous acid, and finally thorough washing in an abundance of water. (*A. J. P.*, xliv. 355.) When intended for surgical purposes, the softest, finest, and most elastic sponges should be selected; for forming *burnt sponge* the coarser will answer equally well. According to Mr. Hatchett, the chemical constituents of sponge are gelatin, coagulated albumen, common salt, and carbonate of calcium. Magnesia, silica, iron, sulphur, and phosphorus have been detected in it, as also have iodine and bromine, combined with sodium and potassium. From the experiments of Mr. Croockewit, it would appear that sponge is closely analogous to, if not identical with, the fibroïn of Mulder, differing from it only in containing iodine, sulphur, and phosphorus. (*Annal. der Chem. und Pharm.*, xlviii. 43.) *Fibroïn* is an animal principle, found by Mulder in the interior of the fibres of silk.

Medical Properties and Uses. Sponge, in its unaltered state, is not employed as a medicine; but, in consequence of its softness, porosity, and property of imbibing liquids, it is very useful in surgical operations. From the same qualities it may be advantageously applied over certain ulcers, the irritating sanies from which it removes by absorption. Compressed upon a bleeding vessel, it is sometimes useful for promoting the coagulation of the blood, especially in hemorrhage from the nostrils. In the shape of *sponge tent* it is employed for dilating sinuses. This is prepared by dipping sponge into melted wax, compressing it between two flat surfaces till the wax hardens, and then cutting it into pieces of a proper form and size. By the heat of the body the wax becomes soft, and the sponge, expanding by the imbibition of moisture, gradually dilates the wound or sinus in which it may be placed. When a conical sponge tent of equable calibre is required, as for dilating the uterine cavity, a better plan is to cut the sponge into a conical shape whilst fresh and compress when moist, by winding it carefully with a fine, tightly-drawn cord, removing the cord when perfectly dry, and dipping the tent into melted wax, so as to get a thick coating. For other modes of preparing sponge tent, as well as of saturating the sponge at the same time with substances calculated to make a remedial impression, as carbolic acid, alum, acetate of lead, etc., see *A. J. P.*, 1868, p. 410; 1869, p. 446.

SPONGIA USTA. *U. S.* 1850. *Burnt Sponge.* The following was the U. S. formula for its preparation. "Take of sponge *a convenient quantity.* Cut it into pieces, and beat it that any extraneous matter may be separated; then burn it in a close iron vessel until it becomes black and friable; lastly, rub it into very fine powder." The sponge is decomposed, the volatile matters being driven off by the heat, and a black, friable coal remaining. Preuss found that, of 1000 parts of sponge submitted to calcination, 343·848 were dissipated; and the residue consisted of 327 parts of carbon and insoluble matters, 112·08 of chloride of sodium, 16·43 of sulphate of calcium, 21·422 of iodide of sodium, 7·57 of bromide of magnesium, 103·2 of carbonate of calcium, 35·0 of phosphate of calcium, 4·73 of magnesia, and 28·72 of protoxide of iron. (*Pharm. Centralblatt*, 1837, p. 169.) Herberger found in burnt sponge 1 per cent. of iodide of potassium, and 0·5 per cent. of bromide of potassium. (*Annal. der Pharm.*, xx. 204.) As the remedial value of burnt sponge depends chiefly upon the presence of iodine, it cannot be esteemed good unless it affords purple fumes when acted upon by sulphuric acid assisted by heat. It is said that the preparation is most efficient as a remedy when the sponge is kept on the fire no longer than is necessary to render it friable. The powder is then of a much lighter color. Guibourt recommends that the sponge selected for burning should be unwashed, of a strong odor, firm, and compact, that it should be put into a roaster like that used for coffee, and heated over a moderate fire till it becomes of a blackish brown color, that it should then be removed, powdered, and enclosed in a well-stopped glass bottle. It is best when recently prepared, as the iodine is dissipated by time, and the specimens, at first richest in this principle, contain little of it at the end of a year. (*Journ. de Chim. Méd.*, Dec. 1831.) According to Herberger, the fine and coarse sponges do not materially differ in the proportion of their organic constituents; so that the coarse may be selected for this operation. Burnt sponge has been highly recommended in goitre, glandular swellings of a scrofulous character, and obstinate cutaneous eruptions. It is most conveniently administered mixed with syrup or honey, in the form of an electuary, with the addition of some aromatic, as powdered cinnamon. The dose is from one to three drachms.

STATICE CAROLINIANA. *Marsh Rosemary* is considered by some botanists as a mere variety of the *Statice Limonium* of Europe; by others as a distinct species. It is an indigenous maritime plant with a perennial root, sending up annually tufts of leaves, which are obovate or cuneiform, entire, obtuse, mucronate, smooth, and on long footstalks. They differ from the leaves of *S. Limonium* in being perfectly flat on the margin, while the latter are undulated.

Marsh rosemary grows in the salt marshes along the sea-coast, from New England to Florida, and flowers in August and September. The root, which was formerly in the secondary list of the U. S. Pharmacopœia, is large, spindle-shaped or branched, fleshy, compact, rough, and of a purplish brown color. It is bitter and extremely astringent, but odorless. It contains tannic acid (12·4 per cent.), gum, extractive, albumen, volatile oil, resin, caoutchouc, coloring matter, lignin, and various salts. (*A. J. P.*, xiv. 116.) Statice is powerfully astringent, and in some parts of the United States, particularly in New England, is much employed. It may be used for all the purposes for which kino and catechu are given; but its chief popular application is in decoction to aphthous and ulcerative affections of the mouth and fauces.

In Brazil and Buenos Ayres the roots of *S. Brasiliensis* and *S. Antarctica* are employed under the name of *Buaycura* or *Guaycura*. (*P. J. Tr.*, ix. 466.)

In Russia and Spain the very large roots of *S. latifolia* are used for tanning, and in Morocco the roots of *S. mucronata* are employed, under the name of *safrifa*, as a nervine.

STERCULIA ACUMINATA. *Cola acuminata.* Daniell. This is a large African tree, known as the source of the *kola nuts* of Guinea, or *guru nuts* of Soudan, which are extensively used and highly valued throughout a large part of Africa, being chewed for their agreeable effects on the system, and the remarkable property of causing wakefulness. The possession of this property is explained by the caffein, which was first proved to exist in the seeds by Dr. Daniell. (*P. J. Tr.*, 1865, 2d ser., vi. 450.) Dr. Attfield found in 100 parts of the seeds 13·65 of water, 20·00 of cellulose and coloring matter, 41·50 of starch, 1·52 of volatile and fixed oil, 6·33 of an albuminoid substance, 10·67 of gum, sugar, and other organic matter, and 2·13 of thein (caffein); and obtained 2·13 per cent. of ashes. The nuts contain no tannin, and in this respect differ from coffee, which they otherwise resemble. Dr. Attfield separated the caffein by precipitating a decoction with subacetate of lead, removing the excess of lead by sulphuretted hydrogen, and allowing the clear solution to evaporate to dryness. The residue was treated with hot alcohol, and the alcoholic solution evaporated to a small bulk. On cooling, this solidified into a crystalline mass, which was found to have all the properties of caffein. The kola nut is described as roundish, compressed, resembling the European chestnut, and of a bitter taste. According to Dr. Daniell, they are very useful in tropical diarrhœas. (*A. J. P.*, 1865, p. 205.)

STILLINGIA SEBIFERA. *Tallow-tree.* This is a species of the family Euphorbiaceæ, cultivated in the Chinese provinces of Kiang-se, Kiang-wau, and Chih-kiang for the sake of the fatty matters extracted from the nuts by methods detailed in *A. J. P.*, 1872, p. 264. (See also *P. J. Tr.*, June, 1872.) The "tallow" occurs in hard, brittle, opaque, white, tasteless, and odorless masses of about 80 pounds' weight. It is said to be nearly pure stearine. The oil is largely used for lighting purposes. The remnants of the nut are used as fuel and as manure.

STROPHANUS HISPIDUS. This is a tree of Gaboon, belonging to the Apocyneæ, whose seeds yield a cardiac poison, *inæine*. (*Lancet*, Dec. 1872, p. 827.) MM. Hardy and Gallois have obtained from it two crystalline principles. One, which is neither an alkaloid nor a glucoside, they call ***strophantin;*** the second, an alkaloid, they name *inæine*. The first named appears to be the active principle of the poison. (*Journ. de Pharm.*, 3e sér., xxv. 176.)

Wanika, an acrid poison, which has been studied by Prof. S. Ringer, is probably the same as inæine. It causes systolic arrest of the heart's movement. (*P. J. Tr.*, April, 1881.)

STRYCHNOS POTATORUM. *Chilbinj. Clearing Nuts. Indian Gum Nuts.* The nuts of this species of Strychnos are very largely used in some parts of India for clearing muddy water, and are stated to have found their way into American commerce. (*A. J. P.*, 1871.) The fruit is also employed by the native practitioners of Hindostan, under the name of *nirmali*, as an emetic and in dysentery. They do not contain strychnine. In clearing water, one of the dried nuts is rubbed hard for a short time around the inside of the earthen water-pot; on settling, the water is left pure and tasteless. The seeds contain a large quantity of an albuminous principle, upon which their virtues probably depend. The tree, which grows to a very large size, produces a shining, black, one-seeded berry (that of the nux vomica being many-seeded). The seeds are described (*P. J. Tr.*, 1871, p. 44) as broadly lenticular, about half an inch in diameter and a quarter of an inch in thickness, of a dirty whitish gray color, and covered with a thick coating of delicate appressed hairs. These are so small that the seed to the naked eye looks mealy. Under the microscope the hairs are seen to be agglutinated in bundles of from 3 to 6, and to consist each of a single pointed cylindrical cell.

SUCCINIC ACID. *Acidum Succinicum.* ($C_4H_6O_4$.) This acid is obtained by distilling amber. (See *Succinum*.) The product is an aqueous solution of impure succinic acid, associated with empyreumatic oil. (See *Oleum Succini*.) By filtering the liquor the solution of the impure acid passes through, while the oil is absorbed by the paper. The acid may be purified by boiling the solution with nitric acid, diluted with twice its bulk of water, and then evaporating to crystallize. Should the crystals not be colorless, the treatment with nitric acid must be repeated until they are so. Succinic acid is formed artificially by the action of nitric acid on the fatty acids, and may be produced in a great many ways from various substances. Thus it is invariably formed in small amount in the alcoholic fermentation of sugar. M. Desaignes obtained it more advantageously from malate of calcium, subjected to fermentation excited by casein. The malate was converted into succinate of calcium, which was then decomposed by sulphuric acid, so as to yield succinic acid. For the details of the process for obtaining succinic acid from malate of calcium, see the paper of E. J. Kohl, in *A. J. P.*, vol. xxviii., July. Succinic acid, when pure, is in white, transparent crystals, having no odor, and a somewhat acrid taste. It dissolves in five times its weight of cold and twice its weight of boiling water. It is less soluble in alcohol, but very sparingly in ether. Nitric acid is without action on it. It melts at 180° C. (356° F.), and boils without alteration at 235° C (455° F.). It sublimes, however, at a much lower temperature. According to Wackenroder, it is sometimes adulterated with tartaric acid, soaked in oil of amber.

Succinic acid, though formerly officinal, is at present seldom used in medicine. It has been ascertained to be a product of vital action, having been detected by M. Heintz in the colorless liquid found in hydatid cysts of the liver. (See *Journ. de Pharm.*, Sept. 1850.) One of its salts, *succinate of ammonium*, $C_4H_4(NH_4)_2O_4$, made by supersaturating succinic acid with ammonia, evaporating and crystallizing, has been used with great alleged success in delirium tremens. This salt is occasionally used as a precipitant of ferric oxide.

SULPHATE OF ALUMINIUM AND IRON. *Ferroso-aluminic Sulphate.* ($Al_2Fe(SO_4)_4,24H_2O$.) This double salt was brought forward by Sir James Murray, of Dublin, as an astringent, styptic, and vermifuge. His method of preparing it is not very clearly expressed, but it may be presumed to be formed by dissolving alumina and carbonate of iron, both recently precipitated, in sulphuric acid, and duly evaporating the solution. Klauer states that it is produced in crystalline tufts when a solution of the component salts mixed with an excess of sulphuric acid is left to stand in a warm place. (*Watt's Dict.*, vol. v. p. 583.) Sir James recommends it in chronic dysentery, diarrhœa, fluor albus, and the colliquative sweats and diarrhœa which attend hectic fever and consumption. Externally he found it a powerful styptic, useful as a gargle in relaxation of the tonsils and uvula, and in salivation, as an injection in hemorrhages, and as a wash for foul and flabby ulcers. The dose for internal exhibition is from five to ten grains, dissolved in some aromatic water.

SULPHATE OF BARIUM. BARYTÆ SULPHAS. ($BaSO_4$.) (See *Barii Chloridum*.) Sulphate of barium is a heavy, lamellar, brittle mineral, varying in sp. gr. from 4·4 to 4·6. It is generally translucent, but sometimes transparent or opaque, and its usual color is white or flesh-red. When crystallized, it is usually in very flat rhombic prisms.

Before the blowpipe it strongly decrepitates, and melts into a white enamel, which, in the course of ten or twelve hours, falls to powder. It is thus partially converted into sulphide of barium, and, if applied to the tongue, will give a taste like that of putrid eggs, from the formation of sulphuretted hydrogen. This salt, on account of its great insolubility, is not poisonous. It is, however, soluble in a great excess of dilute hydrochloric acid. (*Chem. News*, 1871, p. 69.) Ground to fine powder it is sometimes mixed with white lead, but impairs the quality of that pigment. The artificial sulphate of barium, under the name of *permanent white* or *blanc-fixe*, is much used in the arts as a water-color. It is made from both the native sulphate and carbonate. It forms a dazzling white color, unalterable by light, heat, air, or sulphuretted hydrogen. It is used by the manufacturers of paper hangings, and for mixing with other colors, the tone of which it does not impair.

SULPHATE OF CALCIUM. CALCII SULPHAS. *Gypsum. Plaster of Paris.* ($CaSO_4,2H_2O$.) We notice this salt simply in relation to its employment by the surgeons. There are one or two of its chemico-physical properties which demand attention from this point of view. In the first place, it is so slightly soluble in water that it may be considered for ordinary purposes insoluble. According to Bucholz, it is soluble in 460 parts of water cold or hot, according to Giese, in 380 parts of cold and 388 of boiling water. Notwithstanding the statement of Bucholz, the fact has been well established that its solubility varies with the temperature, but, like that of sulphate of sodium, very unequally. Thus, according to M. Poggiale, it is greatest at 35° C. (95° F.), and above or below that temperature gradually diminishes, so that at 100° C. (212° F.), or the boiling point of water, it is very nearly the same as at 5° (41° F.), not far from the freezing point. (*Journ. de Pharm.*, 4e sér., v. 86.) The other point is that, when deprived of its water by heat, and reduced to the state of a white powder, it rapidly absorbs water added to it, and from the state of semi-liquid paste into which it is brought with that fluid, quickly hardens without change of bulk. It is this property which fits plaster of Paris so well for all kinds of moulding; and to this also it owes its peculiar adaptability to the purpose of a splint. To prepare it for use, the gypsum must first be deprived of the greater part of its water by exposure to a heat of 100° C. (212° F.), or from that to 121·1° C. (250° F.). It loses both its molecules of water of crystallization at a temperature of from 110°–120° C. (230°–248° F.), and is then known as *burnt gypsum.* If heated above 205° C. (401° F.) it becomes *dead-burnt*, and does not take up water readily and does not harden. When dehydrated, it is reduced to fine powder, and kept in air-tight vessels for use. As thus prepared, if mixed with two parts of water, it forms a semi-liquid cream-like mass, which becomes solid and hard in 15 or 20 minutes, the temperature rising during the process, as in the slaking of lime. The hydrated gypsum expands in solidifying, hence its advantages in preparing casts,—the expansion causes it to accurately fill all interstices. According to Mr. T. E. Stark, a medical officer in the British army, flannel is the best material for bandages to be used with gypsum. It should be cut into strips an inch and a half broad and two or three yards long, which should first be spread on a table and rubbed well with the powdered gypsum on both sides and always in the direction of the thread. The bandages should then be rolled up loosely, and kept for use in air-tight cases. Thus applied, the bandages, first thoroughly wetted, should be rolled round the limb, overlapping at the edges, so as to make a uniform covering. After application, it should be left to harden, which generally happens in 15 or 20 minutes. A simpler method of using the gypsum for this purpose is, after the application of the bandages, to paint the whole thoroughly and carefully with the milk of gypsum, which will solidify, and enclose the part in a firm case.

SULPHATE OF NICKEL. *Niccoli Sulphas.* ($NiSO_47H_2O$.) This salt is formed by dissolving carbonate of nickel in dilute sulphuric acid, concentrating the solution, and setting it aside to crystallize. The carbonate is procured by dissolving the impure arsenide of nickel, sold under the name of *speiss*, coarsely powdered and mixed with half its weight of iron filings, in nitro-hydrochloric acid. The solution is evaporated to dryness, and the residue treated with water, which takes up the impure chloride of nickel, and leaves the arsenic in the form of the insoluble arseniate of iron. The liquid is then acidulated with hydrochloric acid, treated with sulphuretted hydrogen in excess, which precipitates the copper, and, after filtration, boiled with a little nitric acid to oxidize any remaining iron. The cold liquid, largely diluted with water, is next treated with a solution of bicarbonate of sodium, gradually added, which throws down the iron in the state of ferric oxide. Lastly, the filtered solution, containing the chloride of nickel nearly pure, is boiled with carbonate of sodium, which, by double decomposition, throws down a pale green precipitate of carbonate of nickel. Sulphate of nickel is in the form of emerald-green crystals, efflorescent in the air, soluble in three parts of cold water, but insoluble in alcohol and ether. It has a sweet, astringent taste.

Prof. Simpson, of Edinburgh, has made some therapeutic trials with this salt, and found it to act as a gentle tonic, like the preparations of iron and quinine, yet somewhat differently. He used it successfully in a case of severe and obstinate periodic headache. The dose is from half a grain to a grain three times a day, given in the form of pill, or of simple solution. In large doses it is liable to produce nausea and vomiting, especially on an empty stomach. (See *Braithwaite's Retrospect*, xxvii. 446.) Dr. J. D. Palmer, of Monticello, Florida, considers sulphate of nickel as a sedative; having employed it in a variety of painful affections, and also simply as a soporific in cases which did not admit the use of opium, and in every instance with the desired result. (*A. J. P.*, 1868, p. 516.)

SULPHITES, BISULPHITES, HYPOSULPHITES. These salts have, at a comparatively recent date, been introduced into medicine, because of their extraordinary hostility, through their acid ingredient, to the lower forms whether of vegetable or animal life. Microscopic plants and animals cannot exist in the presence of sulphurous or hyposulphurous acid; and, as their salts are easily decomposed, with the liberation of the acid, they are capable of exercising the same destructive influence. As it is now generally admitted that a number of our external complaints are caused by these microscopic organisms, the local use of these remedies is often indicated, and, in fact, has been found by experience to be very efficient. Examples of affections of this kind we have in scabies, porrigo, prurigo senilis, different forms of ringworm, pityriasis versicolor, the sore mouth or thrush of infants, etc.; and in all these complaints benefit may be expected from the local application of these remedies. In cases of fermentative dyspepsia the sulphites may be of value in checking the changes of the food. But a much more extensive use of them has been suggested by a prevalent opinion, first, that the various fermentations have their origin in these invisible organic beings, and, secondly, that a wide circle of diseases, all those, in fact, to which the term zymotic has been applied, are nothing more than the results of different forms of fermentation going on in the human system; such, for example, as cholera, miasmatic fever, yellow fever, typhus and typhoid fevers, diphtheria, and all the contagious febrile complaints. In these diseases the salts here considered have been prescribed to a considerable extent, and many favorable reports have been made of their effects; but the theory on which their employment is based is by no means established, and clinical experience has failed to demonstrate the utility of the treatment

Of the *sulphites*, those which have been employed are the *sulphites of sodium, potassium, ammonium, magnesium*, and *calcium*. The *sulphites of magnesium, sodium*, and *potassium* are officinal, having been recognized by the U. S. Pharmacopœia, and will be found treated of in the first part of the Dispensatory. The *sulphite of ammonium* may be prepared in the same way; that is, by passing sulphurous acid through a solution of the alkaline carbonate. When the carbonate is insoluble, as in the case of magnesia and lime, it is better to have recourse to the method of double decomposition; but the sulphite of calcium may be prepared by using lime-water for the saturation of the sulphurous acid.

In all instances, in the preparation of the sulphites, where evaporation is employed, it should be carefully conducted so as not to drive off the acid, and with as little exposure to the air as possible; as the sulphites in solution are strongly disposed to absorb oxygen, and pass into the state of sulphates. Even in the solid state they slowly undergo the same change, and should therefore be kept, as far as can be conveniently done, excluded from the air.

The sulphites in general have a mild sulphurous taste, and on exposure to heat, or with the addition of an acid, emit the characteristic odor of sulphurous acid. They are distinguishable from the *hyposulphites* by not depositing sulphur on the addition of dilute sulphuric acid to their solution. As the efficiency of the sulphites is ascribable to their acid, they may be used indiscriminately, one being preferred to another according to solubility, or other property affecting the convenience of exhibition. In reference to the individual sulphites it will be necessary to say but little.

Sulphites of sodium, magnesium, and *potassium* have been fully described, and the remarks in reference to their therapeutical application may be considered as applicable to the others.

Sulphite of ammonium, $(NH_4)_2SO_3$, has an acrid sulphurous taste, at first deliquesces in the air, and afterwards dries, gradually being converted into the sulphate by the absorption of oxygen. It is soluble in its weight of cold, and in less than its weight of boiling water. It decrepitates with heat, losing a part of its ammonia, and then sublimes as an acid sulphite.

Sulphite of calcium, $CaSO_3$, is a white powder, and distinguished by its difficult solubility, requiring 800 parts of water for solution. An excess of acid renders it more soluble; and from its hot saturated solution it is deposited, on the cooling of the liquid, in hexagonal needles.

The influence of these salts on the system in health is feeble. So far as observation has hitherto gone, they are quite destitute of poisonous properties. Six drachms have been taken in 24 hours, without any injury whatever. When taken internally, they are absorbed, and partly eliminated unchanged with the urine, partly changed by the absorption of oxygen into sulphates, as happens on exposure out of the body. This is proved by an examination of the urine, which will at first be found to contain a sulphite, and after 24 hours a sulphate. From the largest doses of the sulphites only a laxative operation on the bowels, and an increased secretion of urine, are obtained. For their use in medicine they are solely indebted to the destructive influence they exert over all the lower forms of animal and vegetable life. In reference to this influence they are used both internally and externally; the sulphite of magnesium being usually preferred for the former purpose, the sulphite of sodium for the latter. Their long-continued use is said to prove injurious, by inducing debility and anæmia. From fifteen grains to a drachm may be given, so repeated as to amount to from two drachms to an ounce in 24 hours. They may be administered in solution, or, in the case of the sulphite of magnesium, suspended in water, to which sugar and an aromatic tincture may be added. As almost all acids decompose the sulphites, they should not be administered with any acid substance, and no acid should be allowed to exist in the stomach at the time. Should the bowels be disturbed, a little of some opiate may be given. For external use, one part of the salt employed may be dissolved in from five to ten parts of water.

Bisulphites (*Acid Sulphites*). These are quite as efficient as the sulphites, probably more so, in consequence of their relatively greater proportion of acid. They might be and probably are used indiscriminately with the sulphites; as, in the preparation of the latter by the direct union of their constituents, the sulphurous acid may readily be, and often no doubt is, used in excess, and thus gives rise to the formation of the bisulphite. Indeed, Berzelius states that the salt, formed by passing sulphurous acid through a solution of carbonate of sodium until the liquid shall sensibly redden litmus paper, is really the bisulphite of sodium; and that the sulphite may be prepared by adding to this salt a quantity of soda equal to that already contained in it. The bisulphites generally may be prepared by passing sulphurous acid in excess through the alkaline solution, or through the solution of a sulphite already formed. (See also *P. J. Tr.*, 1872, p. 844.) They may be distinguished from the sulphites by being quite neutral to test-paper, while the latter salts have a feeble alkaline reaction. They may be given for the same purposes and in the same dose and method of administration as the sulphites.

The *bisulphite of calcium* has assumed a somewhat distinguished position in consequence of the claims urged in its favor by Mr. W. Lascelles Scott as an important pharmaceutical agent. In a communication made by him to the "British Pharmaceutical Conference," he states, as the result of his experiments, that bisulphite of calcium is entirely preservative of oleaginous or fatty substances against spontaneous change; several preparations of this kind having been kept absolutely fresh and sweet by the presence of a little of this salt, for a period of six or seven months, while the same preparations, under otherwise precisely the same circumstances, were quite spoiled. For ointments he has found that a fluidrachm of a strong (probably saturated) solution of this salt is sufficient for their preservation, while it is compatible chemically with the great majority of unctuous matters with which it may be thus associated. Beef-tea for use in hospitals may be preserved from injurious change by a few drops of the solution added to each pint; and the same may be said of jellies and other liquid food prepared for use in the sick-chamber. Cloths soaked in the solution, and hung up in a chamber, act as a most efficient disinfectant, while they are free from the unpleasant smell of carbolic acid, or the irritating vapors as well as the offensive odors from the chloride of lime. Mr. Scott has also employed the solution successfully for the preservation of anatomical preparations, and others of an organic nature; being preferable to other agents used for the purpose by exercising no injurious influence whatever on the preparation, and by the entire absence of the poisonous properties of some of these agents, as the mercurials and arsenicals. (*P. J. Tr.*, 1867, p. 189.)

Hyposulphites (*Thiosulphates* or *Sulpho-sulphates*). These may be considered as absolutely identical for therapeutic purposes with the sulphites; as, when they undergo decomposition, it is sulphurous acid which is eliminated. The hyposulphites consist of bases combined with an acid, which, in the free state, would be $H_2S_2O_3$, but which, when liberated, separates into sulphurous acid and sulphur. They are prepared by boiling a sulphite or bisulphite in solution with sulphur, as in the example of sodium thiosulphate, $2Na_2SO_3 + S_2 = 2Na_2S_2O_3$. The chief advantage possessed by the hyposulphites is that they are less disposed than the sulphites to change into sulphates by the absorption of oxygen. They may be recognized by the deposition of sulphur when an acid is added to their solution. They are freely soluble in water, even the hyposulphites of calcium and of magnesium. They may be used for the same purposes and in the same doses as the sulphites, and administered in the same way.

SULPHOCYANATE OF MERCURY. ($Hg(CyS)_2$.) Sulphocyanate of mercury, formerly called sulphocyan*ide* of mercury, is produced by mixing dilute solutions of mercurous nitrate and sulphocyanate of potassium. The white precipitate which falls, when dried, swells up suddenly when heated, giving off nitrogen, carbon disulphide, and vapor of mercury, leaving a gray residue, *mellone*. The salt is used in the preparation of the toy "*Pharaoh's serpents*."

SULPHOCYANATE OF POTASSIUM. (CNKS.) Sulphocyanate of potassium, formerly called sulphocyan*ide* of potassium, is prepared by fusing in an iron vessel, at a low red heat, a mixture of two parts of dried ferrocyanide of potassium, and one part of flowers of sulphur. The mass, when cold, is dissolved in boiling water;

and, to decompose some sulphocyanate of iron, the solution is treated with carbonate of potassium, which throws down the iron as a carbonate, and gives rise to the formation of a fresh portion of sulphocyanate of potassium. The whole is then boiled for a quarter of an hour, filtered to separate the precipitated iron, and evaporated that crystals may form. These are purified from carbonate of potassium by being dissolved in alcohol, which takes up the sulphocyanate and leaves the carbonate. The alcoholic solution is then allowed to crystallize. Sulphocyanate of potassium is in long, striated, anhydrous prisms, deliquescent in a moist atmosphere, very soluble in alcohol, and having a cooling, somewhat biting taste. It has been proposed as a medicine by Sömmering, as a substitute for hydrocyanic acid and cyanide of potassium, on the ground that it possesses the same therapeutic properties, without their inconveniences.

SULPHOMETHYLATE OF SODIUM. (CH_3Na,SO_4,H_2O.) A new purgative, investigated by Rabuteau. In 240 grain (15 Gm.) doses it produced catharsis without cramp. (*A. J. P.*, 1880, p. 220.)

SULPHOVINATE OF SODIUM. *Ethylsulphate of Sodium.* ($C_2H_5NaSO_4,H_2O$.) This salt occurs as a white granular powder or in hexagonal tabular crystals, according to the method of its preparation. Its taste is cooling and rather aromatic, nearly destitute of bitterness. It is very deliquescent, and is soluble in 0·7 parts of water.

When sulphuric acid is added to alcohol the temperature rises at once, and a certain proportion of sulphovinic acid is formed, but, as water is at the same time developed, the reaction is soon arrested by the dilution of the mass. The first practical method of overcoming the difficulty was afforded by the process of Limousin. Nineteen and a half ounces (avoirdupois) each of pure sulphuric acid, sp. gr. 1·715, and of concentrated alcohol, about 96°, are slowly introduced by means of two funnels (one for the alcohol and the other for the acid) into a third funnel arranged in a flask plunged into a freezing mixture or kept in a current of cold water, the flow of the two liquids into the flask being so regulated as to keep the alcohol in excess. The mixture is kept for four or five days at a temperature of 20° C. (68° F.) to 25° C. (77° F.), then diluted with 9 to 10 pints of distilled water, and carefully saturated with somewhat less than forty-eight ounces of pure carbonate of barium in solution. When the point of saturation has been attained, the liquid is left to deposit the sulphate of barium, and afterwards filtered. The solution of sulphovinate of barium so obtained is saturated with between 27 and 29 ounces of pure carbonate of sodium dissolved in four litres of distilled water. When no more precipitate is formed by the addition of the alkaline solution, and the liquid is neutral to test-paper, the transformation of the sulphovinate of barium into sulphovinate of sodium is complete. The liquor, decanted and filtered, is evaporated in a water-bath to about sp. gr. 1·33 and left to crystallize. The drained crystals are dried in a stove.

Recently, various other processes have been proposed. T. L. Phipson (*Chem. News*, 1874, p. 221; also *A. J. P.*, xlvii. 27) mixes small quantities of concentrated sulphuric acid and alcohol; keeps for 8 to 10 hours at a temperature of 37·7° C. (100° F.); cools; adds the mixture drop by drop to about 20 times its volume of cold distilled water, cooling at times; adds chalk to this solution until effervescence ceases; filters, heats the filtrate with a little carbonate of calcium for about half an hour; filters while warm, and evaporates at a heat not exceeding 37·7° C. (100° F.) till a permanent saline crust forms on the surface, and sets aside to crystallize. The sulphovinate of calcium thus formed is in large brilliant plates, readily converted into a corresponding salt of sodium. M. Dubois modifies (*Journ. de Pharm.*, 1875, p. 44) the method of Limousin by saturating the first mixture, containing sulphovinic acid, with a concentrated solution of caustic soda in strong alcohol, keeping the mixture constantly cold, and adding the alkaline mixture by small portions. The filtered liquid is evaporated as in the method of Phipson, or, preferably, Dubois precipitates the mixture, diluted with strong alcohol, with carbonate of sodium. Limousin's process, as thus modified, appears to be preferable to that of Mr. Chas. Rice, detailed in *A. J. P.*, 1873, p. 60. Sulphovinate of sodium is said to be a mild although active cathartic. According to Dr. Rabuteau, five drachms of it dissolved in three glasses of water will generally produce in the adult four or five liquid stools without pain. The dose for children is from two to three drachms. The pleasantness of its taste and action would render it a favorite purgative were it not for its dearness and the difficulty of preserving it, all of the sulphovinates having a great tendency on exposure to the air to break up into alcohol and a salt of sulphuric acid.

SWIETENIA FEBRIFUGA. A large tree growing in the East Indies. The bark is smooth and red internally, rough and gray on the outer surface, of a feeble aromatic odor, and an astringent bitter taste. Water extracts its virtues by infusion or decoction. It is said to have been much used in India as a substitute for Peruvian bark, in doses of half a drachm.

The *Swietenia Mahagoni*, or *mahogany-tree*, which grows in the West Indies and other parts of tropical America, has also a bitter astringent bark, containing catechin. (*Bull. Soc. Chim. de Paris*, xxiv. 118.) The bark of *S. Senegalensis* is used on the coast of Africa in the cure of intermittents, and M. Caventou has extracted an alkaloid from it. (See *Am. Journ. of Med. Sci.*, N. S., xx. 168.)

SYMPHYTUM OFFICINALE. *Comfrey.* A perennial European plant, cultivated in our gardens for medical use. Its root, which is the part employed, is spindle-shaped, branched, often more than an inch thick and a foot long, externally smooth and blackish, internally white, fleshy, and juicy. By drying it becomes wrinkled, of a firm horny consistence, and of a dark color within. It is almost inodorous, and has a mucilaginous, feebly astringent taste. Among its constituents are mucilage in great abundance, and a small quantity of tannin. It was formerly highly esteemed as a vulnerary, but has lost its credit in this respect. Its virtues are chiefly those of a demulcent, and it may be advantageously used for all the purposes to which the marshmallow is applied. It is a very common ingredient in the domestic cough mixtures, employed in chronic catarrh, consumption, and other pectoral affections. The most convenient form of administration is that of decoction, which may be made either from the fresh or dried root. According to Lewis, comfrey root yields to water a larger proportion of mucilage than the root of Althæa.

SYNANTHROSE. ($C_{12}H_{22}O_{11}$.) This is a carbohydrate, isomeric with cane sugar, discovered by O. Popp in *Helianthus tuberosus.* For details, see *A. J. P.*, 1871, p. 312.

SYRINGA VULGARIS. *Common Lilac.* The leaves and fruit of this common garden plant have a bitter and somewhat acrid taste, and have been used as a tonic and as an antiperiodic in malarial affections. MM. Petroz and Robinet found in the fruit a sweet and bitter principle. The latter was afterwards obtained pure by M. Meillet, who gave it the name of *lilacin.* The green capsules, which yield it in largest proportion, are boiled in water, the decoction is concentrated, subacetate of lead is added, the liquor is evaporated to the consistence of syrup, magnesia is added in excess, and the whole is evaporated to dryness. The residuum is powdered, digested in water at 32·2° C. or 37·7° C. (90° F. or 100° F.), and then treated with boiling alcohol and animal charcoal. The alcoholic solution, being filtered and concentrated, yields lilacin upon cooling. This principle, though not alkaline, is thought by M. Meillet to exist in the fruit combined with malic acid. It is crystallizable, bitter, and insoluble in water. (*A. J. P.*, xiv. 139; from *Journ. de Pharm.*)

TACAMAHAC. *Tacamahaca.* The resinous substance, commonly known by this name, is supposed to be derived from the *Fagara octandra* of Linn. (*Elaphrium tomentosum*, Jacq., *Amyris tomentosa*, Spreng.), a tree of considerable size, growing in the island of Curaçoa, and in Venezuela. The juice exudes spontaneously, and hardens on exposure. As brought into the market, it is in irregularly shaped pieces of various sizes, some not larger than a mustard seed, others as much as an inch or two inches in diameter. The color is usually light yellowish or reddish brown; but in the larger masses is more or less diversified. The pieces are in general translucent, though frequently covered with powder upon their surface, so as to render them apparently opaque. They are heavier than water, brittle, and pulverizable, yielding a pale yellow powder. Their odor is resinous and agreeable, their taste bitter, balsamic, and somewhat acrid. Exposed to heat they melt and exhale a stronger odor. Tacamahac is partially soluble in alcohol, and completely so in ether and the fixed oils. It consists of resin with a little volatile oil.

Another variety is obtained from the East Indies, and called *tacamahaca orientale*, or *tacamahaca in testis.* It is supposed to be derived from the *Calophyllum Inophyllum*, and comes into the market in gourd-shells covered with rush leaves. It is of a pale yellow color inclining to green, slightly translucent, soft, and adhesive, of an agreeable odor, and an aromatic bitterish taste. It is at present very rare in commerce. The tree which yields this resin produces a drupe, about as large as a plum, from the seeds of which 50 per cent. of a greenish yellow fixed oil is obtained by expression, used in India for lamps, and as a local application in the itch. (*Journ. de Pharm.*, 1861, p. 23.)

Guibourt describes several other varieties of tacamahac, which, however, are little known. Among them is a soft, adhesive, dark green oleoresin (*Journ. de Pharm.*, 3e sér., xxiv. 396), said to be procured from the *Calophyllum Tacamahaca*, growing in the islands of Bourbon and Madagascar.

Tacamahac was formerly highly esteemed as an internal remedy, but is now employed medicinally only in the composition of ointments and plasters, and little even for this purpose. Its properties are analogous to those of the turpentines. It is sometimes used as incense.

TANNATE OF ALUMINA. *Aluminæ Tannas.* Mr. Rogers Harrison, of London, has employed an aqueous solution of a substance which he calls by this name, as an injection in gonorrhœa, after the acute symptoms have passed. He makes it of such a strength as to produce smarting. The substance is described to be in crystals, about the size of those of coarse sugar, of a dirty yellowish color, and readily soluble in hot water. (*Lond. Med. Gaz.*, xiii. 853.) It is doubtful what was the substance employed by Mr. Harrison, as the tannate of aluminium is nearly insoluble in water. (*A. J. P.*, xxv. 25.)

TANNATE OF IRON. *Ferri Tannas.* This salt is prepared by dissolving 44 parts of precipitated subcarbonate of iron, moderately dried, in a boiling solution of 9 parts of pure tannic acid, evaporating the solution at the temperature of 176°, in a porcelain vessel, until it becomes thick, pouring it out on a glass or porcelain plate, and drying it with a gentle heat. As thus obtained, tannate of iron is in flat pieces, of a crimson color, without taste, and insoluble in water. It is not a definite chemical compound. It acts as an astringent and tonic, and may be given in chlorosis, in the dose of from eight to thirty grains, in the course of the day, made into pills. *Ink* is an aqueous solution of the gallo-tannate of iron, and probably possesses similar medical properties. It is a popular application to ringworm.

TANNATE OF LEAD. *Plumbi Tannas.* This is obtained by precipitating a solution of tannin with acetate of lead, added drop by drop. It has been used as an external application with success by Dr. Fantonetti in two cases of white swelling of the knee-joint. He employed it at first mixed with a third of its weight of lard, and afterwards pure, the fresh precipitate admitting of application as an ointment. Autenrieth recommends it as a dressing to gangrenous ulcers; and it is probably peculiarly efficacious in bed-sores. With this intention, the precipitate, either uncombined or mixed in its dry state with simple ointment in the proportion of two drachms to the ounce, may be spread on linen, and applied to the sore. Van den Corput uses it in excoriations, applying it freshly precipitated, and rubbed up with glycerin. (*Ann. de Thérap.*, 1865, p. 266.) It is especially commended in sore nipples. (*Med. Record*, 1875, p. 575.) The preparation here described is a bitannate. Other tannates of lead exist.

TAPIOCA. Under this name the U. S. P. formerly recognized the fecula obtained from the Janipha Manihot. *Janipha Manihot.* Curtis's *Bot. Mag.* 3071.—*Jatropha Manihot.* Willd. *Sp. Plant.* iv. 562. *Manihot utillisima Pohl.*, B. & T. 235, is the *cassava* plant or *manioc* of the West Indies, the *mandioca* or *tapioca* of Brazil. It is a shrub belonging to the Euphorbiaceæ, about six or eight feet high, with a very large, white, fleshy, tuberous root, which often weighs thirty pounds. The stem is round, jointed, and furnished at its upper part with alternate petiolate leaves, deeply divided into three, five, or seven oval-lanceolate, very acute lobes, which are somewhat wavy upon their borders, deep green on their upper surface, glaucous and whitish beneath. The flowers are in axillary racemes.

Janipha Manihot is a native of South America, and is cultivated extensively in the West Indies, Brazil, and other parts of tropical America, and in Liberia, for the sake of its root, which is much employed as an article of food. The plant is propagated by cuttings. It is of quick growth, and the root arrives at perfection in about eight months. There are two chief varieties, but it is said that in Brazil as many as thirty different forms of the plant are recognized by cultivators. The root of the *sweet* cassavas may be eaten with impunity; that of the *bitter*, which is the most extensively cultivated, abounds in an acrid milky juice, which renders it highly poisonous if eaten in the recent state. By MM. Henry and Boutron-Charlard it has been ascertained that the bitter cassava owes its poisonous properties to hydrocyanic acid. (*Journ. de Pharm.*, xxii. 119.) Both varieties contain a large proportion of starch. The root is prepared for use by washing, scraping, and grating or grinding it into a pulp, which, in the bitter variety, is submitted to pressure so as to separate the deleterious juice. It is now in the state of meal or powder, which is made into bread, cakes, or puddings. As the poisonous principle is volatile, the portion which may have remained in the meal is entirely dissipated by the heat employed in cooking. The preparation denominated tapioca among us is obtained from the expressed juice. This, upon standing, deposits a powder, which, after repeated washings with cold water, is nearly pure starch. It is dried by exposure to heat, which renders it partially soluble in cold water, and enables it to assume its characteristic consistence. When dried without heat, it is pulverulent, and closely resembles the fecula of arrowroot. In Demarara, as we are told by M. Pagot, the manioc juice, after having been deprived of all injurious properties by boiling, is used as a sauce for the table. (*P. J. Tr.*, 1873, p. 569.)

Tapioca is in irregular, hard, white, rough grains, possessing little taste, partially soluble in cold water, and affording a fine blue color when iodine is added to its filtered solution. The partial solubility in cold water is owing to the rupture of the starch-granules by heat. Examined under the microscope, the granules appear partly broken, partly entire. The latter are muller-shaped, about the two-thousandth of an inch in diameter, more uniform in size than the granules of most other varieties of fecula, with a distinct hilum, which is surrounded by rings, and cracks in a stellate manner. *Tapioca meal*, called sometimes *Brazilian arrow-root*, and by the French *moussache*, is the fecula dried without heat. Its granules are identical with those already described. Being nutritious, and at the same time easy of digestion, and destitute of irritating properties, tapioca forms an excellent diet for the sick and convalescent. It is prepared for use by boiling it in water. Lemon-juice and sugar are usually grateful additions; and in low states of disease or cases of debility, it may be advantageously impregnated with wine and nutmeg or other aromatic.

A factitious tapioca is found in the shops, consisting of very small, smooth, spherical grains, and supposed to be prepared from potato starch. It is sold under the name of *pearl tapioca.*

TARTRATE OF SODIUM. *Sodii Tartras.* ($Na_2C_4H_4O_6,2H_2O$.) This salt, in crystals, has been recommended by M. Delioux as an agreeable purgative, almost without taste, and acting with power equal to that of the sulphate of magnesium in the dose of ten drachms. The *soda powders*, so much used in the United States, form an extemporaneous tartrate of sodium, somewhat aërated with carbonic acid. A *solution of tartrate of sodium* has been used as a substitute for solution of citrate of magnesia. It may be made by dissolving 6 drachms of tartaric acid in 2 fluidounces of water, and 7½ drachms of bicarbonate of sodium in 7 fluidounces of water, mixing the solutions gradually and filtering; the filtrate should be poured into a strong 12 fluidounce bottle and 2 fluidounces of lemon syrup added slowly, so that it will sink to the bottom of the bottle without mixing very much with the solution; 80 grains of tartaric acid are to be added without agitating the bottle, which is to be corked at once securely and set aside in a cool place. The bottle is to be shaken just before the contents are administered.

TAXUS BACCATA. *Common European Yew Tree.* The fruit of this handsome and well-known evergreen appears to be a deadly poison. A child was found in a field, where, as proved by the contents of the stomach, he had been eating the berries of the yew, semi-comatose, with convulsions, a cold and clammy skin, difficult respirations, dilated pupils, and attempts at vomiting. He died before anything else could be done than to administer an emetic, which acted promptly. Other children had eaten the same fruit without serious consequences; but they had swallowed the pulp only, rejecting the stones; while these, in a masticated state, were found in the stomach of the deceased child; so that the poisonous property would seem to reside in the stone of the fruit, as in the peach and bitter almond. A horse, having eaten some of the fruit, died in an hour. In the child, death did not take place under four hours. (Dr. James Thompson, *Lancet*, 1868, p. 530.) A second fatal case occurring in an adult is recorded. (*Med. Times and Gaz.*, 1870, ii. 446.) The leaves also have produced death. (*Lancet*, 1870, p. 471; also, *P. J. Tr.*, viii. 361.) W. Marmé obtained from yew seeds and leaves an alkaloid to which the name of *taxia* has been given. (*A. J. P.*, 1876, p. 353.) Prof. Redwood believes that the leaves also contain a poisonous volatile oil.

TAYUYA. The root of the *Dermophylla pendulina*, Manso, is used in Brazil under the name of *Tayuya* in syphilis, etc. (*N. R.*, 1877, p. 234); also under the same name the root of the *Trianospermia ficifolia* (*P. J. Tr.*, x. 667), and probably various other roots. In *T. ficifolia* an alkaloid, *trianospermine*, has been found (*P. J. Tr.*, x. 667), and in *T. dermophylla* a green resin, bitter extractive, and tannic acid (*Bull. Gén. de Thérap.*, lxxxiv. 174; xci. 220). See also *Proc. A. P. A.*, xxiv. 184.

TEA. The plant which furnishes tea—*Thea Chinensis*—is an evergreen shrub belonging to the natural order Ternstromiaceæ. It is usually from four to eight feet high, though capable, in a favorable situation, of attaining the height of thirty feet. It has numerous alternate branches, furnished with elliptical-oblong or lanceolate, pointed leaves, which are serrate except at the base, smooth on both sides, green, shining, marked with one rib and many transverse veins, and supported alternately upon short footstalks. They are two or three inches long, and from half an inch to an inch in breadth. The flowers are either solitary, or supported, two or three together, at the axils of the leaves. They are of considerable size, not unlike those of the myrtle in appearance, consisting of a short green calyx with five or six lobes, of a corolla with from four to nine large unequal snow-white petals, of numerous stamens with yellow anthers and connected at their base, and of a pistil with a three-parted style. The fruit is a three-celled and three-seeded capsule. It has not been certainly determined whether more than one species of the tea-plant exists. Linnæus admitted two species —*T. Bohea* and *T. viridis*—differing in the number of their petals; but this ground of distinction is untenable, as the petals are known to vary very much in the same plant. Hayne makes three species—*T. stricta*, *T. Bohea*, and *T. viridis*—which are distinguished severally by the shape of their leaves and fruit, and the direction of the footstalk. De Candolle admits but one species, with two varieties—the *viridis* or green tea, with "lanceolate flat leaves, three times as long as they are broad," and the *Bohea*, with "elliptical-oblong, subrugose leaves, twice as long as broad." Lindley recognizes the two Linnæan species, distinguishing them by the leaves, which in *T. viridis* are acuminate, and emarginate at the apex, and in *T. Bohea* are smaller, flatter, darker green, with small serratures, and terminate gradually in a point, but are not at all acuminate or emarginate. (*Flora Medica*, 120.)

The tea-plant is a native of China and Japan, and is cultivated in both countries, but most abundantly in the former. In Japan it forms hedge-rows around the rice-and corn-fields; in China, whence immense quantities of tea are exported, whole fields are devoted to its culture. It is propagated from the seeds, which are planted in holes at certain distances, six or eight seeds being placed in each hole, in order to insure the growth of one. In three years the plant yields leaves for collection, and in six attains the height of a man. When from seven to ten years old, it is cut down, in order that the numerous shoots which issue from the stump may afford a larger product of leaves. These are picked separately by the hand. Three harvests, according to Kæmpfer, are usually made during the year; the first at the end of February, the second at the beginning of April, and the third in June. As the youngest leaves are the best, the product of the first collection is most valuable, while that of the third, consisting of the oldest leaves, is comparatively little esteemed. Sometimes only one or two harvests are made; but care is always taken to assort the leaves according to their age; and thus originate numerous commercial varieties of tea. The character of the plant, dependent upon the soil, situation, climate, and culture, has also a great influence upon the value of the leaves. It is said that the best tea is procured from the shrubs which grow upon the sides of steep hills with a southern exposure. Though the plant grows both about Pekin in the north and Canton in the south of China, it is said to attain greater perfection in the intermediate country, in the neighborhood of Nankin, for instance, where the climate is neither so cold as in the first-mentioned vicinity, nor so hot as in the second. Some of the commercial varieties have their origin in this cause; and it is highly probable, though the fact has not been certainly proved, that difference in species may be another source of diversity. After having been gathered, the leaves are dried by artificial heat in shallow iron pans, from which they are removed while still hot, and rolled with the fingers, or in the palm of the hand, so as to be brought into the form in which they are found in commerce. For further particulars as to the cultivation of tea, see *P. J. Tr.*, 1871, p. 386. The odor of the tea-leaves themselves is very slight; and it is customary to mix with them the flowers of certain aromatic plants, as those of the orange, different species of jasmine, the rose, *Olea fragrans*, and *Camellia Sasanqua*, in order to render them pleasant to the smell. The flowers are afterwards separated by sifting or otherwise. (See *P. J. Tr.*, xv. 112.) The cultivation of tea has been successfully introduced into Brazil, and into the British possessions in India. Samples of Himalaya tea, chemically examined by T. Zoeller, were found to be equal to the best Chinese product, containing at least 5 per cent. of theine and 5·38 per cent. of nitrogen. (*P. J. Tr.*, 1871, p. 162.) Attempts have been made, under the auspices of the Government, to introduce the tea culture into the United States. Large numbers of the seeds were, through arrangements made by the Patent Office, imported from China, and, having been planted in the propagating garden in Washington, germinated satisfactorily. No general result has been reached, but it is stated that a Captain James Campbell produces yearly in Tennessee the tea required for his family. (*A. J. P.*, 1870, p. 468.)

Bush Tea and *Hönig Thee*, used at the Cape of Good Hope as a substitute for tea, are the dried leaves and tops of species of *Cyclopia*, probably *C. brachypoda* and *C. genistoides* respectively. According to the analyses of Mr. Henry G. Greenish, they do not contain theine, but a new alkaloid, *cyclopine*. (*P. J. Tr.*, xi. 549.)

Tea is brought to this country from Canton and other ports of China. Numerous varieties exist in commerce, differing in the shape communicated by rolling, in color, in flavor, or in strength; but they may all be arranged in the two divisions of *green* and *black teas*, which, at least in their extremes, differ so much in properties that it is difficult to conceive that they are derived from the same species.

Properties. *Green tea* is characterized by a dark green color, sometimes inclining more or less to blue or brown. It has a peculiar, refreshing, somewhat aromatic odor, and an astringent, slightly pungent, and agreeably bitterish taste. Its infusion has a pale greenish yellow color, with the odor and taste of the leaves. According to Mr. Warington, who examined numerous varieties of tea carefully both by the microscope and chemical tests, many of the green teas imported into Great Britain owe their color to a powdery coating, consisting of sulphate of calcium and Prussian blue; others to a mixture of these with a yellowish vegetable substance; and others, again, to sulphate of calcium alone. (*P. J. Tr.*, iv. 37.) *Black tea* is distinguished by a dark brown color. It is usually less firmly rolled and lighter than the green, and contains the petioles of the plant mingled with the leaves. Its odor is fainter, and of a somewhat different character, though still fragrant. Its taste, like that of green tea, is astringent and bitterish, but is less pungent, and to many persons less agreeable. To hot water it imparts a brown color, with its sensible properties of taste and smell. These vary exceedingly in degree in the different varieties; and some black teas are almost wholly destitute of aromatic or agreeable flavor. According to Blyth, green tea is prepared from young leaves which are roasted over a wood fire within an hour or two after being gathered; while the black tea leaves, on the other hand, are allowed to lie in heaps for ten or twelve hours after they have been plucked, during which time they undergo a sort of fermentation; the leaves then pass through certain processes, and are slowly dried over charcoal fires. (Wynter Blyth, *Foods, Composition and Analysis*, 1882.) A sophisticated tea is largely exported from China, consisting of powdered tea mixed with sand and other earth, and agglutinated with gum; that which is to pass for black being colored with plumbago, and the green with the coating above referred to. On analysis, these teas were found to afford from 35 to 45 per cent. of ashes, while the genuine yields only 5 per cent. They may be detected by not unfolding when steeped in boiling water. (*Ibid.*) Willow leaves are also sometimes used to adulterate tea. (*P. J. Tr.*, 1871, p. 208.) For methods of detecting the various adulterations, see *Ibid.*, 1873, p. 331.

Analyzed by G. J. Mulder, 100 parts of green Chinese tea afforded 0·79 of volatile oil, 2·22 of chlorophyll, 0·28 of wax, 2·22 of resin, 8·56 of gum, 17·80 of tannic acid of the variety contained in galls, 0·43 of theine (caffeine), 22·80 of extractive, traces of apotheme, 23·60 of hydrochloric extract, 3·00 of albumen, 17·68 of lignin, and 5·56 of salts. The hydrochloric extract was the matter taken up by diluted hydrochloric acid from tea previously exhausted successively by ether, alcohol, and water, and consisted of artificial tannin. The same chemist obtained from 100 parts of black Chinese tea 0·60 of volatile oil, 1·84 of chlorophyll, 3·64 of resin, 7·28 of gum, 12·88 of tannic acid, 0·46 of theine (caffeine), 19·88 of extractive, 1·48 of apotheme, 19·12 of hydrochloric extract, 2·80 of albumen, 28·32 of lignin, and 5·24 of salts. (*Annal. der Pharm.*, xxviii. 317.) Dr. Rochleder found also a peculiar acid, which he calls *boheic acid*, $C_7H_{10}O_6$. According to Stenhouse, the tannin of tea, though always accompanied with a little gallic acid, differs essentially from that of galls; not being like it a glucoside, but yielding, under the influence of sulphuric acid, a dark brown substance, almost insoluble in water. (See *A. J. P.*, 1862, p. 254.) M. Eug. Peligot obtained a much larger proportion of theine or caffeine than was found by Mulder, the lowest quantity from green tea being 2·4 per cent. and the highest 4·1 per cent.; but even this quantity is too small to represent all the nitrogen contained in tea. (*Journ. de Pharm.*, 3e sér., iv. 224.) Stenhouse has found from 2 to 2·1 per cent. of theine in tea.* M. Pucetti found about twice as much in black as in green tea. (*A. J. P.*, xxviii. 234.) The volatile oil is citron-yellow, lighter than water, has a strong odor of the tea plant, solidifies easily by cold, and resinifies on exposure to air. It is probably one of the principles upon which depend the effects of tea upon the nervous system. Hence old teas are less energetic than the recently imported; and it is said that the fresh leaves have often produced dangerous effects in China. Nevertheless, the tannic acid is not without influence upon the system; and it is not improbable that the extractive contributes to the peculiar influence of this valuable product. Of these active ingredients, the volatile oil, tannic acid, and extractive are found most largely, according to the analysis of Mulder, in the green tea. *Theine*, $C_8H_{10}N_4O_2$, is a crystallizable principle discovered by Oudry. It was afterwards proved by Jobst to have the same composition as caffeine. (See *Coffee*, *Ilex*, *Paullinia*, and *Sterculia acuminata.*) According to Mulder, it exists in tea combined with tannic acid. Peligot obtained it by adding to a hot infusion of tea, first subacetate of lead, and then ammonia, filtering the liquid, passing sulphuretted hydrogen through it, again filtering, and evaporating with a moderate heat. On cooling, the liquid deposited theine abundantly, and yielded an additional quantity by a careful evaporation. (*Journ. de Pharm.*, 3e sér., iv. 224.) It may be cheaply prepared by putting some old spoiled tea in an iron pot covered with filtering paper, enclosing the whole in a cylindrical paper cap, and cautiously applying heat. Theine rises in vapor, and condenses on the paper. (See *Chem. Gaz.*, No. 178, p. 119.) Theine has a feebly bitter taste; is, in the state of crystals, dissolved by 80 parts of water, 35 of alcohol, and slightly soluble in ether; melts at about 350° F., and at 185° C. (365° F.) sublimes in white vapors, which condense in minute needles. From its watery solution the following reagents precipitate it: phospho-molybdic acid, yellow precipitate; iodine with potassium iodide, dirty-brown precipitate; chloride of platinum, yellow hair-like crystals insoluble in cold hydrochloric acid, slowly separating; chlorides of gold, mercury, and nitrate of silver also give precipitates. Infusion of galls causes a deposit of tannate of theine, which is again, however, dissolved by heating the water.

Medical Properties and Uses. Tea is astringent and gently excitant, and in its finer varieties exerts a decided influence over the nervous system, evinced by the feelings of comfort and even exhilaration which it produces, and the unnatural wakefulness to which it gives rise, when taken in unusual quantities, or by those unaccustomed to its use. Its properties, however, are not of so decided a character as to render it capable of very extensive application as a medicine; and its almost exclusive use is as a grateful beverage at the evening and morning meals. Taken moderately, and by healthy individuals, it may be considered as perfectly harmless; but long continued, in excessive quantity it is capable of inducing unpleasant nervous and dyspeptic symptoms, the necessary consequences of over-excitement of the brain and stomach. Green tea is decidedly more injurious in these respects than black, and should be avoided by dyspeptic individuals, and by those whose nervous systems are peculiarly excitable. As a medicine, tea may sometimes be given advantageously in diarrhœa; and a strong infusion will often be found to relieve nervous headache. The mode of preparing it for use is too well known to require description. An extract is made from it in China, which is said to be useful in fevers. Owing to the great activity of the empyreumatic oil of coffee, coffee and tea do not have exactly the same action upon the human system, although they contain the same alkaloid.

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* For methods of estimating percentage of theine in a sample of tea, see *Journ. de Pharm.*, 4e sér., xviii. 436.

TELLURIUM. (Te. Atomic weight, 128.) Several of the combinations of this metal have been tried on the living organism by M. Hansen. Five grains of the *tellurite of potassium*, given to dogs, produced stupefaction and vomiting, and the garlic-like odor of tellurium in the breath. The same salt, tried upon himself for seven successive days, in a dose daily of half a grain, afterwards increased to a grain, caused drowsiness at first, followed, after the seventh day, by a sense of oppression in the cardiac region, nausea, an increased flow of saliva, and loss of appetite. The breath had a garlic-like odor throughout the experiment. (*Chem. Gaz.*, 1854, p. 90.) Prof. Simpson, of Edinburgh, relates the case of a student who inadvertently took a dose of tellurium, and exhaled so persistent an odor that he had to sit apart from his fellow-students. (See *Am. Journ. of Med. Sci.*, 1855, p. 496.) This disagreeable effect of tellurium precludes its employment in medicine.

TEPHROSIA VIRGINIANA. *Turkey Pea. Goat's Rue.* Several species of Tephrosia are employed in different parts of the world, though unknown in general commerce. They are leguminous plants, shrubby or herbaceous, with leaves unequally pinnate, and flowers in axillary or terminal racemes. They are generally possessed of cathartic properties; their leaves or roots being employed. *Tephrosia Virginiana* grows in most parts of the United States. It is a foot or two high, with pubescent stems and leaves and handsome terminal flowers. (See Griffith's *Med. Bot.*, p. 237.) The roots, which are slender, long, and matted, are tonic and aperient, and are said to have been used by the Indians as a vermifuge, given in the form of decoction. Dr. B. O. Jones, of Atlanta, Ga., has used the plant with advantage as a mild stimulating tonic and laxative, having a tendency to increase most of the secretions, and has found it specially useful in typhoid fever. He prepares it by boiling eight ounces of the plant with two ounces of *Rumex acutus* in four quarts of water to a quart, and straining; adding, when the preparation is to be kept, an equal bulk of diluted alcohol or brandy, and half its weight of sugar, and macerating for several days. The dose is one or two tablespoonfuls. (*A. J. P.*, xxviii. 218.)

TEREBENE. ($C_{10}H_{16}$.) This is a substance which is produced by the action of sulphuric acid upon oil of turpentine. For an elaborate account of its preparation and properties, by M. Ribau, see *Journ. de Pharm.*, 4e sér., xviii. 186, 374; xix. 443.

TESTA PRÆPARATA. *Prepared Oyster-shell. U. S.* 1870. "Take of Oyster-shell *a convenient quantity.* Free the Oyster-shell from extraneous matter, wash it with boiling water, and, having reduced it to a fine powder, treat this in the manner directed for Prepared Chalk." *U. S.* Prepared oyster-shell differs from prepared chalk in containing animal matter, which, being very intimately blended with the carbonate of calcium, is supposed by some physicians to render the preparation more acceptable to a delicate stomach. It is given as an antacid in diarrhœa, in the dose of from ten to forty grains or more, frequently repeated. A preparation has been introduced into use in this country, under the name of *Castillon's powders*, consisting of sago, salep, and tragacanth, each, in powder, *a drachm*, prepared oyster-shell *a scruple*, and sufficient cochineal to give color to the mixture. A drachm of this is boiled in a pint of milk, and the decoction used *ad libitum* as a diet in chronic bowel affections.

TEUCRIUM CHAMÆDRYS. *Germander. Chamædrys.* A small, didynamous, labiate, perennial European plant, the leaves and tops of which have an agreeable aromatic odor, diminished by drying, and a bitter, somewhat astringent, aromatic, durable taste. They have been employed as a mild corroborant, in uterine, rheumatic, gouty, and scrofulous affections, and intermittent fevers; but are at present little used, and never in this country. Germander was an ingredient in the *Portland powder*, noted as a remedy in gout. This powder, according to the original prescription, consisted of equal parts of the roots of *Aristolochia rotunda* and *Gentiana lutea*, of the tops and leaves of *Teucrium Chamædrys* and *Erythræa centaurium*, and of the leaves of *Ajuga chamæpitys*, or *ground pine.* The dose was a drachm every morning before breakfast, for three months, then two scruples for three months, afterwards half a drachm for six months, and finally half a drachm every other day for a year. (*Parr.*) Two other species of Teucrium have been used in medicine,—*T. Marum*, *cat thyme*, or *Syrian herb mastich*, indigenous in the south of Europe, and *T. scordium*, or *water germander*, growing in the higher latitudes of the same continent. The former is a warm, stimulating, aromatic bitter, and has been recommended in hysteria, amenorrhœa, and nervous debility; the latter has the odor of garlic, and a bitter, somewhat pungent taste, and was formerly highly esteemed as a corroborant in low forms of disease; but neither of them is now much employed. *T. Marum*, however, has been revived somewhat of late, having been given successfully, by Dr. Lucanus, in pertussis and other cases of spasmodic cough, in the forms of syrup and confection. (*Revue Pharmaceut.*, 1858, p. 32.) This species also acts as an errhine, and was formerly an ingredient of the *Pulvis Asari Compositus.* The dose of either of the three species is about half a drachm. A plant said to have been used advantageously in cholera in the Levant, a specimen of which was sent to Paris, proved to be *Teucrium Polium.* (*Journ. de Pharm.*, xv. 352.)

THALLIUM. (Tl. Atomic weight, 204.) This is one of the metals discovered by means of spectrum analysis, and has been found to prevail widely in nature, and to yield itself readily to chemical agencies. The credit of its discovery by Crooks in 1861 has been disputed by Lamy. The point about it principally interesting to the physician at present is, that it has been ascertained to act energetically as a poison. M. Lamy, having experienced, while making chemical investigations in reference to thallium, extreme general lassitude, with pains in the lower extremities, was disposed to consider these symptoms as the result of a poisonous influence of the metal. To determine the point, he dissolved 75 grains of sulphate of thallium in some milk, intending to try its effects on a couple of puppies, which, however, after tasting it, refused to swallow more. Accidentally it was placed where other animals had access to it; and the consequences were that the milk disappeared, and a middle-sized dog, a hen, and six ducks died from having drunk it. There was no vomiting or purging, but violent intestinal pains, and spasm of the posterior limbs, followed by paralysis; and this last seemed to be the most characteristic effect of the poison. Death took place in two or three days; and, what is of much importance, the two puppies which had only tasted of the milk were seized with similar symptoms, and died at the end of four days. The poison, therefore, must be very energetic; and a circumstance worthy of remark in relation to it is, that, even in a fatal dose, it may produce no sensible effect for a considerable time. M. Lamy afterwards gave about a grain and a half to a puppy, which died in forty hours. There seems to be a remarkable coincidence between the poisonous effects of thallium and those of lead. Connected with its deleterious action, it is an interesting circumstance that thallium is not unfrequently associated with metals used in medicine, as with copper and bismuth for example. Spectrum analysis affords an easy method of detecting the poison. M. Lamy readily recognized it in the tissues of animals which perished with it, by subjecting small pieces to examination by the spectroscope. A sharply defined green line in the spectrum gave undoubted evidence of the presence of the poison. (*Journ. de Pharm.*, 1863, p. 285.) The effects of thallium on the system have more recently been carefully investigated by Dr. Wm. Marmé, by experiments on different animals, with the following results. Small doses of the different preparations are tolerated for a short time, but the effects are cumulative; and perseverance with their use gives rise to very serious consequences; as the system does not become accustomed to the poison. After continued administration of the preparations of thallium, the appetite is impaired, pain is felt in the bowels, and vomiting occurs with diarrhœa, hemorrhage, salivation, and emaciation. General debility, embarrassed respiration, weakness of the circulation, disordered muscular action, as tremors and want of co-ordination, are added to the other symptoms; and, when the poisoning becomes general, conjunctivitis, with free secretion of mucus, is a frequent symptom. After death, small effusions of blood and infiltration of the lungs are observed, as are also intense congestion of the bowels, copious pericardial effusion, and ecchymoses on the heart's surface. The poison is absorbed, and is eliminated by all the secretions. (See also *Journ. de Pharm.*, 4e sér., x. 263.) It seems to disorganize the blood. There is no known antidote. (*B. and F. Medico-Chir. Rev.*, 1868, p. 254.) According to M. Rabuteau, after death from thallium the muscles are found to have lost their irritability. (*Ed. Med. Journ.*, 1874, p. 272.)

THAPSIA GARGANICA. An umbelliferous plant, growing in Southeastern Europe, and well known to the ancients, who named it from the isle of *Thapsos*, where it was obtained. Theophrastus speaks of its root as emetic and purgative. After long neglect, it has again come into notice in France, where a resinous substance derived from it has of late been in much esteem as a local irritant and revulsive, under the name of *resin of thapsia*. (*Ann. de Thérap.*, 1868, p. 210.) The bark of the root and the resin are both objects of commerce. The bark is described by M. Stanis. Martin as almost always doubly quilled, unless where altogether in small fragments, exteriorly rugose with the epidermis here and there detached in patches larger or smaller, and of a deep brown color, interiorly smooth and whitish, and of a fibrous fracture. The size of the pieces varies extremely, the largest not exceeding 24 inches in length and about an inch in circumference. At the point where the root begins there is often adherent a ligneous fibre about an inch long; and over their whole surface there are found but few radicles. It is said that great care is necessary, in removing the root from the bales, not to be injured by the powder which escapes, and which causes itching and swellings of the face and hands. An extract of the *root*, which is sold as a *resin*, has really little claim to be so named; as, of 15 parts of it, 6 are dissolved by cold water, and the 9 parts of resinous matter which remain are of a deep brown color, while the resin extracted by carbon disulphide is of a fine yellow. (*Ibid.*, 1869, p. 221; from *Bulletin Thérapeutique.*) By submitting thapsia to the successive action of alcohol and ether M. Pressoir obtained two resins. Sulphuric acid colored that soluble in alcohol scarlet, that soluble in ether blue. (*Journ. de Pharm.*, 4e sér., xi. 328.) M. Cazenave objects to the plaster prepared from the resin, and kept in masses; as it deteriorates by time. He proposes the following method of preparing a plaster extemporaneously when wanted. Dissolve the resin in alcohol, and with the aid of a brush spread it on a suitable recipient, which may be ordinary plaster, waxed taffetas, or simply gummed paper. A single layer is sufficient for the purpose of an active revulsion; but the effect may be increased at pleasure, by increasing the number of layers. (*Journ. de Pharm.*, 1868, p. 29.) The root of the *Thapsia silphium*, an Algerian plant, contains a resin resembling that of *T. garganica*, but, according to Herlaut, much more active. (*Trans. A. P. A.*, xxvi. 250.)

THEVETIA. *Yccotli.* Inhabiting the damp, hot valleys of the Mexican Cordilleras is a large tree belonging to the Apocynaceæ, whose fruit are known by the native Mexicans as the *Ocodos de fraile*, or *friar's elbow*, and are used as a topical application in hemorrhoids. The tree is the *Thevetia Yccotli.* (De C., *Prodromus*, viii. 343.) In the seeds Prof. Alfonso Herrera has found a glucoside, to which he gives the name of *thevetin.* (*A. J. P.*, 1877, p. 145.) Closely allied to *T. yccotli* is the *T. neriifolia*, Juss. (De C., *Prodromus*, viii. 343), a tree which probably grows also in Mexico, but has been found by botanists chiefly, if not solely, in the East India Islands, New Granada, Peru, and other parts of South America. De Vrij very many years ago discovered in the seeds of *T. neriifolia* a glucoside which was closely studied by Blas. (*Neues Jahrb. f. Pharmacie*, Bd. xxxiv., 1854, p. 1.) He gave it the name of thevetin, and determined that its formula was $C_{54}H_{84}O_{24}$, and that it was identical with *cerberin*, previously found by Oudemann in *Cerbera odallam*, Ham., also an apocynaceous plant. Blas found that the thevetin of De Vrij boiled in dilute sulphuric acid splits into glucose and *theveresin*, which has the formula $C_{48}H_{70}O_{17}$. Thevetin occurs in minute crystals, odorless, of a bitter taste, slightly soluble in cold water (12 parts), freely so in boiling water, dilute and strong alcohol, acetic acid, insoluble in ether. Its most characteristic reaction appears to be its dissolving in concentrated sulphuric acid, with the production of a reddish brown color, changing to a cherry-red, and after some hours to a violet color. Theveresin is only slightly soluble in boiling water. These substances are active poisons. A number of cases of poisoning by the seeds of the East Indian thevetia have occurred; the symptoms have been repeated vomiting, a slow, very feeble pulse, delirium, convulsive movements, and coma. The physiological action of the thevetin from *T. neriifolia* has been investigated chiefly by Dr. König. (*Archiv Exper. Path. und Pharm.*, Bd. v. p. 228.)

The glucoside of *T. yccotli* has been studied by Dr. David Cerna. (*Phila. Med. Times*, ix. 396.) He finds that with sulphuric acid it affords a clear greenish yellow solution, gradually passing to brown and brownish violet, and finally becoming a permanent cherry-brown color, which changes on the addition of bicarbonate of potassium to an emerald-green. Dr. Cerna determined that it is in moderate doses stimulant both to the circulation and respiration, but finally paralyzes the heart muscle and some portion of the respiratory apparatus; that it causes cerebral convulsions and spinal paralysis, abolishing sensation and reflex activity before voluntary movement by an influence upon the sensory nerves or spinal tract.

TIMBO. The bark of the root of the *Paullinia pinnata*, of Brazil, is said to possess decided narcotic properties. M. Stanislas Martin asserts that he has found in it an alkaloid, *timbonine.* (*Bull. Gén. de Thérap.*, xcii. 264.)

TIN. (Sn. At. wt. 118.) *Stannum.* This was recognized in the late Ed. and Dub. Pharmacopœias, and in the U. S. of 1850; but is no longer officinal. It was, however, too long ranked among recognized remedies to be passed without notice. Tin is one of the metals which have been known from the earliest ages. It exists generally as an oxide (*tin stone* and *wood tin*), rarely as a sulphide (*tin pyrites*), and is by no means generally diffused. It is found in England, Spain, Germany, Bohemia, and Hungary, in Europe, and sparingly in some parts of the United States; in the island of Banca and the Peninsula of Malacca in Asia; in Chili; and at Durango in Mexico. Tin mines are particularly abundant and rich in the Tenasserim provinces of British India. (*Dr. Royle.*) The Cornwall mines are the most productive, but those of Asia furnish the purest tin. The metal is extracted from the native oxide. When this occurs in its purest state, in detached roundish grains, called *stream tin*, the reduction is effected by heating with charcoal. When the common oxide, called *mine tin*, is reduced, it requires to be freed, by pounding and washing, from the adhering gangue; after which it is roasted to drive off sulphur, arsenic, and antimony, and finally reduced in furnaces by means of stone coal. The metal, as thus obtained, is called *block tin*, and is not pure. The purest kind of tin, known in commerce, is called *grain tin.*

Properties. Tin is a malleable, rather soft metal, of a silver-white color. It may be beaten out into thin leaves, called *tin foil.* It undergoes a superficial tarnish in the air. Its taste is slight, and when rubbed it exhales a peculiar smell. Its ductility and tenacity are small; when bent to and fro, it emits a crackling noise, which is characteristic. Its sp. gr. is 7·29, melting point 235° C. (455° F.), and it volatilizes at a white heat. It forms three oxides. The *stannous oxide*, SnO, or *protoxide*, is of a grayish black color. When perfectly pure it has, according to Dr. Roth, a red color. The *sesquioxide*, Sn_2O_3, is gray. *Stannic oxide*, SnO_2, or *di-oxide*, forms two hydrates, both being acids: *stannic acid*, SnO_2,H_2O, and *metastannic acid*, $Sn_5O_{10},5H_2O$, or $(H_2SnO_3)_5$.

The tin of commerce is often impure, being contaminated with other metals, introduced by fraud, or present in consequence of the mode of extraction from the ore. A high specific gravity is an indication of impurity. When its color has a bluish or grayish cast, the presence of copper, lead, iron, or antimony, may be suspected. Arsenic renders it whiter, but at the same time harder; and lead, copper, and iron cause it to become brittle. Pure tin is converted by nitric acid into a white powder (*metastannic acid*), without being dissolved. Boiled with hydrochloric acid, it forms a solution which gives a white precipitate with ferrocyanide of potassium. A blue precipitate with this test indicates iron, a brown one copper, and a violet-blue one both iron and copper. If lead be present, a precipitate will be produced by sulphate of magnesium. The Malacca and Banca tin, and the English grain tin, are the purest kinds found in commerce. Banca tin, from analyses by Mulder, appears to be particularly pure, containing only one-twenty-fifth of 1 per cent. of foreign metals. Block tin and the metal obtained from Germany are always of inferior quality.

Uses. Tin enters into the composition of bronze, bell-metal, pewter, and plumber's solder. It is used also in making tin-plate, which is sheet-iron coated with tin, in making tin amalgam for silvering looking-glasses, and in forming the solution of bichloride of tin (stannous chloride), a combination essential for the dyer's use. It is employed in fabricating various vessels and instruments useful in domestic economy and the arts. Being unaffected by weak acids, it forms a good material for vessels intended for boiling operations in pharmacy. A *false tin foil* is considerably used at present, made by coating lead with tin, and then rolling it out into thin sheets. As tin foil is employed for enclosing medicinal powders, and in other ways is brought into contact with medicinal substances, care should be taken not to use this substituted preparation, lest the patient might be exposed to the poisonous action of lead. According to Ernest Baudrimont, lemons, cacao butter, and other perishable articles may be preserved for a long time by carefully wrapping them in tin foil. (*P. J. Tr.*, July, 1870.)

STANNI PULVIS. *U. S.* 1850. *Powder of Tin.* The following directions were given for preparing powder of tin in the U. S. Pharmacopœia of 1850. "Take of Tin *a convenient quantity.* Melt it in an iron vessel over the fire, and, while it is cooling, stir it until it is reduced to a powder, which is to be passed through a sieve." Tin, being very fusible, is easily granulated by fusion, and subsequent agitation while solidifying. On a small scale, the granulation is most conveniently performed in a wooden box, the inside of which has been well rubbed with chalk. This should be afterwards washed away with water; and, as the granulated powder is of unequal fineness, the coarser particles must be separated by a sieve.

Medical Properties and Uses. Powder of tin was used exclusively as an anthelmintic, and is supposed to act by its mechanical properties. It was considered particularly adapted to the expulsion of Ascaris lumbricoides, and was also employed to expel the tapeworm. For internal exhibition it should be free from oxidation. The dose is half an ounce, mixed with molasses, given for several successive mornings, and then followed by a brisk cathartic. Dr. Alston was in the habit of administering larger doses for the expulsion of the tapeworm. He began by giving an ounce on an empty stomach, which was followed, for two successive days, by half an ounce each day, and finally by a brisk purge. In the *Journ. de Pharm.*, 4e sér., xix. 78, is reported a case in which death was believed to have been caused by tin.

TONGA. Tonga is a composition of unknown barks compounded by the natives of the Fiji Islands for medicinal purposes. It was introduced to the notice of the medical profession by Drs. Sidney Ringer and Wm. Murrell, of London, as a remedy for neuralgia. (*Lancet*, ii., 1880.) The natives are said to steep the bundle as prepared by them for twenty minutes in half a tumblerful of cold water, and then, squeezing it dry, drink the infusion, and preserve the bundle in a dry place for further use. A fluid extract (Parke, Davis & Co) has been put upon the market, and evidence of its value brought forward. We have known a fluidrachm of this extract given every two hours for two days without obvious effect, but the dose usually recommended is half a drachm.

TONKA BEAN. The seed of *Dipterix odorata* of Willd., the *Coumarouna odorata* of Aublet, a large tree growing in Guiana. The fruit is an oblong-ovate pod, enclosing a single seed, from an inch to an inch and a half long, from two to four lines broad, usually somewhat compressed, with a dark brown, wrinkled, shining, thin, and brittle skin, and a light brown oily kernel. The bean has a strong, agreeable, aromatic odor, and a bitterish, aromatic taste. Its active constituent is a crystallizable, odorous substance, analogous to the volatile oils and camphor, and called *coumarin*, $C_9H_6O_2$, by Guibourt. It is capable of sublimation; but, to obtain it in crystals in this way, a low temperature is necessary. (Waddington, *P. J. Tr.*, 1868, p. 410.) This substance is sometimes found in a crystalline state, between the two lobes of the kernel. It has been shown by M. Bleibtreu to be identical with the odorous principle of *Asperula odorata*, *Trifolium melilotus*, and *Anthoxanthum odoratum* (see *Chem. Gaz.*, 1852, p. 61), and, by Prof. Procter, of our indigenous *Liatris odoratissima*, a plant sometimes used to protect woollens from moths. (*A. J. P.*, 1859, p. 556.) Dr. Gössmann obtains coumarin in the following manner. The beans, cut finely, are heated for a long time with an equal bulk of alcohol of 0·863, nearly to boiling; and, the tincture being decanted, the residue is treated in the same manner. The tinctures are mixed, the alcohol distilled off until turbidness appears, when four times the bulk of water is added, which precipitates coumarin and fatty matter. The precipitate is then heated to boiling, and the liquid passed through a moistened filter. The fatty matter remains on the filter, and the hot solution which passes deposits the coumarin on cooling. More may be obtained by concentrating the liquid, and may be purified by animal charcoal. One pound of the beans yielded 108 grains of coumarin. (*Ibid.*, 1856, p. 211.) Coumarin has been prepared synthetically. (*A. J. P.*, 1869, p. 205; *Journ. de Pharm.*, xxvii. 238.) The tonka bean is used to flavor snuff, being either mixed with it in the state of powder, or put entire into the snuff-box. Prof. Köhler has studied the physiological action of coumarin. (*Centralb. Med. Wissensch.*, 1875, pp. 869, 881.) He finds that it is a decided narcotic, and is at first stimulant, afterwards paralyzant, to the heart. The fluid extract of the bean has been used with asserted advantage in hooping-cough, in doses equivalent to five to eight grains for children five years old. (*A. J. P.*, 1869, p. 27.)

TORMENTILLA. (*Tormentille*, Fr.; *Tormentillwurzel*, G.; *Tormentilla*, It.; *Tormentila*, Sp.) Various species of the Rosaceous genus Potentilla have been employed in medicine. (See *A. J. P.*, 1875, p. 109.) It is asserted (*Ibid.*) that our common *P. Canadensis* is a valuable sudorific and diuretic, capable of curing puerperal peritonitis, when given in large hot draughts of the decoction until free perspiration is produced.

Potentilla Tormentilla. Stokes (1787). *Tormentilla erecta.* Linn. Willd. *Sp. Plant*, ii. 1112. *T. officinalis.* Smith, *Flor. Brit.* The tormentil, or *septfoil*, a small perennial plant of Europe, which was formerly in the secondary list of the U. S. Pharmacopœia. The stems, which rise about six or eight inches in height from a woody root, are slender, more or less erect, branching towards the top, and furnished with sessile leaves, which on the stalk usually consist of seven, on the branches of five, digitate, elliptical, villous, deeply serrated leaflets, three larger than the others. The flowers are small, yellow, and solitary upon axillary peduncles. All parts of the plant are astringent, especially the root, which is the part employed. It is gathered in spring. The root of tormentil is cylindrical or roundish, rather larger above than at the lower extremity, an inch or two in length, about as thick as the finger, knotty, sometimes contorted, brown or blackish externally, and reddish within. It has a slight aromatic odor, and a very astringent taste. Tannin is an abundant constituent. There is also a red coloring principle, soluble in alcohol, but insoluble in water. Besides these ingredients Meissner found resin, cerin, myricin, gummy extractive, gum, extractive, lignin, water, and a trace of volatile oil. Tormentil has since been chemically examined by Rembold, who obtained tormentilla red by boiling the tannin of the root (*tormentil-tannic acid*, $C_{26}H_{22}O_{11}$) with sulphuric acid. It has the same composition as rhatany red. He also obtained *kinovic acid*, $C_{24}H_{38}O_4$, from the root by boiling it with milk of lime, adding hydrochloric acid to the decoction, boiling the precipitate with solution of baryta, decomposing again by hydrochloric acid, dissolving the precipitate in alcohol, decolorizing with animal charcoal, filtering, concentrating, and crystallizing. Small quantities of *ellagic* acid, $C_{14}H_6O_8$, were also noted by him. (*A. J. P.*, 1868, p. 311; from *Ann. der Chem. und Pharm.*, cxliv. 5.) The root is said to be used for tanning leather in the Orkneys and Western Islands of Scotland, and for staining leather red by the Laplanders. Tormentil is a simple and powerful astringent, applicable to all cases of disease in which this class of medicines is indicated. It may be given in substance, decoction, or extract. The dose of the powder is from thirty grains to a drachm.

TRIGONELLA FŒNUMGRÆCUM. *Fenugreek.* An annual plant growing spontaneously in different parts of the south of Europe, and cultivated in France and Germany for the sake of its seeds. These are oblong-cylindrical, somewhat compressed, obliquely truncated at each extremity, one or two lines in length, brownish yellow externally, yellow internally, and marked with an oblique furrow running half their length. They have a strong peculiar odor, and an oily, bitterish, farinaceous taste, and contain fixed and volatile oil, mucilage, bitter extractive, and a yellow coloring substance. An ounce of the seeds, boiled in a pint of water, renders it thick and slimy. They yield the whole of their odor and taste to alcohol. Their virtues depend chiefly upon their oil and mucilage. On the continent of Europe they are employed in the preparation of emollient cataplasms and enemata, and enter into some officinal ointments and plasters. They are never used internally.

TRILLIUM. This is an indigenous genus of pretty, little, herbaceous plants, growing generally in woods and shady places. The roots are reputed to possess valuable remedial properties. They were employed by the aborigines, have been long used in domestic practice in some parts of the country, and were noticed as medicinal in Henry's Herbal, published in 1812. Dr. S. W. Williams published a paper upon them in the *New England Journ. of Med. and Surg.*, in the year 1820, and afterwards another in the *N. Y. Journ. of Med.*, viii. 94. The roots have a somewhat balsamic odor and taste, and produce, when chewed, a sense of heat and irritation, with an increased flow of saliva. A root received by Mr. E. S. Wayne, of Cincinnati, is described by him as an "oblong rhizome, with numerous rootlets attached to it, and of a yellowish brown color." Upon the removal of the epidermis, it is white and starchy, and gives a deep blue with tincture of iodine. Mr. Wayne found in the root an acrid principle, analogous to if not identical with saponin. (*Tr. A. P. A.*, 1856, p. 36; *A. J. P.*, xxviii. 512.) Besides this acrid principle, the Trillium roots are said to contain volatile oil, gum, starch, extractive, resin, and tannic acid. They are astringent; and tonic, expectorant, and alterative properties have been ascribed to them. They have been used by the vulgar to hasten parturition. The complaints in which they are said to have proved most advantageous are the hemorrhages; but they have been used also in cutaneous affections, and externally in obstinate ulcers. Dr. Williams gave a drachm of the powdered root three times a day. Of the different species *T. erectum* is generally esteemed most active. *T. pendulum* is referred to, in the *Peninsular and Independent Med. Journ.*, 1859, p. 187, as among the most valued indigenous plants of Michigan; being used especially in menorrhagia.

TRIOSTEUM PERFOLIATUM. *Fever-root, fever-wort*, or *wild ipecac*, as this plant is variously called, though not very abundant, is found in most parts of the United States, preferring a limestone soil and shady situations. The root, the part used, is horizontal, long, about three-quarters of an inch in diameter, thicker and tuberculated near the origin of the stem, of a yellowish or brownish color externally, whitish within, and furnished with fibres which may be considered as branches of the main root. When dry it is brittle and easily pulverized. It has a sickening odor, and a bitter, nauseous taste. It yields its active properties to both water and alcohol. Fever-root is cathartic, and in large doses emetic, and perhaps diuretic. The bark of the root may be given in doses of twenty or thirty grains, or the extract in half the quantity.

TRIPOLI. *Terra Tripolitana.* An earthy mineral, of a whitish, yellowish, or pale straw color, sometimes inclining to red or brown, usually friable, often adhesive to the tongue, and presenting the aspect of argillaceous earth, though differing from clay by the roughness and hardness of its particles, and by not forming a paste with water. The *Venice tripoli* is said to come from Corfu. Tripoli is sometimes artificially prepared by calcining certain argillites. It is used for cleaning and polishing metals.

TROMPATILA. This is the stem and branches of *Bouvardia triphylla*, a Mexican plant used by the natives for hydrophobia. (*A. J. P.*, 1874, p. 51.)

TURPETHUM. *Turpeth. Resin of Turpeth. Résine de Turbith*, Fr. This product is obtained from the *Ipomœa Turpethum* (*Convolvulus Turpethum*, Linn.), an East Indian plant. Mérat and De Lens describe the root, the only part used, as "long, of the size of the little finger or larger, covered by a rather thick bark, grayish without, white within, porous, liable to decay, very resinous when fresh, and in this state yielding a juice capable of coagulating, and constituting, when coagulated, a gum-resin similar to scammony." In choosing the roots, those should be selected in which the bark is perfect, as most of the activity of the root resides in this part. It is without odor, and has little taste. Examined by M. Boutron-Charlard, it was found to contain resin, a fatty substance, volatile oil, albumen, starch, a yellow coloring matter, lignin, salts, and oxide of iron. (*Journ. de Pharm.*, viii. 121.) The root contains 10 per cent. of resin. (M. Andouard, *Ann. de Thérap.*, 1866, p. 118.) According to M. Spirgatis, this resin is a glucoside, *turpethin*, $C_{34}H_{56}O_{16}$, like that of other Convolvulaceæ, insoluble in ether, but soluble in alcohol, to which it imparts a brown color not removable by animal charcoal. To obtain it pure, the alcoholic solution is concentrated; the resin precipitated by water, boiled with this vehicle, then dried, reduced to powder, digested with ether, and finally redissolved by absolute alcohol, and thrown down by ether. After being treated several times in this way, it is obtained in the state of a brownish resin, yielding on pulverization a gray powder, which strongly irritates the mucous membrane of the nostrils and mouth, and fusible at 360° F. It is inflammable, burning with a smoky flame, and emitting irritant vapors. With strong bases it acts like jalapin, fixes water, and is transformed into a soluble acid, *turpethic acid*, $C_{34}H_{60}O_{18}$, while with dilute acids it is decomposed into *turpetholic acid*, $C_{16}H_{32}O_4$, and glucose. (*Journ. de Pharm.*, 4e sér., i. 236.)

Turpeth root is purgative, somewhat less powerful than jalap, and rather slow in its action. From one to three drachms may be given in decoction, and from fifteen grains to a drachm in powder. (*Mérat and De Lens.*) M. Andouard states that the resin purges perfectly well in doses of seven or eight grains, though perhaps somewhat less active than jalap or scammony. (*Ann. de Thérap.*, 1866, p. 119.)

TUSSILAGO FARFARA. *Coltsfoot.* Coltsfoot is a perennial herb, with a creeping root, which early in the spring sends up several leafless, erect, simple, unifloral scapes or flower-stems, five or six inches high, and bearing appressed scale-like bracts of a brownish pink color. The flower, which stands singly at the end of the scape, is large, yellow, compound, with hermaphrodite florets in the disk, and female florets in the ray. The latter are numerous, linear, and twice the length of the former. The leaves do not make their appearance until after the flowers have blown. They are radical, petiolate, large, cordate, angular, toothed at the margin, bright green upon their upper surface, white and downy beneath. The plant grows spontaneously both in Europe and North America. In this country it is found upon the banks of streams in the Middle and Northern States, and flowers in April. The whole of it is employed, but the leaves most so. They should be gathered after their full expansion, but before they have attained their greatest magnitude. The flowers have an agreeable odor, which they retain after desiccation. The dried root and leaves are inodorous, but have a rough, bitterish, mucilaginous taste. Boiling water extracts their virtues. Coltsfoot exercises little sensible influence upon the human system. It is, however, demulcent, and is sometimes used in chronic coughs, consumption, and other affections of the lungs. The expectorant properties which it was formerly thought to possess are not obvious. The leaves were smoked by the ancients in pulmonary complaints; and in some parts of Germany they are at the present time said to be substituted for tobacco. Cullen states that he found the expressed juice of the fresh leaves, taken to the extent of some ounces every day, beneficial in several cases of scrofulous sores; and a decoction of the dried leaves, as recommended by Fuller, answered a similar purpose. The usual form of administration is that of decoction. An ounce or two of the plant may be boiled in two pints of water to a pint, of which a teacupful may be given several times a day.

TUTTY. *Tutia. Impure Oxide of Zinc.* This oxide is formed during the smelting of lead ores containing zinc. It is deposited in the chimneys of the furnaces, in the form of incrustations, moderately hard and heavy, and studded over with small protuberances of a brownish color on the outside, and yellowish within. As it occurs in commerce, the pieces occasionally present a bluish cast, from the presence of small particles of metallic zinc. Sometimes a spurious substance is sold for tutty, consisting of a mixture of blue clay and copper filings, made into a paste with water and dried on an iron rod. It is distinguished from the genuine tutty by its diffusing in water and exhaling an earthy smell, and by its greater friability. Tutty is used as an external application only, being employed as a desiccant in excoriations. To fit it for medicinal use it must be reduced to fine powder, which is dusted over the affected part, or applied in the form of ointment.

ULTRAMARINE. *Outremer.* This fine blue pigment was formerly obtained from *lapis lazuli*, or *lazulite*, a mineral of Siberia. It is now prepared artificially on a very large scale, the total production at the present time being estimated at 30 million kilogrammes per year (*Wagner's Technology*, 11th ed., p. 412), of which three-fourths is made in Germany. In preparing it, a mixture of soft clay with Glauber salt, charcoal, soda, and sulphur is heated in crucibles. In this way a colorless compound is first produced, termed white ultramarine. This, however, soon becomes of a green color. The green ultramarine thus obtained, which is also used as a color, is then mixed with sulphur and heated. The sulphur takes fire and is allowed to burn in the air, when the product becomes of a fine blue color. (*Roscoe and Schorlemmer*, vol. ii. p. 459.) It is thought to be a compound of the silicates of aluminium and sodium with polysulphide of sodium, although the sulphur present is contained in two conditions, part being deposited when ultramarine is treated with acids and part escaping as hydrogen sulphide.

UMBER. *Terra Umbria.* A mineral of a fine compact texture, light, dry to the touch, shining when rubbed by the nail, and of a fine pale brown color, which changes to a peculiar beautiful deep brown by heat. According to Klaproth, it contains 13 parts of silica, 5 of alumina, 48 of oxide of iron, 20 of manganese, and 14 of water in 100. *Burnt umber*, as well as the mineral in its unaltered state, is used in painting. The umber of commerce is said to be brought chiefly from the island of Cyprus.

UPAS ANTIAR AND UPAS TIEUTE. Under these names, two poisons have long been used by the natives of Java and other East India islands for poisoning their arrow-heads; and very exaggerated notions have prevailed among the people of the Western World in relation to the tremendously destructive power over animal life of the upas-tree in Java, from which it was supposed that the poison was derived. The tale was told that birds and animals perished when within the influence of its exhalations, and that man came into its near vicinity at the peril of life. All such accounts have proved to be fabulous; but there is no doubt as to the exceedingly poisonous character of the arrow-poison to which reference has been made. It seems now to be pretty well determined that the active ingredient of the *upas antiar* is a gum-resinous exudation proceeding from incisions in the trunk of the *Antiaris toxicaria*, a large tree belonging to the Urticaceæ, growing in Java, Celebes, and the neighboring islands, and described in *Lindley's Flora Medica* (p. 301). Like certain species of Rhus, this plant exhales an aëriform matter, which very unpleasantly affects many of those who approach it, causing eruptions upon the skin and exterior swelling, while others seem altogether insensible to its influence. The juice is mixed with various substances which probably have little other effect than to give a due consistence to the poison. This, whether taken internally or introduced into the system through a wound, acts with extreme violence, producing vomiting, with great prostration, a feeble irregular pulse, involuntary evacuations, and convulsive movements, which are soon followed by death, which Brodie ascertained to be due to cardiac paralysis. From a chemical examination by Pelletier and Caventou, it appears that the antiar owes its activity to a peculiar principle *antiarin*, crystallizable, soluble in water and alcohol, but scarcely so in ether, and consisting of carbon, hydrogen, and oxygen, $C_{14}H_{20}O_5$. (See *A. J. P.*, 1863, p. 474.) Antiarin appears to act directly as a paralyzant on the cardiac muscle, diminishes the irritability of the peripheral vagus, and stimulates the vaso-motor centres. (*N. R.*, 1875, p. 308.)

The *upas tieute* is even more poisonous than the *antiar*. This is said to be obtained from a climbing woody plant growing exclusively in Java, and belonging to the genus Strychnos, specially designated by Leschenault as *Strychnos Tieute*. It is from the bark of the root, according to this author, that the poison is prepared. A decoction of the bark is concentrated to the consistence of syrup, then mixed with onions, garlic, pepper, etc., and allowed to stand till it becomes clear. Leschenault, having dipped the point of an arrow in the poison and allowed it to dry, pricked a chicken with it, which died in a minute or two in violent convulsions. MM. Delille and Magendie found that the poison had not lost its strength in four years. (Hammond, *Am. Journ. of Med. Sci.*, 1860, p. 366.) Three grains have produced in man very violent symptoms resembling those caused by strychnine, which alkaloid has indeed been found in the poison. (*Chemist and Druggist*, May 15, 1863)

Dr. Wm. A. Hammond made some experiments with a poisonous substance brought by Dr. Ruschenberger from Singapore, which proved to have the combined effects of the two poisons above mentioned, both diminishing directly the power of the heart, and causing tetanic spasms of the muscles; suggesting the idea that it might be a mixture of the antiar and tieute; but Dr. Hammond seems, from other considerations, to have been led to the opinion that it had a different origin from either. (*Am. Journ. of Med. Sci.*, 1860, p. 371.)

URATE OF AMMONIUM. *Ammonii Uras.* ($C_5H_3(NH_4)N_4O_3$.) This is an acid salt, and may be formed by digesting uric acid in solution of ammonia, or by adding sal ammoniac to the solution of other urates. Uric acid is generally obtained from the dried and powdered excrement of the boa serpent, and of other large snakes, by dissolving it in a weak solution of potassa with the aid of heat, and precipitating the uric acid from the filtered solution by hydrochloric acid, added in excess. Urate of ammonium is a white, amorphous, very sparingly soluble salt. It is a constituent of some varieties of guano; and the medicinal properties of that substance are attributed by some to its presence. This salt has been used externally with asserted good effects by Dr. Bauer, of Germany, in the form of ointment, in chronic cutaneous eruptions, and in tuberculous diseases of the lungs. The ointment is made with a scruple of the salt to an ounce of lard, and is applied to the eruptions night and morning, and, in the pectoral disease, by friction, night and morning, alternately to the back and front of the chest. (*Medico-Chirurg. Review*, 1852, p. 207; from *Buchner's Repert.*) The urates should be given with caution internally, for fear of producing oxalic acid in the urine. When uric acid was given to rabbits in the dose of from thirty to forty-five grains in their daily food, Dr. Neubauer found that the urea in the urine was considerably increased, showing that the acid was transformed into urea in the economy. When, however, a large quantity of uric acid was given, the urine, in addition to an increased amount of urea, contained some uric acid, and traces of oxalic acid. (*Ranking's Abstract*, 1857, p. 298.)

UREA. $CO(NH_2)_2$. For an account of the physical and chemical properties of urea, the reader is referred to treatises upon physiology.

Urea was proposed many years ago by the French physicians as a diuretic, and its use in this way has been revived by Dr. T. H. Tanner, of London. In the few cases in which Dr. Tanner tried the remedy, it acted as a powerful diuretic without giving rise to any unpleasant symptom whatever. Prof. Mauthner, of Vienna, also bears testimony to its diuretic properties, having found it, in two cases occurring in children, promptly to remove the anasarca following scarlet fever. The dose for an adult to begin with is ten grains every six hours dissolved in water, flavored with syrup; the action of the medicine being aided by the free administration of diluents, and by keeping the skin moderately cool. (See *Braithwaite's Retrospect*, xxv. 161.)

URTICA DIOICA. *Common nettle.* The common nettle was formerly deemed diuretic and astringent, and was employed in nephritic complaints, hemorrhages, consumption, jaundice, worms, etc. Dr. Benavente commends in uterine hemorrhage a decoction made with thirty parts of the plant to five hundred parts of water (℥i to Oj) given in cupful doses, several times a day. (*Ann. de Thérap.*, 1867, p. 92); and Dr. Rome gives half drachm doses of the fluid extract in dropsy. (*New Prep.*, iii. 275.) The young shoots are boiled and eaten by the common people as a remedy in scurvy; and the fresh plant is sometimes used to excite external irritation in cases of torpor and local palsy, the part being beaten with it till the requisite degree of action is produced. The irritant effect of the nettle applied to the skin is said to be owing to the presence of free formic acid in the sharp hairs. (*A. J. P.*, xxii. 181.) The root of *Urtica dioica* was examined by Mr. Benj. Shoemaker, with the view of discovering the principle to which it owes its diuretic properties. This he thinks he has found in a volatile oil. (*Ibid.*, 1866, p. 492.) *U. urens*, or *dwarf nettle*, which is an annual plant, and smaller than the former species, has similar properties, and is used for the same purposes. This species also grows wild both in America and Europe. The two plants were formerly distinguished by the name of *Urtica major* applied to *U. dioica*, and of *Urtica minor* to *U. urens.* Dr. U. B. Johnson, of Marion, Alabama, has found *U. urens* very efficacious in uterine hemorrhage. (*N. O. Med. and Surg. Journ.*, vi. 452.) *Urtica gigas* of Australia is said to attain a height of 30 feet, and to produce a sting whose impression lasts for months. It is asserted that horses are not rarely killed by it. (*N. R.*, 1875, p. 352.)

VALEREN. *Amylen.* This compound was alluded to under amylic alcohol. It is a hydrocarbon of the *olefin* series, having the formula C_5H_{10}. Amylen was discovered by M. Balard, of Paris, in 1844. It is prepared by distilling amylic alcohol with a concentrated solution of chloride of zinc, which acts by dehydrating and withdraws a molecule of water. The product is redistilled, and that which comes over first, constituting the more volatile part, is separately collected, and agitated with concentrated sulphuric acid, when the amylen, freed from water, will rise to the surface. Amylen is a colorless, very mobile liquid, having the density 0·655 at 10° C. (50°F.). Its boiling point is 34° C. (93·2° F.). Its smell is peculiar and disagreeable. It is soluble in alcohol and ether, in all proportions, but very sparingly so in water. When pure it does not act on potassium, and is not colored by a prolonged contact with caustic potassa.

Amylen was proposed as a new anæsthetic by Dr. Snow, in a paper read before the London Medical Society on the 10th of Jan., 1857. The advantages claimed for it, compared with other anæsthetics, were that its vapor is less pungent; that it abolishes pain with a stupor less deep; and that there is no struggling on the part of the patient, and no sick stomach after its administration. Its bad smell was admitted as an objection. These alleged advantages have not been found to counterbalance the dangers of its use. Dr. Snow admits "the absolute safety which seems to attend sulphuric ether under all circumstances;" an admission which makes it less necessary to seek for a new anæsthetic. Within the brief period during which it was tried, two deaths occurred, although the amylen was administered by Dr. Snow himself. The French Academy of Medicine, after a deliberate examination of its alleged advantages, have condemned it as dangerous. From a chemical examination of various specimens of commercial amylen, as well as of the purest form of it as prepared by the process of M. Balard, Dr. Schauenstein has found that they all contain chlorine; and the uncertainty thus thrown upon the nature of the compound adds to the motives, previously existing, for abandoning its use. (See *B. and F. Med.-Chir. Rev.*, Am. ed., Jan. 1858, p. 193.)

Hydride of Amyl, *Pentane*, C_5H_{12}, is another new anæsthetic, proposed by Prof. Simpson, of Edinburgh. It was discovered by Dr. E. Frankland, of Manchester, who obtained it by a complicated process, which has been rendered more easy of execution by Messrs. T. & H. Smith, of Edinburgh, who prepared the substance at the request of Prof. Simpson. (See T. & H. Smith's paper, in the *P. J. Tr.*, June, 1857.) It is a saturated hydrocarbon, and has been proved to be one of the light products in American petroleum, being the portion boiling at 37°–39° C. (98·6°–102° F.) (*Schorlemmer*). Hydride of amyl is a colorless, volatile, mobile liquid, possessing a grateful fruity odor, but no taste. It is one of the lightest liquids known, having the sp. gr. 0·626 at 17° C. (62·6° F.) It boils at 37·7 C. (100° F.), and the sp. gr. of its vapor is 2·5. It is very inflammable, and burns with a brilliant white flame. It is readily soluble in alcohol and ether, but insoluble in water. "It is a very stable compound, resisting the action of fuming sulphuric acid and the most powerful oxidizing agents."

Besides the hydride of amyl, other compounds have been examined by Dr. B. W. Richardson, of London, among which are *amylic alcohol*, the *iodide*, the *acetate*.

In relation to *amylen*, Dr. Richardson observed that, though it is capable of producing insensibility, this is attended with a kind of consciousness, leading to certain actions, of which there is no remembrance after awaking. *Amylic alcohol*, when inhaled by men or the lower animals, produces a state of muscular paralysis with paroxsyms of convulsive trembling, which are excited by the slightest cause, as a simple touch, or breathing on the surface. *Iodide of amyl* acts similarly to amylic alcohol, with this superadded symptom, that when the animal begins to move, whether spontaneously or under excitation, he does so for a considerable time in a circle. The *acetate of amyl* exerts an influence similar to those of the nitrite and iodide, but less marked. All of these compounds have the property of preventing putrefaction in vegetable substances. None of them can be used as anæsthetic agents; as they do not, like the compounds of formyl or ethyl, produce general insensibility to pain. (*B. and F. Med.-Chir. Rev.*, Jan. 1867, p. 245.) The *valerianate of amyl* is said by Dr. W. F. Wade, of Birmingham, to act similarly to valerian, and to afford a most elegant remedy. He dissolves one part of it in nineteen of alcohol and two per cent. of a spirit of acetate of amyl (one part to twenty). The dose of this mixture is from six to eight drops.

VALERIANATE OF BISMUTH. *Bismuthi Valerianas.* ($Bi(C_5H_9O_2)_3$.) This salt is formed by double decomposition between solutions of ternitrate of bismuth and valerianate of sodium. Valerianate of bismuth precipitates as a white powder, which is washed with water, and dried with a gentle heat. It has been recommended by Righini in neuralgia, and in painful affections of the stomach. The dose is from half a grain to two grains, repeated several times a day, and given in the form of pill.

VALERIANATE OF IRON. FERRI VALERIANAS. *Dub. Ferric Valerianate.* ($Fe_2(C_5H_9O_2)_6$.) This officinal of the late Dublin Pharmacopœia has not been retained in the British. The following was the Dublin process. "Take of Valerianate of Soda *five ounces and* 164 *grains* [avoirdupois]; Sulphate of Iron *four ounces* [av.]; Distilled Water *one pint* [Imperial measure]. Let the Sulphate of Iron be converted into a persulphate, as directed in the formula for *Ferri Peroxydum Hydratum*, and, by the addition of distilled water, let the solution of the persulphate be augmented to the bulk of eight [fluid]ounces [Imp. meas.]. Dissolve the Valerianate of Soda in ten [fluid] ounces of the Water, then mix the two solutions cold, and, having placed the precipitate which forms upon a filter, and washed it with the remainder of the Water, let it be dried by placing it for some days rolled up in bibulous paper on a porous brick. This preparation should be kept in a well-stopped bottle." The first step in this process is to convert the sulphate of iron into the tersulphate. Then by a double decomposition between this salt and valerianate of sodium, sulphate of sodium is formed in solution, and valerianate of iron is precipitated.

Properties, etc. This salt is in the form of a dark tile-red, loose, amorphous powder, having a faint odor and taste of valerianic acid. It is insoluble in cold water, and decomposed by boiling water, which extracts all its acid, and leaves the sesquioxide of iron behind. It is soluble in alcohol. Citrate and tartrate of iron, impregnated with oil of valerian, have been fraudulently sold for valerianate of iron. The genuine salt may be distinguished from these substitutions by being insoluble in water and soluble in alcohol, and by the action of a little dilute hydrochloric acid, which sets free the valerianic acid, readily recognized by its disagreeable odor, which is quite distinct from that of the oil of valerian. In relation to the modes of distinguishing the true from the spurious valerianates, see *P. J. Tr.*, viii. 577. See also, on the composition, properties, and preparations of this salt, a paper by Mr. Francis Sutton, of Norwich, England, in the same journal (2d ser., viii. 131). Valerianate of iron has been given in hysterical affections, complicated with chlorosis. The dose is about a grain, repeated several times a day.

VALERIANIC ACID. *Acidum Valerianicum.* ($HC_5H_9O_2$. Mol. wt. 102.)

(*Acide valérianique*, Fr.; *Valeriansäure, Baldriansäure*, G.; *Acido valerianico*, It., Sp.; *Acidum valericum; Acide valérique.*)

In the 1860 U. S. revision this acid was transferred from the Preparations to the Materia Medica list; in that of 1880 it was dropped entirely. "Valerianic Acid is a colorless liquid, of an oily consistence, a penetrating, disagreeable odor, and caustic taste; and of the sp. gr. 0·935." *U. S.* 1870.

"Take of Valerianate of Soda, in coarse powder, *eight troyounces;* Sulphuric Acid, Water, each, *a sufficient quantity.* To the Valerianate of Soda add, first, three fluidounces of Water, and then three troyounces and a half of Sulphuric Acid. Mix them thoroughly, and from the mixture, after standing, separate the oily acid liquid which rises to the surface. Agitate this repeatedly with small portions of Sulphuric Acid until its specific gravity is reduced below 0·950. Then introduce it into a retort, and distil nearly to dryness, rejecting the distillate so long as it has a specific gravity above 0·940, and keeping the remainder for use. The rejected portion of the distillate, after agitation with Sulphuric Acid, may be returned to the retort during the progress of the distillation." *U. S.* 1870.

The object of this process is merely to procure valerianic acid in a state adapted for the preparation of valerianate of ammonium. The sulphuric acid, uniting with the soda of the valerianate of sodium, separates the valerianic acid, which rises to the surface with the appearance of an oil. In this state it is still mixed with water, and, as the pure acid is wanted, the direction is given to agitate it with sulphuric acid, which deprives it of the excess of water. It is now distilled in order to separate any sulphuric acid and water that may be mixed with it. The process is that of Mr. B. J. Crew, published in *A. J. P.*, 1860, p. 109. Mr. F. C. Musgiller, of Brooklyn, N.Y., states that the acid cannot be obtained by the U. S. process of a sp. gr. so low as 0·933 with ordinary sulphuric acid, and suggests that 0·935 be adopted as the officinal standard; as acid of this strength is equally well adapted for the preparation of the valerianates, for which alone it is used. This suggestion, as to the sp. gr., was adopted at the revision of the U. S. Pharmacopœia of 1870. Mr. Musgiller proposes some modifications of the process which appear to be judicious. (See *A. J. P.*, 1869, p. 83; also *Proc. A. P. A.*, 1868.)

For modes of preparing valerianic acid from the oil and roots of valerian, the reader is referred to the article on Valerian in this work. It is prepared also from fusel oil (amylic alcohol) by reaction with a mixture of bichromate of potassium and sulphuric acid, as the first step in the preparation of valerianate of sodium. (See *Sodæ Valerianas.*)

Valerianic acid received its name from having been found in the oil distilled from the root of *Valeriana officinalis.* It is sometimes called also *valeric acid.* It was first obtained in 1817 by Chevreul from the oil of the dolphin, and received the name of *delphinic acid,* which, however, upon the discovery of its identity with the acid afterwards obtained by Pentz from valerian, was superseded by its present title. It has been obtained also from the bark and fruit of *Viburnum opulus*, the sap-wood of the European elder (*Sambucus nigra*), the root of *Angelica Archangelica*, and from various organic products whether of the vegetable or animal kingdom.

Properties. Valerianic acid is a colorless liquid, of an oily consistence, a repulsive odor, recalling, however, that of valerian, and a pungent, sour, acrid, disagreeable taste. Its sp. gr. is variously given from 0·930 at 55° to 0·944 at 50°. (*Gmelin.*) As stated in the U. S. P. 1870, it is 0·935. It remains liquid at 8° below zero, and boils at 132° C. (270° F.). (*Trommsdorff.*) It is soluble in 30 parts of cold water, and when agitated with water takes up about 20 per cent., without losing its oily consistence, and rises to the surface of the liquid. Alcohol and ether mix with it in all proportions. It is very soluble in strong acetic acid, and dissolves camphor and some resins. (*Trommsdorff.*) It forms salts with the alkalies, and reddens litmus paper strongly, but the blue color gradually returns in a warm place. Its composition is represented by $C_5H_{10}O_2$, and it bears to fusel oil a similar relation to that existing between acetic acid and alcohol. Thus amyl alcohol, or *fusel oil*, contains the radical amyl (C_5H_{11}), combined with hydroxyl (OH), as a hydrate, C_5H_{11},OH. On oxidation this radical, C_5H_{11}, is changed by the loss of two atoms of hydrogen and the gain of one atom of oxygen into C_5H_9O, which then exists in the acid hydrate, C_5H_9O,OH. The strong acid readily unites with a molecule of water to form a hydrated acid, $C_5H_{10}O_2 + H_2O$. This compound, formerly known as the *terhydrate*, has a sp. gr. 0·945, and boils at a lower temperature than the strong acid. It has a much milder taste than the pure acid, and at the same time somewhat saccharine. The U. S. P. 1870 gave the following tests of the officinal acid. "A solution of Valerianic Acid, in 50 parts of hot water, saturated with hydrated carbonate of zinc, yields a liquid, which, when filtered and evaporated to 10 parts and cooled, affords white pearly crystals of valerianate of zinc. The mother-water, drained from these crystals, should not yield, by further evaporation and cooling, a salt crystallizing in six-sided tables, and very soluble in water. When the Acid is added to a concentrated solution of acetate of copper, the transparency of the solution is not disturbed." The former of the last two tests indicates the absence of acetic, the latter of butyric acid.

Medical Properties and Uses. In the state in which it is obtained by this process, valerianic acid has not been used as a medicine. The acid distilled from the oil or root of valerian has been employed in nervous affections, and possesses properties similar to those of valerian. According to Landerer, the acid artificially produced does not operate therapeutically so satisfactorily as the native product. The dose would probably be about the same as that of the oil of valerian. It may be given in sweetened water.

VALONIA. This is the great cups of the acorns of the *Quercus œgilops*, a native of Bosnia. They contain a very large percentage of tannin, are extensively exported for dyeing and tanning, and have been employed as an astringent in diarrhœa.

VANDELLIA DIFFUSA. This is an herb of Paraguay, said to be used by the natives as an emetic. (*P. J. Tr.*, 1872, p. 849.)

VENETIAN RED. *Bolus Veneta.* A dull red ochrey substance used in painting.

VERATRUM ALBUM. *U. S.* 1870. *White Hellebore.* (*Ellebore blanc*, Fr.; *Weisse Niesswurzel*, G.; *Elleboro bianco*, It.; *Veratro blanco*, Sp.) White hellebore is a native of the mountainous regions of continental Europe, and abounds in the Alps and Pyrenees. It so closely resembles *V. viride* both in appearance and minute characteristics that the specific distinction of the two is very doubtful. All parts of the plant are said to be acrid and poisonous, and the rhizome was formerly officinal. (*U. S.*) This is brought from Germany in the dried state, in pieces from one to three inches long by an inch or less in mean diameter, cylindrical or in the shape of a truncated cone, internally whitish, externally blackish, wrinkled, and rough with the remains of the fibres which have been cut off near their origin. Sometimes the fibres continue attached to the root. They are numerous, yellowish, and of the size of a crow's quill. White hellebore deteriorates by keeping.

The fresh root has a disagreeable odor, which is lost by drying. The taste is at first sweetish, and afterwards bitterish, acrid, burning, and durable. The powdered root is grayish. Analyzed by Pelletier and Caventou, white hellebore was found to contain an oily matter consisting of olein, stearin, and a volatile acid; *veratrine*, $C_{32}H_{52}N_2O_8$, in combination with gallic acid; a yellow coloring matter; starch, gum, and lignin; silica, and various salts of lime and potassa. The existence of gallic acid in veratrum was, however, denied by Pfaff and by Wiegand. The medicinal properties of the root were believed to reside in the veratrine, which was first discovered in the seeds of *Veratrum Sabadilla.* Simon found *jervine*, $C_{30}H_{46}N_2O_3$, in white hellebore. (*Pharm. Centralblatt*, 1837, p. 191.) Chas. Bullock, Chas. L. Mitchell, and A. Tobien confirmed the presence of *jervine*, the formula of which, however, according to Tobien, is $C_{27}H_{47}N_2O_8$. Wright and Luff (*Journ. Chem. Soc.*, xxxv. 405) found *jervine*, *rubijervine*, and *pseudojervine.* Chas. L. Mitchell discovered a second alkaloid, *veratralbia*, $C_{28}H_{43}NO_5$, the presence of which has been confirmed by Wright and Luff and other investigators.

Medical Properties and Uses. White hellebore is a violent emetic and cathartic, capable of producing dangerous and fatal effects if incautiously administered. For a very well observed case of poisoning, recorded by Dr. Peugnet, see *N. R.*, 1872, p. 174. Even in small doses it has occasioned severe vomiting, hypercatharsis with bloody stools, and alarming general prostration. Like many other acrid substances, it appears, in small doses, to be a general stimulant to the secretions. Applied externally upon a portion of the surface denuded of the cuticle, as upon ulcers, for example, it gives rise to griping pain in the bowels, and sometimes violent purging. When snuffed up the nostrils, it occasions great irritation with violent sneezing, and its use in this way is not free from danger. It was employed by the ancients in dropsy, mania, epilepsy, leprosy, elephantiasis, and other obstinate disorders, not without occasional advantage; but the severity of its action has led to its general abandonment. It is sometimes used as an errhine, diluted with some mild powder, in cases of gutta serena and lethargic affections; and the decoction, and an ointment prepared by mixing the pulverized root with lard, have been found beneficial as external applications in the itch, and other cutaneous eruptions. From the resemblance of its operation to that of the *eau médicinale d'Husson*, so celebrated for the cure of gout, it was at one time, though erroneously, conjectured to be the chief constituent of that remedy. A mixture of the wine of white hellebore and the wine of opium, in the proportion of three parts of the former to one of the latter, was introduced into use by Mr. Moore, of London, as a substitute for the *eau médicinale.*

In whatever way white hellebore is used, it requires cautious management. It has been given in doses varying from one grain to a scruple. Not more than two grains should be administered at first. When employed as an errhine, it should be mixed with five or six parts of pulverized liquorice root, or other inactive powder. Ten or twelve grains of the mixture may be snuffed up the nostrils at one time.

VERBASCUM THAPSUS. *Mullein.* The ordinary mullein weed is too well known to need description. As remedial agents, both leaves and flowers have been employed. They have a very slight odor, and a mucilaginous, herbaceous, bitterish, feeble taste. Mullein leaves are demulcent and emollient, and are thought to possess anodyne properties, which render them useful in pectoral complaints. On the continent of Europe, an infusion of the flowers, strained in order to separate the rough hairs, is considerably used in mild catarrhs. Dr. Holmes found a decoction of the leaves useful in diarrhœa. The infusion or decoction may be prepared in the proportion of an ounce of the leaves to a pint of water, and given in the quantity of four fluidounces. Dr. N. R. Newkirk, of Bridgeton, N. J., informed the author that he had found the smoking of dried mullein leaves useful in aphonia from irritation of the larynx. The leaves are also employed externally, steeped in hot water, as a feebly anodyne emollient. An ointment is prepared by boiling the leaves in the recent state, in lard, and used for the same purposes. It will be found advantageous to moisten the leaves with water previously to the boiling.

VERDITER. Two preparations of copper, employed as pigments, are known by this name in commerce, and are distinguished by the epithets of blue and green. *Blue verditer* is prepared in London from the solution of nitrate of copper obtained in precipitating silver by copper. According to Gray, this solution is poured hot upon whiting (carbonate of calcium), and the mixture stirred every day till the liquor loses its color, when it is decanted, and fresh portions added till the proper color is obtained. By a process for procuring this pigment, invented by Pelletier, the solution of nitrate of copper is decomposed by quicklime, and the precipitate, after being washed, is incorporated intimately with another portion of quicklime. By the former process, a carbonate of copper is obtained; by the latter, a mixture of the hydrated oxide of copper and hydrate of lime. *Green verditer* is prepared by precipitating a solution of nitrate of copper by chalk or a white marl, and consists of carbonate of copper mixed with an excess of the calcareous carbonate.

VERONICA OFFICINALIS. *Speedwell.* Several species of Veronica, common to Europe and this country, have been medicinally employed. Of these, *V. officinalis* and *V. beccabunga*, or *brooklime*, are the most conspicuous. *V. officinalis* has a bitterish, warm, and somewhat astringent taste. Examined by Enz, it was found to contain, in the fresh juice and an extract from the herb, a bitter principle soluble in water and alcohol, but scarcely so in ether, and precipitated by the salts of lead but not by tannic acid; an acrid principle; red coloring matter; a variety of tannic acid producing a green color with the salts of iron; a crystallizable fatty acid, with malic, tartaric, citric, acetic, and lactic acids; mannite; a soft, dark green bitter resin. Prof. Mayer, of New York, in an examination of the herb, found evidences of the existence of an alkaloid, and a small quantity of a saponaceous principle. (*A. J. P.*, 1863, p. 209.) The plant has been considered diaphoretic, diuretic, expectorant, tonic, etc.; and was formerly employed in pectoral and nephritic complaints, hemorrhages, and diseases of the skin, and in the treatment of wounds. The *beccabunga*, which is very succulent, was employed in the fresh state with the view of purifying the blood, and as a remedy in scurvy. Both plants, however, are at present out of use.

VINCA MAJOR. *Greater Periwinkle.* VINCA MINOR. *Lesser Periwinkle.* These English plants are said to be very useful in arresting menorrhagic and other hemorrhages. (*P. J. Tr.*, 1871, p. 961; *Ibid.*, 1873, p. 963; also *A. J. P.*, 1872, p. 209.)

VIRGINIA CREEPER. *Ampelopsis Quinquefolia. American Ivy.* This indigenous woody creeper, conspicuous in autumn by its bright crimson leaves, has been used by the eclectics as an alterative, tonic, and expectorant. The bark and twigs are the parts used. Dr. McCall employs the bark collected late in the fall, and exhibited it in the state of decoction or infusion, in dropsy, with asserted very good results. (*Penins. and Independ. Med. Jour.*, June, 1858, p. 169.) Two cases of poisoning by the leaves have been reported by Mr. Bernays; the symptoms were violent vomiting and purging, collapse, and deep sleep, with dilated pupils. (*P. J. Tr.*, vii. 80.)

VISCUM ALBUM. *Mistletoe.* A European evergreen parasitic shrub, growing on various trees, particularly the apple and other fruit trees, and forming a pendent bush from two to five feet in diameter. The plant is famous in the history of druidical superstition. In the religious rites of the Druids, the mistletoe of the oak was employed, and hence was afterwards preferred when the plant came to be used as a remedy; but it is in fact identical in all respects with those which grow upon other trees. The fresh bark and leaves have a peculiar disagreeable odor, and a nauseous, sweetish, slightly acrid and bitterish taste. *Viscin*, which forms the glutinous constituent in the berries, leaves, and stalks of the mistletoe, is the principal constituent of *birdlime.* Crude viscin may be obtained by kneading the finely-bruised mistletoe bark with water, as long as anything is dissolved, and removing the ligneous impurities mechanically. A purer product may be obtained by boiling the crude product in strong alcohol, macerating the residue with ether, evaporating the ethereal extracts, purifying these extracts by kneading first with alcohol and then with water. The berries, which are white, and about the size of a pea, abound in the peculiar viscid principle, and are sometimes used in the preparation of birdlime, of which this principle is the basis. Mistletoe is said to be capable of vomiting and purging when largely taken. A case has been recorded by M. Gampert, in France, in which a child three years old was poisoned by eating the berries. Vomiting and prostration were produced, and on the arrival of the physician the patient was found insensible, with a fixed and somewhat contracted pupil, coldness of the skin, and convulsive movements of the extremities. An emetic brought away a considerable quantity of the berries, and the child recovered. (*Ann. de Thérap.*, 1859, p. 36.) A fatal case is recorded in the *Medical Times and Gazette* (1867, p. 26). The plant was formerly looked upon as powerfully antispasmodic, and highly esteemed in epilepsy, palsy, and other nervous diseases; but it is now out of use. The leaves and wood were given in the dose of a drachm in substance, and of an ounce in decoction.

The *American mistletoe* is the *Phoradendron flavescens*, Nuttall (*Viscum flavescens*, Pursh). It is probably the plant reported as growing upon the elm, by which several children were poisoned. (Dr. Henry Dye, of Texas, Memphis *Med. Recorder*, iv. 344.) The prominent symptoms were vomiting and great thirst, followed by frequent discharges of bloody mucus from the bowels, with tenesmus. One of the children was found in a collapsed state, in which death took place. Dr. Dye states also that, in other instances, as he had been informed, children had eaten the *berries* without any ill effect. Dr. W. H. Long asserts (*New Prep.*, ii. 31) that the American mistletoe is a very certain oxytocic, and very efficacious in arresting post-partum and other varieties of uterine hemorrhage. He gives a drachm of the fluid extract every twenty minutes in labor until the effect is produced; every four to six hours in menorrhagia.

VULCANITE. For cases of poisoning by *artificial gum* made of vulcanite colored with vermilion, see *Med. Press and Circular*, Dec. 1874.

WARBURG'S TINCTURE. This famous remedy, at first a proprietary medicine, afterwards by the voluntary act of its inventor had its formula revealed. There is so much testimony as to its extraordinary virtues in the severe remittent and pernicious malarial fevers of India that its powers can scarcely be questioned. After the bowels of the patient in the acutest stage of the disorder have been freely opened, a half ounce of the tincture is given undiluted, all drink being withheld, and at the end of three hours a second half ounce is given in a similar manner. Soon after the second dose a violent, aromatic perspiration comes on, and the fever is usually broken. The remedy is also commended in *collapse* without organic disease. The formula given by Dr. Warburg is as follows. Socotrine aloes 1 ℔.; rhubarb, angelica fruit, confection of Damocratis, each, ℥iv; elecampane, saffron, fennel, prepared chalk, each, ℥ij; gentian, zedoary, cubebs, myrrh, camphor, agaric, each, ℥i. Digest the whole with 500 oz. proof spirit in a water-bath for 12 hours, express, add 10 oz. sulphate of quinia, dissolve by the aid of a water-bath, cool and filter. Hager has simplified this preparation, and eliminated the "farrago of inert substances." His formula is sulphate of quinia 1 part; spirit of camphor 2 parts; elixir proprietatis (*P. G.*) 22 parts; alcohol 16 parts. The value of the original formula is established: whether the remedy made after the method of Hager would act as well is unknown.

WHITE CEDAR, OIL OF. Dr. F. K. Bailey reports the case of a girl, aged fifteen, who took 16 drops of the oil of white cedar, and directly afterwards fell unconscious. He found her in clonic spasms, and, forcing open her jaws, poured in some castor oil, which vomited her. The clonic spasms then yielded to epileptiform convulsions lasting at intervals for several hours. Long-continued irritation of the stomach resulted, and it was a year before health was fully recovered. (*N. R.*, 1872.)

WHITING. This is essentially the same as prepared chalk, being made by the pulverization and elutriation of crude chalk. It is used as a coarse paint, and for various purposes in the arts, for which carbonate of calcium is requisite. *Paris white* is a variety of the same material.

WINTER'S BARK. WINTERA. *U. S.* 1850. *The Bark of Drimys Winteri.* Natural order Magnoliaceæ (*Juss.*), Winteraceæ (*Lindley*). The following is the generic character. "*Calyx* with two or three deep divisions. *Corolla* with two or three petals, sometimes more numerous. *Stamens* with the filaments thickened at the summit, and anthers having two separate cells. *Ovaries* from four to eight, changing into the same number of small, many-seeded berries." (*A. Richard.*) This plant, which is figured in *Carson's Illustrations of Medical Botany* (i. 11, pl. 5), is an evergreen tree, varying very much in size, sometimes rising forty or fifty feet in height, sometimes not more than six or eight feet. The bark of the trunk is gray, that of the branches green and smooth. Its leaves are alternate, petiolate, oblong, obtuse, somewhat coriaceous, entirely smooth, green on their upper surface, of a pale bluish color beneath, with two caducous stipules at their base. The flowers are small, sometimes solitary, but more frequently in clusters of three or four, upon the summit of a common peduncle about an inch in length, simple, or divided into as many pedicels as there are flowers. The tree is a native of the southern parts of South America, growing along the Straits of Magellan, and extending as far north as Chili. According to Martius, it is found also in Brazil. The bark of the tree was brought to England, in the latter part of the sixteenth century, by Captain Winter, who attended Drake in his voyage round the world, and while in the Straits had learned its aromatic and medicinal properties. Since that period a bark has been occasionally employed in medicine under the name of Winter's bark; but it is now believed not to have been derived from *Drimys Winteri;* as it does not correspond with the specimens of the bark obtained from that tree, still preserved in the cabinets of Europe. The origin of the commercial Winter's bark is unknown. The following is the description of a specimen which came into the possession of Dr. George B. Wood many years since. It corresponds closely with Guibourt's description of commercial Winter's bark. It is in quilled pieces, usually a foot in length and an inch or more in diameter, appearing as if scraped or rubbed on the outside, where the color is pale yellowish or reddish gray, with red elliptical spots. On the inside the color is that of cinnamon, though sometimes blackish. The pieces are sometimes flat and very large. The bark is two or three lines in thickness, hard and compact, and when broken exhibits on the exterior part of the fracture a grayish color, which insensibly passes into reddish or yellowish towards the interior. The powder resembles in color that of Peruvian bark. The odor is aromatic, the taste spicy, pungent, and even burning. Winter's bark was found by M. Henry to contain resin, volatile oil, coloring matter, tannic acid, several salts of potassa, malate of calcium, and oxidized iron. The presence of tannic acid and oxide of iron serves to distinguish it from *canella alba*, with which it has often been confounded. The bark above described as commercial Winter's bark is destitute both of tannic acid and oxide of iron, and cannot, therefore, be the bark examined by M. Henry.*

Medical Properties and Uses. Winter's bark is a stimulant aromatic tonic, and was employed by Winter as a remedy for scurvy. It may be used in half drachm doses for similar purposes with cinnamon or canella alba, but is scarcely known in the medical practice of this country. The *Drimys Chilensis* of De Candolle, growing in Chili, yields a bark having similar properties. (Carson, *A. J. P.*, xix. 81.)

WOOD OIL. *Gurjun Balsam. Balsamum Dipterocarpi.* In the *P. J. Tr.* for August, 1854 (p. 65), appeared an account by Mr. Charles Lowe, of Manchester, of a "*new variety of balsam of copaiba*," derived from the East Indies. In a subsequent communication to the same journal (1856, p. 321) from Mr. Daniel Hanbury, it appears that this product, though offered for sale in the London market as *balsam of copaiba*, is known in India under the names of *wood oil* and *Gurjun balsam.* Considerable quantities had been imported from Maulmein, in Burmah; and specimens of a similar drug had been received from Canara and Tenasserim; and it appears to be widely diffused in the Indian markets.

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* M. Guibourt, in the third edition of his "Drogues Simples," published in 1850, gives the following description of a specimen of the true Winter's bark, presented to him by Robert Brown, and labelled "*Port Famine, Captain P. King, Drimys Winteri.*" The bark is 3 millimetres (1·18 of an inch) thick, and covered with a grayish white, very thin, and rather smooth epidermis. It is of a deep reddish brown color internally, and has a spongy appearance, especially in the part in contact with the wood, where it appears to be formed of longitudinal, radiating ligneous layers, isolated one from the other. It has a strong odor, somewhat analogous to that of canella and slightly camphorous, and a taste in like manner very aromatic, with considerable acrimony. Another specimen brought from the Straits of Magellan, in 1840, bears a close resemblance to the above, being in quills as large as the little finger, with a thickness of 2 millimetres. and an epidermis thin, smooth, and of a whiteness strongly contrasting with the reddish brown color of the interior. Beneath the epidermis there is a certain number of very compact concentric layers; but most of the thickness of the bark is formed of radiating and distinct ligneous layers, altogether like those of the preceding specimen. Guibourt also describes the barks of two other species of Drimys, those of *D. Mexicana* and *D. Granatensis*, growing respectively in Mexico and New Granada, both of which have considerable resemblance to the preceding.—(Tom. iii. pp. 681, 682.)

According to Hanbury, this liquid is obtained from *Dipterocarpus lævis*, a very large tree, growing in Pegu and other parts of Farther India. A large notch is cut in the trunk of the tree, between two and three feet from the ground, and a fire made so as to char the wound. The juice then begins to flow, and is received in suitable vessels. Every three or four weeks, the charred surface is cut off and burned anew. A single tree sometimes yields 40 gallons during the season. Other species of Dipterocarpus afford a similar product; and hence probably the difference which has been observed in the specimens examined. It is at first turbid, but may be clarified either by filtration or deposition. After filtration, wood oil is a clear, dark brown liquid, of the sp. gr. 0·964 (*Hanbury*), and, in consistence, smell, and taste, bears a close resemblance to copaiba. It is soluble in two parts of alcohol of the sp. gr. 0·796, with the exception of a very small proportion of darkish flocculent matter, which subsides on standing. According to Lowe, it contains 65 per cent. of volatile oil, 34 of resin, and 1 of acetic acid and water. A characteristic property noticed first by Mr. Lowe, by which it may be distinguished from copaiba, is that, when heated in a closed vial to 266° (230°, Lowe), it becomes slightly turbid and coagulates, so that the vial may be inverted without changing the position of its contents; and this consistence is retained when the liquid cools. By a gentle heat with agitation the fluidity returns; but the liquid again coagulates if heated to 266°. Guibourt states that it does not solidify like copaiba, with one-sixteenth of magnesia; and the two separate on standing. (*Journ. de Pharm.*, xxx. 192.) De Vrij, of Rotterdam, proposes the reaction of benzol with wood oil and copaiba respectively as a test to distinguish them. With an equal volume of the wood oil, benzol forms a turbid mixture, from which, after a long time, a resinous matter is deposited in flocculi; with copaiba it forms a transparent solution. (*P. J. Tr.*, 1857, p. 374.) According to De Vrij, the volatile oil obtained by distillation has the sp. gr. 0·928, and boils at 255°. Flückiger (*Archiv d. Pharm.*, 1876, p. 420) noticed that wood oil may be recognized by the violet color it assumes, if dissolved in 20 parts of carbon bisulphide and mixed with a drop of a cold mixture of equal parts of concentrated sulphuric and nitric acids. A liquid is much employed in India for painting ships, houses, etc., which is also called *wood oil;* this is obtained from a different source, *Aleurites cordata* (*Müller.*). According to Dr. O'Shaughnessy, the oil of dipterocarpus is little inferior to copaiba in the diseases for which that medicine is employed. Dr. T. B. Henderson has found it very successful in gonorrhœa, given in the dose of a teaspoonful two or three times a day, uncombined. He has used it only in cases where copaiba had failed; and in every case it was successful within a week, and no inconvenience occurred in any instance. (*Med. T. and Gaz.*, 1865, p. 571.) It probably has a similar remedial influence on diseased mucous membranes with the different turpentines, which it appears to resemble in composition. The juice may be given in emulsion, in doses of from fifteen to forty drops (0·9–2·5 C.c.); the volatile oil from ten to thirty drops (0·6–1·9 C.c.).

WOORARI. *Woorara. Woorali. Urari. Curare.* This powerful South American arrow-poison was first brought to Europe by the celebrated traveller Waterton; it was in the form of a thick syrup, but as it now occurs in commerce it is a blackish extract, brittle, somewhat resinoid in appearance, encrusting the sides of gourds or little rude earthenware jars, into which it has almost certainly been poured in a liquid state. The drug varies much in strength. It has been variously described. According to the researches of Prof. Planchon (*P. J. Tr.*, xi. 491), there are really four distinct varieties of curare. 1. That from the Upper Amazon, obtained from the *Strychnos Castelnœana*, Wedl, and possibly from an undescribed Strychnos, *S. yapurensis.* 2. That from the Upper Orinoco, extending towards the Rio Negro, yielded by *S. Gubleri;* this is the variety spoken of by Humboldt. 3. That of British Guiana, obtained from *S. toxifera*, Schomb., associated with *S. Schomburgkii*, Kl., and *S. cogens*, Benth. 4. That of French Guiana, made out of *S. Crevauxii.* If this classification be correct, it is very important to distinguish the varieties of the woorari; this at present cannot be done. Dr. H. C. Wood has received, however, two distinct wooraris, one said to come from the Upper Amazon, therefore No. 1 of Planchon, and the other believed to come from the Orinoco. They are distinguished by the former being free from and the latter full of ants, evidently put in whilst the poison was liquid. The preparation of woorari has been witnessed by various travellers and variously described. (See *P. J. Tr.*, xvi. 502; *B. and F. Med.-Chir. Rev.*, Oct. 1865; *P. J. Tr.*, x., 1881.) It usually consists in making a decoction and finally extract of various plants, including the active Strychnos. Dr. Jobert asserts that the Tecuma Indians use, besides *S. Castelnœana*, *Cocculus toxiferus* and an arum ("*Taya*"), which he found to be very poisonous. It is entirely possible that the varieties of woorari vary in their alkaloid and their physiological properties. Allied, it may be, to the third variety of woorari are the arrow-poisons brought by Dr. W. S. W. Ruschenberger from New Granada, and studied by Drs. W. A. Hammond and S. Weir Mitchell. (*Am. Journ. Med. Sci.*, July, 1859.) *Corroval* was in dark brown lumps, having the appearance of a vegetable extract, and of an intensely bitter and persistent taste. Under the microscope it presented the appearance of vegetable remains, but nothing animal. It yielded its active properties to water and alcohol, and was found to depend for its activity upon a peculiar alkaloid, *corrovaline.* In a few minutes after the introduction of the poison through a wound, paralytic phenomena became obvious, and the animal soon died, without preliminary spasm or convulsions. But the heart, instead of continuing to act after apparent death, had entirely ceased to beat, and had quite lost its irritability, so that it could not be excited by galvanism. They inferred that the action of the poison is directly and primarily on the heart, possibly through the ganglia contained in its tissue. There was no evidence whatever, whether chemical or physiological, of the presence of strychnia in the poison. *Vao* or *bao* was a vegetable extract containing *corrovaline*, and apparently only a diluted or adulterated corroval.

The attempts first made to isolate the poisonous principle of woorari were without satisfactory results. Dr. Heintz succeeded in obtaining the poison in an exceedingly concentrated form, but not entirely separated from other principles. (*Am. Med. Gaz.*, vii. 6.) In 1828, MM. Boussingault and Roulin separated a substance which they regarded as an alkaloid, but which neither they nor other chemists obtained in a crystalline state. At length, however, M. W. Preyer, at the urgent request of M. Bernard, who desired to find some physical test of the identity of the different substances which bore the common name of curare, undertook a laborious investigation into the subject, and succeeded in isolating a crystallizable alkaloid, which is undoubtedly the active principle of woorari, and which has received the appropriate name of *curarine* (*curaria*). From the different specimens examined by him he extracted the same alkaloid; and it is no doubt common to all the varieties of this poison which produce its characteristic effects on the system. The following is the process employed by him. It was first necessary to separate substances added by the Indians to give consistence to the poison and aid in its preservation. Such are the resin, gum, and perhaps the lime of the woorari. For this purpose he treats the poison successively with alcohol and water, both of which dissolve the alkaloid, though the former less than the latter. Having added a few drops of a saturated solution of carbonate of sodium to the powdered woorari, he treats this with absolute alcohol boiling hot, then distils off the alcohol, and adds distilled water to the residue in the retort. Having filtered the watery solution, he adds solution of mercuric chloride in excess, which precipitates the whole of the curarine. The precipitate is suspended in water, and treated with a current of sulphuretted hydrogen, which throws down sulphide of mercury, leaving curarine hydrochlorate in solution. To obtain this pure, however, it is necessary to repeat the treatment with the bichloride several times. A colorless, or nearly colorless, solution is thus obtained, from which the hydrochlorate of curarine crystallizes under the receiver of an air-pump. Another proceeding is given by M. Preyer, in which phosphomolybdic acid is employed as the precipitant. The alkaloid may be obtained from the hydrochlorate in the ordinary mode. Besides the hydrochlorate, he has obtained the nitrate, sulphate, and acetate, all soluble and crystallizable. Curarine differs from all the other crystallizable alkaloids, with one exception, in containing no oxygen. It consists of carbon, hydrogen, and nitrogen, and M. Preyer presents as a provisional formula $C_{10}H_{15}N$. Curarine is extremely deliquescent, of an extreme and persistent bitterness, crystallizing in quadrilateral prisms, which are colorless, soluble in water, caustic alkalies, and alcohol in all proportions, little soluble in chloroform or amylic alcohol, insoluble in anhydrous ether, benzol, oil of turpentine, or carbon disulphide. It very feebly changes litmus blue, and its soluble salts do not redden it. Pure concentrated sulphuric acid gives it a very durable magnificent blue color, which is not the case with strychnia. With bichromate of potassium the same acid develops the same violet color as with strychnia, but much more persistent. Concentrated nitric acid renders it purple. By these tests curare may be readily detected in the fluids of animals poisoned with it. (*Journ. de Pharm.*, 4e sér., ii. 296.)

Woorari is one of those poisons whose active principle passes through animal membranes with difficulty, and hence when given by the stomach or rectum it acts very slowly, and in some cases elimination may proceed so rapidly that no marked influence is exerted, because not enough of the alkaloid is in the blood at any one time. There is also some reason for believing that the alkaloid is destroyed in the liver. When injected into a vein, or introduced by the hypodermic needle or the poisoned arrow into the cellular tissue, it acts with great promptness. The symptoms caused are progressive loss of muscular power, the animal growing weaker and weaker, the respirations becoming more and more feeble, until death by asphyxia results. Not rarely there are marked muscular twitchings, or even convulsive movements, which Vulpian asserts (*Leçons Subs. Toxiq.*, 1881, p. 202) are not due to the asphyxia, because they are not prevented by artificial respiration. The heart usually continues beating after cessation of breathing, and only very large doses of the poison affect early the arterial pressure. It has indeed very little action upon the cardiac or vaso-motor apparatus. The failure of muscular power and loss of reflex activity are not due to any influence upon the nerve centres or the muscles. It is abundantly proved that it is the motor nerves which are paralyzed, and it is probable, as Vulpian believes, that it is the extreme peripheral endings of these which first suffer. At a certain stage of the poisoning response occurs in the tributary muscle when a nerve is galvanized, although reflex and voluntary impulses are unable to force a passage to the muscles. The sensory, vasomotor, and inhibitory nerves are not affected unless by enormous doses. Couty and De Lacuda have recently brought forward some evidence to show that the muscles do not escape as absolutely as has been believed. (*Schwalbe's Jahresb.*, 1881, p. 203.)

Glycosuria has very often been noticed, and the curarine has frequently been detected in the urine, which also usually contains an abundance of crystals of oxalate of lime. In regard to action upon the bodily temperature the evidence is somewhat contradictory. Bernard noticed an extraordinary rise, but, according to more recent observations, the temperature of the central portions of the body falls, whilst that of the extremities, and sometimes even of the lower rectum, rises. MM. Voisin and Liouville divide the effects on the human subject into two classes, according to their severity. The milder symptoms are chiefly exhibited in the circulatory system. The pulse is increased in force and frequency, the respiration is rendered somewhat more frequent, the temperature is slightly elevated, perspirations sometimes occur, and the urine is augmented in quantity, is remarkably light-colored, and contains glucose. From larger quantities of the poison violent febrile phenomena occur, commencing with the characteristic symptoms of a severe chill. There are shivering, chattering of the teeth, sensations of severe cold, cutis anserina, startings, and general trembling, with small and rapid pulse, anxiety, sighing, etc. The power of the lower extremities rapidly diminishes or quite ceases, co-ordination of motion is disturbed, and sometimes the patient is unable to move the legs. Thirst, headache, insomnia, and sometimes diuresis, are added to the other symptoms. The first coldness is followed by a hot skin, frequent and full pulse, redness of the surface, injected conjunctiva, and a profuse sweat. The paralysis of the lower extremities continues generally for a few minutes, at most for an hour; but care was taken to arrest the action of the poison by compressing the vessels above the point of insertion. The fever continues longer; sometimes, when the dose is large, for five or six days, gradually diminishing. The elimination of the poison by the kidneys appears to cease in about twenty-four hours. In cases of poisoning from the injection of woorari, a ligature round the limb between the place of injection and the heart, the free exhibition of diluents and evacuants, and artificial respiration when required, are the measures recommended. (*Ed. Med. Journ.*, 1867, p. 667.)

As a remedy curare has very little value, even in tetanus, hydrophobia, and other severe convulsive affections; it will undoubtedly quiet the spasm, but does not have any direct curative influence upon the disease, which is due to an irritation of the centres and not of the nerve trunks. According to the elaborate experiments of M. Du Cazal (*Arch. Gén.*, Sept. 1869), from 5 to 10 milligrammes (·077 to ·154 gr.) daily were borne by a dog without inconvenience; at the dose of 10 milligrammes the characteristic phenomena began to show themselves, but disappeared in a few hours; with 14 milligrammes the animal perished. For man the doses administered by subcutaneous injection were from 1 to 5 centigrammes (·1543 to ·7715 gr.), and exceptionally from 6 to 7. From these quantities, the appearance of glucose in the urine proved the presence of the poison in the system; and some slight characteristic symptoms, as dazzling, headache, vertigo, general lassitude, have appeared, but without any serious disturbance of the locomotor apparatus. MM. Jousset and Bellesme prepare an infusion in the proportion of one part of the medicine to ten parts of boiling water, and, after filtration, inject subcutaneously, at short intervals, a quantity of the infusion equivalent to half a centigramme (about one-thirteenth of a grain), to be increased or diminished according to its effects. (*Ann. de Thérap.*, 1866, p. 37.) According to Bernard, *curarine* is at least twenty times as strong as *curara*, and should be given in proportionate dose.

WRIGHTIA ANTIDYSENTERICA. (R. Brown.) *Nerium Antidysentericum.* (Linn.) An East India tree, belonging to the Apocynaceæ, the bark of which was, about a century since, in some repute in Europe as a remedy in dysentery, diarrhœa, and febrile diseases. Though no longer used in Europe, it still retains its reputation in India, among the native practitioners. Dr. Stenhouse has obtained from the seeds, besides a fixed oil which they contain in large quantity, a peculiar bitter principle called by him *wrightine*, $C_{25}H_{22}NO$, which, though uncrystallizable, and forming uncrystallizable compounds with the acids, has claims to be ranked with the alkaloids. (See *P. J. Tr.*, 1864, p. 493.) Haines had previously obtained the same alkaloid, and described it under the name of *conessine*. (*P. J. Tr.* (2) vi. 432.)

XANTHIUM SPECIOSUM. This composite was a few years since lauded in Europe as a remedy for hydrophobia, but is certainly valueless in that disease. M. Guichard believes that he has found an alkaloid in it. (*P. J. Tr.*, vii. 249.)

XANTHORRHŒA RESINS. *Gum Acaroides. Gum Acroides.* A yellow and a red resinous substance, the products of different species of Xanthorrhœa, have been introduced into England from New Holland. They are obtained by spontaneous exudation from the stems of the plants, which are usually shrubs, and it is asserted that they are the commercial source of *benzoic acid* of European manufacture. The *yellow variety* is in tears, in flattish pieces having on one side the mark of the stem, or in masses of various size and irregular shape. It has a reddish yellow color, resembling gamboge when broken, and when heated emits a fragrant odor like that of Tolu balsam. It contains resin, cinnamic and benzoic acids, and a trace of volatile oil, and may therefore be ranked among the balsams. When heated with nitric acid, it yields a large product of picric acid. In medical properties it is said to bear a close resemblance to storax and the balsam of Tolu. A tincture, made in the proportion of two ounces to a pint of alcohol, may be given in the dose of one or two fluidrachms. The *red variety* resembles dragon's blood in color, and appears to be analogous to the other variety in properties. (See *A. J. P.*, 1881, pp. 191, 219, 257, 283, 328.)

XANTHORRHIZA. *Yellow-root. Xanthorrhiza apiifolia.* Willd. *X. tinctoria.* Woodhouse. This is a ranunculaceous shrub, two or three feet in height, with a horizontal root, which sends off numerous suckers. The stem is simple, rather thicker than a goose-quill, with a smooth bark, and bright yellow wood. The leaves, which stand thickly at the upper part of the stem, are compound, consisting of several ovate-lanceolate, acute, doubly serrate leaflets, sessile upon a long petiole, which embraces the stem at its base. The flowers are small, purple, and disposed in long, drooping, divided racemes, placed immediately below the first leaves. The yellow-root grows in the interior of the Southern and in the Western States. Nuttall says that it is abundant on the banks of the Ohio. It flowers in April. The root was formerly in the secondary list of the U. S. Pharmacopœia; but the bark of the stem possesses the same virtues. The root is from three inches to a foot or more in length, and about half an inch in thickness near the stem. It shrinks somewhat in drying, and, as found in the shops, is in slender pieces of various lengths, diminishing from three or four lines in thickness to the dimensions of a knitting-needle, wrinkled longitudinally, with a light yellowish brown, easily separable epidermis, a thick, hard, bright yellow woody portion, and a very slender central pith. It is inodorous, and of a simple but extremely bitter taste. It imparts its color and taste to water. The infusion is not affected by a solution of sulphate of iron. Dr. J. Dyson Perrins has found *berberine* in it. (*P. J. Tr.*, May, 1862.) Xanthorrhiza possesses properties closely analogous to those of columbo, quassia, and other simple tonic bitters, and may be used for the same purposes, and in the same manner. Dr. Woodhouse employed it in the dose of two scruples.

XYLOL. ($C_6H_4(CH_3)_2$.) There are three hydrocarbons of this formula, all contained in coal-tar. A mixture of them was first extracted from naphtha by Dr. Hugo Müller, and was brought forward by Dr. Zuelzer as a specific in smallpox, but has failed to make good the claims made for it. (*P. J. Tr.*, 1872, p. 623.)

YERBA REUMA. Under this name the leaves of the *Waukenia grandiflora*, a common weed in California, Nevada, and Texas, especially near the sea, have been used as a local astringent stimulant application in nasal, vaginal, and other catarrhs, external ulcerations, skin affections, etc. (*New Prep.*, ii., iii.); also internally in dysentery and bronchitis. Mr. Carl Jungk found in the dried leaves 28 per cent. of chloride of sodium, 17 per cent. of sour resin, and 6 per cent. of tannic acid. The fluid extract has been given internally in doses of ten to twenty minims.

YLANG YLANG OIL. *Cananga Oil. Oleum Anonæ. Oleum Unonæ.* This is a volatile oil obtained from the flowers of *Cananga odorata*, a large tree inhabiting most parts of Southern Asia. It contains a benzoic ether, phenol, and an aldehyd, or ketone. It is used only as a perfume. The so-called "Macassar Hair Oil" is said to be a solution of it in cocoanut oil. (See *A. J. P.*, 1881, p. 123.)

ZEDOARY. *Radix Zedoariæ.* There are two kinds of zedoary, the long and the round, distinguished by the old officinal titles of *radix zedoariæ longæ*, and *radix zedoariæ rotundæ;* the former produced by the *Curcuma Zedoaria* of Roxburgh, the latter, as some suppose, by the *Kæmpferia rotunda* of Linn., but, according to others, by the *Curcuma Zerumbet* of Roxburgh. Both kinds come from the East Indies. The *long zedoary* is in slices, from an inch and a half to three inches in length, and from half an inch to an inch thick, obtuse at the extremities, and exhibiting the remains of the radical fibres. The *round* is also usually in slices, which are the sections of a roundish root, ending in a point beneath, and divided longitudinally into two parts, each of which is flat on one side, convex on the other, and heart-shaped in its outline. Sometimes the root of the latter variety is entire, and sometimes in quarters instead of halves. It is marked with circular rings on the convex surface, and, like the former, with small projecting points which are the remains of radical fibres. Both are grayish white on the outside, yellowish brown within, hard, compact, of an agreeable aromatic odor, and a bitterish, pungent, camphorous taste. The round, however, is less spicy than the long. They yield a volatile oil, when distilled with water. Zedoary is a warm, stimulating aromatic, useful in flatulent colic and debility of the digestive organs. It is not now employed, as it produces no effects which cannot be as well or better obtained from ginger. The dose is from ten grains to half a drachm.

ZERECHTIT. *Tschuking.* The leaves, flowers, and fruit of an Abyssinian composite, *Uhyæa Schimperi*, for an account of which see *Proc. A. P. A.*, xxvi. 228.

ZERUMBET. *Cassumuniar.* Under these names an East India root was formerly used, having some analogy in sensible and medical properties to ginger, and ascribed to the *Zingiber Zerumbet* of Roscoe. Some consider the cassumuniar as a distinct root, and refer it to the *Zingiber Cassumuniar* of Roxburgh. The difference of opinion is of little importance, as neither of the roots, supposing them not to be the same, is at present to be found in the markets. By some authors the zerumbet has been erroneously confounded with the round zedoary. Geiger describes it as in pieces of the size of a fig or larger, externally grayish brown and wrinkled, internally yellowish, hard and tough, of a biting, aromatic taste, and a spicy odor.

ZIZYPHUS VULGARIS. Lamarck. *Rhamnus Ziziphus.* Linn. A shrub, or small tree, growing on the shores of the Mediterranean, and cultivated in Italy, Spain, and the south of France. The fruit is the part used. This consists of oval drupes, of the size of a large olive, with a thin, coriaceous, red or reddish brown skin, a yellowish, sweet, acidulous pulp, and an oblong, pointed stone in the centre. These have the officinal name of *jujubæ.* By drying, their pulp becomes softer and sweeter, and acquires a vinous taste, evincing the commencement of fermentation. They are nutritive and demulcent, and are used in the form of decoction in pectoral complaints. *Jujube paste* consists properly of gum arabic and sugar, dissolved in a decoction of this fruit, and evaporated to the proper consistence. As a demulcent, it is in no respect superior to a paste made with gum arabic and sugar alone; and the preparation commonly sold in this country under the name, contains in fact none of the fruit.

The fruits of two other species of Zizyphus, *Z. Lotus*, growing in the north of Africa, and *Z. Jujuba*, a native of the East Indies, possess properties similar to those of the *Z vulgaris*, and are used as food by the inhabitants of the countries where they grow.

PART III.

In this division are included the subjects formerly embraced in the Appendix of this work, with the addition of the officinal tests and various tables, many of which are introduced for the first time in this edition of the Dispensatory.

TESTS.

LIST OF REAGENTS. *U.S.*

The constant reference to tests in the previous pages, and the adoption of volumetric test-solutions in the U. S. Pharmacopœia of 1880, necessitate the insertion of the officinal reagents and solutions used in the quantitative and qualitative tests. Great care should be used, in preparing these tests and selecting the reagents, to see that they come fully up to the officinal requirements, as the whole value of the test depends upon the purity of the reagent and the accuracy with which the solution has been made.

Articles used in Testing. *U.S.* 1880.

Absolute Alcohol. "Ethyl Alcohol [C_2H_5HO; 46] nearly or quite free from water. It should have the specific gravity 0·794 at 15·6° (60° F.); should respond to the tests of purity given under Alcohol; and a portion shaken with well-dried sulphate of copper should not impart color to the latter." *U. S.*

Acids. "All acids used in testing must fulfil the requirements of strength and purity mentioned in the Pharmacopœia, with the additional condition, that the reactions for purity shall not depend upon a limit of time, nor permit any recognizable trace of impurity. Besides responding to all other tests for purity, *Hydrochloric Acid*, diluted with five times its volume of distilled water, and *Sulphuric Acid*, diluted with fifteen times its volume of distilled water, when treated by the method given under Test-Zinc, should give no indication of the presence of arsenic." *U. S.*

Aluminium. "Metallic Aluminium [Al; 27] in the form of wire or ribbon. It should be soluble in solution of potassa, without leaving a residue." *U. S.*

Chromate of Potassium. "The crystallized salt [K_2CrO_4; 194·4.]." *U. S.*

Copper. "Metallic Copper [Cu; 63·2] in slender wire, or thin foil cut into strips." *U. S.*

Gelatinized Starch. "A gelatinous solution, freshly prepared by mixing *one part* of Starch (see *Amylum*) with *two hundred parts* of distilled water, and boiling the mixture for five or six minutes." *U. S.*

Gold. "Metallic Gold [Au; 196·2] in the form of leaf. It should not be affected by nitric acid, but should readily dissolve, without residue, in nitro-hydrochloric acid." *U. S.*

Hydrosulphuric Acid. "The gas [H_2S; 34] generated by treating Ferrous Sulphide [FeS; 87·9] with Diluted Sulphuric Acid (see page 110), and washed by being passed through a small quantity of distilled water in a wash-bottle. *One part* of ferrous sulphide is sufficient for *fifteen parts* of diluted sulphuric acid, or for *one and a half parts* of sulphuric acid when this is diluted with *eight* to *ten times* its weight of distilled water; and the resulting gas will saturate about *fifty parts* of distilled water. Distilled water so saturated may be used, when fresh, as a test-solution of Hydrosulphuric Acid. It should give the strong odor of the acid, and should abundantly blacken test-solution of acetate of lead." *U. S.*

Indigo. "Indigo Blue [C_8H_5NO; 131]." *U. S.*

Litmus Paper. "*Blue Litmus Paper.* Unsized white paper colored with Solution of Litmus. *Red Litmus Paper.* Unsized white paper colored with Solution of Litmus previously reddened by the smallest requisite quantity of sulphuric acid." *U. S.*

Molybdate of Sodium. "The salt [$Na_2MoO_4.H_2O$; 223·5] in crystals, or in clear, white, fused masses." *U. S.*

Solution of Litmus. "A solution prepared by macerating *one part* of Litmus, in powder, with *ten parts* of Diluted Alcohol, in a closed vessel, for two days, and filtering." *U. S.*

Solution of Turmeric. "A solution prepared by macerating *one part* of bruised Turmeric, with *six parts* of Diluted Alcohol, in a closed vessel, for seven days, and filtering." *U. S.*

Turmeric Paper. "Unsized white paper colored with Solution of Turmeric, by steeping and drying it without the application of heat." *U. S.*

Test-Zinc. "Metallic Zinc [Zn; 64·9] free from arsenic, and in slender sticks, or small fragments, or in thin disks, prepared by melting the metal and pouring it in a thin stream into water.

"Test-Zinc should be soluble in diluted sulphuric acid and leave no residue or not more than a slight one (absence of more than small proportions of lead). If Test-Zinc does not cause rapid effervescence in diluted sulphuric acid, this difficulty may be overcome by sprinkling the metal with test-solution of platinic chloride previously diluted with about five hundred times its volume of distilled water, and then drying on the water-bath." *U. S.*

"*Test for the Absence of Arsenic.* A flask of 300 to 400 C.c. capacity is connected, through a tubulated stopper, with a drying-tube, one end of which is filled with fragments of dried chloride of calcium, and the other end with fragments of dry potassa or soda. The drying-tube is connected with a horizontal tube of hard glass, about ten inches (25 cm.) in length and one-fourth of an inch (6 mm.) in diameter, having the farther end drawn out narrow and turned downward, so as nearly to reach the bottom of a test-tube adjusted to receive it. Near its further horizontal portion, the hard glass tube is narrowed to about one-third its diameter, and the whole tube is supported securely, leaving a space of three inches (7 cm.), next before the narrowed portion, free for the flame of a lamp placed underneath. A portion of 4 to 5 Gm. of the Zinc to be tested is placed in the flask, with 120 to 150 C.c. of diluted sulphuric acid (known to be free from arsenic), the connections are closed, and 3 or 4 C.c. of test-solution of nitrate of silver poured in the test-tube to receive the gas. When the gas has bubbled briskly through the solution in the test-tube for at least five minutes, and until the air is expelled from the apparatus, the lamp is placed so as to heat the hard glass tube nearly or quite to redness, and this temperature is maintained for at least twenty minutes, while the gas is passing. No mirror should appear in the narrowed portion of the heated tube, beyond the flame, and no black precipitate, or not more than a slight darkening of color should appear in the test-solution of nitrate of silver (abs. of arsenic). Also no mirror should appear in the tube next before its heated portion (abs. of antimony)." *U. S.*

Water. "Whenever Water is mentioned in the descriptions of chemicals, or for use in any test, Distilled Water is to be employed." *U. S.*

TEST-SOLUTIONS. *U. S.*

[Test-Solutions should be preserved in well-stopped bottles of hard glass.]

Test-Solution of Acetate of Lead. "A solution of *one part* of Acetate of Lead (see page 1129) in *ten parts* of distilled water, with the addition of a few drops of Acetic Acid (see page 25) if necessary to give the liquid a faint acid reaction. The solution should be clear." *U. S.*

Test-Solution of Albumen. "A solution recently prepared by triturating the White of one Egg with 100 C.c. of distilled water and filtering through cotton moistened with distilled water." *U. S.*

Test-Solution of Ammonio-Nitrate of Silver. "A solution prepared by adding Water of Ammonia (see page 226), in drops, to Test-Solution of Nitrate of Silver, until the precipitate at first formed is very nearly all dissolved, and filtering." *U. S.*

Test-Solution of Ammonio-Sulphate of Copper. "A solution prepared by adding Water of Ammonia (see page 226), in drops, to Test-Solution of Sulphate of Copper, until the precipitate at first formed is very nearly all dissolved, and filtering." *U. S.*

Test-Solution of Bichromate of Potassium. "A clear solution prepared by dissolving *one part* of Bichromate of Potassium (see page 1151) in *ten parts* of distilled water." *U. S.*

Test-Solution of Bitartrate of Sodium. "A clear solution prepared by dissolving *one part* of pure Bitartrate of Sodium [$NaHC_4H_4O_6.H_2O$] in *nine parts* of distilled water, with the aid of heat, and filtering when cold." *U. S.*

Test-Solution of Carbonate of Ammonium. "A clear solution prepared by dissolving *one part* of Carbonate of Ammonium (see page 171) in *ten parts* of distilled water." *U. S.*

Test-Solution of Carbonate of Sodium. "A clear solution prepared by dissolving *one part* of Carbonate of Sodium (see page 1321) in *ten parts* of distilled water." *U. S.*

Test-Solution of Chloride of Ammonium. "A clear solution prepared by dissolving *one part* of Chloride of Ammonium (see page 173) in *ten parts* of distilled water." *U. S.*

TEST-SOLUTION OF CHLORIDE OF BARIUM. "A clear solution prepared by dissolving *one part* of pure crystallized Chloride of Barium [$BaCl_2.2H_2O$; 243·6] in *ten parts* of distilled water." *U. S.*

TEST-SOLUTION OF CHLORIDE OF CALCIUM. "A clear solution prepared by dissolving *one part* of pure crystallized Chloride of Calcium [$CaCl_2.6H_2O$; 218·8] in *ten parts* of distilled water." *U. S.*

TEST-SOLUTION OF CHLORIDE OF GOLD. "A clear solution prepared by dissolving *one part* of Chloride of Gold [$AuCl_3$; 302·4] in *twenty parts* of distilled water." *U. S.*

TEST-SOLUTION OF CHROMATE OF POTASSIUM. "A clear solution prepared by dissolving *one part* of pure Chromate of Potassium [K_2CrO_4; 194·4] in *ten parts* of distilled water." *U. S.*

TEST-SOLUTION OF FERRIC CHLORIDE. "A clear solution prepared by dissolving *one part* of Ferric Chloride (see page 660) in *ten parts* of distilled water." *U. S.*

TEST-SOLUTION OF FERRICYANIDE OF POTASSIUM. "A recently prepared and perfectly clear solution, made by dissolving *one part* of pure Ferricyanide of Potassium [$K_3Fe(CN)_6$; 328·9] in *ten parts* of distilled water. A portion of the solution diluted with ten times its volume of distilled water should give no blue precipitate on the addition of a few drops of test-solution of ferric chloride." *U. S.*

TEST-SOLUTION OF FERROCYANIDE OF POTASSIUM. "A clear solution prepared by dissolving *one part* of Ferrocyanide of Potassium (see page 1170) in *ten parts* of distilled water." *U. S.*

TEST-SOLUTION OF FERROUS SULPHATE. "A recently prepared solution made by dissolving *one part* of selected, clear crystals of Ferrous Sulphate (see page 683) in *ten parts* of distilled water. A portion of the solution, diluted with ten times its volume of distilled water, should give an abundant, blue precipitate on the addition of a few drops of test-solution of ferricyanide of potassium." *U. S.*

TEST-SOLUTION OF GELATIN. "A solution recently prepared by digesting *one part* of Isinglass (see page 783) in *fifty parts* of distilled water, on a water-bath, for half an hour, and, if necessary, filtering through cotton moistened with distilled water." *U. S.*

TEST-SOLUTION OF HYDROSULPHURIC ACID. "A solution of Hydrosulphuric Acid gas in distilled water, as described under Hydrosulphuric Acid (see page 1784)." *U. S.*

TEST-SOLUTION OF HYPOSULPHITE OF SODIUM. "A clear solution prepared by dissolving *one part* of Hyposulphite of Sodium (see page 1330) in *ten parts* of distilled water." *U. S.*

TEST-SOLUTION OF INDIGO. "A liquid prepared by digesting *one part* of Indigo, in powder, with *twelve parts* of Sulphuric Acid, on a water-bath, for one hour, pouring the solution into *five hundred parts* of Sulphuric Acid, then leaving the mixture to subside, and decanting the clear portion for use." *U. S.*

TEST-SOLUTION OF IODIDE OF MERCURY AND POTASSIUM. "A clear solution prepared by adding *one hundred parts* of test-solution of mercuric chloride to *three hundred and sixty-seven parts* of test-solution of iodide of potassium." *U. S.*

TEST-SOLUTION OF IODIDE OF POTASSIUM. "A clear, colorless solution prepared by dissolving *one part* of Iodide of Potassium (see page 1173) in *twenty parts* of distilled water. The solution should have a neutral reaction." *U. S.*

TEST-SOLUTION OF IODINE. "A dark-colored, clear solution prepared by dissolving *one part* of Iodine (see page 803) in a solution of *three parts* of Iodide of Potassium in *fifty parts* of distilled water." *U. S.*

TEST-SOLUTION OF MAGNESIUM. "A clear solution prepared by dissolving *one part* of Sulphate of Magnesium (see page 913), and *two parts* of Chloride of Ammonium (see page 173), in *eight parts* of distilled water, then adding *four parts* of Water of Ammonia (see page 226), setting aside for two or three days, and filtering." *U. S.*

TEST-SOLUTION OF MERCURIC CHLORIDE. "A clear solution prepared by dissolving *one part* of Mercuric Chloride (see page 747) in *twenty parts* of distilled water." *U. S.*

TEST-SOLUTION OF NITRATE OF BARIUM. "A clear solution prepared by dissolving *one part* of pure Nitrate of Barium [$Ba(NO_3)_2$; 260·8] in *twenty parts* of distilled water." *U. S.*

TEST-SOLUTION OF NITRATE OF SILVER. "A clear solution prepared by dissolving *one part* of crystallized Nitrate of Silver (see page 244) in *twenty parts* of distilled water." *U. S.*

TEST-SOLUTION OF OXALATE OF AMMONIUM. "A clear solution prepared by dissolving *one part* of pure Oxalate of Ammonium [$(NH_4)_2C_2O_4.H_2O$; 142] in *twenty parts* of distilled water." *U. S.*

TEST-SOLUTION OF PERMANGANATE OF POTASSIUM. "A solution recently prepared by dissolving *one part* of Permanganate of Potassium (see page 1184) in *one thousand* *parts* of distilled water. 62·8 C.c. of this solution, acidified with 5 C.c. of diluted sulphuric acid, should require 2 C.c. of the volumetric solution of oxalic acid for complete decoloration." *U. S.*

Test-Solution of Phosphate of Ammonium. "A clear solution prepared by dissolving *one part* of Phosphate of Ammonium in *ten parts* of distilled water." *U. S.*

Test-Solution of Phosphate of Sodium. "A clear solution prepared by dissolving *one part* of Phosphate of Sodium (see page 1333) in *ten parts* of distilled water." *U. S.*

Test-Solution of Picric Acid. "A saturated, aqueous solution prepared by dissolving *one part* of well-crystallized Picric Acid [$HC_6H_2(No_2)_3O$; 229] in *one hundred parts* of distilled water, by the aid of heat, setting aside to cool, and filtering after twelve hours." *U. S.*

Test-Solution of Platinic Chloride. "A clear solution prepared by dissolving *one part* of pure Platinic Chloride [$PtCl_4 5H_2O$; 426] in *twenty parts* of distilled water." *U. S.*

Test-Solution of Potassio-Cupric Tartrate. "A solution prepared by dissolving 6·93 Gm. of selected crystals of Sulphate of Copper (see page 508) in 20 C.c. of distilled water; also dissolving 36 Gm. of Tartrate of Potassium (see page 1189) in 140 C.c. of Solution of Soda (see page 892); then adding the former solution gradually to the latter, while stirring, and finally adding to the mixture a sufficient quantity of the Solution of Soda to make the liquid measure 200 C.c. Test-Solution of Potassio-Cupric Tartrate should be free from yellowish-brown sediment, and should deposit none upon boiling." *U. S.*

Test-Solution of Sulphate of Calcium. "A saturated solution prepared by digesting *one part* of powdered, native, crystallized Sulphate of Calcium [$CaSO_4.2H_2O$; 172] with about *three hundred parts* of distilled water, at the ordinary temperature, with repeated agitation, for several days, and decanting the clear liquid." *U. S.*

Test-Solution of Sulphate of Copper. "A solution prepared by dissolving *one part* of selected crystals of Sulphate of Copper (see page 508) in *ten parts* of distilled water." *U. S.*

Test-Solution of Sulphate of Potassium. "A solution prepared by dissolving *one part* of Sulphate of Potassium (see page 1186) in *fifteen parts* of distilled water." *U. S.*

Test-Solution of Sulphate of Silver. "A solution prepared by dissolving *one part* of Sulphate of Silver [Ag_2SO_4; 311·4] in *two hundred and fifty parts* of distilled water, with the aid of a gentle heat." *U. S.*

Test-Solution of Sulphide of Ammonium. "An aqueous solution, chiefly of ammonium sulphide [$(NH_4)_2S$; 68] prepared by passing washed Hydrosulphuric Acid gas into *three parts* of Water of Ammonia (see page 226) until the latter is saturated with the gas, and then adding *two parts* of Water of Ammonia. The solution should not be rendered turbid by the addition of test-solution of sulphate of magnesium, or of test-solution of chloride of calcium (absence of ammonium hydrate, or carbonate)." *U. S.*

Test-Solution of Tannic Acid. "A clear solution prepared by dissolving *one part* of Tannic Acid (see page 114) in *nine parts* of distilled water, and adding *one part* of alcohol. When this solution becomes turbid it should be rejected." *U. S.*

Test-Solution of Tartaric Acid. "A recently prepared and clear solution made by dissolving *one part* of Tartaric Acid (see page 118) in *five parts* of distilled water." *U. S.*

VOLUMETRIC SOLUTIONS FOR QUANTITATIVE TESTS. *U. S.*

Volumetric Solution of Bichromate of Potassium. *U. S.*

$K_2Cr_2O_7$; 294·8. 14·74 Gm. in 1000 C.c.

"Bichromate of Potassium, *fourteen and seventy-four hundredths grammes;* Distilled Water, *a sufficient quantity,* To make *one thousand cubic centimeters.* Dissolve the Bichromate of Potassium in about *seven hundred cubic centimeters* of Distilled Water, and then add of the latter enough to make the solution measure *one thousand cubic centimeters.*" *U. S.*

Note. In the estimation of iron, in ferrous combinations, the aqueous solution of the salt is acidified with diluted sulphuric acid, and afterward the Volumetric Solution of Bichromate of Potassium gradually added, from a burette, until a drop taken out upon a white surface no longer shows a blue color with a drop of test-solution of ferricyanide of potassium.

One cubic centimeter is the equivalent of:

	Gramme.
Potassium Bichromate	0·01474
Iron in ferrous combination	0·01677
Ferrous Carbonate	0·03477
Ferrous Sulphate, crystallized	0·08337
Ferrous Sulphate, dried	0·05097

The following-named officinals are tested with this solution: Ferri Carbonas Saccharatus, Ferri Sulphas, Ferri Sulphas Præcipitatus.

Volumetric Solution of Hyposulphite of Sodium. *U. S.*

$Na_2S_2O_3.5H_2O$; 248. 24·8 Gm. in 1000 C.c.

"Hyposulphite of Sodium, *thirty-two grammes;* Volumetric Solution of Iodine, *one hundred cubic centimeters;* Distilled Water, *a sufficient quantity,* To make *one thousand cubic centimeters.* Dissolve the Hyposulphite of Sodium in enough Distilled Water to make the solution measure *one thousand cubic centimeters.* To the Volumetric Solution of Iodine, which should measure exactly *one hundred cubic centimeters,* add a sufficient quantity of the Solution of Hyposulphite of Sodium, from a burette, nearly to decolorize the Iodine solution, then add freshly gelatinized starch, and continue the addition of the Hyposulphite until the blue color of the mixture is just destroyed, noting the number (n) of cubic centimeters added. Then take of the Solution of Hyposulphite of Sodium ten times ($10n$) this number of cubic centimeters, and add thereto enough Distilled Water to make the solution measure *one thousand cubic centimeters.* This solution should decolorize exactly an equal volume of the Volumetric Solution of Iodine." *U. S.*

Note. The article to be tested, containing free iodine, either in itself or after addition of test-solution of iodide of potassium, is treated with this Volumetric Solution, added from a burette, until, on stirring, the color of iodine is just discharged. A little gelatinized starch being added just before the iodine color disappears, the addition of the solution is continued for the exact discharge of the blue color of iodized starch.

One cubic centimeter is the equivalent of:

	Gramme.
Sodium Hyposulphite, crystallized, $Na_2S_2O_3.5H_2O$	0·02480
Bromine, Br	0·00798
Chlorine, Cl	0·00354
Iodine, I	0·01266

The following-named officinals are tested with this solution: Aqua Chlori, Calx Chlorata, Iodum, Liquor Iodi Compositus, Liquor Sodæ Chloratæ, Tinctura Iodi.

Volumetric Solution of Iodine. *U. S.*

I; 126·6. 12·66 Gm. in 1000 C.c.

"Iodine, *twelve and sixty-six hundredths grammes;* Iodide of Potassium, *eighteen grammes;* Distilled Water, *a sufficient quantity,* To make *one thousand cubic centimeters.* Dissolve the Iodide of Potassium in about *seven hundred cubic centimeters* of Distilled Water; in this solution dissolve the Iodine, and add enough Distilled Water to make the solution measure *one thousand cubic centimeters.*" *U. S.*

Note. The article to be tested is first treated with a little gelatinized starch, and afterward the Volumetric Solution added, from a burette, until, on stirring, the blue color ceases to be discharged.

One cubic centimeter is the equivalent of:

	ramme.
Iodine	0·01266
Arsenious Acid (anhydride)	0·004945
Potassium Sulphite, crystallized	0·0097
Sodium Bisulphite	0·0052
Sodium Hyposulphite, crystallized	0·0248
Sodium Sulphite, crystallized	0·0126
Sulphurous Acid (anhydride)	0·0032

The following-named officinals are tested with this solution: Acidum Arseniosum, Acidum Sulphurosum, Liquor Acidi Arseniosi, Liquor Potassii Arsenitis, Potassii Sulphis, Sodii Bisulphis, Sodii Sulphis.

Volumetric Solution of Nitrate of Silver. *U. S.*

$AgNO_3$; 169·7. 16·97 Gm. in 1000 C.c.

"Nitrate of Silver, well-crystallized and dry, *sixteen and ninety-seven hundredths* *grammes;* Distilled Water, *a sufficient quantity*, To make *one thousand cubic centimeters.* Dissolve the Nitrate of Silver in about *seven hundred parts* of Distilled Water, and add of the latter enough to make the solution measure *one thousand cubic centimeters.*" *U. S.*

Note. The Volumetric Solution is added, from a burette, to the solution to be tested, previously treated with a few drops of test-solution of bichromate of potassium, until a red precipitate remains after stirring. In testing cyanides, without addition of bichromate, the Volumetric Solution is added until a precipitate just visible remains after stirring.

One cubic centimeter is the equivalent of:

	Gramme.
Silver Nitrate	0·01697
Ammonium Bromide	0·00978
Ammonium Chloride	0·00534
Ferrous Bromide	0·010775
Ferrous Iodide	0·015455
Hydrocyanic Acid, absolute	0·0054
Hydriodic Acid	0·01276
Potassium Bromide	0·01188
Potassium Chloride	0·00744
Potassium Cyanide (to dissolve the precipitate)	0·0130
Sodium Bromide	0·01028
Sodium Chloride	0·00584

The following-named officinals are tested with this solution: Acidum Hydrocyanicum Dilutum, Ammonii Bromidum, Potassii Bromidum, Potassii Cyanidum, Sodii Bromidum, Syrupus Acidi Hydriodici, Syrupus Ferri Bromidi, Syrupus Ferri Iodidi.

Volumetric Solution of Oxalic Acid. *U. S.*

$H_2C_2O_4.2H_2O$; 126. 63 Gm. in 1000 C.c.

"Oxalic Acid, in perfect crystals, *sixty-three grammes;* Distilled Water, *a sufficient quantity*, To make *one thousand cubic centimeters.* Dissolve the Oxalic Acid in about *seven hundred cubic centimeters* of Distilled Water, and then add of the latter enough to make the solution measure *one thousand cubic centimeters.*" *U. S.*

Note. The Volumetric Solution is gradually added, from a burette, to the article to be tested, until the mixture, after stirring, shows a neutral reaction with litmus or some other suitable indicator. If carbonic acid gas be liberated in the operation, it must be wholly expelled, by heat, before the neutral reaction can be obtained.

One cubic centimeter is the equivalent of:

	Gramme.
Oxalic Acid, crystallized	0·0630
Ammonia, absolute	0·0170
Ammonium Carbonate	0·05233
Lead Acetate, crystallized	0·18925
Lead Subacetate, as $Pb_2O(C_2H_3O_2)_2$	0·13675
Potassium Acetate*	0·0980
Potassium Bicarbonate	0 1000
Potassium Carbonate, anhydrous	0·0690
Potassium Citrate, crystallized*	0·1080
Potassium Hydrate (Absolute Potassa)	0·0560
Potassium Permanganate	0·0314
Potassium Sodium Tartrate*	0·1410
Potassium Tartrate*	0·1175
Sodium Bicarbonate	0·0840
Sodium Borate, crystallized	0·1910
Sodium Carbonate, crystallized	0·1430
Sodium Carbonate, anhydrous	0·0530
Sodium Hydrate (Absolute Soda)	0·0409

The following-named officinals are tested with this solution: Ammonii Carbonas, Aqua Ammoniæ, Aqua Ammoniæ Fortior, Liquor Plumbi Subacetatis, Liquor Potassæ, Liquor Sodæ, Potassa, Potassii Acetas, Potassii Bicarbonas, Potassii Carbonas, Potassii Citras, Potassii et Sodii Tartras, Potassii Permanganas, Potassii Tartras, Soda, Sodii Bicarbonas, Sodii Bicarbonas Venalis, Sodii Carbonas, Sodii Carbonas Exsiccatus, Spiritus Ammoniæ.

Volumetric Solution of Soda. *U. S.*

NaHO; 40. 40 Gm. in 1000 C.c.

"Oxalic Acid, in perfect crystals, *six and three-tenths grammes;* Solution of Soda,

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* After ignition.

Distilled Water, of each, *a sufficient quantity*, To make *one hundred parts.* To the Oxalic Acid add, from a burette, enough Solution of Soda exactly to neutralize the acid, as indicated by the color of litmus, and note the number (n) of cubic centimeters of the Solution of Soda required. Take ten times ($10n$) this number of cubic centimeters of the same solution of Soda, and add thereto enough Distilled Water to make the solution measure *one thousand cubic centimeters.* This solution should neutralize exactly an equal volume of Volumetric Solution of Oxalic Acid." *U. S.*

Note. The Volumetric Solution is gradually added, from a burette, to the article to be tested, until the mixture, on stirring, shows a neutral reaction with litmus or some other suitable indicator.

One cubic centimeter is the equivalent of:

	Gramme.
Sodium Hydrate (Soda, absolute)	0·0400
Acetic Acid, absolute	0·0600
Citric Acid, crystallized	0·0700
Hydrobromic Acid, absolute	0·0808
Hydrochloric Acid, absolute	0·0364
Hydriodic Acid, absolute	0·1276
Lactic Acid, absolute	0·0900
Nitric Acid, absolute	0·0630
Oxalic Acid, crystallized	0·0630
Sulphuric Acid, absolute	0·0490
Tartaric Acid, crystallized	0·0750

The following-named officinals are tested with this solution: Acidum Aceticum, Acidum Aceticum Dilutum, Acidum Aceticum Glaciale, Acidum Citricum, Acidum Hydrobromicum Dilutum, Acidum Hydrochloricum, Acidum Hydrochloricum Dilutum, Acidum Lacticum, Acidum Nitricum, Acidum Nitricum Dilutum, Acidum Sulphuricum, Acidum Sulphuricum Aromaticum, Acidum Sulphuricum Dilutum, Acidum Tartaricum.

QUALITATIVE TESTS. *Br.*

Those here given are all in the state of solution, and are used for determining the character of particular substances, whether isolated or in composition; thus enabling us to ascertain the identity of medicines, their purity or impurity, and the character of the foreign ingredients, which may be mixed with them accidentally, or with a view to adulteration.

Solution of Acetate of Copper. "Take of Subacetate of Copper of Commerce, in fine powder, *half an ounce* [avoirdupois]; Acetic Acid *one fluidounce* [Imperial measure]; Distilled Water *a sufficiency.* Dilute the Acid with half a fluidounce [Imp. meas.] of the Water; digest the Subacetate of Copper in the mixture at a temperature not exceeding 212° F. with repeated stirring, and continue the heat until a dry residue is obtained. Digest this in four [fluid]ounces of boiling Distilled Water, and by the addition of more of the Water make up the solution to five fluidounces [Imp. meas.]. Filter it." *Br.*

Solution of Acetate of Potassa. Dissolve half an avoirdupois ounce of Acetate of Potassa in five fluidounces [Imp. meas.] of Distilled Water, and filter. *Br.*

Solution of Acetate of Soda. Dissolve half an avoirdupois ounce of Acetate of Soda in five fluidounces [Imp. meas.] of Distilled Water, and filter. *Br.*

Solution of Albumen. Mix, by trituration in a mortar, the White of one Egg and four fluidounces [Imp. meas.] of Distilled Water, and filter through clean tow previously moistened with Distilled Water. The solution should be prepared when wanted for use. *Br.*

Solution of Ammonio-nitrate of Silver. "Take of Nitrate of Silver, in crystals, *a quarter of an ounce* [avoirdupois]; Solution of Ammonia *half a fluidounce*, or *a sufficiency;* Distilled Water *a sufficiency.* Dissolve the Nitrate in eight fluidounces of the Water, and to the solution add the Ammonia until the precipitate first formed is nearly dissolved. Filter, and add Distilled Water, so that the bulk may be ten fluidounces [Imp. meas.]." *Br.*

Solution of Ammonio-sulphate of Copper. "Take of Sulphate of Copper, in crystals, *half an ounce* [avoirdupois]; Solution of Ammonia, Distilled Water, each, *a sufficiency.* Dissolve the Sulphate in eight fluidounces of the Water, and to the solution add the Ammonia until the precipitate first formed is nearly dissolved. Filter, and then add Distilled Water, so that the bulk may be ten fluidounces [Imp. meas.]." *Br.*

Solution of Ammonio-sulphate of Magnesia. "Take of Sulphate of Magnesia *one ounce* [avoirdupois]; Chloride of Ammonium *half an ounce;* Solution [Water] of Ammonia *half a fluidounce;* Distilled Water *a sufficiency.* Dissolve the Sulphate and Chloride in eight fluidounces of the Water, and to the Solution add the Ammonia, and as much Distilled Water as will make up the bulk to ten fluidounces [Imp. meas.]. Filter it." *Br.*

SOLUTION OF BORACIC ACID. Dissolve *fifty grains* of Boracic Acid in one fluidounce [Imp. meas.] of Rectified Spirit, and filter. *Br.*

SOLUTION OF BROMINE. Upon *ten minims* of Bromine, in a bottle furnished with an accurately fitting glass stopper, pour *five fluidounces* [Imp. meas.] of Distilled Water, and shake several times. Keep the solution excluded from the light. *Br.*

SOLUTION OF CARBONATE OF AMMONIA. "Take of Carbonate of Ammonia, in small pieces, *half an ounce* [avoirdupois]; Distilled Water *ten fluidounces* [Imp. meas.]. Dissolve and filter." *Br.*

SOLUTION OF CHLORIDE OF AMMONIUM. *Solution of Hydrochlorate of Ammonia.* Dissolve *one avoirdupois ounce* of Chloride of Ammonium in *ten fluidounces* [Imp. meas.] of Distilled Water, and filter. *Br.*

SOLUTION OF CHLORIDE OF BARIUM. "Take of Chloride of Barium in crystals *one ounce* [av.]; Distilled Water *ten fluidounces* [Imp. meas.]. Dissolve and filter." *Br.*

SOLUTION OF CHLORIDE OF CALCIUM. "Take of Chloride of Calcium *one ounce* [av.]; Distilled Water ten fluidounces [Imp. meas.]. Dissolve and filter." *Br.*

SATURATED SOLUTION OF CHLORIDE OF CALCIUM. Dissolve *four ounces* [avoirdupois] of Chloride of Calcium in *five fluidounces* [Imp. meas.] of Distilled Water, and filter. *Br.*

SOLUTION OF CHLORIDE OF GOLD. "Take of fine Gold, reduced by a rolling machine to a thin lamina, *sixty grains;* Nitric Acid *one fluidrachm and a half* [Imperial measure]; Hydrochloric Acid *seven fluidrachms* [Imp. meas.]; Distilled Water *a sufficiency.* Place the Gold in a flask with the Nitric and six fluidrachms of the Hydrochloric Acid, first mixed with four fluidrachms of the Water, and digest until it is dissolved. Add to the solution the additional fluidrachm of Hydrochloric Acid, evaporate at a heat not exceeding 212° F. until acid vapors cease to be given off, and dissolve the Chloride of Gold thus obtained in five fluidounces of Distilled Water. The solution should be kept in a stoppered bottle." *Br.*

SOLUTION OF CHLORIDE OF TIN. "Take of Granulated Tin *one ounce* [avoirdupois]; Hydrochloric Acid *three fluidounces;* Distilled Water *a sufficiency.* Dilute the Acid in a flask with one fluidounce of the Water, and, having added the Tin, apply a moderate heat until gas ceases to be evolved. Add as much of the Water as will make up the bulk to five fluidounces, and transfer the solution, together with the undissolved tin, to a bottle with an accurately ground stopper." *Br.*

SOLUTION OF GELATIN. "Take of Isinglass [Ichthyocolla], in shreds, *fifty grains;* Warm Distilled Water *five fluidounces.* Mix and digest for half an hour on a water-bath with repeated shaking, and filter through clean tow moistened with Distilled Water." *Br.*

SOLUTION OF IODATE OF POTASH. "Take of Iodine, Chlorate of Potash, each, *fifty grains;* Nitric Acid *eight minims;* Distilled Water *ten fluidounces and a half.* Rub the Iodine and Chlorate of Potash together to a fine powder; place the mixture in a Florence flask, and, having poured upon it half a [fluid]ounce of the Water acidulated with the Nitric Acid, digest at a gentle heat until the color of the iodine disappears. Boil for one minute, then transfer the contents of the flask to a capsule, and evaporate to perfect dryness at 212° F. Finally dissolve the residue in the remaining ten [fluid]ounces of Distilled Water, filter the solution, and keep it in a stoppered bottle." *Br.*

SOLUTION OF IODIDE OF POTASSIUM. Dissolve *one avoirdupois ounce* of Iodide of Potassium in *ten fluidounces* of Distilled Water, and filter. *Br.*

SOLUTION OF OXALATE OF AMMONIA. "Take of Oxalate of Ammonia *half an ounce* [avoirdupois]; Warm Distilled Water *one pint* [Imperial measure]. Dissolve and filter." *Br.*

SOLUTION OF PERCHLORIDE OF PLATINUM. "Take of thin platinum foil *a quarter of an ounce* [avoirdupois]; Nitric Acid, Hydrochloric Acid, each, *a sufficiency;* Distilled Water *seven fluidounces.* Mix a fluidounce of the Nitric Acid with four fluidounces of the Hydrochloric Acid and two fluidounces of the Water; pour the mixture into a small flask containing the Platinum, and digest at a gentle heat, adding more of the Acids mixed in the same proportion, should this be necessary, until the metal is dissolved. Transfer the solution to a porcelain capsule, add to it a fluidrachm of Hydrochloric Acid, and evaporate on a water-bath until acid vapors cease to be given off. Let the residue be dissolved in the remaining five [fluid]ounces of Distilled Water. Filter and preserve in a stoppered bottle." *Br.*

SOLUTION OF PHOSPHATE OF SODA. Dissolve *one avoirdupois ounce* of crystallized Phosphate of Soda in *ten fluidounces* of Distilled Water, and filter. *Br.*

SOLUTION OF RED PRUSSIATE OF POTASH. *Solution of Ferricyanide of Potassium.*

Dissolve *a quarter of an ounce* [avoirdupois] of crystallized Red Prussiate of Potash in five fluidounces of Distilled Water, and filter. *Br.*

SOLUTION OF SULPHATE OF INDIGO. "Take of Indigo, dry and in fine powder, *five grains;* Sulphuric Acid *ten fluidounces.* Mix the Indigo with a fluidrachm of the Acid in a small test tube, and apply the heat of a water-bath for an hour. Pour the blue liquid into the remainder of the Acid, agitate the mixture, and when the undissolved indigo has subsided, decant the clear liquid into a stoppered bottle." *Br.*

SOLUTION OF SULPHATE OF IRON. Dissolve *ten grains* of Granulated Sulphate of Iron in *one fluidounce* of boiling Distilled Water, and filter. This solution should be prepared when wanted for use. *Br.*

SOLUTION OF SULPHATE OF LIME. "Take of Plaster of Paris *a quarter of an ounce* [avoirdupois]; Distilled Water *one pint* [Imperial measure]. Rub the Plaster of Paris in a porcelain mortar for a few minutes with two [fluid]ounces of the Water, introduce the mixture thus obtained into a pint bottle [Imp. meas.] containing the rest of the Water, shake well several times, and allow the undissolved sulphate to subside. When this has occurred, filter." *Br.*

SOLUTION OF SULPHIDE OF AMMONIUM. "Take of Solution of Ammonia *five fluidounces.* Put three fluidounces of the Ammonia into a bottle, and conduct into this a stream of Sulphuretted Hydrogen so long as the gas continues to be absorbed; then add the remainder of the Ammonia, and transfer the solution to a green-glass bottle furnished with a well-ground stopper." *Br.*

SOLUTION OF TARTARIC ACID. Dissolve *one avoirdupois ounce* of crystallized Tartaric Acid in *eight fluidounces* of Distilled Water, add *two fluidounces* of Rectified Spirit, and keep the solution in a stoppered bottle. The spirit is added to preserve the solution. *Br.*

SOLUTION OF YELLOW PRUSSIATE OF POTASH. *Solution of Ferrocyanide of Potassium.* Dissolve *a quarter of an ounce* [avoirdupois] of crystallized "Yellow Prussiate of Potash" in five fluidounces of Distilled Water, and filter. *Br.*

QUANTITATIVE TESTS. *Br.*

The quantitative tests are intended to estimate the quantity of any particular substance in the mixture or compound submitted to examination. They are all liquid, being denominated as in the U. S. Pharmacopœia *Volumetric Solutions*, and have individually been frequently referred to, throughout the Dispensatory, when it was deemed proper to indicate a method of determining the strength of medicines or their preparations, and to distinguish the British tests from those officinal in the U. S. Pharmacopœia *Br.* is always appended to the former. The processes for volumetric estimations may be performed either with British or with metrical weights and measures, and the solutions are so arranged that they will be of the same strength, and the same indications will be obtained in using them, whichever system is employed, without the necessity of altering any of the figures by which the quantities of the substances tested or of the test-solutions required in the process are expressed. The method of operating in volumetric analysis is simple. The quantities of the substance to be tested are expressed by grains, those of the test-solution by grain-measures, that is, the volume of a grain of distilled water at 60° F. According to the metrical system the quantities of the substances to be tested are expressed in grammes by weight, whilst the quantities of the test-solutions employed in testing are expressed in cubic centimetres, the cubic centimetre being the volume of a gramme of distilled water. As the cubic centimetre bears the same relation to the gramme that the grain-measure bears to the grain, the one system may be substituted for the other with no difference in the results, excepting that, by the metrical system, all the quantities will be expressed in relation to a weight (the gramme) which is more than fifteen times as great as the British grain. In practice it will be found convenient, in substituting metrical for British weights and measures, to reduce the values of all the numbers to one-tenth, by moving the decimal points, as is done in the British tables appended to the descriptions of the volumetric solutions. The quantities indicated in the Pharmacopœia, which in grains and grain-measures can be conveniently used, would be found inconveniently large if the same numbers of grammes and cubic centimetres were employed. A glass tube (*burette*) is to be provided, capable, when filled up to a point marked 0, of containing 1000 grains of distilled water at 60° F., and beneath this point graduated into 100 equal parts. Each part, therefore, corresponds to 10 grain-measures. Into this tube the volumetric solution is to be introduced of a certain strength, so that the quantity of the substance dissolved which may be consumed in the application of the test is at once known, by observing the number of grain-measures of the volumetric solution which have disappeared. This quantity, being known, measures the quantity of the substance acted on by the test, supposing the nature of the reactions to be understood, and the equivalents of the several substances well ascertained. For convenient measurement it will be necessary to have a cylindrical glass jar, capable of holding 10,000 grains of distilled water up to a point marked 0, and below this point graduated into 100 equal parts; and a flask which, when filled to a mark on the neck, contains precisely 10,000 grains of distilled water at 60°, or, in other words, has a capacity of 10,000 grain-measures. For metrical weights and measures: 1. A glass flask which, when filled to a mark on the neck, contains one litre or 1000 cubic centimetres. 2. A graduated cylindrical jar which, when filled to 0, contains one litre (1000 cubic centimetres), and is divided into 100 equal parts. 3. A burette. A graduated tube which, when filled to 0, holds 100 cubic centimetres, and is divided into 100 equal parts. One cubic centimetre is the volume of one gramme of distilled water at 4° C.* 1000 cubic centimetres equal one litre. The volumetric solutions, before being used, should be well shaken, in order that they may be uniform throughout. They should be kept in stoppered bottles. All the measurements should be made at 60° F.

VOLUMETRIC SOLUTION OF BICHROMATE OF POTASH. Formula of the salt $KO,2CrO_3 = 147{\cdot}5$, or $\mathbf{K_2Cr_2O_7} = 295$. "Take of Bichromate of Potash 147·5 *grains;* Distilled Water *a sufficiency.* Put the Bichromate into the 10,000 grain flask, and, having half filled the flask with the Water, allow the salt to dissolve; then dilute the solution with more Water, until it has the exact bulk of 10,000 grain-measures." (*Br.*) The quantity of this solution which fills the volumetric tube to 0 (1000 grain-measures) contains 14·75 grains of the Bichromate, $\frac{1}{10}$th of $KO,2CrO_3$ or $\frac{1}{20}$th of $\mathbf{K_2Cr_2O_7}$, and, when added to a solution of a protosalt of iron acidulated with hydrochloric acid, is capable of converting 16·8 grains of iron from the state of a protosalt to that of a persalt. Grammes and cubic centimetres may be employed instead of grains and grain-measures, but for convenience $\frac{1}{10}$th of the numbers should be taken. Thus, 14·75 grammes of bichromate of potash should be made to form 1000 cubic centimetres of solution. 100 cubic centimetres of this solution contain 1·475 grammes of the bichromate ($\frac{1}{100}$th of $KO,2CrO_3$ or $\frac{1}{200}$th of $\mathbf{K_2Cr_2O_7}$ in grammes), and when added to a solution of protosalt of iron acidulated with hydrochloric acid are capable of converting 1·68 grammes of iron ($\frac{1}{100}$th of 6Fe or $\frac{1}{200}$th of **6Fe**, in grammes) from the state of protosalt to that of persalt. In practising this volumetric process, it is known that the whole of the protosalt has been converted into a persalt, when a minute drop of the solution, placed in contact with a drop of the solution of ferricyanide of potassium, on a white plate, ceases to strike with it a blue color. *Br.*

VOLUMETRIC SOLUTION OF HYPOSULPHITE OF SODA. Formula of the crystallized salt $NaO,S_2O_2 + 5HO = 124$, or $\mathbf{Na_2H_2S_2O_4.4H_2O} = 248$. "Take of Hyposulphite of Soda, in crystals, 280 *grains;* Distilled Water *a sufficiency.* Dissolve the Hyposulphite in 10,000 grain-measures of the Water. Fill a burette with this solution and drop it cautiously into 1000 grain-measures of the volumetric solution of Iodine until the brown color is just discharged. Note the number of grain-measures (*n*) required to produce this effect; then put 8000 grain-measures of the same solution into a graduated jar, and augment this quantity by the addition of Distilled Water until it amounts to $\frac{8000 \times 1000}{N}$ grain-measures. If, for example, $n = 950$, the 8000 grain-measures of solution should be diluted to the bulk of $\frac{8000 \times 1000}{950} = 8421$ grain-measures. Of this solution 1000 grain-measures contain 24·8 grains of the hyposulphite ($\frac{1}{10}$th of $2(NaO,S_2O_2 + 5HO)$, or $\frac{1}{10}$th of $\mathbf{Na_2H_2S_2O.4H_2O}$, in grains), and, therefore, correspond to 12·7 grains of iodine ($\frac{1}{10}$th of an equivalent). Grammes and cubic centimetres may be employed instead of grains and grain-measures, but for convenience $\frac{1}{10}$th of the numbers should be taken. 100 cubic centimetres of this solution contain 2·48 grammes of the hyposulphite ($\frac{1}{100}$th of $2(NaO,S_2O_2 + 5HO)$, or $\frac{1}{100}$th of $\mathbf{Na_2H_2S_2O_44H_2O}$, in grammes) and therefore correspond to 1·27 grains of iodine ($\frac{1}{100}$th of an equivalent)." *Br.*

"This solution is used for estimating free iodine, an object which it accomplishes by forming with the iodine, iodide of sodium and tetrathionate of soda. One thousand grain-measures of it include one-tenth of two eqs. of the hyposulphite in grains, and therefore correspond to 12·7 grains of free iodine." *Br.* 1864.

VOLUMETRIC SOLUTION OF IODINE. Formula $I = 127$. "Take of Iodine 127 *grains;* Iodide of Potassium 180 *grains;* Distilled Water *a sufficiency.* Put the Iodide of Potassium and Iodine into the 10,000 grain flask, fill the flask to about two-thirds of its bulk with the Distilled Water, gently agitate until solution is complete, and then dilute the solution with more of the Water, until it has the exact volume of 10,000 grain-measures. Of this solution 1000 grain-measures contain $\frac{1}{10}$th of an eq. in grains (12·7 grains) of iodine, and therefore correspond to 1·7 grains of sulphuretted hydrogen, 3·2 grains of sulphurous, and 4·95 grains of arsenious acid. Grammes and cubic centimetres may be employed instead of grains and grain-measures, but for convenience $\frac{1}{10}$th of the numbers should be taken. 100 cubic centimetres contain 1·27 grammes of iodine and correspond to 0·17 grammes of sulphuretted hydrogen, 0·32 grammes of sulphurous, and 0·495 grammes of arsenious acid." *Br.*

This solution may be employed for determining the amount of sulphuretted hydrogen or of a metallic sulphide in a fluid, but is chiefly used for the estimation of sulphurous and arsenious acids. It is dropped from the burette into the liquid to be tested until free iodine begins to appear in the solution.

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* It is customary to make the measurements with metrical apparatus at 60° F.

VOLUMETRIC SOLUTION OF NITRATE OF SILVER. Formula of the salt $AgO,NO_5 = 170$, or $\mathbf{AgNO_3} = 170$. "Take of Nitrate of Silver 170 *grains;* Distilled Water *a sufficiency.* Put the Nitrate into the 10,000 grain flask, and having half filled the flask with the Water, allow the salt to dissolve; then dilute the solution with more of the Water until it has the exact bulk of 10,000 grain-measures. The solution should be kept in an opaque stoppered bottle. Of this solution 1000 grain-measures contain $\frac{1}{10}$th of an eq. in grains of nitrate of silver (or 17·0 grains). Grammes and cubic centimetres may be employed instead of grains and grain-measures, but for convenience $\frac{1}{10}$th of the numbers should be taken. 100 cubic centimetres contain $\frac{1}{100}$th of an equivalent in grammes of nitrate of silver (or 1·7 grammes)." *Br.* Upon dropping it into dilute hydrocyanic acid rendered alkaline by soda, the precipitate first formed is upon agitation redissolved, and continues to be so until the whole of the cyanogen of the acid has united with the sodium and silver, forming the double cyanide of sodium and silver.

VOLUMETRIC SOLUTION OF OXALIC ACID. Formula of crystallized oxalic acid $2HO, C_4O_6 + 4HO = 126$, or $\mathbf{H_2C_2O_4.2H_2O} = 126$. "Take of Purified Oxalic Acid, in crystals, quite dry, but not effloresced, 630 *grains;* Distilled Water *a sufficiency.* Put the Oxalic Acid into the 10,000 grain flask, fill the flask to about two-thirds of its bulk with the Water, allow the acid to dissolve, and then dilute the solution with more of the Water until it has the exact volume of 10,000 grain-measures. Of this solution 1000 grain-measures contain half an eq. in grains (63) of oxalic acid, and are therefore capable of neutralizing one eq. in grains of an alkali or alkaline carbonate. Grammes and cubic centimetres may be employed instead of grain and grain-measures, but for convenience $\frac{1}{10}$th of the numbers should be taken. 100 cubic centimetres contain $\frac{1}{20}$th of an equivalent in grammes (6·3 grammes) of oxalic acid, and will neutralize $\frac{1}{10}$th of an equivalent in grammes of an alkali." *Br.*

VOLUMETRIC SOLUTION OF SODA. Formula of hydrate of soda $NaO,HO\ 40, =$ or $\mathbf{NaHO} = 40$. "Take of Solution of Soda, Distilled Water, each, *a sufficiency.* Fill a burette with the Solution of Soda, and cautiously drop this into 63 grains of Purified Oxalic Acid dissolved in about two ounces of the Water, until the acid is exactly neutralized as indicated by litmus. Note the number of grain-measures (n) of the solution used, and having then introduced 9000 grain-measures of the Solution of Soda into a graduated jar, augment this quantity by the addition of water, until it becomes $\frac{9000 \times 1000}{N}$ grain-measures. If, for example, $n = 930$, the 9000 grain-measures should be augmented to $\frac{9000 \times 1000}{930} = 9677$ grain-measures. Of this solution 1000 grain-measures contain one eq. in grains (40 grains) of hydrate of soda, and will, therefore, neutralize one eq. in grains of any monobasic acid. Grammes and cubic centimetres may be employed instead of grains and grain-measures, but for convenience $\frac{1}{10}$th of the numbers should be taken. 100 cubic centimetres contain $\frac{1}{10}$th of an equivalent in grammes (4 grammes) of hydrate of soda, and will neutralize $\frac{1}{10}$th of an equivalent in grammes of an acid." *Br.*

ART OF PRESCRIBING MEDICINES.

THE art of prescribing medicines, *i.e.*, of adapting them to the treatment of individual cases, is one of prime importance, which, however, can scarcely with propriety be fully discussed in a work like the present. As explanatory of our own text, and as affording some guidance to the young practitioner, and also to the apothecary in interpreting prescriptions, we offer a few remarks, with practical examples.

1. Dose of Medicines. In this work a minimum and maximum dose for adults is usually given for each article. In interpreting these doses the practitioner should remember that it is rarely proper to begin with the amount stated as maximum, whilst, on the other hand, the minimum dose will only, in exceptional cases, produce the full physiological effect of the remedy. When a powerful remedy is being used, and a decided effect is desired, it is best to commence with the smaller dose and to increase cautiously. There are various circumstances modifying the dose which demand attention.

AGE. The young require a smaller dose than those of maturity; and the old, though their systems are, perhaps, less susceptible to the action of medicines than those of the middle-aged, cannot bear an equally forcible impression from depressing remedies.

The following rule of Dr. Young is almost universally adopted.

"For children under twelve years, the doses of most medicines must be diminished in the proportion of the age to the age increased by twelve; thus, at two years to $\frac{1}{7}$; viz., $\frac{2}{2+12} = \frac{1}{7}$. At twenty-one the full dose may be given."

To the above rule some exceptions are offered in particular medicines. Thus, purgatives, diaphoretics, and diuretics must usually be given to children in larger, and narcotics in smaller, doses than those called for by Young's rule. A babe six months old will often not be affected by one-fourth the adult dose of castor oil, or one-sixth the dose of calomel, but will not bear well more than one twenty-fifth the dose of opium.

SEX, TEMPERAMENT, and IDIOSYNCRASY. Females usually require somewhat smaller doses than males, and persons of sanguine temperament than the phlegmatic. Constitutional peculiarities, called idiosyncrasies, often exist in individuals, rendering them more than usually susceptible or insusceptible to the action of certain remedies, the dose of which must be modified accordingly. Thus, in some persons a grain or two of calomel will excite salivation, while in others scarcely any quantity which can be safely administered will produce this effect. Sometimes, moreover, a medicine operates on an individual in a manner wholly different from its ordinary mode. In all such cases experience is the only sure guide; and when a physician is called to a patient, not before known, careful inquiries should always be made.

HABIT. Generally speaking, the susceptibility to the action of medicines is diminished by their frequent and continued use; and, in order to maintain a given impression, the quantity must be regularly increased. This is especially true in regard to the narcotics, which are sometimes borne in enormous doses by those habituated to their use. It is a good practical rule in prescribing, when circumstances demand the continuance, for a considerable length of time, of some particular effect, to vary the medicine, and employ successively several with the same general powers, so as not too rapidly to exhaust the susceptibility to the action of any individual remedy. A patient accustomed to one narcotic is usually found blunted towards other cognate medicines.

2. Mode of Administering Medicines. This has reference both to the combination of medicines with one another, and to the form in which they are exhibited.

Simplicity in prescription is always desirable. Remedies should never be mixed together without a definite purpose. Those exceedingly complex prescriptions, formerly so much in vogue, of which the ingredients were so numerous as to render altogether impossible a reasonable estimate of their bearing on each other, or of their effects on disease, have been generally abandoned by modern practitioners. The only ground upon which any of them can be justifiably retained is that, by very frequent trials, through a long course of years, and in various states of disease, their influence on the system may have been fully ascertained, so that they may be considered rather in the light of a single remedy than a compound of many. A brief enunciation of a few general principles in regard to the art of combination may be useful.

Remedies of the same general character may be given in connection, in order to increase their energy, or to render their action more certain. It has been well ascertained that substances thus combined will often act vigorously, when, severally, they would produce comparatively little effect; and it sometimes happens that, while their activity is augmented, they are rendered less irritating, as in the case of the drastic cathartics.

Different medicines are very often mixed together, in order to meet different and coexisting indications, without any reference to the influence which they may reciprocally exert on each other. Thus, in the same patient we not unfrequently meet with debility of stomach and constipation of the bowels, connected with derangement of the hepatic function. To answer the indications presented by these morbid conditions, we may properly combine, in the same dose, a tonic, cathartic, and mercurial alterative. For similar reasons we often unite tonics, purgatives, and emmenagogues, anodynes and diaphoretics, emetics and cathartics, antacids, astringents, and tonics.

Medicines acting differently in certain respects are combined to modify each other's powers, or to gain strength at some especial point where their actions overlap. In this way seemingly new powers are sometimes developed, and those previously existing are greatly increased. Examples of such a result are afforded in the officinal powder of ipecacuanha and opium, which acts as a diaphoretic beyond the capabilities of either of its constituents. The effects of one medicine are, in numerous instances, increased by the influence of another in augmenting the natural susceptibility of the system to its action. Thus, bitters enable cathartics to operate in smaller doses; purgatives awaken the dormant susceptibility to the action of mercury. In some instances, the action of one medicine is promoted by that of another apparently of a nature wholly opposite. Thus, when calomel and opium are given in colic, the purgative operation of the former is facilitated by the relaxation of intestinal spasm produced by the latter. Medicines, in addition to the effects for which they are administered, very frequently produce disagreeable symptoms, which may be moderated or altogether prevented, by combination with other medicines; and this object may usually be accomplished without in the least degree interfering with the remedial influence desired. Thus, the griping produced by cathartics, and the nausea by these and various other medicines, may be often corrected by the simultaneous use of aromatics. To cover the disagreeable taste or odor of certain medicines, and to afford a convenient vehicle for their administration, are also important objects of combination; as upon these circumstances often depend the acceptability of the medicine to the stomach, and even the possibility of inducing the patient to swallow it. Substances should be preferred as vehicles which are calculated to render the medicine acceptable to the palate and stomach, and in other ways to correct its disagreeable effects; as syrups for powders, the aromatic waters for medicines given in the form of mixture, and carbonic acid water for the neutral salts.

But, in the mixing of medicines, care should be taken that they are neither chemically nor physiologically incompatible; in other words, that they are not such as will react on each other so as to produce new and unexpected combinations, nor such as will exert contrary and opposite effects upon the system. Thus, when the operation of an acid is desired, an alkali should not be given at the same time, as they unite to form a third substance entirely different from either; nor should a soluble salt of lime, barium, or lead be given with sulphuric acid or a soluble sulphate, as decomposition would ensue, with the production of an inert compound. So, also, in relation to physiological incompatibility, diaphoretics and diuretics should not, as a general rule, be united with a view to their respective effects; as these are to a certain extent incompatible, one being diminished by whatever has a tendency to increase the other. There are cases, however, in which we may advantageously combine medicines with a view to their chemical reaction, as in the instance of the effervescing draught; and circumstances sometimes call for the union of remedies apparently opposite, as in the case of colic before alluded to, in which opium may be advantageously combined with purgatives. Still, such combinations should never be formed, unless with a full understanding of their effects.

The *form in which medicines are exhibited* is often an object of considerable importance. By variation in this respect, according to the nature of the medicine, the taste of the patient, or the condition of the stomach, we are frequently enabled to secure the favorable operation of remedies, which, without such attention, might prove useless or injurious. Medicines may be given in the solid state, as in the form of powder, pill, troche, or electuary; in the state of mixture, in which a solid is suspended in a liquid, or one liquid is mechanically mixed with another in which it is insoluble; or in the state of solution, under which may be included the various forms of infusion, decoction, tincture, wine, vinegar, syrup, honey, and oxymel.

In writing extemporaneous prescriptions, neatness, order, and precision should always be observed; as, independently of the pleasing moral effect, a positive practical advantage results in the greater accuracy which the habit of attending to them gives to the prescriber, and the comparative certainty which they afford that his directions will be strictly complied with. As a general rule, when medicines are combined in prescription, the most important should come first in order, next the adjuvant or corrigent, and lastly the vehicle. Sometimes, however, it is important to indicate to the pharmacist the succession in which the substances should be combined, and this may render convenient a deviation from the order above mentioned. The physician should always be careful either to write out the full name of the medicine, or to employ such abbreviations as cannot be misunderstood. Fatal mistakes have been occasioned by a neglect of this precaution. The following table and formulas explain and illustrate the signs, abbreviations, and methods habitually used in prescribing.

Table of Signs and Abbreviations.

℞	Recipe.	Take.
āā	Ana.	Of each.
lb	Libra vel libræ.	A pound or pounds.
℥	Uncia vel unciæ.	An ounce or ounces.
ʒ	Drachma vel drachmæ.	A drachm or drachms.
℈	Scrupulus vel scrupuli.	A scruple or scruples.
O	Octarius vel octarii.	A pint or pints.
f℥	Fluiduncia vel fluidunciæ.	A fluidounce or fluidounces.
fʒ	Fluidrachma vel fluidrachmæ.	A fluidrachm or fluidrachms.
♏	Minimum vel minima.	A minim or minims.
C c.	Cubic centimetre.	About 16 minims.
Chart.	Chartula vel chartulæ.	A small paper or papers.
Coch.	Cochlear vel cochlearia.	A spoonful or spoonfuls.
Collyr.	Collyrium.	An eye-water.
Cong.	Congius vel congii.	A gallon or gallons.
Decoct.	Decoctum.	A decoction.
Ft.	Fiat.	Make.
Garg.	Gargarysma.	A gargle.
Gm.	Gramme or gram.	15·5 grains.
Gr.	Granum vel grana.	A grain or grains.
Gtt.	Gutta vel guttæ.	A drop or drops.
Haust.	Haustus.	A draught.
Infus.	Infusum.	An infusion.
M.	Misce.	Mix.
Mass.	Massa.	A mass.
Mist.	Mistura.	A mixture.
Pil.	Pilula vel pilulæ.	A pill or pills.
Pulv.	Pulvis vel pulveres.	A powder or powders.
Q. S.	Quantum sufficit.	A sufficient quantity.
S.	Signa.	Write.
Ss.	Semis.	A half.

Examples of Common Extemporaneous Prescriptions.

POWDERS.

℞ Zinci Sulphatis,
Pulveris Ipecacuanhæ, āā, gr. xx.
Fiat pulvis.
S. To be taken in a wineglassful of sweetened water.

An active emetic in narcotic poisoning, etc.

℞ Pulveris Jalapæ gr. x.
Potassii Bitartratis ʒii.
Misce.
S. To be taken in syrup or molasses.

A hydragogue cathartic, used in dropsy, and in scrofulous inflammation of the joints.

℞ Sulphuris ℥i.
Potassii Bitartratis ʒii.
Misce.
S. To be taken in syrup or molasses.

A laxative used in piles and cutaneous diseases.

℞ Pulveris Rhei gr. x.
Magnesiæ ʒss.
Fiat pulvis.
S. To be taken in syrup or molasses.

A laxative and antacid, used in diarrhœa, dyspepsia, etc.

℞ Potassii Nitratis ʒi.
Antimonii et Potassii Tartratis gr. i.
Hydrargyri Chloridi Mitis gr. vi.
Fiat pulvis, in chartulas sex dividendus.
S. One to be taken every two hours in syrup or molasses.

A refrigerant, diaphoretic, and alterative, used in bilious fevers; usually called *nitrous powders.*

℞ Pulveris Calumbæ,
Pulveris Zingiberis, āā, ʒi.
Fiat pulvis, in chartulas sex dividendus.
S. One to be taken three times a day in syrup or molasses.

A tonic, used in dyspepsia.

PILLS.

℞ Pulveris Aloes,
Pulveris Rhei, āā, ʒss.
Olei Caryophylli gtt. x.
Saponis ℈i.
Misce, et cum aquâ fiat massa in pilulas viginti dividenda.
S. Two or three to be taken daily, at bedtime, or before a meal.

An excellent laxative in habitual constipation.

℞ Pulveris Aloes,
Extracti Quassiæ, āā, ʒi.
Olei Anisi ♏x.
Syrupi q. s.
Misce, et fiat massa in pilulas triginta dividenda.
S. Two to be taken once, twice, or three times a day.

A laxative, tonic, and carminative, useful in dyspepsia.

℞ Pulveris Scillæ ℈i.
Hydrargyri Chloridi Mitis gr. x.
Pulveris Acaciæ,
Syrupi, āā, q. s.
Misce, et fiat massa in pilulas decem dividenda.
S. One to be taken twice or three times a day.

A diuretic and alterative, much used in dropsy, especially when complicated with organic visceral disease.

℞ Plumbi Acetatis, in pulv. triti, gr. xii.
Pulveris Opii gr. i.
Pulveris Acaciæ,
Syrupi, āā, q. s. ut fiat massa in pilulas sex dividenda.
S. One every two, three, or four hours.

An astringent much employed in hæmoptysis and uterine hemorrhage.

MIXTURES.

℞ Magnesiæ ʒi.
Syrupi f℥i.
Tere simul, et affunde
Aquæ Acidi Carbonici f℥iv.
Fiat haustus.
S. To be taken at a draught, the mixture being well shaken.

An agreeable magnesia mixture.

℞ Mannæ ℥i.
Fœniculi contusi ʒi.
Aquæ bullientis f℥iv.
Fiat infusum et cola; dein adjice
Magnesii Carbonatis ʒii.
Ft. mist.
S. One-third to be taken every three or four hours till it operates.

℞ Olei Ricini f℥iss.
Tincturæ Opii ♏xxx.
Pulveris Acaciæ,
Sacchari, āā, ʒii.
Aquæ Menthæ Viridis f℥iv.
Acaciam et saccharum cum paululo aquæ menthæ tere; dein oleum adjice, et iterum tere; denique aquam reliquam paulatim infunde, et omnia misce.
S. A tablespoonful to be taken every hour or two hours till it operates.

Used as a gentle laxative in dysentery and diarrhœa. It is usually known by the name of *oleaginous mixture.*

Effervescing Draught.

℞ Potassii Carbonatis ʒii.
Aquæ f℥iv.
Liqua.

Or,

℞ Potassii Bicarbonatis ʒiii.
Aquæ f℥iv.
Liqua

S. Add a tablespoonful of the solution to the same quantity of lemon or lime juice, previously mixed with a tablespoonful of water; and give the mixture in the state of effervescence, every hour or two hours.

An excellent diaphoretic and anti-emetic in fever with nausea or vomiting. If morphine is needed, it should be dissolved in the lemon juice. It is precipitated from alkaline solutions.

℞ Acidi Nitrosi fʒi.
Tincturæ Opii gtt. xl.
Aquæ Camphoræ f℥viii.
Misce.

S. One-fourth to be taken every three or four hours.

Hope's camphor mixture, used in dysentery, diarrhœa, and cholera.

SOLUTIONS.

℞ Magnesii Sulphatis ℥i.
Syrupi Limonis f℥i.
Aquæ Acidi Carbonici f℥vi.
Misce.

S. To be taken at a draught.

An agreeable mode of administering sulphate of magnesium.

℞ Quiniæ Sulphatis gr. xii.
Acidi Sulphurici Aromatici gtt. xxiv.
Syrupi f℥ss.
Aquæ Menthæ Piperitæ f℥i.
Misce.

S. A teaspoonful to be taken every hour or two hours.

A good mode of administering sulphate of quinine in solution.

INFUSIONS.

℞ Sennæ ʒiii.
Magnesii Sulphatis,
Mannæ, āā, ℥ss.
Fœniculi ʒi.
Aquæ bullientis Oss.

Macera per horam in vase leviter clauso, et cola.

S. A teacupful to be taken every four or five hours till it operates.

An excellent purgative in febrile complaints.

℞ Calumbæ contusæ,
Zingiberis contusi, āā, ℥ss.
Sennæ ʒii.
Aquæ bullientis Oi.

Macera per horam in vase leviter clauso, et cola.

S. A wineglassful to be taken morning, noon, and evening, or less frequently if it operate too much.

An excellent remedy in dyspepsia with constipation and flatulence.

METRIC PRESCRIPTIONS.

Of late years, since the more general use of the metric system, prescriptions written according to this method have been frequently employed, especially in sections of our country inhabited by those who are accustomed to use the system, which is now almost exclusively employed in Europe. For an explanation of its principles the reader is referred to the article on weights and measures, page 1801. Two distinct methods are in vogue in the United States, called respectively *gravimetric* and *volumetric;* in the *gravimetric* plan, which is almost exclusively used abroad, no *measures* of capacity are employed, weights being alone used; the unit of weight, the *gramme*, and its subdivisions constituting the sole weights. This method is objected to by many, who are habituated to the usual American practice of measuring instead of weighing liquids, and the *volumetric* method, in which liquids are measured, is preferred, the unit of measure selected being the *cubic centimetre* (abbreviated C.c., and sometimes called *fluigramme*), which is equivalent to a gramme of water at 4° C. One of the principal arguments in favor of the volumetric method is that no plan has yet been devised by which the patient can take the dose by weight; teaspoons, tablespoons, or graduated glasses are used altogether for administering liquid medicines, and it is a needless and impracticable task for the practitioner to constantly bear in mind the difference in specific gravity between chloroform, ether, glycerin, syrups, water, and other liquids, for this is absolutely necessary to secure accurate dosage if the gravimetric method is adopted; and in addition to this the pharmacist would be compelled to weigh the liquids in compounding prescriptions, a troublesome innovation, or to calculate the corresponding volume of each liquid if graduated measures are used. Arabic numerals are exclusively employed in metric formulæ, and they are never used after the denomination, as in ordinary prescriptions; this custom should never be deviated from, as it is one of the means of recognizing these prescriptions. The following examples will illustrate the various forms of metric prescriptions in general use, but it is very important that but *one* of these forms should be adopted and *adhered to* if the merits of this system are to be fully realized. We decidedly prefer form Number 1.

PILLS.

Form Number 1.

	Gramma.	
℞ Pulv. Aloes	2	
Pulv. Rhei	1	5
Olei Caryophylli		6
Saponis	1	25

Make twenty pills.

The advantages of the decimal line are that the decimal dot is abolished with its dangerous complications, for a spot or a fly-speck on the prescription paper may increase or decrease the quantity of an ingredient *ten times*, and the use of the decimal line is familiar to all who use a dollar and cents column.

Form Number 2.

℞ Pulv. Aloes	2·
Pulv. Rhei	1·5
Olei Caryophylli	·6
Saponis	1·25

Make twenty pills.

This form is used frequently, because of the familiarity with the arithmetical method of using a dot to denote a decimal fraction; and where metric prescriptions are altogether in use, as in Continental Europe, there is no necessity for indicating the denomination, gramme being always understood.

Form Number 3.

℞ Pulv. Aloes	2	Gm.
Pulv. Rhei	1·5	Gm.
Olei Caryophylli	·6	Gm.
Saponis	1·25	Gm.

Make twenty pills.

This form is an improvement on Number 2, and would be far superior to it for use in this country, where prescriptions written in the old systems will long continue to be used; for next to writing out in full the word *gramme*, the indication of the unusual quantity by underscoring will prevent its being mistaken for *grain*.

LIQUIDS.

Form Number 1.

(*Volumetric.*)

	Gm. C.c.	
℞ Magnesiæ Sulph.	30	
Acid. Sulph. Dil.		6
Syrup. Limonis	30	
Aquæ	180	

Make a draught.

Form Number 2.

(*Gravimetric.*)

℞ Magnesiæ Sulph.	30·
Acid. Sulph. Dil.	·6
Syrup. Limonis	30·
Aquæ	180·

Make a draught.

Form Number 3.

(*Volumetric.*)

℞ Magnesiæ Sulph.	30	Gm.
Acid. Sulph. Dil.	·6	C.c.
Syrup. Limonis	30	C.c.
Aquæ	180	C.c.

Make a draught.

TABLES OF WEIGHTS AND MEASURES.

APOTHECARIES' WEIGHT. *U. S.*

Pound.		Troyounces.		Drachms.		Scruples.		Troy Grains.
℔ 1	=	12	=	96	=	288	=	5760
		℥ 1	=	8	=	24	=	480
				ʒ 1	=	3	=	60
						℈ 1	=	gr. 20

The Imperial Standard Troy weight, at present recognized by the British laws, corresponds with the Apothecaries' weight in pounds, ounces, and grains; but differs from it in the division of the ounce, which, according to the former scale, contains twenty pennyweights, each weighing twenty-four grains.

AVOIRDUPOIS WEIGHT. *Br.*

Pound.		Ounces.		Drachms.		Troy Grains.
℔ 1	=	16	=	256	=	7000
		oz. 1	=	16	=	437·5
				dr. 1	=	gr. 27·34375

Relative Value of Troy and Avoirdupois Weights.

Pound.		Pounds.			Pound.	Ounces.	Grains.
1 Troy	=	0·822857	Avoirdupois	—	0	13	72·5
1 Avoirdupois	=	1·215277	Troy	—	1	2	280

APOTHECARIES' OR WINE MEASURE. *U. S.*

Gallon.		Pints.		Fluidounces.		Fluidrachms.		Minims.		Cubic Inches.
Cong. 1	=	8	=	128	=	1024	=	61440	=	231
		O 1	=	16	=	128	=	7680	=	28·875
				f℥ 1	=	8	=	480	=	1·8047
						fʒ 1	=	♏ 60	=	·2256

IMPERIAL MEASURE.

Adopted by the British Pharmacopœia.

Gallon.		Pints.		Fluidounces.		Fluidrachms.		Minims.
1	=	8	=	160	=	1280	=	76800
		1	=	20	=	160	=	9600
				1	=	8	=	480
						1	=	60

Relative Value of Apothecaries' and Imperial Measure.

APOTHECARIES' MEASURE.		IMPERIAL MEASURE.			
		Pints.	Fluidounces.	Fluidrachms.	Minims.
1 gallon	=	6	13	2	23
1 pint	=		16	5	18
1 fluidounce	=		1	0	20
1 fluidrachm	=			1	2·5
1 minim	=				1·04

IMPERIAL MEASURE.		APOTHECARIES' MEASURE.				
		Gallon.	Pints.	Fluidoz.	Fluidr.	Minims.
1 gallon	=	1	1	9	5	8
1 pint	=		1	3	1	38
1 fluidounce	=				7	41
1 fluidrachm	=					58
1 minim	=					0·96

Relative Value of Weights and Measures in Distilled Water at 60° Fahrenheit.

1. Value of Apothecaries' Weight in Apothecaries' Measure.

				Pints.	Fluidoz.	Fluidr.	Minims.
1 pound	=	0·7900031 pints	=	0	12	5	7·2238
1 ounce	=	1·0533376 fluidounces	=	0	1	0	25·6020
1 drachm	=	1·0533376 fluidrachms	=	0	0	1	3·2002
1 scruple	=			0	0	0	21·0667
1 grain	=			0	0	0	1·0533

2. Value of Apothecaries' Measure in Apothecaries' Weight.

				℔	℥	ʒ	℈	Gr.		Grains.
1 gallon	=	10·12654270 pounds	=	10	1	4	0	8·88	=	58328·886
1 pint	=	1·26581783 pounds	=	1	3	1	1	11·11	=	7291·1107
1 fluidounce	=	0 94936332 ounces	=	0	0	7	1	15·69	=	455·6944*
1 fluidrachm	=	0·94936332 drachms	=	0	0	0	2	16·96	=	56·9618
1 minim	=	0·94936332 grains	=							·9493

3. Value of Avoirdupois Weight in Apothecaries' Measure.

				Pints.	Fluidounces.	Fluidrachms.	Minims.
1 pound	=	0·9600732 pints	=	0	15	2	53 3622
1 ounce	=	0·9600732 fluidounces	=	0	0	7	40·8351

4. Value of Apothecaries' Measure in Avoirdupois Weight.

1 gallon = 8·33269800 pounds.
1 pint = 1·04158725 pounds.
1 fluidounce = 1·04158725 ounces.

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* Dr. W. H. Pile, in a communication to the *American Journal of Pharmacy*, gives the following weights of the fluidounce of water, on different authorities. at 60° F.; United States standard 455·6216 grains; Sir G. Shuckburg (U.S.D.) 455·6944; British standard 455.6910; average weight 455·6690.

5. Value of Imperial Measure in Apothecaries' and Avoirdupois Weights.

Imperial Measure.		Apothecaries' Weight.						Avoirdupois Weight.			Grains.		Cubic Inches.
1 gallon	=	12 ℔	1 ℥	6 ʒ	2 ℈	0 gr.	=	10 ℔	0 oz.	=	70,000	=	277·27384
1 pint	=	1	6	1	2	10	=	1	4	=	8,750	=	34·65923
1 fluidounce	=			7	0	17·5	=		1	=	437·5	=	1·73296
1 fluidrachm	=				2	14·69	=				54·69	=	0·21662
1 minim	=										·91	=	0·00361

In converting the weights of liquids heavier or lighter than water into measures, or conversely, a correction must be made for specific gravity. In converting weights into measures, the calculator may proceed as if the liquid was water, and the obtained measure will be to the true measure *inversely* as the specific gravity. In the converse operation, of turning measures into weights, the same assumption may be made, and the obtained weight will be to the true weight *directly* as the specific gravity.

METRIC WEIGHTS AND MEASURES.

The French *metrical* system is based upon the idea of employing, as the unit of all measures, whether of length, capacity, or weight, a uniform unchangeable standard, adopted from nature, the multiples and subdivisions of which should follow in decimal progression. To obtain such a standard, the length of one-fourth part of the terrestrial meridian, extending from the equator to the pole, was ascertained. The ten-millionth part of this arc was chosen as the unit of measures of length, and was denominated *metre.*[*] The cube of the tenth part of the metre was taken as the unit of measures of capacity, and denominated *litre.* The weight of distilled water, at its greatest density, which this cube is capable of containing, was called *kilogramme,* of which the thousandth part was adopted as the unit of weight, under the name of *gramme.* The multiples of these measures, proceeding in the decimal progression, are distinguished by employing the prefixes, *deca,*[†] *hecto, kilo,* and *myria,* taken from the Greek numerals; and the subdivisions, following the same order, by *deci, centi, milli,* from the Latin numerals. Since the introduction of this system it has been adopted by the principal nations of Europe, excepting Great Britain, and in many of them its use is compulsory. It is in general use in France, Germany, Austria, Italy, Spain, Norway, Sweden, Netherlands, Switzerland, Greece, and British India. It was legalized in Great Britain in 1864, and in the United States by an act of Congress in 1866.

The *metre*, or unit of length, at 32°, = 39·370432 inches.
The *litre*, or unit of capacity, = 33·816 fluidounces. *U. S.*
The *gramme*, or unit of weight, = 15·43234874 Troy grains.

Upon this basis the following tables have been constructed.

MEASURES OF LENGTH.

		English Inches.		Miles.	Rods.	Yards.	Feet.	Inches.
Millimetre (mm.)	=	·03937						
Centimetre (cm.)	=	·39370						
Decimetre (dm.)	=	3·93704						
Metre (m.)	=	39·37043	=	0	0	1	0	3·370
Decametre (Dm.)	=	393·70432	=	0	0	10	2	9·704
Hectometre (Hm.)	=	3937·04320	=	0	0	109	1	1·043
Kilometre (Km.)	=	39370·43200	=	0	160	213	1	10·432
Myriametre (Mm.)	=	393704·32000	=	6	40	156	0	8·320

MEASURES OF CAPACITY.

		English Cubic Inches.		Apothecaries' Measure.
Millilitre (C.c.)	=	·061028	=	16·2318 minims.
Centilitre (cl.)	=	·610280	=	2·7053 fluidrachms.
Decilitre (dl.)	=	6·102800	=	3·3816 fluidounces.
Litre (l.)	=	61·028000	=	2·1135 pints.
Decalitre (Dl.)	=	610·280000	=	2·6419 gallons.
Hectolitre (Hl.)	=	6102·800000		
Kilolitre (Kl.)	=	61028·000000		
Myrialitre (Ml.)	=	610280·000000		

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[*] There are two methods of spelling the metric units in common use, one, the original, *metre, litre, gramme;* in the other, these are spelled *meter, liter,* and *gram.* The U. S. Pharmacopœia of 1880 sanctions both methods, which, in our opinion, is unfortunate. *Metre* and *litre* are spelled meter and liter, whilst the original orthography is retained for *gramme.*

[†] Deca and hecto are sometimes written deka and hekto.

MEASURES OF WEIGHT.

	Troy Grains.		℔ (Troy).	℥	ʒ	Gr.
Milligramme (mg.) =	·0154					
Centigramme (cg.) =	·1543					
Decigramme (dg.) =	1·5432					
Gramme (Gm.) =	15·4323					
Decagramme (Dg.) =	154·3234	=	0	0	2	34·3
Hectogramme (Hg.) =	1543·2348	=	0	3	1	43·2
Kilogramme (Kg.) =	15432·3487	=	2	8	1	12·3
Myriagramme (Mg.) =	154323·4874	=	26	9	4	3 4

Value of Avoirdupois Weights and Imperial Measures, in Metrical Weights and Measures, as stated in the British Pharmacopœia.

Avoirdupois Weights.	Metrical Weights.	Imperial Measures.	Metrical Measures.
1 pound =	453·5925 grammes.	1 gallon =	4·543487 litres.
1 ounce =	28·3495 "	1 pint =	0·567936 "
1 grain =	0·0648 "	1 fluidounce =	0·028396 "
		1 fluidrachm =	0·003549 "
		1 minim =	0·000059 "

Relative Value of United States and Metric Measures of Length.

Inches.	Centimetres.	Inches.	Centimetres.	Inches.	Millimetres.	Inches.	Millimetres.
12 =	30·48	6 =	15·24	$\frac{1}{25}$ =	1·00	$\frac{5}{8}$ =	15·85
11 =	27·94	5 =	12·70	$\frac{1}{12}$ =	2·11	$\frac{2}{3}$ =	16·92
10 =	25·40	4 =	10·16	$\frac{1}{8}$ =	3·17	$\frac{3}{4}$ =	19 05
9 =	22·86	3 =	7·62	$\frac{1}{4}$ =	6·35	$\frac{5}{6}$ =	21·15
8 =	20·32	2 =	5·08	$\frac{1}{3}$ =	8·46	$\frac{7}{8}$ =	22·19
7 =	17·78	1 =	2·54	$\frac{1}{2}$ =	12·70	$\frac{11}{12}$ =	23·28

Relative Value of Apothecaries' and Metric Fluid Measures.

Minims.	Cubic Centimetres.	Minims.	Cubic Centimetres.	Fluid-ounces.	Cubic Centimetres.	Fluid-ounces.	Cubic Centimetres.
1 =	0·06	25 =	1·54	**1** =	**30·00***	21 =	621·00
2 =	0·12	**30** =	**1·90**	2 =	59·20	22 =	650·00
3 =	0·18	35 =	2·16	3 =	89·00	23 =	680·00
4 =	0·24	40 =	2·50	4 =	118·40	24 =	710·00
5 =	0·30	45 =	2·80	5 =	148·00	25 =	740·00
6 =	0·36	50 =	3·08	6 =	178·00	26 =	769·00
7 =	0·42	55 =	3·40	7 =	207·00	27 =	798·50
8 =	0·50	Fluid-drachms.		8 =	236·00	28 =	828·00
9 =	0·55			9 =	266·00	29 =	858·00
10 =	0·60	**1** =	**3·75**	10 =	295·70	30 =	887·25
11 =	0·68	1¼ =	4·65	11 =	325·25	31 =	917·00
12 =	0·74	1½ =	5·60	12 =	355·00	32 =	946·00
13 =	0·80	1¾ =	6·51	13 =	385·00	48 =	1419·00
14 =	0·85	2 =	7·50	14 =	414·00	56 =	1655·00
15 =	0·92	3 =	11·25	15 =	444·00	64 =	1892·00
16 =	1·00	4 =	15·00	**16** =	**473·11**	72 =	2128·00
17 =	1·05	5 =	18·50	17 =	503·00	80 =	2365·00
18 =	1·12	6 =	22·50	18 =	532·00	96 =	2839·00
19 =	1·17	7 =	26·00	19 =	562·00	112 =	3312·00
20 =	1·25			20 =	591·50	**128** =	**3785·00**

* The more accurate equivalent is 29·57 C.c.

Relative Value of Metric Fluid and Apothecaries' Measure.

Cubic Centimetres.	Fluid-ounces.	Cubic Centimetres.	Fluid-ounces.	Cubic Centimetres.	Fluid-drachms.	Cubic Centimetres.	Minims.
1000	= 33·81	400	= 13·53	25	= 6·76	4	= 64·8
900	= 30·43	300	= 10·14	10	= 2·71	3	= 48·6
800	= 27·05	200	= 6.76	9	= 2·43	2	= 32·4
700	= 23·67	100	= 3·38	8	= 2·16	**1†**	= **16.00**
600	= 20·29	75	= 2·53	7	= 1·89	0·09	= 1·46
500	= 16·90	50	= 1·69	6	= 1·62	0·07	= 1·14
473	= 16·00	**30**	= **1·00***	5	= 1·35	0·05	= 0·81

* Or, more exactly, 1·01.

† Or, more exactly, 16·23.

Relative Value of Apothecaries' and Metric Weight.

Grains.	Grammes.	Grains.	Grammes.	Grains.	Grammes.	Drachms.	Grammes.
$\frac{1}{100}$	= 0·00065	1	= 0·065	24	= 1·55	1	= 3·9
$\frac{1}{64}$	= 0·00101	2	= 0·130	25	= 1·62	2	= 7·8
$\frac{1}{60}$	= 0·00108	3	= 0·195	26	= 1·70	3	= 11·65
$\frac{1}{50}$	= 0·00130	4	= 0·260	27	= 1·75	4	= 15·50
$\frac{1}{45}$	= 0·00135	5	= 0·324	28	= 1·82	5	= 19·40
$\frac{1}{40}$	= 0·00162	6	= 0·400	29	= 1·87	6	= 23·30
$\frac{1}{36}$	= 0·00180	7	= 0·460	30	= 1·95	7	= 27·20
$\frac{1}{32}$	= 0·00202	8	= 0·520	31	= 2·00	Ounces.	
$\frac{1}{30}$	= 0·00216	9	= 0·600	32	= 2·10	1	= **31·10‖**
$\frac{1}{25}$	= 0·00259	10	= 0·650	33	= 2·16	2	= 62·20
$\frac{1}{24}$	= 0·00270	11	= 0·715	34	= 2·20	3	= 93·30
$\frac{1}{20}$	= 0·00324	12	= 0·780	35	= 2·25	4	= 124·40
$\frac{1}{18}$	= 0·00360	13	= 0·845	36	= 2·30	5	= 155·50
$\frac{1}{16}$	= 0·00405	14	= 0·907	37	= 2·40	6	= 186·60
$\frac{1}{15}$	= 0·00432	15	= 0·972	38	= 2·47	7	= 217·70
$\frac{1}{12}$	= 0·00540	**‡15.5**	= **1.000**	39	= 2·55	8	= 248·80
$\frac{1}{10}$	= 0·00648	16	= 1·040	40	= 2·60	9	= 280·00
$\frac{1}{8}$	= 0·00810	17	= 1·102	42	= 2·73	10	= 311·00
$\frac{1}{6}$	= 0·01080	18	= 1·160	44	= 2·86	11	= 342·14
$\frac{1}{5}$	= 0·01296	19	= 1·240	48	= 3·00	12	= 373·23
$\frac{1}{4}$	= 0·01620	20	= 1·300	50	= 3·25	14	= 435·50
$\frac{1}{3}$	= 0·02160	21	= 1·360	52	= 3·40	16	= 497·60
$\frac{1}{2}$	= 0·03240	22	= 1·425	56	= 3·65	24	= 746·40
$\frac{3}{4}$	= 0·04860	23	= 1·460	58	= 3·75	48	= 1492·80
						100	= 3110·40

‡ Or, more exactly, 15·432+gr. = 1 gramme.

‖ Or, more exactly, 31·10349 grammes.

Relative Value of Metric and Apothecaries' Weight.

Grammes.	Grains.	Grammes.	Grains.	Grammes.	Grains.	Grammes.	Grains.
0·0010	= $\frac{1}{64}$	0·065	= 1·003	1	= 15·43	100	= 1543·23
0·0020	= $\frac{1}{32}$	0·100	= 1·543	2	= 30·86	125	= 1929·04
0·0040	= $\frac{1}{16}$	0·130	= 2·006	3	= 46·30	150	= 2314·85
0·0065	= $\frac{1}{10}$	0·150	= 2·315	4	= 61·73	175	= 2700·65
0·0081	= $\frac{1}{8}$	0·180	= 2·778	5	= 77·16	450	= 6944·55
0·0108	= $\frac{1}{6}$	0·200	= 3·086	6	= 92·60	550	= 8487·78
0·0162	= $\frac{1}{4}$	0·300	= 4·630	7	= 98·02	650	= 10031·01
0·0324	= $\frac{1}{2}$	0·500	= 7·716	8	= 123·46	750	= 11574·26
0·0486	= $\frac{3}{4}$	0·700	= 10·803	9	= 138·90	850	= 13117·49
0·0567	= $\frac{7}{8}$	0·900	= 13·890	10	= 154·32	1000	= 15432·35

Relative Value of Avoirdupois and Metric Weight.

Avoir. Ounces.		Grammes.	Avoir. Ounces.		Grammes.	Avoir. Ounces.		Grammes.	Avoir. Pounds.		Grammes.
$\frac{1}{16}$	=	1·772	5	=	141·75	13	=	368·54	3	=	1360·78
$\frac{1}{8}$	=	3·544	6	=	170·10	14	=	396·90	4	=	1814·37
$\frac{1}{4}$	=	7·088	7	=	198·45	15	=	425·25	5	=	2267·96
$\frac{1}{2}$	=	14·175	8	=	226·80	Avoir.			6	=	2721·55
1	=	28·350	9	=	255·15	Pounds.			7	=	3175·14
2	=	56·700	10	=	283·50	1	=	453·60	8	=	3628·74
3	=	85·050	11	=	311·84	2	=	907·18	9	=	4082·33
4	=	113·400	12	=	340·20	2·2	=	1000·00	10	=	4535.92

Relative Value of Metric and Avoirdupois Weight.

Grammes.		Oz.	Gr.	Grammes.		Oz.	Gr.	Grammes.		Oz.	Gr.	Grammes.		Oz.	Gr.
28·35	=	1		38	=	1	149	125	=	4	179	600	=	21	72
29	=	1	10	39	=	1	164	150	=	5	127	650	=	22	405
30	=	1	25	40	=	1	180	200	=	7	24	700	=	24	303
31	=	1	41	50	=	1	334	250	=	8	358	750	=	26	198
32	=	1	56	60	=	2	50	300	=	10	255	800	=	28	96
33	=	1	72	70	=	2	205	350	=	12	152	850	=	29	429
34	=	1	87	80	=	2	360	400	=	14	48	900	=	31	326
35	=	1	103	85	=	3		450	=	15	382	950	=	33	222
36	=	1	118	90	=	3	76	500	=	17	279	1000	=	35	120
37	=	1	133	100	=	3	230	550	=	19	175				

APPROXIMATE MEASUREMENT.

For the sake of convenience, in the absence of proper instruments, we often make use of means of measurement, which, though not precise nor uniform, afford results sufficiently accurate for ordinary purposes. Of this kind are certain household implements, of a capacity approaching to uniformity, and corresponding to a certain extent with the regular standard measures. Custom has attached a fixed value to these implements, with which it is proper that the practitioner should be familiar; although their capacity, as they are now made, with the exception of the wineglass, generally somewhat exceeds that at which they were originally and still continue to be estimated.

A *tea-cup* is estimated to contain about four fluidounces, or a gill.
A *wineglass*.................................. two fluidounces.
A *tablespoon* (cochlear magnum)......... half a fluidounce.
A *teaspoon* (cochlear parvum)............ a fluidrachm.

In reading French medical works, if unacquainted with their customary expressions of measure, we are often left in great uncertainty as to the precise quantity indicated by the names. The following table, translated from the French Codex of 1866, will obviate this difficulty. (See Metric Table, page 1803.)

	Grammes.
A coffeespoon (*cuillerée à café*, Fr., *teaspoon*)........................	5
A common spoon (*cuillerée*, Fr., *tablespoon*), 4 coffeespoons, or...	20
A glass (*verre*, Fr.), 8 common spoons..................	160
A handful (*poignée*, Fr.) of barleyseed................................	80
“ “ “ flaxseed	50
“ “ “ flaxseed-meal	150
“ “ “ dried mallow leaves..............................	40
“ “ “ “ chicory “	30
A pinch (*pincée*, Fr.) of chamomile flowers..........................	2
“ “ “ arnica “	1
“ “ “ marshmallow “	2
“ “ “ mallows “	1
“ “ “ linden “	2
“ “ “ fruits of anise..............................	2
“ “ “ “ fennel..............................	2
A hen's egg, newly weighed, has the mean weight of	64
“ the white alone....................	40
“ the yellow alone	20
Blanched almonds have the mean weight, each, of..................	1

Small quantities of liquid medicines are often administered by *drops*, each of which is usually considered equivalent to a minim, or the sixtieth part of a fluidrachm. The drop of water and of watery fluids is, sometimes, about that size; but the same is by no means the case with all medicinal liquids, and the drop even of the same liquid varies much in bulk, according to the circumstances under which it is formed. This is, therefore, an uncertain mode of estimating the quantity of liquids, and should be superseded where minim measures can be had. Certain general rules, however, influence the formation of drops, which will enable us to form some notion of their probable relative number, in the same amount of liquid, when possessed of the requisite data. Thus, the heavier the liquid, the smaller, other things being equal, is the size of the drops, and the greater their number in a given measure. The drop of chloroform, for example, which is a very heavy liquid, is very small, much smaller than that of alcohol or ether. The greater or less viscidity and greater or less mobility of the liquid have much influence the former in increasing, the latter in diminishing the size of the drops. The adhesiveness of liquids, which opposes their disposition to leave the surface from which they fall, requires a greater mass to overcome it, and consequently augments the size of the drop. The rapidity of the movement acts in a contrary direction, and the drop from a full bottle should be less than from one more or less emptied. The broader the surface from which they fall, the greater is their size. The drops from a thick-lipped bottle are larger than from one with thin lips.

The results stated in the following table were obtained by Mr. Stephen L. Talbot. They may be relied on as accurate, and in most cases correspond with the results obtained by Mr. Durand and Prof. Procter (see *A. J. P.*, i. 169; 1865, p. 389; 1880, p. 337), but should be considered as indicating only the relative number of drops afforded by the several liquids mentioned; for, under other circumstances than those of Mr. Talbot's experiments, entirely different results might be obtained as relates to each liquid. The preparations experimented with were those of the U. S. Pharmacopœia 1870.

*Table exhibiting the number of Drops in a fluidrachm of different Liquids, with the Weight in Grains and Grammes.**

	Drops in fʒj.	Weight of fʒj.			Drops in fʒj.	Weight of fʒj.	
		in gr.	in Gm.			in gr.	in Gm.
Acetum Opii	90	61	3·95	Ext. Calumbæ Fluid	139	50	3·24
Acetum Sanguinariæ	78	55½	3·59	Ext. Chimaphilæ Fluid.	128	63	4·08
Acetum Scillæ	68	57	3·69	Ext. Cimicifugæ Fluid	147	48	3·11
Acid. Aceticum	108	58	3·75	Ext. Cinchonæ Fluid	138	58	3·75
Acid. Aceticum Dilut	68	55	3·56	Ext. Colchici Rad. Fluid.	160	57	3·69
Acid. Carbolicum	111	59	3·82	Ext. Colch. Sem. Fluid	158	55	3·56
Acid. Hydrochloric	70	65	4·21	Ext. Conii Fruct. Fluid.	137	61	3·95
Acid. Hydrochlor. Dilut.	60	56	3·62	Ext. Cubebæ Fluid	147	48	3·11
Acid. Hydrocyanic	60	54	3·49	Ext. Digitalis Fluid	134	62	4·01
Acid. Lacticum	111	66	4·27	Ext. Dulcamaræ Fluid.	130	46	2·98
Acid. Nitricum	102	77	4·98	Ext. Ergotæ Fluid	133	60	3·88
Acid. Nitricum Dilut.	60	58	3·62	Ext. Gelsemii Fluid	149	49	3·14
Acid. Nitrohydrochloric.	76	66	4·27	Ext. Gentianæ Fluid	144	64	4·14
Acid. Phosphoric. Dilut.	59	57	3·69	Ext. Geranii Fluid	125	60	3·88
Acid. Sulphuricum	128	101	6·54	Ext. Glycyrrhizæ Fluid.	133	61	3·95
Acid. Sulphur. Aromat	146	53	3·43	Ext. Gossypii Fluid	134	58	3·75
Acid. Sulphuric. Dilut	60	58½	3·79	Ext. Hydrastis Fluid	160	54	3·49
Acid. Sulphurosum	59	55	3·56	Ext. Hyoscyami Fluid	160	59	3·82
Acid. Valerianic	158	51	3·30	Ext. Ipecac. Fluid	120	60	3·88
Æther	172	41½	2·69	Ext. Krameriæ Fluid	132	60	3·88
Æther Fortior	176	39	2·52	Ext. Lupulini Fluid	140	55	3·56
Alcohol	146	44	2·85	Ext. Mezerei Fluid	155	46	3·01
Alcohol Dilutum	137	49	3·17	Ext. Pareiræ Fluid	140	57	3·72
Aqua	60	55	3·56	Ext. Pruni Virg. Fluid.	103	61	3·95
Aqua Ammoniæ	64	52	3·36	Ext. Rhei Fluid	158	61	3·95
Aqua Ammoniæ Fortior	66	50	3·24	Ext. Rubi Fluid	132	61	3·95
Aqua Destillata	60	53½	3·46	Ext. Sabinæ Fluid	148	49	3·17
Balsam. Peruvianum	101	60	3·88	Ext. Sarsap. Comp. Fl.	134	60	3·88
Bromum	250	165	10·69	Ext. Scillæ Fluid	161	58	3·75
Chloroform. Purificatum	250	80	5·18	Ext. Senegæ Fluid	137	62	4·01
Copaiba	110	51	3·30	Ext. Serpentariæ Fluid.	148	47	3·07
Creasotum	122	56½	3·66	Ext. Stillingiæ Fluid	134	58	3·75
Ext. Belladon. Fluid	156	57	3·69	Ext. Taraxaci Fluid	134	63	4·08
Ext. Buchu Fluid	150	47½	3·07	Ext. Uva Ursi Fluid	137	60	3·88

* Continued on page 1806.

Table exhibiting the number of Drops in a fluidrachm of different Liquids, with the Weight in Grains and Grammes.—(Continued.)

	Drops in fʒj.	Weight of fʒj.	
		in gr.	in Gm.
Ext. Valerianæ Fluid....	150	49	3·17
Ext. Verat. Virid. Fluid.	150	50	3·24
Ext. Zingiberis Fluid...	142	48	3·11
Glycerinum	67	68	4·40
Hydrargyrum	150	760	49·24
Liquor Ammonii Acet...	75	56	3·62
Liquor Acid. Arseniosi..	57	55	3·56
Liquor Arsen. et Hydrarg. Iod................	58	55	3·56
Liquor Ferri Chlorid....	71	72	4·66
Liquor Ferri Citratis....	71	72	4·66
Liquor Ferri Nitratis....	59	59	3·82
Liquor Ferri Subsulph.	73	83	5·37
Liquor Ferri Tersulph..	83	72	4·66
Liquor Hydrarg. Nit....	131	123	7·97
Liquor Iodi Comp........	63	59	3·82
Liquor Plumbi Subacet.	74	70	4·53
Liquor Potassæ...........	62	58	3·75
Liquor Potassii Arsen...	57	55	3·56
Liquor Sodæ Chloratæ...	63	62	4·01
Liquor Zinci Chlorid....	89	88	5·70
Oleores. Aspidii...........	130	52	3·36
Oleores. Capsici............	120	51	3·30
Oleores. Cubebæ...........	123	52	3·36
Oleum Æthereum.........	125	50	3·24
Oleum Amygd. Amaræ.	115	55	3·56
Oleum Amygd. Express.	108	48½	3·14
Oleum Anisi..................	119	54	3·49
Oleum Bergamii..........	130	46	2·98
Oleum Cajuputi...........	134	48	3·11
Oleum Cari....................	132	50	3·24
Oleum Caryophylli.......	130	57	3·69
Oleum Chenopodii........	135	52	3·36
Oleum Cinnamomii......	126	53½	3·46
Oleum Copaibæ...	123	49½	3·20
Oleum Cubebæ..............	125	51	3·30
Oleum Erigerontis........	132	57½	3·72
Oleum Fœniculi...........	125	53	3·43
Oleum Gaultheriæ........	125	62	4·01
Oleum Hedeomæ..........	132	51	3·30
Oleum Juniperi............	148	49	3·17
Oleum Lavandulæ........	138	52	3·36
Oleum Limonis............	129	47	3·04
Oleum Lini....................	113	49	3·17
Oleum Menthæ Piperitæ	129	50	3·24
Oleum Menthæ Viridis..	126	51½	3·33
Oleum Morrhuæ...........	110	49	3·17
Oleum Myristicæ.........	135	46	2·98
Oleum Olivæ.................	107	48½	3·14
Oleum Ricini...............	77	51½	3·33
Oleum Rosæ.................	132	47	3·04
Oleum Rosmarini.........	143	50	3·24
Oleum Rutæ.................	138	46	2·98
Oleum Sabinæ..............	146	50	3·24
Oleum Sassafras	133	58	3·75
Oleum Sesami........... ..	104	49½	3·20
Oleum Succini.............	140	47	3·04
Oleum Terebinthinæ.....	136	45½	2·94
Oleum Tiglii................	104	50	3·24
Spiritus Æther. Comp...	148	45	2·91
Spiritus Æther. Nitrous	146	47	3·04
Spiritus Ammon. Arom.	142	48	3·11
Spiritus Camphor.........	143	47	3·04
Spiritus Chloroform......	150	48	3·11
Spiritus Menthæ Pip....	142	47	3·04
Syrupus	65	72	4·66
Syrupus Acaciæ...........	44	73	4·73
Syrupus Ferri Iodidi....	65	77	4·98
Syrupus Rhei..............	82	72	4·66
Syrupus Scillæ............	75	74	4·79
Syrupus Scillæ Comp....	102	70	4·53
Syrupus Senegæ..........	106	70	4·53
Tinctura Aconiti..........	146	46	2·98
Tinctura Belladon........	137	53	3·43
Tinct. Benzoini Comp...	148	48	3·11
Tinctura Cantharid......	131	51	3·33
Tinct. Cinchon. Comp...	140	49	3·17
Tinctura Digitalis........	128	53	3·43
Tinctura Ferri Chlorid..	150	53	3·43
Tinctura Iodi..............	148	47	3·04
Tinctura Nucis Vom.....	140	44	2·85
Tinctura Opii..............	130	53	3·43
Tinctura Opii Camp......	130	52	3·36
Tinctura Opii Deod......	110	54	3·49
Tinctura Valerianæ......	130	52	3·36
Tinctura Verat. Virid...	145	46	2·98
Tinctura Zingiberis......	144	46	2·98
Vin. Colchici Rad........	107	55	3·56
Vin. Colchici Sem...... ..	111	54	3·49
Vin. Opii...........	100	55	3·56

ALPHABETICAL TABLE OF FORMULAS AND MOLECULAR WEIGHTS.

Note.—The figures in Roman numerals after the symbols of elements represent their *equivalence* or combining value referred to hydrogen as unity.

Name.	Symbol or Formula.	Atomic or Molecular Weight.
Acetic ether	$C_2H_5.C_2H_3O_2$	88
Acid, acetic	$HC_2H_3O_2$	60
Acid, antimonic	H_3SbO_4	187
Acid, antimonous	H_3SbO_3	171
Acid, arsenic	H_3AsO_4	141·9
Acid, arsenious. See also Arsenious oxide	H_3AsO_3	125·9
Acid, benzoic	$HC_7H_5O_2$	122
Acid, boric	H_3BO_3	62
Acid, camphoric	$H_2C_{10}H_{14}O_4$	200
Acid, carbolic	$C_6H_5.OH$	94
Acid, carbonic. See also Carbon dioxide	H_2CO_3	62
Acid, chromic. See Chromium trioxide.		
Acid, cinnamic	$HC_9H_7O_2$	148
Acid, citric	$H_3C_6H_5O_7 + H_2O$	210
Acid, cyanic	$HCNO$	43
Acid, gallic	$HC_7H_5O_5 + H_2O$	188
Acid, hydriodic	HI	127·6
Acid, hydrobromic	HBr	80·8
Acid, hydrochloric	HCl	36·4
Acid, hydrocyanic	HCN	27
Acid, hydrofluoric	HFl	20
Acid, hydrosulphuric. See Hydrogen sulphide.		
Acid, kinic (quinic)	$HC_7H_{11}O_6$	192
Acid, lactic	$HC_3H_5O_3$	90
Acid, meconic	$C_7H_4O_7$	200
Acid, metaphosphoric	HPO_3	80
Acid, molybdic. See Molybdic oxide.		
Acid, nitric	HNO_3	63
Acid, nitrous	HNO_2	47
Acid, oleic	$HC_{18}H_{33}O_2$	282
Acid, oxalic	$H_2C_2O_4 + 2H_2O$	126
Acid, palmitic	$HC_{16}H_{31}O_2$	256
Acid, phosphoric	H_3PO_4	98
Acid, phosphorous	H_2PHO_3	82
Acid, picric	$C_6H_2(NO_2)_3OH$	229
Acid, prussic. See Acid hydrocyanic.		
Acid, pyrophosphoric	$H_4P_2O_7$	178
Acid, salicylic	$HC_7H_5O_3$	138
Acid, silicic. See also Silicic oxide	H_2SiO_3	78
Acid, stearic	$HC_{18}H_{35}O_2$	284
Acid, succinic	$H_2C_4H_4O_4$	118
Acid, sulphuric	H_2SO_4	98
Acid, sulphurous	H_2SO_3	64
Acid, tannic	$C_{14}H_{10}O_9$	322
Acid, tartaric	$H_2C_4H_4O_6$	150
Acid, titanic. See Titanic oxide.		
Acid, tungstic. See Tungstic oxide.		
Acid, uric	$C_5H_4N_4O_3$	168
Acid, valerianic	$HC_5H_9O_2$	102
Aconitine	$C_{30}H_{47}NO_7$	533
Alcohol amylic	$C_5H_{11}.OH$	88
Alcohol ethylic	$C_2H_5.OH$	46
Alcohol methylic	$CH_3.OH$	32
Aldehyd	C_2H_4O	44
Alum (ammonia-alum)	$Al_2(SO_4)_3 + (NH_4)_2SO_4 + 24H_2O$	906
Alum (dried)	$Al_2(SO_4)_3 + K_2SO_4$	516
Alum (potash-alum)	$Al_2(SO_4)_3 + K_2SO_4 + 24H_2O$	948
Aluminum	$Al \quad [(Al_2)^{VI}]$	27
Aluminum hydrate	$Al_2(OH)_6$	156
Aluminum sulphate	$Al_2(SO_4)_3 + 18H_2O$	666

Ammonia	NH_3	17
Ammoniated mercury. See Mercur-ammonium chloride.		
Ammonio-ferric sulphate	$Fe_2(SO_4)_3 + (NH_4)_2SO_4 + 24H_2O$	963 8
Ammonium benzoate	$NH_4C_7H_5O_2$	139
Ammonium bromide	NH_4Br	97·8
Ammonium carbonate (officinal)	$NH_4HCO_3.NH_4NH_2CO_2$	157
Ammonium carbonate (pure)	$(NH_4)_2CO_3$	96
Ammonium chloride	NH_4Cl	53·4
Ammonium iodide	NH_4I	144·1
Ammonium nitrate	NH_4NO_3	80
Ammonium oxalate	$(NH_4)_2C_2O_4 + H_2O$	142
Ammonium phosphate	$(NH_4)_2HPO_4$	132
Ammonium sulphate	$(NH_4)_2SO_4$	132
Ammonium valerianate	$NH_4C_5H_9O_2$	119
Amyl acetate	$C_5H_{11}C_2H_3O_2$	130
Amyl nitrite	$C_5H_{11}NO_2$	117
Antimonous chloride	$SbCl_3$	226·2
Antimonous oxide	Sb_2O_3	288
Antimonous sulphide	Sb_2S_3	336
Antimony	Sb **[III, V]**	120
Antimonyl potassium tartrate	$2KSbOC_4H_4O_6 + H_2O$	664
Apomorphine	$C_{17}H_{17}NO_2$	267
Apomorphine hydrochlorate	$C_{17}H_{17}NO_2HCl$	303·4
Arabin	$(C_6H_{10}O_5)_2 + H_2O$	342
Arsenic	As **[III, V]**	74·9
Arsenic iodide	AsI_3	454·7
Arsenic oxide	As_2O_5	229·8
Arsenic sulphide	As_2S_5	309·8
Arsenous oxide	As_2O_3	197·8
Arsenous sulphide	As_2S_3	245·8
Atropine	$C_{17}H_{23}NO_3$	289
Atropine sulphate	$(C_{17}H_{23}NO_3)_2H_2SO_4$	676
Barium	Ba **[II, IV]**	136·8
Barium carbonate	$BaCO_3$	196·8
Barium chloride	$BaCl_2 + 2H_2O$	243·6
Barium hydrate	$Ba(OH)_2$	170·8
Barium nitrate	$Ba(NO_3)_2$	260·8
Barium peroxide	BaO_2	168 8
Barium sulphate	$BaSO_4$	232·8
Benzoic aldehyd	C_7H_6O	106
Benzol	C_6H_6	78
Benzyl alcohol	$C_7H_7.OH$	108
Beryllium	Be **[II]**	9
Bismuth	Bi **[III, V]**	210
Bismuth carbonate (basic)	$(BiO)_2CO_3 + H_2O$	530
Bismuth carbonate (normal)	$Bi_2(CO_3)_3$	600
Bismuth citrate	$BiC_6H_5O_7$	399
Bismuth oxychloride	$BiOCl$	261·4
Bismuth subnitrate	$BiONO_3 + H_2O$	306
Boron	B **[III]**	11
Bromine	Br **[I, III, V, VII]**	79·8
Brucine	$C_{23}H_{26}N_2O_4$	394
Cadmium	Cd **[II]**	111·8
Cadmium iodide	CdI_2	365
Cadmium sulphate	$CdSO_4$	207·8
Cæsium	Cs **[I]**	132·6
Caffeine	$C_8H_{10}N_4O_2 + H_2O$	212
Calcium	Ca **[II, IV]**	40
Calcium acetate	$Ca(C_2H_3O_2)_2$	158
Calcium bromide	$CaBr_2$	199·6
Calcium carbonate	$CaCO_3$	100
Calcium chloride	$CaCl_2$	110·8
Calcium chloride (crystallized)	$CaCl_2 + 6H_2O$	218·8
Calcium hydrate	$Ca(OH)_2$	74
Calcium hypochlorite	$Ca(OCl)_2$	142·8
Calcium hypophosphite	$CaH_4(PO_2)_2$	170
Calcium oxalate	CaC_2O_4	128
Calcium oxide	CaO	56
Calcium sulphate	$CaSO_4$	136

Calcium sulphate (crystallized)	$CaSO_4 + 2H_2O$	172
Calcium tartrate	$CaC_4H_4O_6$	188
Calomel. See Mercurous chloride.		
Camphor	$C_{10}H_{16}O$	152
Camphor monobromated	$C_{10}H_{15}BrO$	230·8
Carbon	$C\ [\mathbf{IV}]$	12
Carbon dioxide	CO_2	44
Carbon disulphide	CS_2	76
Cerium	$Ce\ [\mathbf{IV}]\ (\mathbf{Ce}_2)^{\mathbf{VI}}$	141
Cerium oxalate	$Ce_2(C_2O_4)_3 + 9H_2O$	708
Chloral hydrate	$C_2HCl_3O + H_2O$	165·2
Chlorine	$Cl\ [\mathbf{I, III, V, VII}]$	35·4
Chloroform	$CHCl_3$	119·2
Chrome alum	$Cr_2(SO_4)_3 + K_2SO_4 + 24H_2O$	998·8
Chromium	$Cr\ [\mathbf{II, VI}]\ (\mathbf{Cr}_2)^{\mathbf{VI}}$	52·4
Chromium sesquioxide	Cr_2O_3	152·8
Chromium trioxide	CrO_3	100·4
Cinchonidine	$C_{20}H_{24}N_2O$	308
Cinchonidine sulphate	$(C_{20}H_{24}N_2O)_2H_2SO_4 + 3H_2O$	768
Cinchonine	$C_{20}H_{24}N_2O$	308
Cinchonine sulphate	$(C_{20}H_{24}N_2O)_2H_2SO_4 + 2H_2O$	750
Cinnabar. See Mercuric sulphide.		
Cobalt	$Co\ [\mathbf{II, VI}]\ (\mathbf{Co}_2)^{\mathbf{VI}}$	58·9
Codeine	$C_{18}H_{21}NO_3 + H_2O$	317
Columbium. See Niobium.		
Conine	$C_8H_{15}N$	125
Copper	$Cu\ [\mathbf{II}]\ (\mathbf{Cu}_2)^{\mathbf{II}}$	63·2
Copper acetate	$Cu(C_2H_3O_2)_2 + H_2O$	199 2
Copper acetate (basic)	$Cu(C_2H_3O_2)_2 + CuO + 6H_2O$	368·4
Copper carbonate (basic)	$CuCO_3 + Cu(OH)_2$	220·4
Copper sulphate	$CuSO_4 + 5H_2O$	249·2
Copper sulphate (ammoniacal)	$CuSO_4 + 4NH_3 + H_2O$	245·2
Corrosive sublimate. See Mercuric chloride.		
Cupric oxide	CuO	79·2
Cuprous oxide	Cu_2O	142·4
Cyanogen	$(CN)_2$	52
Didymium	$Di\ [(\mathbf{Di}_2)^{\mathbf{VI}}]$	144·6
Elaterin	$C_{20}H_{28}O_5$	348
Erbium	$E\ [(\mathbf{E}_2)^{\mathbf{VI}}]$	165·9
Ether ethylic (common sulphuric)	$(C_2H_5)_2O$	74
Ethyl acetate. See Acetic ether.		
Ethylene	C_2H_4	28
Ethyl nitrite	$C_2H_5NO_2$	75
Ferric acetate	$Fe_2(C_2H_3O_2)_6$	465·8
Ferric chloride	$Fe_2Cl_6 + 12H_2O$	540·2
Ferric citrate	$Fe_2(C_6H_5O_7)_2 + 6H_2O$	597·8
Ferric hydrate	$Fe_2(OH)_6$	213·8
Ferric hypophosphite	$Fe_2(H_2PO_2)_6$	501·8
Ferric nitrate	$Fe_2(NO_3)_6$	483·8
Ferric oxide (sesquioxide)	Fe_2O_3	159·8
Ferric phosphate	$Fe_2(PO_4)_2$	301·8
Ferric pyrophosphate	$(Fe_2)_2(P_2O_7)_3$	745·6
Ferric sulphate (basic)	$Fe_4O(SO_4)_5$	719·6
Ferric sulphate (normal)	$Fe_2(SO_4)_3$	399·8
Ferricyanic acid	$H_6Fe_2(CN)_{12}$	429·8
Ferrocyanic acid	$H_4Fe(CN)_6$	212·9
Ferrous bromide	$FeBr_2$	215·5
Ferrous carbonate	$FeCO_3$	115·9
Ferrous hydrate	$Fe(OH)_2$	89·9
Ferrous iodide	FeI_2	309·1
Ferrous lactate	$Fe(C_3H_5O_3)_2 + 3H_2O$	287·9
Ferrous oxalate	$FeC_2O_4 + H_2O$	161·9
Ferrous oxide	FeO	71·9
Ferrous sulphate	$FeSO_4 + 7H_2O$	277·9
Ferrous sulphate (dried)	$FeSO_4 + H_2O$	169·9
Fluorine	$Fl\ [\mathbf{I}]$	19
Gallium	$Ga\ [(\mathbf{Ga}_2)^{\mathbf{VI}}]$	68·8
Glucinum. See Beryllium.		
Glucose	$C_6H_{12}O_6$	180
Glycerin	$C_3H_5(OH)_3$	92

Glycol	$C_2H_4(OH)_2$	62
Gold	Au **[I, III]**	196·2
Gold and Sodium chloride	$AuCl_3 + NaCl$	360·8
Gold chloride	$AuCl_3$	302·4
Grape sugar. See Glucose.		
Hydrogen	H **[I]**	1
Hydrogen dioxide	H_2O_2	34
Hydrogen oxide (water)	H_2O	18
Hydrogen sulphide	H_2S	34
Hyoscyamine	$C_{17}H_{23}NO_3$	289
Hyoscyamine sulphate	$(C_{17}H_{23}NO_3)_2H_2SO_4$	676
Indigo-blue	C_8H_5NO	131
Indium	In $[(\mathbf{In_2})^{\mathbf{VI}}]$	113·4
Iodine	I **[I, III, V, VII]**	126·6
Iodoform	CHI_3	392·8
Iridium	Ir **[II, IV]** $(\mathbf{Ir_2})^{\mathbf{IV}}$	192·7
Iron Compounds. See Ferrous and Ferric.	Fe **[II, VI]** $(\mathbf{Fe_2})^{\mathbf{VI}}$	55·9
Lactose. See Sugar of milk.		
Lanthanum	La $[(\mathbf{La_2})^{\mathbf{VI}}]$	138·5
Lead	Pb **[II, IV]**	206·5
Lead acetate	$Pb(C_2H_3O_2)_2 + 3H_2O$	378·5
Lead acetate (basic)	$Pb_2O(C_2H_3O_2)_2$	547
Lead carbonate (officinal)	$2(PbCO_3) + Pb(OH)_2$	773·5
Lead carbonate (pure)	$PbCO_3$	266·5
Lead dioxide	PbO_2	238 5
Lead iodide	PbI_2	459 7
Lead nitrate	$Pb(NO_3)_2$	330·5
Lead oxide	PbO	222·5
Lead, red oxide of	Pb_3O_4	683·5
Lime. See Calcium oxide.		
Lithium	Li **[I]**	7
Lithium benzoate	$LiC_7H_5O_2$	128
Lithium bromide	$LiBr$	86·8
Lithium carbonate	Li_2CO_3	74
Lithium citrate	$Li_3C_6H_5O_7$	210
Lithium salicylate	$2LiC_7H_5O_3 + H_2O$	306
Magnesium	Mg **[II]**	24
Magnesium carbonate (officinal)	$(MgCO_3)_4.Mg(OH)_2 + 5H_2O$	484
Magnesium carbonate (pure)	$MgCO_3$	84
Magnesium oxide (magnesia)	MgO	40
Magnesium sulphate	$MgSO_4 + 7H_2O$	246
Magnesium sulphite	$MgSO_3 + 6H_2O$	212
Manganese	Mn **[II, IV, VI]** $(\mathbf{Mn_2})^{\mathbf{VI}}$	54
Manganese dioxide	MnO_2	86
Manganous sulphate	$MnSO_4 + 4H_2O$	222
Mercur-ammonium chloride	NH_2HgCl	251·1
Mercuric chloride	$HgCl_2$	270·5
Mercuric cyanide	$Hg(CN)_2$	251·7
Mercuric iodide	HgI_2	452·9
Mercuric nitrate	$Hg(NO_3)_2$	327·7
Mercuric oxide	HgO	215·7
Mercuric sulphate (normal)	$HgSO_4$	295·7
Mercuric sulphate (yellow or basic)	$Hg(HgO)_2SO_4$	727·1
Mercuric sulphide	HgS	231·7
Mercurous chloride	Hg_2Cl_2	470·2
Mercurous iodide	Hg_2I_2	652·6
Mercurous nitrate	$Hg_2(NO_3)_2$	523·4
Mercurous sulphate	Hg_2SO_4	495·4
Mercury	Hg **[II]** $(\mathbf{Hg_2})^{\mathbf{II}}$	199 7
Methyl alcohol. See Alcohol methylic.		
Molybdenum	Mo **[II, IV, VI]** $(\mathbf{Mo_2})^{\mathbf{VI}}$	95·5
Molybdic oxide	MoO_3	143·5
Morphine	$C_{17}H_{19}NO_3 + H_2O$	303
Morphine acetate	$C_{17}H_{19}NO_3.HC_2H_3O_2 + 3H_2O$	399
Morphine hydrochlorate	$C_{17}H_{19}NO_3HCl + 3H_2O$	375·4
Morphine sulphate	$(C_{17}H_{19}NO_3)_2H_2SO_4 + 5H_2O$	758
Narceine	$C_{23}H_{29}NO_9$	693
Narcotine	$C_{22}H_{23}NO_7$	643
Nickel	Ni **[II, VI]** $(\mathbf{Ni_2})^{\mathbf{VI}}$	58
Nicotine	$C_{10}H_{14}N_2$	162

Niobium	Nb [III, V]	94
Nitrogen	N [I, III, V]	14
Olefiant gas. See Ethylene.		
Osmium	Os [II, IV, VI, VIII]	198·5
Oxygen	O [II]	16
Palladium	Pd [II, IV]	105·7
Paracyanogen	$(CN)_3$	78
Paramorphine. See Thebaine.		
Phosphorus	P [III, V]	31
Phosphorus oxychloride	$POCl_3$	153·2
Phosphorus pentachloride	PCl_5	208
Phosphorus trichloride	PCl_3	137·2
Physostigmine salicylate	$C_{15}H_{21}N_3O_2C_7H_6O_3$	413
Picrotoxine	$C_9H_{10}O_4$	182
Pilocarpine hydrochlorate	$C_{11}H_{16}N_2O_2HCl$	244·4
Piperine	$C_{17}H_{19}NO_3$	285
Platinic chloride	$PtCl_4 + 5H_2O$	426
Platinum	Pt [II, IV]	194·4
Potassium	K [I]	39
Potassium acetate	$KC_2H_3O_2$	98
Potassium acid carbonate	$KHCO_3$	100
Potassium acid oxalate (salt of sorrel)	KHC_2O_4	128
Potassium and Sodium tartrate	$KNaC_4H_4O_6 + 4H_2O$	282
Potassium arsenite	K_3AsO_3	239·9
Potassium bichromate	$K_2Cr_2O_7$	294·8
Potassium bitartrate	$KHC_4H_4O_6$	188
Potassium bromide	KBr	118·8
Potassium carbonate	$(K_2CO_3)_23H_2O$	330
Potassium chlorate	$KClO_3$	122·4
Potassium chloride	KCl	74·4
Potassium chromate	K_2CrO_4	194·4
Potassium citrate	$K_3C_6H_5O_7 + H_2O$	324
Potassium cyanide	KCN	65
Potassium ferricyanide	$K_3Fe(CN)_6$	328·9
Potassium ferrocyanide	$K_4Fe(CN)_6 + 3H_2O$	421·9
Potassium hydrate	KOH	56
Potassium hypophosphite	KH_2PO_2	104
Potassium iodide	KI	160·6
Potassium nitrate	KNO_3	101
Potassium permanganate	$K_2Mn_2O_8$	314
Potassium sulphate	K_2SO_4	174
Potassium sulphite	$K_2SO_3 + 2H_2O$	194
Potassium tartrate	$(K_2C_4H_4O_6)_2 + H_2O$	470
Prussian blue (ferric ferrocyanide)	$Fe_4(Fe(CN)_6)_3$	859·3
Prussic acid. See Acid hydrocyanic.		
Quinidine	$C_{20}H_{24}N_2O_2$	324
Quinidine sulphate	$(C_{20}H_{24}N_2O_2)_2H_2SO_4 + 2H_2O$	782
Quinine	$C_{20}H_{24}N_2O_2 + 3H_2O$	378
Quinine bisulphate	$(C_{20}H_{24}N_2O_2)H_2SO_4 + 7H_2O$	548
Quinine hydrobromate	$C_{20}H_{24}N_2O_2HBr + 2H_2O$	440·8
Quinine hydrochlorate	$C_{20}H_{24}N_2O_2HCl + 2H_2O$	396·4
Quinine sulphate	$(C_{20}H_{24}N_2O_2)_2H_2SO_4 + 7H_2O$	872
Quinine valerianate	$C_{20}H_{24}N_2O_2C_5H_{10}O_2 + H_2O$	444
Rhodium	Rh [II, IV] $(Rh_2)^{VI}$	104·1
Rubidium	Rb [I]	85·3
Ruthenium	Ru [II, IV, VI, VIII]	104·2
Salicin	$C_{13}H_{18}O_7$	286
Santonin	$C_{15}H_{18}O_3$	246
Scandium	Sc $[(Sc_2)^{VI}]$	44
Selenium	Se [II, IV, VI]	78·8
Silica. See Silicic oxide.		
Silicic oxide	SiO_2	60
Silicon	Si [IV]	28
Silver	Ag [I]	107·7
Silver bromide	$AgBr$	187·5
Silver chloride	$AgCl$	143·1
Silver cyanide	$AgCN$	133·7
Silver iodide	AgI	234·3
Silver nitrate	$AgNO_3$	169·7
Silver nitrate (ammoniacal)	$AgNO_3 + 2NH_3$	203·7

Silver oxide	Ag_2O	231·4
Silver sulphate	Ag_2SO_4	311·4
Sodium	Na **[I]**	23
Sodium acetate	$NaC_2H_3O_2 + 3H_2O$	136
Sodium arseniate	$Na_2HASO_4 + 7H_2O$	311·9
Sodium benzoate	$NaC_7H_5O_2 + H_2O$	162
Sodium bicarbonate	$NaHCO_3$	84
Sodium bisulphite	$NaHSO_3$	104
Sodium bitartrate	$NaHC_4H_4O_6 + H_2O$	190
Sodium borate	$Na_2B_4O_7 + 10H_2O$	382
Sodium bromide	$NaBr$	102·8
Sodium carbonate	$Na_2CO_3 + 10H_2O$	286
Sodium chlorate	$NaClO_3$	106·4
Sodium chloride	$NaCl$	58·4
Sodium hypophosphite	$NaH_2PO_2 + H_2O$	106
Sodium hyposulphite (thiosulphate)	$Na_2S_2O_3 + 5H_2O$	248
Sodium iodide	NaI	149·6
Sodium molybdate	$Na_2MoO_4 + H_2O$	223·5
Sodium nitrate	$NaNO_3$	85
Sodium phosphate	$Na_2HPO_4 + 12H_2O$	358
Sodium pyrophosphate	$Na_4P_2O_7 + 10H_2O$	446
Sodium salicylate	$2NaC_7H_5O_3 + H_2O$	338
Sodium santoninate	$2NaC_{15}H_{19}O_4 + 7H_2O$	698
Sodium sulphate	$Na_2SO_4 + 10H_2O$	322
Sodium sulphite	$Na_2SO_3 + 7H_2O$	252
Sodium sulphocarbolate	$NaC_6H_5SO_4 + 2H_2O$	232
Stannous chloride	$SnCl_2$	188·5
Strontium	Sr **[II, IV]**	87·4
Strontium nitrate	$Sr(NO_3)_2 + 4H_2O$	283·4
Strychnine	$C_{21}H_{22}N_2O_2$	334
Strychnine hydrochlorate	$C_{21}H_{22}N_2O_2.HCl$	370·4
Strychnine sulphate	$(C_{21}H_{22}N_2O_2)_2H_2SO_4 + 7H_2O$	892
Sugar (cane sugar)	$C_{12}H_{22}O_{11}$	342
Sugar of milk (lactose)	$C_{12}H_{22}O_{11} + H_2O$	360
Sulphur	S **[II, IV, VI]**	32
Sulphuretted hydrogen. See Hydrogen sulphide.		
Tantalum	Ta **[III, V]**	182
Tartar emetic. See Antimonyl-potassium tartrate.		
Tellurium	Te **[II, IV, VI]**	128
Terebene	$C_{10}H_{16}$	136
Thallium	Tl **[I, III]**	203·7
Thorium	Th **[IV]**	233
Thymol	$C_{10}H_{13}OH$	150
Tin	Sn **[II, IV]**	117·7
Tin protochloride. See Stannous chloride.		
Titanic oxide	TiO_2	80
Titanium	Ti **[IV]**	48
Tungsten	W **[II, IV, VI]**	183·6
Tungstic oxide	WO_3	231·6
Uranium	U **[IV, VI]**	238·5
Urea	$CO(NH_2)_2$	60
Vanadium	V **[I, III, V]**	51·3
Veratrine	$C_{32}H_{52}N_2O_8$	592
Ytterbium	Yb **[$(Yb_2)^{VI}$]**	172·7
Yttrium	Y **[$(Y_2)^{VI}$]**	89·8
Zinc	Zn **[II]**	64·9
Zinc acetate	$Zn(C_2H_3O_2)_2 + 3H_2O$	236·9
Zinc bromide	$ZnBr_2$	224·5
Zinc carbonate (officinal)	$(ZnCO_3)_2 + 3Zn(OH)_2$	546·5
Zinc carbonate (pure)	$ZnCO_3$	124·9
Zinc chloride	$ZnCl_2$	135·7
Zinc iodide	ZnI_2	318·1
Zinc oxide	ZnO	80·9
Zinc phosphide	Zn_3P_2	256·7
Zinc sulphate	$ZnSO_4 + 7H_2O$	286·9
Zinc sulphide	ZnS	96·9
Zinc valerianate	$Zn(C_5H_9O_2)_2 + H_2O$	284·9
Zirconium	Zr **[IV]**	90

ALCOHOL.

TABLE OF PERCENTAGE AND SPECIFIC GRAVITY (according to Hehner).*

Sp. Gravity at 15·6° C. (60° F.).	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Sp. Gravity at 15·6° C. (60° F.).	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Sp. Gravity at 15·6° C. (60° F.).	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.
1·0000	0·00	0·00	0·9665	24·00	29·22	0·9330	43·24	50·82
0·9995	0·26	0·33	0·9660	24·38	29·67	0·9325	43·48	51·07
0·9990	0·53	0·66	0·9655	24·77	30·13	0·9320	43·71	51·32
0·9985	0·79	0·99	0·9650	25·14	30·57	0·9315	43·95	51·58
0·9980	1·06	1·34	0·9645	25·50	30·98	0·9310	44·18	51·82
0·9975	1·37	1·73	0·9640	25·86	31·40	0·9305	44·41	52·06
0·9970	1·69	2·12	0·9635	26·20	31·80	0·9300	44·64	52·29
0·9965	2·00	2·51	0·9630	26·53	32·19	0·9295	44·86	52·53
0·9960	2·28	2·86	0·9625	26·87	32·58	0·9290	45·09	52·77
0·9955	2·56	3·21	0·9620	27·21	32·98	0·9285	45·32	53·01
0·9950	2·83	3·55	0·9615	27·57	33·39	**0·9280**†	45·55	53·24
0·9945	3·12	3·90	0·9610	27·93	33·81	0·9275	45·77	53·48
0·9940	3·41	4·27	0·9605	28·25	34·18	0·9270	46·00	53·72
0·9935	3·71	4·63	0·9600	28·56	34·54	0·9265	46·23	53·95
0·9930	4·00	5·00	0·9595	28·87	34·90	0·9260	46·46	54·19
0·9925	4·31	5·39	0·9590	29·20	35·28	0·9255	46·68	54·43
0·9920	4·62	5·78	0·9585	29·53	35·66	0·9250	46·91	54·66
0·9915	4·94	6·17	0·9580	29·87	36·04	0·9245	47·14	54·90
0·9910	5·25	6·55	0·9575	30·17	36·39	0·9240	47·36	55·13
0·9905	5·56	6·94	0·9570	30·44	36·70	0·9235	47·59	55·37
0·9900	5·87	7·32	0·9565	30·72	37·02	0·9230	47·82	55·60
0·9895	6·21	7·74	0·9560	31·00	37·34	0·9225	48·05	55·83
0·9890	6·57	8·18	0·9555	31·31	37·69	0·9220	48·27	56·07
0·9885	6·93	8·63	0·9550	31·62	38·04	0·9215	48·50	56·30
0·9880	7·27	9·04	0·9545	31·94	38·40	0·9210	48·73	56·54
0·9875	7·60	9·45	0·9540	32·25	38·75	0·9205	48·96	56·77
0·9870	7·93	9·86	0·9535	32·56	39·11	0·9200	49·16	56·98
0·9865	8·29	10·30	0·9530	32·87	39·47	**0·9198**‡	49·24	57·06
0·9860	8·64	10·73	0·9525	33·18	39·81	0·9195	49·39	57·20
0·9855	9·00	11·17	0·9520	33·47	40·14	0·9190	49·64	57·45
0·9850	9·36	11·61	0·9515	33·76	40·47	0·9185	49·86	57·69
0·9845	9·71	12·05	0·9510	34·05	40·79	0·9180	50·09	58·92
0·9840	10·08	12·49	0·9505	34·29	41·05	0·9175	50·30	58·14
0·9835	10·46	12·96	0·9500	34·52	41·32	0·9170	50·52	58·36
0·9830	10·85	13·43	0·9495	34·76	41·58	0·9165	50·74	58·58
0·9825	11·23	13·90	0·9490	35·00	41·84	0·9160	50·96	58·80
0·9820	11·62	14·37	0·9485	35·25	42·12	0·9155	51·17	59·01
0·9815	12·00	14·84	0·9480	35·50	42·40	0·9150	51·38	59·22
0·9810	12·38	15·30	0·9475	35·75	42·67	0·9145	51·58	59·43
0·9805	12·77	15·77	0·9470	36·00	42·95	0·9140	51·79	59·63
0·9800	13·15	16·24	0·9465	36·28	43·26	0·9135	52·00	59·84
0·9795	13·54	16·70	0·9460	36·56	43·56	0·9130	52·23	60·07
0·9790	13·92	17·17	0·9455	36·83	43·87	0·9125	52·45	60·30
0·9785	14·36	17·70	0·9450	37·11	44·18	0·9120	52·68	60·52
0·9780	14·82	18·25	0·9445	37·39	44·49	0·9115	52·91	60·74
0·9775	15·25	18·78	0·9440	37·67	44·79	0·9110	53·13	60·97
0·9770	15·67	19·28	0·9435	37·94	45·10	0·9105	53·35	61·19
0·9765	16·08	19·78	0·9430	38·22	45·41	0·9100	53·57	61·40
0·9760	16·46	20·24	0·9425	38·50	45·71	0·9095	53·78	61·62
0·9755	16·85	20·71	0·9420	38·78	46·02	0·9090	54·00	61·84
0·9750	17·25	21·19	0·9415	39·05	46·32	0·9085	54·24	62·07
0·9745	17·67	21·69	0·9410	39·30	46·59	0·9080	54·48	62·31
0·9740	18·08	22·18	0·9405	39·55	46·86	0·9075	54·71	62·55
0·9735	18·46	22·64	0·9400	39·80	47·13	0·9070	54·95	62·79
0·9730	18·85	23·10	0·9395	40·05	47·40	0·9065	55·18	63·02
0·9725	19·25	23·58	0·9390	40·30	47·67	0·9060	55·41	63·24
0·9720	19·67	24·08	0·9385	40·55	47·94	0·9055	55·64	63·46
0·9715	20·08	24·58	0·9380	40·80	48·21	0·9050	55·86	63·69
0·9710	20·50	25·07	0·9375	41·05	48·48	0·9045	56·09	63·91
0·9705	20·92	25·57	0·9370	41·30	48·75	0·9040	56·32	64·14
0·9700	21·31	26·04	0·9365	41·55	49·02	0·9035	56·55	64·36
0·9695	21·69	26·49	0·9360	41·80	49·29	0·9030	56·77	64·58
0·9690	22·08	26·95	0·9355	42·05	49·55	0·9025	57·00	64·80
0·9685	22·46	27·40	0·9350	42·29	49·81	0·9020	57·21	65·01
0·9680	22·85	27·86	0·9345	42·52	50·06	0·9015	57·42	65·21
0·9675	23·23	28·31	0·9340	42·76	50·31	0·9010	57·63	65·41
0·9670	23·62	28·77	0·9335	43·00	50·57	0·9005	57·83	65·61

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* The above table will be found more complete than the one inserted upon page 143, and has been abridged from that of Hehner's in the U. S. P. 1880.

† Officinal diluted alcohol.

‡ Proof.

Sp. Gravity at 15·6° C. (60° F.).	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Sp. Gravity at 15·6° C. (60° F.).	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Sp. Gravity at 15·6° C. (60° F.).	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.
0·9000	58·05	65·81	0·8640	73·38	79·86	0·8280	87·96	91·75
0·8995	58·27	66·03	0·8635	73·58	80·04	0·8275	88·16	91·90
0·8990	58·50	66·25	0·8630	73·79	80·22	0·8270	88·36	92·05
0·8985	58·73	66·47	0·8625	74·00	80·40	0·8265	88·56	92·21
0·8980	58·95	66·69	0·8620	74·23	80·60	0·8260	88·76	92·36
0·8975	59·17	66·90	0·8615	74·45	80·80	0·8255	88·96	92·51
0·8970	59·39	67·11	0·8610	74·68	81·00	0·8250	89·16	92·66
0·8965	59·61	67·32	0·8605	74·91	81·20	0·8245	89·35	92·80
0·8960	59·83	67·53	0·8600	75·14	81·40	0·8240	89·54	92·94
0·8955	60·04	67·73	0·8595	75·36	81·60	0·8235	89·73	93·09
0·8950	60·26	67·93	0·8590	75·59	81·80	0·8230	89·92	93·23
0·8945	60·46	68·13	0·8585	75·82	82·00	0·8225	90·11	93·36
0·8940	60·67	68·33	0·8580	76·04	82·19	0·8220	90·29	93·49
0·8935	60·88	68·52	0·8575	76·25	82·37	0·8215	90·46	93·62
0·8930	61·08	68·72	0·8570	76·46	82·54	0·8210	90·64	93·75
0·8925	61·29	68·91	0·8565	76·67	82·72	0·8205	90·82	93·87
0·8920	61·50	69·11	0·8560	76·88	82·90	**0.8200**†	91·00	94·00
0·8915	61·71	69·30	0·8555	77·08	83·07	0·8195	91·18	94·13
0·8910	61·92	69·50	0·8550	77·29	83·25	0·8190	91·36	94·26
0·8905	62·14	69·71	0·8545	77·50	83·43	0·8185	91·54	94·38
0·8900	62·36	69·92	0·8540	77·71	83·60	0·8180	91·71	94·51
0·8895	62·59	70·14	0·8535	77·92	83·78	0·8175	91·89	94·64
0·8890	62·82	70·35	0·8530	78·12	83·94	0·8170	92·07	94·76
0·8885	63·04	70·57	0·8525	78·32	84·11	0·8165	92·26	94·90
0·8880	63·26	70·77	0·8520	78·52	84·27	0·8160	92·44	95·03
0·8875	63·48	70·97	0·8515	78·72	84·44	0·8155	92·63	95·16
0·8870	63·70	71·17	0·8510	78·92	84·60	0·8150	92·81	95·29
0·8865	63·91	71·38	0·8505	79·12	84·77	0·8145	93·00	95·42
0·8860	64·13	71·58	0·8500	79·32	84·93	0·8140	93·18	95·55
0·8855	64·35	71·78	0·8495	79·52	85·10	0·8135	93·37	95·69
0·8850	64·57	71·98	0·8490	79·72	85·26	0·8130	93·55	95·82
0·8845	64·78	72·18	0·8485	79·92	85·42	0·8125	93·74	95·95
0·8840	65·00	72·38	0·8480	80·13	85·59	0·8120	93·92	96·08
0·8835	65·21	72·58	0·8475	80·33	85·77	0·8115	94·10	96·20
0·8830	65·42	72·77	0·8470	80·54	85·94	0·8110	94·28	96·32
0·8825	65·63	72·96	0·8465	80·75	86·11	0·8105	94·45	96·43
0·8820	65·83	73·15	0·8460	80·96	86·28	0·8100	94·62	96·55
0·8815	66·04	73·34	0·8455	81·16	86·45	0·8095	94·80	96·67
0·8810	66·26	73·54	0·8450	81·36	86·61	0·8090	94·97	96·78
0·8805	66·48	73·73	0·8445	81·56	86·77	0·8085	95·14	96·90
0·8800	66·70	73·93	0·8440	81·76	86·93	0·8080	95·32	97·02
0·8795	66·91	74·13	0·8435	81·96	87·09	0·8075	95·50	97·15
0·8790	67·13	74·33	0·8430	82·15	87·24	0·8070	95·68	97·27
0·8785	67·33	74·52	0·8425	82·35	87·40	0·8065	95·86	97·39
0·8780	67·54	74·70	0·8420	82·54	87·55	0·8060	96·03	97·51
0·8775	67·75	74·89	0·8415	82·73	87·70	0·8055	96·20	97·62
0.8770	67·96	75·08	0·8410	82·92	87·85	0·8050	96·37	97·73
0·8765	68·17	75·27	0·8405	83·12	88·00	0·8045	96·53	97·83
0·8760	68·38	75·45	0·8400	83·31	88·16	0·8040	96·70	97·94
0·8755	68·58	75·64	0·8395	83·50	88·31	0·8035	96·87	98·05
0·8750	68·79	75·83	0·8390	83·69	88·46	0·8030	97·03	98·16
0·8745	69·00	76 01	0·8385	83·88	88·61	0·8025	97·20	98·27
0·8740	69·21	76·20	**0·8380***	84·08	88·76	0·8020	97·37	98·37
0·8735	69·42	76·39	0·8375	84·28	88·92	0·8015	97·53	98·48
0·8730	69·63	76·57	0·8370	84·48	89·08	0·8010	97·70	98·59
0·8725	69·83	76·76	0·8365	84·68	89·24	0·8005	97·87	98·69
0·8720	70·04	76·94	0·8360	84·88	89·39	0·8000	98·03	98·80
0·8715	70·24	77·12	0·8355	85·08	89·55	0·7995	98·19	98·89
0·8710	70·44	77·29	0·8350	85·27	89·70	0·7990	98·34	98·98
0·8705	70·64	77·46	0·8345	85·46	89·84	0·7985	98·50	99·07
0·8700	70·84	77·64	0·8340	85·65	89·99	0·7980	98·66	99·16
0·8695	71·04	77·82	0·8335	85·85	90·14	0·7975	98·81	99·26
0·8690	71·25	78·00	0·8330	86·04	90·29	0·7970	98·97	99·35
0·8685	71·46	78·18	0·8325	86·23	90·43	0·7965	99·13	99·45
0·8680	71·67	78·36	0·8320	86·42	90·58	0·7960	99·29	99·55
0·8675	71·88	78·55	0·8315	86·62	90·73	0·7955	99·45	99·65
0·8670	72·09	78·73	0·8310	86·81	90·88	0·7950	99·61	99·75
0·8665	72·30	78·93	0·8305	87·00	91·02	0·7945	99·78	99·86
0·8660	72·52	79·12	0·8300	87·19	91·17	0·7940	99·94	99·96
0·8655	72·74	79·31	0·8295	87·38	91·31		Absolute	Alcohol.
0·8650	72·96	79·50	0·8290	87·58	91·46	0·7938	100·00	100·00
0·8645	73·17	79·68	0·8285	87·77	91·60			

* Spiritus Rectificatus.

† Officinal alcohol.

TABLES SHOWING SPECIFIC GRAVITY CORRESPONDING WITH DEGREES OF HYDROMETERS.

Baumé's hydrometer is usually employed. In this instrument, the sp. gr. of distilled water is assumed as the zero of the descending scale, in relation to fluids heavier than itself, and as ten on the ascending scale in relation to lighter fluids. In the following tables, the specific gravity of liquids is given, corresponding with the several degrees of this hydrometer. The first column of specific gravities is taken from the French Codex. The second is based on the calculations of Huss. The third column was calculated by Mr. Henry Pemberton, of Philadelphia, in 1851. The figures in this column correspond with the degrees of the hydrometers prepared by the late Dr. W. H. Pile.

For Liquids Lighter than Water.

Degree of hydrometer.	Specific Gravity.			Degree of hydrometer.	Specific Gravity.		
	By Baumé.				By Baumé.		
10	1·000	1·0000	1·0000	44	0·809	0·8047	0·8045
11	0·993	0·9930	0·9929	45	0·804	0·8001	0·8000
12	0·986	0·9861	0.9859	46	0·800	0·7956	0·7954
13	0·979	0·9792	0·9790	47	0·795	0·7911	0·7909
14	0·973	0·9724	0·9722	48	0·791	0·7866	0·7865
15	0·966	0·9657	0·9655	49	0·787	0·7821	0·7821
16	0·960	0.9591	0·9589	50	0·783	0·7777	0·7777
17	0·953	0·9526	0·9523	51	0·778	0·7733	0·7734
18	0·947	0·9462	0·9459	52	0·774	0·7689	0·7692
19	0·941	0·9399	0·9395	53	0·770	0·7646	0·7650
20	0·935	0·9336	0·9333	54	0·766	0·7603	0·7608
21	0·929	0·9274	0·9271	55	0·762	0·7560	0·7567
22	0·923	0·9212	0·9210	56	0·758	0·7518	0·7526
23	0·917	0·9151	0·9150	57	0·754	0·7476	0·7486
24	0·911	0·9091	0·9090	58	0·750	0·7435	0·7446
25	0·905	0·9032	0·9032	59	0·746	0·7394	0·7407
26	0·900	0·8974	0·8974	60	0·742	0·7354	0·7368
27	0·894	0·8917	0·8917	61	0·738	0·7314	0·7329
28	0·889	0·8860	0·8860	62	0·735	0·7275	0·7290
29	0·883	0·8804	0·8805	63	0·731	………	0·7253
30	0·878	0·8748	0·8750	64	0·727	………	0·7216
31	0·872	0·8693	0·8695	65	0·724	………	0·7179
32	0·867	0.8638	0·8641	66	0·720	………	0·7142
33	0·862	0·8584	0·8588	67	0·716	………	0·7106
34	0·857	0·8531	0·8536	68	0·713	………	0·7070
35	0·852	0·8479	0·8484	69	0·709	………	0·7035
36	0·847	0·8428	0·8433	70	0·706	………	0·7000
37	0·842	0·8378	0·8383	71	0·702	………	0·6965
38	0·837	0·8329	0·8333	72	0·699	………	0·6930
39	0·832	0·8281	0·8284	73	0·696	………	0·6896
40	0·827	0·8233	0·8235	74	0·692	………	0·6863
41	0·823	0·8186	0·8187	75	0·689	………	0·6829
42	0·818	0·8139	0.8139	76	0·686	………	0·6796
43	0·813	0·8093	0·8092	77	0·682	………	0·6763

The following formulas, furnished by Dr. Pile, may prove useful by enabling any one to calculate the sp. gr. corresponding with the several degrees of Baumé's hydrometer, and, conversely, the degree of Baumé's corresponding with the sp. gr.

1. *For Liquids lighter than Water.* The following formulas give the sp. gr. as represented in the first column in the foregoing table; or, the specific gravity being known, give the correspondent degree of Baumé.

$$\frac{144}{\text{B}^\circ+134}=\text{sp. gr.};\ \text{and}\ \frac{144}{\text{sp. gr.}}-134=\text{B}^\circ.$$

The following formulas apply to the third column of specific gravities.

$$\frac{140}{\text{B}^\circ+130}=\text{sp. gr.};\ \text{and}\ \frac{140}{\text{sp. gr.}}-130=\text{B}^\circ.$$

2. *For Liquids heavier than Water.* For the first column, $\frac{144}{144-\text{B}^\circ}=\text{sp. gr.}$, and $144-\frac{144}{\text{sp. gr.}}=\text{B}^\circ$; for the third, $\frac{145}{145-\text{B}^\circ}=\text{sp. gr.}$, and $145-\frac{145}{\text{sp. gr.}}=\text{B}^\circ$.

For Liquids heavier than Water.

Degree of hydrometer.	Specific Gravity.			Degree of hydrometer.	Specific Gravity.		
	By Baumé.				By Baumé.		
0	1·000	1·0000	1·0000	38	1·359	1·3559	1·3551
1	1·007	1·0070	1·0069	39	1·372	1·3686	1·3679
2	1·014	1·0141	1·0139	40	1·384	1·3815	1·3809
3	1·022	1·0213	1·0211	41	1·398	1·3947	1·3942
4	1·029	1·0286	1·0283	42	1·412	1·4082	1·4077
5	1·036	1·0360	1·0357	43	1·426	1·4219	1·4215
6	1·044	1·0435	1·0431	44	1·440	1·4359	1·4356
7	1·052	1·0511	1·0507	45	1·454	1·4501	1·4500
8	1·060	1·0588	1·0583	46	1·470	1·4645	1·4646
9	1·067	1·0666	1·0661	47	1·485	1·4792	1·4795
10	1·075	1·0745	1·0740	48	1·501	1·4942	1·4949
11	1·083	1·0825	1·0820	49	1·516	1·5096	1·5104
12	1·091	1·0906	1·0902	50	1·532	1·5253	1·5263
13	1·100	1·0988	1·0984	51	1·549	1·5413	1·5425
14	1·108	1·1071	1·1068	52	1·566	1·5576	1·5591
15	1·116	1·1155	1·1153	53	1·583	1·5742	1·5760
16	1·125	1·1240	1·1240	54	1·601	1·5912	1·5934
17	1·134	1·1326	1·1328	55	1·618	1·6086	1·6111
18	1·143	1·1414	1·1417	56	1·637	1·6264	1·6292
19	1·152	1·1504	1·1507	57	1·656	1·6446	1·6477
20	1·161	1·1596	1·1600	58	1·676	1·6632	1·6666
21	1·171	1·1690	1·1693	59	1·695	1·6823	1·6860
22	1·180	1·1785	1·1788	60	1·715	1·7019	1·7058
23	1·190	1·1882	1·1885	61	1·736	1·7220	1·7261
24	1·199	1·1981	1·1983	62	1·758	1·7427	1·7469
25	1·210	1·2082	1·2083	63	1·779	1·7610	1·7682
26	1·221	1·2184	1·2184	64	1·801	1·7856	1·7901
27	1·231	1·2288	1·2288	65	1·823	1·8082	1·8125
28	1·242	1·2394	1·2393	66	1·847	1·8312	1·8354
29	1·252	1·2502	1·2500	67	1·872	1·8548	1·8589
30	1·261	1·2612	1·2608	68	1·897	1·8790	1·8831
31	1·275	1·2724	1·2719	69	1·921	1·9038	1·9079
32	1·286	1·2838	1·2831	70	1·946	1·9291	1·9333
33	1·298	1·2954	1·2946	71	1·974	1·9548	1·9595
34	1·309	1·3072	1·3063	72	2·002	1·9809	1·9863
35	1·321	1·3190	1·3181	73	2·031	2·0073	2·0139
36	1·334	1·3311	1·3302	74	2·059	2·0340	2·0422
37	1·346	1·3434	1·3425	75	2·087	2·0610	2·0714

Gay-Lussac's centesimal alcoholmeter is applicable only to alcohol. The scale of this instrument is divided into 100 unequal degrees, the zero corresponding to pure water, and 100° to absolute alcohol; and every intermediate degree expresses the percentage of pure alcohol, by measure, contained in the liquors examined. Thus, when the instrument stands at 40° in any alcoholic liquid, it indicates that 100 measures of the liquid contain 40 of pure alcohol and 60 of water. But, as it was graduated for the temperature of 59° of Fahrenheit, the liquors to be tested should be brought to that temperature. *Tralles's centesimal alcoholmeter* is the one used by the U. S. Government in gauging the strength of spirit, and is generally employed in this country by distillers and wholesale dealers in the purchase and sale of alcoholic liquors. The scale of this instrument is, like Gay-Lussac's, divided into 100 unequal parts, each corresponding to the percentage by volume of pure alcohol contained in the liquors examined. As the sp. gr. of water is considered as unity at its temperature of greatest density 39·8° F., and the degrees of this scale are calculated for 60° F., the zero, corresponding to the density of water, will represent a sp. gr. of ·9991.

The following table of Tralles gives the percentage of alcohol *by measure* corresponding with the specific gravity. Under alcohol in the first part of this work a table of the percentage by weight corresponding with the sp. gr. is given. By means of these tables, in connection with the alcoholmeter, every problem that can arise in reference to the strength of spirituous liquors can be solved; and by the appended table, giving the value of Baumé's degrees in those of Tralles, the facility is still further extended.

Alcoholmetrical Table of Tralles.

Alcohol in 100 measures of spirit.	Specific gravity at 60° Fahr.	Alcohol in 100 measures of spirit.	Specific gravity at 60° Fahr.	Alcohol in 100 measures of spirit.	Specific gravity at 60° Fahr.	Alcohol in 100 measures of spirit.	Specific gravity at 60° Fahr.
0	·9991	26	·9689	51	·9315	76	·8739
1	·9976	27	·9679	52	·9295	77	·8712
2	·9961	28	·9668	53	·9275	78	·8685
3	·9947	29	·9657	54	·9254	79	·8658
4	·9933	30	·9646	55	·9234	80	·8631
5	·9919	31	·9634	56	·9213	81	·8603
6	·9906	32	·9622	57	·9192	82	·8575
7	·9893	33	·9609	58	·9170	83	·8547
8	·9881	34	·9596	59	·9148	84	·8518
9	·9869	35	·9583	60	·9126	85	·8488
10	·9857	36	·9570	61	·9104	86	·8458
11	·9845	37	·9556	62	·9082	87	·8428
12	·9834	38	·9541	63	·9059	88	·8397
13	·9823	39	·9526	64	·9036	89	·8365
14	·9812	40	·9510	65	·9013	90	·8332
15	·9802	41	·9494	66	·8989	91	·8299
16	·9791	42	·9478	67	·8965	92	·8265
17	·9781	43	·9461	68	·8941	93	·8230
18	·9771	44	·9444	69	·8917	94	·8194
19	·9761	45	·9427	70	·8892	95	·8157
20	·9751	46	·9409	71	·8867	96	·8118
21	·9741	47	·9391	72	·8842	97	·8077
22	·9731	48	·9373	73	·8817	98	·8034
23	·9720	49	·9354	74	·8791	99	·7988
24	·9710	50	·9335	75	·8765	100	·7939
25	·9700						

Table showing the Value of the Degrees of Baumé's Hydrometer in those of Tralles's Alcoholmeter.

Baumé.	Tralles.	Baumé.	Tralles.	Baumé.	Tralles.	Baumé.	Tralles.
10·12	·0	20	50·1	30	75·6	40	92·9
11	4·3	21	53·2	31	77·6	41	94·2
12	9·8	22	56·1	32	79·6	42	95·5
13	16·1	23	58·9	33	81·5	43	96·7
14	22·9	24	61·6	34	83·4	44	97·8
15	29·2	25	64·2	35	85·1	45	98·8
16	34·5	26	66·6	36	86·8	46	99·7
17	39·2	27	69·0	37	88·4	46·37	100·0
18	43·1	28	71·3	38	90·0		
19	46·8	29	73·5	39	91·4		

RELATIONS BETWEEN THERMOMETERS.

In *Fahrenheit's* thermometer, the freezing point of water is placed at 32°, and the boiling point at 212°, and the number of intervening degrees is 180.

The *Centigrade* or *Celsius's* thermometer, which is now recognized in the U. S. Pharmacopœia and has been adopted generally by scientists, marks the freezing point *zero*, and the boiling point 100°.

In *Reaumur's* thermometer the freezing point is at *zero*, and the boiling point at 80°.

In *De Lisle's* thermometer, used in Russia, the graduation begins at the boiling point, which is marked *zero*, while the freezing point is placed at 150°.

From the above statement, it is evident that 180 degrees of Fahrenheit are equal to 100° of the Centigrade, 80° of Reaumur, and 150° of De Lisle; or 1 degree of the first is equal to $\frac{5}{9}$ of a degree of the second, $\frac{4}{9}$ of a degree of the third, and $\frac{5}{6}$ of a degree of the last. It is easy, therefore, to convert the degrees of one into the equivalent number of degrees of the other; but in ascertaining the corresponding points upon the different scales, it is necessary to take into consideration their different modes of graduation. Thus, as the zero of Fahrenheit is 32° below the point at which that of the Centigrade and of Reaumur is placed, this number must be taken into account in the calculation.

1. If any degree on the *Centigrade* scale, either above or below zero, be multiplied by 1·8, the result will, in either case, be the number of degrees above or below 32°, or the freezing point of *Fahrenheit.*

2. The number of degrees between any point of *Fahrenheit's* scale and 32°, if divided by 1·8, will give the corresponding point on the *Centigrade.*

THERMOMETRIC EQUIVALENTS.

ACCORDING TO THE CENTIGRADE AND FAHRENHEIT SCALES.

C.°	F.°	C.°	F.°	C.°	F.°	C.°	F.°	C.°	F.°
—39·4	—39	—14	6·8	11·1	52	36·6	98	62	143·6
—39	—38·2	—13·8	7	11·6	53	37	98·6	62·2	144
—38·8	—38	—13·3	8	12	53·6	37·2	99	62·7	145
—38 3	—37	—13	8·6	12·2	54	37·7	100	63	145·4
—38	—36·4	—12·7	9	12·7	55	38	100·4	63·3	146
—37·7	—36	—12·2	10	13	55·4	38·3	101	63·8	147
—37·2	—35	—12	10·4	13·3	56	38·8	102	64	147·2
—37	—34·6	—11·6	11	13·8	57	39	102·2	64·4	148
—36·6	—34	—11·1	12	14	57·2	39·4	103	65	149
—36·1	—33	—11	12·2	14·4	58	40	104	65·5	150
—36	—32·8	—10·5	13	**15**	**59**	40·5	105	66	150·8
—35·5	—32	—10	14	15·5	60	41	105·8	66·1	151
—35	—31	—9·4	15	16	60·8	41·1	106	66·6	152
—34·4	—30	—9	15·8	16·1	61	41·6	107	67	152·6
—34	—29·2	—8·8	16	16·6	62	42	107·6	67·2	153
—33·8	—29	—8·3	17	17	62·6	42·2	108	67·7	154
—33·3	—28	—8	17·6	17·2	63	42·7	109	68	154·4
—33	—27·4	—7·7	18	17·7	64	43	109·4	68·3	155
—32·7	—27	—7·2	19	18	64·4	43·3	110	68·8	156
—32·2	—26	—7	19·4	18·3	65	43·8	111	69	156·2
—32	—25·6	—6·6	20	18·8	66	44	111·2	69·4	157
—31·6	—25	—6·1	21	19	66·2	44·4	112	70	158
—31·1	—24	—6	21·2	19·4	67	45	113	70·5	159
—31	—23·8	—5·5	22	20	68	45·5	114	71	159·8
—30·5	—23	—5	23	20·5	69	46	114·8	71·1	160
—30	—22	—4·4	24	21	69·8	46·1	115	71·6	161
—29·4	—21	—4	24·8	21·1	70	46·6	116	72	161·6
—29	—20·2	—3·8	25	21·6	71	47	116·6	72·2	162
—28·8	—20	—3·3	26	22	71·6	47·2	117	72·7	163
—28·3	—19	— 3	26·6	22·2	72	47·7	118	73	163·4
—28	—18·4	—2·7	27	22·7	73	48	118·4	73·3	164
—27·7	—18	—2·2	28	23	73·4	48·3	119	73·8	165
—27·2	—17	—2	28·4	23·3	74	48·8	120	74	165·2
—27	—16·6	—1·6	29	23·8	75	49	120·2	74·4	166
—26·6	—16	—1·1	30	24	75·2	49·4	121	75	167
—26·1	—15	—1	30·2	24·4	76	50	122	75·5	168
—26	—14·8	—0·5	31	**25**	**77**	50·5	123	76	168·8
—25·5	—14	**0**	**32**	25·5	78	51	123·8	76·1	169
—25	—13	0·5	33	26	78·8	51·1	124	76·6	170
—24·4	—12	1	33·8	26·1	79	51·6	125	77	176·6
—24	—11·2	1·1	34	26·6	80	52	125·6	77·2	171
—23·8	—11	1·6	35	27	80·6	52·2	126	77·7	172
—23·3	—10	2	35·6	27·2	81	52·7	127	78	172·4
—23	—9·4	2·2	36	27·7	82	53	127·4	78·3	173
—22·7	—9	2·7	37	28	82·4	53·3	128	78·8	174
—22·2	—8	3	37·4	28·3	83	53·8	129	79	174·2
—22	—7·6	3·3	38	28·8	84	54	129·2	79·4	175
—21·6	—7	3·8	39	29	84·2	54·4	130	80	176
—21·1	—6	4	39·2	29·4	85	55	131	80·5	177
—21	—5·8	4·4	40	30	86	55·5	132	81	177·8
—20·5	—5	5	41	30·5	87	56	132·8	81·1	178
—20	—4	5·5	42	31	87·8	56·1	133	81·6	179
—19·4	—3	6	42·8	31·1	88	56·6	134	82	179·6
—19	—2·2	6·1	43	31·6	89	57	134·6	82·2	180
—18·8	—2	6·6	44	32	89·6	57·2	135	82·7	181
—18·3	—1	7	44·6	32·2	90	57·7	136	83	181·4
—18	—0·4	7·2	45	32·7	91	58	136·4	83·3	182
—17·7	0	7·7	46	33	91·4	58·3	137	83·8	183
—17·2	1	8	46·4	33·3	92	58·8	138	84	183·2
—17	1·4	8·3	47	33·8	93	59	138·2	84·4	184
—16·6	2	8·8	48	34	93·2	59·4	139	85	185
—16.1	3	9	48·2	34·4	94	60	140	85·5	186
—16	3·2	9·4	49	35	95	60·5	141	86	186·8
—15·5	4	10	50	35·5	96	61	141·8	86·1	187
—15	5	10·5	51	36	96·8	61·1	142	86·6	188
—14·4	6	11	51·8	36·1	97	61·6	143	87	188·6

Thermometric Equivalents.—(Continued.)

C.°	F.°	C.°	F.°	C.°	F.°	C.°	F.°	C.°	F.°
87·2	189	114·4	238	142	287·6	169	336·2	196·6	386
87·7	190	115	239	142·2	288	169·4	337	197	386·6
88	190·4	115·5	240	142·7	289	170	338	197·2	387
88·3	191	116	240·8	143	289·4	170·5	339	197·7	388
88·8	192	116·1	241	143·3	290	171	339·8	198	388·4
89	192·2	116·6	242	143·8	291	171·1	340	198·3	389
89·4	193	117	242·6	144	291·2	171·6	341	198·8	390
90	194	117·2	243	144·4	292	172	341·6	199	390·2
90·5	195	117·7	244	145	293	172·2	342	199·4	391
91	195·8	118	244·4	145·5	294	172·7	343	200	392
91·1	196	118·3	245	146	294·8	173	343·4	200·5	393
91·6	197	118·8	246	146·1	295	173·3	344	201	393·8
92	197·6	119	246·2	146·6	296	173·8	345	201·1	394
92·2	198	119·4	247	147	296·6	174	345·2	201·6	395
92·7	199	120	248	147·2	297	174·4	346	202	395·6
93	199·4	120·5	249	147·7	298	175	347	202·2	396
93·3	200	121	249·8	148	298·4	175·5	348	202·7	397
93·8	201	121·1	250	148·3	299	176	348·8	203	397·4
94	201·2	121·6	251	148·8	300	176·1	349	203·3	398
94·4	202	122	251·6	149	300·2	176·6	350	203·8	399
95	203	122·2	252	149·4	301	177	350·6	204	399·2
95·5	204	122·7	253	150	302	177·2	351	204·4	400
96	204·8	123	253·4	150·5	303	177·7	352	205	401
96·1	205	123·3	254	151	303·8	178	352·4	205·5	402
96·6	206	123·8	255	151·1	304	178·3	353	206	402·8
97	206·6	124	255·2	151·6	305	178·8	354	206·1	403
97·2	207	124·4	256	152	305·6	179	354·2	206·6	404
97·7	208	125	257	152·2	306	179·4	355	207	404·6
98	208·4	125·5	258	152·7	307	180	356	207·2	405
98·3	209	126	258·8	153	307·4	180·5	357	207·7	406
98·8	210	126·1	259	153·3	308	181	357·8	208	406·4
99	210·2	126·6	260	153·8	309	181·1	358	208·3	407
99·4	211	127	260·6	154	309·2	181·6	359	208·8	408
100	**212**	127·2	261	154·4	310	182	359·6	209	408·2
100·5	213	127·7	262	155	311	182·2	360	209·4	409
101	213·8	128	262·4	155·5	312	182·7	361	210	410
101·1	214	128·3	263	156	312·8	183	361·4	210·5	411
101·6	215	128·8	264	156·1	313	183·3	362	211	411·8
102	215·6	129	261·2	156·6	314	183·8	363	211·1	412
102·2	216	129·4	265	157	314·6	184	363·2	211·6	413
102·7	217	130	266	157·2	315	184·4	364	212	413·6
103	217·4	130·5	267	157·7	316	185	365	212·2	414
103·3	218	131	267·8	158	316·4	185·5	366	212·7	415
103·8	219	131·1	268	158·3	317	186	366·8	213	415·4
104	219·2	131·6	269	158·8	318	186·1	367	213·3	416
104·4	220	132	269·6	159	318·2	186·6	368	213·8	417
105	221	132·2	270	159·4	319	187	368·6	214	417·2
105·5	222	132·7	271	160	320	187·2	369	214·4	418
106	222·8	133	271·4	160·5	321	187·7	370	215	419
106·1	223	133·3	272	161	321·8	188	370·4	215·5	420
106·6	224	133·8	273	161·1	322	188·3	371	216	420·8
107	224·6	134	273·2	161·6	323	188·8	372	216·1	421
107·2	225	134·4	274	162	323·6	189	372·2	216·6	422
107·7	226	135	275	162·2	324	189·4	373	217	422·6
108	226·4	135·5	276	162·7	325	190	374	217·2	423
108·3	227	136	276·8	163	325·4	190·5	375	217·7	424
108·8	228	136·1	277	163·3	326	191	375·8	218	424·4
109	228·2	136·6	278	163·8	327	191·1	376	218·3	425
109·4	229	137	278·6	164	327·2	191·6	377	218·8	426
110	230	137·2	279	164·4	328	192	377·6	219	426·2
110·5	231	137·7	280	165	329	192·2	378	219·4	427
111	231·8	138	280·4	165·5	330	192·7	379	220	428
111·1	232	138·3	281	166	330·8	193	379·4	220·5	429
111·6	233	138·8	282	166·1	331	193·3	380	221	429·8
112	233·6	139	282·2	166·6	332	193·8	381	221·1	430
112·2	234	139·4	283	167	332·6	194	381·2	221·6	431
112·7	235	140	284	167·2	333	194·4	382	222	431·6
113	235·4	140·5	285	167·7	334	195	383	222·2	432
113·3	236	141	285·8	168	334·4	195·5	384	222·7	433
113·8	237	141·1	286	168·3	335	196	384·8	223	433·4
114	237·2	141·6	287	168·8	336	196·1	385	223·3	434

Thermometric Equivalents.—(Continued.)

C.°	F.°	C.°	F.°	C.°	F.°	C.°	F.°	C.°	F.°
223·8	435	251·1	484	278·3	533	306	582·8	333	631·4
224	435·2	251·6	485	273·8	534	306·1	583	333·3	632
224·4	436	252	485·6	279	534·2	306·6	584	333·8	633
225	437	252·2	486	279·4	535	307	584·6	334	633·2
225·5	438	252·7	487	280	536	307·2	585	334·4	634
226	438·8	253	487·4	280·5	537	307·7	586	335	635
226·1	439	253·3	488	281	537·8	308	586·4	335·5	636
226·6	440	253·8	489	281·1	538	308·3	587	336	636·8
227	440·6	254	489·2	281·6	539	308·8	588	336·1	637
227·2	441	254·4	490	282	539·6	309	588·2	336·6	638
227·7	442	255	491	282·2	540	309·4	589	337	638·6
228	442·4	255·5	492	282·7	541	310	590	337·2	639
228·3	443	256	492·8	283	541·4	310·5	591	337·7	640
228·8	444	256·1	493	283·3	542	311	591·8	338	640·4
229	444·2	256·6	494	283·8	543	311·1	592	338·3	641
229·4	445	257	494·6	284	543·2	311·6	593	338·8	642
230	446	257·2	495	284·4	544	312	593·6	339	642·2
230·5	447	257·7	496	285	545	312·2	594	339·4	643
231	447·8	258	496·4	285·5	546	312·7	595	340	644
231·1	448	258·3	497	286	546·8	313	595·4	340·5	645
231·6	449	258·8	498	286·1	547	313·3	596	341	645·8
232	449·6	259	498·2	286·6	548	313·8	597	341·1	646
232·2	450	259·4	499	287	548·6	314	597·2	341·6	647
232·7	451	260	500	287·2	549	314·4	598	342	647·6
233	451·4	260·5	501	287·7	550	315	599	342·2	648
233·3	452	261	501·8	288	550·4	315·5	600	342·7	649
233·8	453	261·1	502	288·3	551	316	600·8	343	649·4
234	453·2	261·6	503	288·8	552	316·1	601	343·3	650
234·4	454	262	503·6	289	552·2	316·6	602	343·8	651
235	455	262·2	504	289·4	553	317	602·6	344	651·2
235·5	456	262·7	505	290	554	317·2	603	344·4	652
236	456·8	263	505·4	290·5	555	317·7	604	345	653
236·1	457	263·3	506	291	555·8	318	604·4	345·5	654
236·6	458	263·8	507	291·1	556	318·3	605	346	654·8
237	458·6	264	507·2	291·6	557	318·8	606	346·1	655
237·2	459	264·4	508	292	557·6	319	606·2	346·6	656
237·7	460	265	509	292·2	558	319·4	607	347	656·6
238	460·4	265·5	510	292·7	559	320	608	347·2	657
238·3	461	266	510·8	293	559·4	320·5	609	347·7	658
238·8	462	266·1	511	293·3	560	321	609·8	348	658·4
239	462·2	266·6	512	293·8	561	321·1	610	348·3	659
239·4	463	267	512·6	294	561·2	321·6	611	348·8	660
240	464	267·2	513	294·4	562	322	611·6	349	660·2
240·5	465	267·7	514	295	563	322·2	612	349·4	661
241	465·8	268	514·4	295·5	564	322·7	613	350	662
241·1	466	268·3	515	296	564·8	323	613·4	350·5	663
241·6	467	268·8	516	296·1	565	323·3	614	351	663·8
242	467·6	269	516·2	296·6	566	323·8	615	351·1	664
242·2	468	269·4	517	297	566·6	324	615·2	351·6	665
242·7	469	270	518	297·2	567	324·4	616	352	665·6
243	469·4	270·5	519	297·7	568	325	617	352·2	666
243·3	470	271	519·8	298	568·4	325·5	618	352·7	667
243·8	471	271·1	520	298·3	569	326	618·8	353	667·4
244	471·2	271·6	521	298·8	570	326·1	619	353·3	668
244·4	472	272	521·6	299	570·2	326·6	620	353·8	669
245	473	272·2	522	299·4	571	327	620·6	354	669·2
245·5	474	272·7	523	300	572	327·2	621	354·4	670
246	474·8	273	523·4	300·5	573	327·7	622	355	671
246·1	475	273·3	524	301	573·8	328	622·4	355·5	672
246·6	476	273·8	525	301·1	574	328·3	623	356	672·8
247	476·6	274	525·2	301·6	575	328·8	624	356·1	673
247·2	477	274·4	526	302	575·6	329	624·2	356·6	674
247·7	478	275	527	302·2	576	329·4	625	357	674·6
248	478·4	275·5	528	302·7	577	330	626	357·2	675
248·3	479	276	528·8	303	577·4	330·5	627	357·7	676
248·8	480	276·1	529	303·3	578	331	627·8	358	676·4
249	480·2	276·6	530	303·8	579	331·1	628	358·3	677
249·4	481	277	530·6	304	579·2	331·6	629	358·8	678
250	482	277·2	531	304·4	580	332	629·6	359	678·2
250·5	483	277·7	532	305	581	332·2	630	359·4	679
251	483·8	278	532·4	305·5	582	332·7	631	360	680

MINERAL SPRING WATERS.

While the general character of natural waters has been alluded to under the heading Aqua, in Part I., it has been thought advisable to give here analyses of all American mineral springs of known medicinal value, together with a number of well-known European mineral waters.

NEW ENGLAND MINERAL SPRINGS.

Alburg Springs, Grand Isle Co., Vt.

(*Sulphuretted.*)

One pint contains,— (C. T. Jackson, M.D.)	Grains.
Sodium chloride	1·095
Magnesium chloride	0·627
Calcium chloride and carbonate	0·601
Potassium sulphate and sulphide	1·237
Sodium sulphate	0·887
Insoluble matters	0·100
Organic soil acid and loss	0·250
Total	4·797

(The water gives off a large quantity of sulphuretted hydrogen, and is distinctly alkaline from excess of potassium sulphide.—C. T. J.)

Birchdale Springs, Concord, N.H.

(*Calcareous.*)

One pint contains,— (C. F. Chandler, 1873.)	Grains.
Sodium carbonate	0·016
Magnesium carbonate	0·063
Ferrous carbonate	0·034
Calcium carbonate	0·182
Sodium chloride	0·047
Potassium sulphate	0·008
Sodium sulphate	0·032
Sodium phosphate	0·001
Alumina	0·014
Silica	0·115
Organic matter	0·084
Total	0·596

Clarendon Springs, Rutland Co., Vt.

(*Calcareous.*)

One pint contains,— (A. A. Hayes, M.D.)	Grains.
Calcium carbonate	0·38
Calcium chloride Sodium sulphate Magnesium sulphate	0·34
Total	0·72
	Cubic inches.
Carbonic acid gas	5·77
Nitrogen gas	1·20

Highgate Springs, Franklin Co., Vt.

(*Sulphuretted.*)

One pint contains,—	Champlain Spring. (A. A. Hayes.) Grains.	1867. (T. Sterry Hunt.) Grains.
Potassium carbonate	0·459	....
Sodium carbonate	0·153	1·713
Magnesium carbonate	0·152	0·729
Calcium carbonate	0·127	0·175
Ammonium carbonate	trace	....
Potassium chloride	0·093	....
Sodium chloride	0·021	2·930
Sodium sulphate	....	0·306
Ferrous oxide	0·004	....
Crenic acid	0·112	....
Silicic acid	0·102	....
Total	1·223	5·853

Lubec Spring, Lubec Bay, Maine.

(*Saline.*)

One imperial gallon contains,— (Dr. C. T. Jackson.)	Grains.
Sodium chloride	199·000
Calcium sulphate	11·210
Magnesium chloride	62·840
Sodium sulphate	27·985
Ferrous carbonate	2·490
Calcium carbonate	6·250
Calcium chloride	trace
Carbonic acid gas	......
Loss	12·720
Total	322·500

Newbury, Orange Co., Vt.

(*Sulphuretted.*)

One pint contains,— (Prof. Hall.)	Grains.
Sodium carbonate	0·50
Magnesium carbonate	0·30
Calcium carbonate	2·20
Sodium chloride	0·04
Sodium sulphate	0·30
Magnesium sulphate	0·05
Ferrous phosphate	0·05
Ferrous oxide	trace
Potassium nitrate	0·05
Sodium sulphide	0·04
Silica and suspended clay	1·10
Organic matter and ammonia	0·03
Total	4·66

Gas.—Sulphuretted hydrogen, undetermined.

NEW YORK MINERAL SPRINGS.

ADIRONDACK SPRING, WHITEHALL, N.Y.

(*Carbonated.*)

One gallon contains,— (PROF. C. COLLIER.)	Grains.
Calcium sulphate	11·134
Calcium carbonate	18·543
Magnesium carbonate	16·818
Ferrous carbonate	5·040
Manganese carbonate	traces
Potassium carbonate	5·317
Sodium carbonate.	5·135
Lithium carbonate	·023
Sodium chloride	14·340
Alumina	traces
Silica	·742
or in individual constituents.	
Ferric oxide	3·129
Manganese oxide	traces
Calcium oxide	14·970
Magnesium oxide	7·914
Aluminium oxide	traces
Potassa	3·623
Soda	10·602
Lithia	·009
Silica	·742
Carbonic acid, free	31·861
Carbonic acid, combined	22·591
Sulphuric acid	6·594
Chlorine	8·701
	Cubic inches.
Free carbonic acid	67·275

AUBURN SPRINGS, NEAR AUBURN, N.Y.

(*Sulphuretted.*)

One pint contains,— (DR. CHILTON.)	Grains.
Calcium sulphate	15·00
Magnesium sulphate	3·20
Magnesium chloride	0·25
Sodium chloride	0·75
Total	19·20

Sulphuretted hydrogen, 1·5 cubic inches.

ALBANY ARTESIAN WELL, ALBANY, N.Y.

(*Saline.*)

One pint contains,— (DR. MEADE.)	Grains.
Sodium carbonate	5·00
Magnesium carbonate	2·00
Ferrous carbonate (with a little silica)	1·00
Calcium carbonate	4·00
Sodium chloride	63·00
Total	75·00
	Cubic inches.
Carbonic acid gas	28·00

This well is five hundred feet deep.

AVON SPRINGS, LIVINGSTON CO., N.Y.

(*Sulphuretted.*)

One pint contains,—	Upper Spring. (PROF. HADLEY.) Grains.	Lower Spring. (DR. J. R. CHILTON.) Grains.	New Bath Spring. (PROF. BECK.) Grains.
Calcium carbonate	1·000	3·666	3·370
Sodium chloride	2·300	....	0·710
Calcium chloride	....	1·051	....
Sodium sulphate	2·000	1·716	4·840
Magnesium sulphate.	1·250	6·201	1·010
Calcium sulphate	10 500	7·180	0·440
Sodium iodide	....	trace	....
Total	17·050	19·814	10 370
	Cubic inches.	Cubic inches.	Cubic inches.
Carbonic acid gas	0·70	0·49	......
Sulphuretted hydrogen	1·50	1·25	·050

BALLSTON SPA, SARATOGA CO., N.Y.

(*Saline.*)

One pint contains,—	United States. (Geology of N. Y.) Grains.	Ballston Artesian Lithian Well. (C. F. CHANDLER.) Grains.	Franklin Artesian Well. (C. F. CHANDLER.) Grains.	Condo Dentonean Well. (C. F. CHANDLER.) Grains.
Sodium carbonate	2·11	1·034	8·200	2.982
Magnesium carbonate	0·72	13·378	13·175	11·729
Ferrous carbonate	trace	0·143	0.146	0·208
Calcium carbonate	3·65	20·675	17·565	15·494
Lithium carbonate	......	0·701	0·613	0·950
Strontium carbonate	......	0·083	trace	0.018
Barium carbonate	......	0·397	0·125	0·484
Potassium chloride	......	4·159	4·241	1·154
Sodium chloride	53·12	93·753	82·418	80·685
Potassium sulphate	......	0·065	0·095	trace
Sodium sulphate	0·22	....	....	....
Sodium phosphate	......	0·006	0.001	trace
Sodium iodide	......	0·015	0·029	0·028
Sodium bromide	......	0·455	0·583	0·296
Calcium fluoride	......	trace	trace	trace
Sodium biborate	......	trace	trace	trace
Alumina	......	0·009	0·032	0·049
Silica	1·00	0·095	0·092	0·128
Organic matter	......	trace	trace	trace
Total	60·82	134·968	127·315	114·205
	Cubic inches.	Cubic inches.	Cubic inches.	Cubic inches.
Carbonic acid gas	30·50	53.26	57·51	44·79

BALLSTON SPA, SARATOGA CO., N.Y.

(Saline.)

One wine gallon contains,— (STEEL.)	Grains.
Sodium chloride	143·733
Sodium bicarbonate	12·66
Magnesium bicarbonate	39·1
Calcium carbonate	43·407
Ferrous carbonate	5·95
Sodium iodide	1·3
Silica	1·
Total	247·15

CLIFTON SPRINGS, ONTARIO CO., N.Y.

(Sulphuretted.)

One pint contains,— (PROF. J. R. CHILTON.)	Grains.
Magnesium carbonate	1·64
Calcium carbonate	1·21
Sodium chloride	1·16
Magnesium chloride	0·51
Calcium chloride	0·51
Sodium sulphate	0·97
Magnesium sulphate	2·06
Calcium sulphate	8·65
Organic matter	trace
Total	16·71

"Sulphuretted hydrogen and carbonic acid abound, but, the quantity having been materially lessened while conveyed to New York, the proper amount could not be ascertained."

CHERRY VALLEY, OTSEGO CO., N.Y.

One pint contains,—	*(Sulphuretted.)*		*(Saline.)*
	Bath-House Spring. (J. R. CHILTON, M.D.) Grains.	Spring, North of Bath-House. (PROF. PERKINS.) Grains.	Phosphate Spring. (PROF. PERKINS.) Grains.
Magnesium carbonate	2·227	1·245	0·572
Ferrous carbonate	....	0·306	0·078
Calcium carbonate	1·177	1·844	0·358
Potassium chloride	....	0·311	....
Sodium chloride	1·555	0·266	0·059
Magnesium chloride	0·460	....	....
Calcium chloride	0·350	....	....
Sodium sulphate	1·385	....	....
Magnesium sulphate	3·070	....	....
Calcium sulphate	7·210	18·683	0·659
Sodium sulphide	0·075	....	....
Silica and alumina	0·045	....	....
Silex	....	0·455	....
Calcium phosphate	....	....	1·721
Silica	....	....	0·078
Organic matter	0·035	....	....
Total	17·589	23·110	3·525

CHITTENANGO SPRINGS, MADISON CO., N.Y.

(Sulphuretted.)

One pint contains,—	White Sulphur. (PROF. C. F. CHANDLER.) Grains.	Cave Spring. (C. F. CHANDLER.) Grains.	Magnesia. (C. F. CHANDLER.) Grains.
Magnesium carbonate	1·631	1·776	1·439
Ferrous carbonate	0·007	0·014	0·029
Potassium chloride	0·019	0·029	0·041
Sodium chloride	0·129	0·196	0·229
Lithium chloride	trace	trace	trace
Sodium sulphate	0·027	....	....
Magnesium sulphate	0·244	0·948	1·589
Calcium sulphate	10·177	3·265	14·385
Strontium sulphate	trace	trace	trace
Sodium sulphide	0·014	0·043	0·094
Calcium sulphide	....	0·140	0·116
Sodium hyposulphite	....	0·032	0·002
Alumina	0·010	0·027	trace
Silica	0·035	0·064	0·072
Total	12·293	16·534	17·996
	PROF. COLLIER. Cubic inches.	PROF. COLLIER. Cubic inches.	PROF. COLLIER. Cubic inches.
Carbonic acid gas	4·5	3·2	2·3
Sulphuretted hydrogen	0·1	0·4	1·6

COLUMBIA SPRINGS, HUDSON, COLUMBIA CO., N.Y.

(*Sulphuretted.*)

One pint contains,— (ATWOOD.)	Grains.
Calcium carbonate	2·724
Potassium chloride	0·149
Sodium chloride	10·590
Magnesium chloride	3·929
Ferric chloride	0·427
Calcium sulphate	8·117
Sodium phosphate	0·267
Sodium sulphide	1·018
Loss	0·102
Total	27·323
	Cubic inches.
Sulphuretted hydrogen	0·56

FLORIDA, MONTGOMERY CO., N.Y.

(*Sulphuretted.*)

One U. S. gallon contains,—	Grains.
Sodium sulphide	2·008
Potassium sulphate	1·390
Sodium hyposulphite	0·711
Sodium bicarbonate	22·143
Calcium bicarbonate	8·317
Magnesium bicarbonate	6·972
Sodium chloride	5·880
Alumina	trace
Silica	0·793
Ferrous sulphide	0·176
Total	43·390
	Cubic inches.
Sulphuretted hydrogen	3·765
Carbonic acid gas	32·169

LEBANON SPRINGS, COLUMBIA CO., N.Y.

(*Thermal. Temp.* 73°.)

One pint contains,— (PROF. H. DUSSANCE.)		Grains.
Sodium carbonate		0·301
Calcium carbonate		0·506
Sodium chloride		0·120
Potassium sulphate		0·130
Magnesium sulphate		0·132
Sodium sulphide		0·002
Ferric oxide		0·117
Alumina		0·056
Silicic acid		0·406
Organic compounds,	Glairine	0·094
	Barégine	1·183
Total		3·047
Gases.		Cubic inches.
Oxygen		0·25
Nitrogen		0·44
Carbonic acid		0·06
Total		0·75

LONGMUIRS WELL, ROCHESTER, N.Y.

(*Sulphuretted.*)

One pint contains,—	Grains.
Carbonates of lime and magnesia, with trace of oxide of iron	1·48
Sodium chloride	6·52
Sodium sulphate	6·99
Total	14·99
Gases.	Cubic inches.
Carbonic acid	small quantity
Sulphuretted hydrogen	2·16

MASSENA SPRINGS, ST. LAWRENCE CO., N.Y.

(*Sulphuretted.*)

One pint contains,— (PROF. FERD. F. MEYER.)	Grains.
Ferrous carbonate	0·045
Calcium carbonate	0·422
Potassium chloride	0·063
Sodium chloride	9·961
Magnesium chloride	3·741
Sodium sulphate	0·437
Calcium sulphate	7·616
Sodium hyposulphite	0·526
Sodium phosphate	0·165
Magnesium bromide	0·084
Sodium sulphide	0·176
Silicate of soda and organic compounds	1·397
Total	24·633
	Cubic inches.
Sulphuretted hydrogen	0·663

OAK ORCHARD SPRING, GENESEE CO., N.Y.

(*Acid.*)

One gallon contains,— (PROF. PORTER.)	In grains.
Sulphuric acid	133·312
Ferrous sulphate	33·216
Magnesium sulphate	8·491
Calcium sulphate	13·724
Aluminium sulphate	6·413
Potassium sulphate	2·479
Sodium sulphate	3·162
Sodium chloride	1·432
Silicic acid	3·324
Organic matter	6·654
Total grains	211·207

RICHFIELD SPRINGS, OTSEGO CO., N.Y.

(*Sulphuretted.*)

One pint contains,— (PROF. REID.)	Grains.
Magnesium carbonate	1·480
Calcium carbonate	0·870
Sodium and magnesium chlorides	0·187
Magnesium sulphate	3·750
Calcium sulphate	2·500
Magnesium and calcium sulphides	0·250
Undetermined	19·187
Total	28·224
	Cubic inches.
Sulphuretted hydrogen	3·3

SHARON SPRINGS, SCHOHARIE CO., N.Y.

(Sulphuretted.)

One pint contains,—	White Sulphur Spring. (Dr. Chilton.) Grains.	Red Sulphur. (Prof. L. Reed.) Grains.	Gardner Magnesia. (Prof. L. Reed.) Grains.	Chalybeate. (Prof. Maisch, 1861.) Grains.
Sodium carbonate	......	0·043	0·042	......
Magnesium carbonate	......	0·051	0·100	1·120
Calcium carbonate	......	1·122	0·842	......
Sodium chloride	0·28	0·041	0·154	......
Magnesium chloride	·30	0·091	0·054	......
Calcium chloride	......	0·008	0·020	......
Magnesium sulphate	5·30	2·370	2·460	1·019
Calcium sulphate	13·95	12·080	11·687	7·975
Sulphides of sodium and calcium	0.28	......	......	......
Sulphides of calcium and magnesium	......	0·111	0·781	......
Silicic acid	......	0·056	0·050	......
Potassium sulphate	......	......	......	trace
Sodium sulphate	......	......	......	0·467
Ferrous sulphate	......	......	......	0·175
Organic matter	......	......	......	3·560
Total	20·11	15·973	16·190	14·316
	Cubic inches.	Cubic inches.	Cubic inches.	
Carbonic acid	......	0·57	0·277	......
Sulphuretted hydrogen	2·	1·31	0·750	......
Atmospheric air	......	0·50	0·375	......

SARATOGA SPRINGS, SARATOGA CO., N. Y.

(Saline.)

One U. S. gallon contains,—	High Rock. (Chandler.)	Red. (Appleton.)	Congress. (Chandler.)	Columbian. (Chandler.)	Hamilton. (Steele.)	Washington. (Chilton.)	Putnam. (Chilton.)	Star. (Chandler.)	Pavilion. (Chandler.)	United States. (Chandler.)	Empire. (Chandler.)	Excelsior. (Allen.)
	Grains	Grains	Grains	Grains	Grains	Grains	Grains	Grains	Grains	Grains	Grains	Grains
Boracic acid	......	......	......	......	......	......	......	......	......	......	......	......
Silicic acid	......	......	......	......	......	1·500	......	......	......	......	......	......
Alumina	1·223	......	trace	......	......	trace	0·560	trace	0·329	0·094	0·415	......
Alumina and ferric oxide	......	2·100	......	......	......	......	......	......	......	......	......	......
Barium bicarbonate	trace	......	0·928	......	......	......	......	0·996	0·875	0·909	0·070	......
Calcium bicarbonate	131·739	101·256	143·393	68·000	92·400	84·096	68·800	124·459	120·169	93·119	109·656	77·000
Calcium chloride	......	......	......	......	......	·203	......	......	......	......	......	......
Calcium fluoride	trace	......	trace	......	......	......	......	trace	trace	trace	trace	......
Calcium phosphate	trace	......	......	......	......	......	·210	......	......	......	......	......
Calcium sulphate	......	......	......	......	......	......	......	......	......	......	......	......
Ferrous bicarbonate	1·478	......	0·340	5·580	5·390	3·800	7·000	1·213	2·570	0·714	0·793	3·215
Lithium bicarbonate	......	·942	4·761	......	......	......	......	1·586	9·486	4·847	2·080	......
Magnesium bicarbonate	54·924	42·413	121·757	46·710	35·200	65·973	51·600	61·912	76·267	72·883	42·953	32·333
Magnesium chloride	......	......	......	......	......	·680	......	......	......	......	......	......
Magnesium sulphate	......	......	......	......	......	·051	......	......	......	......	......	......
Phosphates	......	trace	......	......	......	......	......	......	......	......	......	......
Potassium bromide	......	......	......	trace	trace	·474	......	......	......	......	......	trace
Potassium chloride	8·497	6·857	8·049	......	......	......	......	9·695	7·660	8·624	4·292	......
Potassium silicate	......	......	......	......	......	......	......	......	......	......	......	7·000
Potassium sulphate	1·608	......	0·889	......	......	......	......	5·400	2·032	......	2·769	......
Silica	2·260	3·255	0·840	2·050	......	......	0·840	1·283	3·155	3·184	1·458	......
Strontium bicarbonate	trace	trace	trace	......	......	......	......	trace	trace	0 018	trace	......
Strontium sulphate	......	......	......	......	......	......	......	......	......	......	......	trace
Sodium biborate	......	......	trace	......	......	......	......	trace	trace	trace	trace	......
Sodium bicarbonate	34·888	15·327	10·775	15·400	27·036	8·474	14·320	12·662	3·764	4·666	9·022	15·000
Sodium bromide	0·731	......	8·559	......	......	......	......	0·571	0·987	0·844	0·266	......
Sodium chloride	390·127	83·530	400·444	267·000	297·300	182·733	214·300	398·361	459·903	141·872	506·630	370·642
Sodium iodide	0·086	......	0·138	2·560	3·000	2·243	2·000	0·126	0·071	0·047	0·006	4·235
Sodium phosphate	......	......	0·016	......	......	......	......	trace	0·007	0·016	0·023	......
Sodium silicate	......	......	......	......	......	......	......	......	......	......	......	4·000
Sodium sulphate	......	......	......	......	......	......	1·680	......	......	......	......	1·321
Organic matter	trace	......	......	......	......	......	......	trace	trace	trace	trace	......
Total	628·039	254·719	700·895	407·300	460·326	350·227	361·010	617·367	687·275	331·837	680·436	514·746
Carbonic acid gas	409·458	......	392·289	272·060	316·000	363·770	348.880	407·650	332·458	245·734	344·669	250·000
Temperature	52° F.	......	......	......	50° F.	45° F.	51° F.	50° F.	......	......	......	......

SARATOGA SPRINGS, SARATOGA CO., N.Y.—*Continued.*

One U. S. gallon contains,—	Saratoga A. (POHLE.)	Seltzer. (CHANDLER.)	Union. (CHANDLER.)	Hathorn. (CHANDLER.)	Eureka. (ALLEN.)	Geyser. (CHANDLER.)	Crystal. (CHANDLER.)	Champion. (CHANDLER.)	Vichy. (CHANDLER.)	Kissingen. (SHARPLESS.)	One pint contains,— Triton. (SHARPLESS.)
	Grains	Grains	Grains	Grains	Grains	Grains	Grains	Grains	Grains	Grains	Grains
Boracic acid	....	trace	....	....	....	....	....	....	....	....	....
Silicic acid	1·460	....	....	....	....	....	....	....	....	....	....
Alumina	0·380	0·374	0·324	0·131	0·231	trace	0·305	0·458	0·473	trace	trace
Alumina and ferric oxide	....	....	....	....	....	....	....	....	....	....	....
Barium bicarbonate	....	trace	1·703	1·737	....	2·014	0·726	2·083	0·593	0 992	0·102
Calcium bicarbonate	56·852	89·869	96·730	170·646	41·321	168·392	101·881	227·070	95·522	140·260	11·407
Calcium chloride	trace	....	....	....	....	....	....	....	....	....	....
Calcium fluoride	....	trace	trace	trace	....	trace	trace	trace	trace	trace	trace
Calcium phosphate	....	trace	....	....	....	....	....	....	....	....	....
Calcium sulphate	0·448	....	....	....	....	....	....	....	....	....	....
Ferrous bicarbonate	1·724	1·703	0·269	1·128	3·000	0·979	2·038	0·647	0·052	1·557	·141
Lithium bicarbonate	1·724	0·899	2·605	11·447	....	9·004	4·326	6·247	1·760	5·129	0·403
Magnesium bicarbonate	20·480	40·339	109·685	176·463	29·340	149·343	75·161	193·912	41·503	70·470	5·221
Magnesium chloride	trace	....	....	....	....	....	....	....	....	....	....
Magnesium sulphate	0·288	....	....	....	2·148	....	....	....	....	....	....
Phosphates	....	....	....	....	....	....	....	....	....	....	....
Potassium bromide	....	....	....	....	1·566	....	....	....	....	....	....
Potassium chloride	0·357	1·335	8·733	9·597	....	24·634	8·327	40·446	14·113	16·980	2·123
Potassium silicate	....	....	....	....	....	....	....	....	....	....	....
Potassium sulphate	0·370	0·557	1·818	....	....	0·318	2·158	....	....	trace	trace
Silica	....	2·561	2·653	1·260	0·532	0·665	3·213	0·699	0·758	1·280	0·160
Strontium bicarbonate	....	trace	trace	trace	....	0·425	trace	0·082	trace	trace	trace
Strontium sulphate	....	....	....	....	....	....	....	....	....	....	....
Sodium biborate	....	trace	trace	trace	....	trace	trace	....	trace	....	....
Sodium bicarbonate	6·752	29·428	17·010	4·288	8·750	71·232	10·064	17·624	82·873	67·617	5·861
Sodium bromide	....	0·630	1·307	1·534	....	2·212	0·414	3·579	0·990	1·800	0·225
Sodium chloride	565·300	134·291	453·299	509·968	166·811	562·080	328·468	702·239	128·689	338·500	29·812
Sodium iodide	....	0·031	0·039	0·198	4·666	0·248	0·066	02·321	trace	0·042	0·005
Sodium phosphate	....	trace	0·026	0·006	....	trace	0·009	0·010	trace	....	....
Sodium silicate	....	....	....	....	....	....	....	....	....	....	....
Sodium sulphate	2·500	....	....	....	....	....	....	....	....	....	....
Organic matter	trace	trace	trace	trace	....	trace	trace	trace	trace	....	....
Total	656·911	302·017	701·174	888·403	258·365	991·546	537·155	1·195·582	315·176	644·627	55.460
Carbonic acid gas	212·000	324·080	384·969	375·747	239·000	454·082	317·452	465·458	383·071	361·500	45·10
Temperature	....	50° F.	48° F.	47° F.	....	46° F.	50° F.	49° F.	50° F.	40° F.	....

PENNSYLVANIA MINERAL SPRINGS.

BEDFORD SPRINGS, BEDFORD CO., PA.

(*Purgative.*)

One pint contains,— (DR. CHURCH.)	Grains.
Ferrous carbonate	0·625
Calcium carbonate	1·000
Sodium chloride	1·250
Calcium chloride	0·375
Magnesium sulphate	10·000
Calcium sulphate	1·875
Loss	0·375
Total	15·500
	Cubic inches.
Carbonic acid	9·25

CRESSON SPRINGS, CAMBRIA CO., PA.

(*Saline.*)

One gallon contains,— (F. A. GENTH.)	Iron Spring. Grains.	Alum Spring. Grains.	Magnesia Spring. Grains.
Ferric sulphate	trace	33·38970	....
Aluminium sulphate	1·60466	21·20498	....
Ferrous sulphate	23·47923	16·25273	....
Magnesium sulphate	22·58007	27·69855	....
Calcium sulphate	48·91824	40·20179	0·10912
Lithium sulphate	trace	0·04693	....
Sodium sulphate	1·64331	0·70389	....
Potassium sulphate	0·32405	0·42622	....
Sodium chloride	0·04063	0·02336	1·22974
Ferrous bicarbonate	5·03471	3·74756	0·01753
Manganese bicarbonate	....	trace	trace
Calcium bicarbonate	3·52946	....	0·02252
Calcium phosphate	0·02914	trace	0·00408

CRESSON SPRINGS.—*Continued.*

One gallon contains,— (F. A. GENTH.)	Iron Spring. Grains.	Alum Spring. Grains.	Magnesia Spring. Grains.
Silicic acid	1·20832	1·86794	0·91455
Magnesium chloride	....	....	0·55962
Calcium chloride	....	....	1·30444
Magnesium bicarbonate	....	....	0·41434
Sodium bicarbonate	....	....	1·42582
Potassium bicarbonate	....	....	0·20671
Alumina	....	....	0·00876
Nitrous acid	....	....	trace
Carbonic acid, free	....	....	0·66390
Total	108·39182	145·56374	6·88113

FAYETTE SPRINGS, FAYETTE CO., PA.

(*Chalybeate.*)

One gallon contains,— (F. A. GENTH.)	Grains.
Magnesium sulphate	0·25472
Calcium sulphate	0·05542
Sodium sulphate	0·19965
Potassium sulphate	0·11525
Sodium chloride	0·08522
Ferrous bicarbonate	1·06709
Manganese bicarbonate	0·04795
Magnesium bicarbonate	1·53414
Calcium bicarbonate	9·33441
Calcium phosphate	0·04822
Alumina	trace
Silicic acid	1·19690
Nitrous acid	trace
Carbonic acid, free	0·38284
Total	14·32181

GETTYSBURG, ADAMS CO., PA.

(*Saline.*)

One gallon contains,—	Katalysine Spring. (F. A. GENTH.) Grains.	Stremmel's Spring. (F. A. GENTH.) Grains.
Barium sulphate	trace	....
Strontium sulphate	0·00427	....
Calcium sulphate	0·83145	0·48243
Magnesium sulphate	6·77940	3·29559
Potassium sulphate	0·20836	0·15399
Sodium sulphate	2·46776	....
Sodium chloride	0 65790	0·31836
Lithium chloride	trace	trace
Sodium bicarbonate	0·70457	3·37602
Calcium bicarbonate	16·40815	9·95838
Magnesium bicarbonate	0·54260	5·82961
Ferrous bicarbonate	0·03585	0·04203
Manganese bicarbonate	0·00669	0·00485
Nickel bicarbonate	trace	....
Cobalt bicarbonate	trace	....
Copper bicarbonate	0·00050	....
Magnesium borate	0·03492	....
Calcium phosphate	0.00679	0 00963
Calcium fluoride	0·00954	....
Alumina	0·00380	0·02425
Silicic acid	2·03076	1·75473
Organic matter, with traces of nitric acid	0·70870	....
Impurities suspended in water, like clays	1·10069	....
Sodium carbonate	....	....
Magnesium carbonate	....	....
Ferrous carbonate	....	....
Manganese carbonate	....	....
Calcium carbonate	....	....
Total	32·54272	25·24987

MINNEQUA SPRING, BRADFORD CO., PA.

(*Saline.*)

One gallon contains,— (F. A. GENTH.)	Grains.
Barium sulphate	0·00175
Lithium chloride	trace

MINNEQUA SPRING.—*Continued.*

One gallon contains,— (F. A. GENTH.)	Grains.
Sodium chloride	0·19209
Zinc bicarbonate	0·01157
Manganese bicarbonate	0·06299
Ferrous bicarbonate	0·04204
Magnesia bicarbonate	1·58988
Calcium bicarbonate	6·52477
Barium bicarbonate	0·01380
Sodium bicarbonate	1·33046
Potassium bicarbonate	0·13885
Magnesium borate	0·07980
Calcium phosphate	0·01231
Nitrite Nitrate } of ammonia	0·00025
Alumina	0·00253
Silicic acid	0·74194
Sulphuretted hydrogen	0·01390
Total	10·75893

SALTILLO SPRINGS, HUNTINGDON CO., PA.

(*Saline.*)

One gallon contains,— (F. A. GENTH.)	McVitty's Spring. Grains.	McCarthy's Spring. Grains.
Magnesium sulphate	0·00456	41·79795
Calcium sulphate	....	72·19660
Sodium sulphate	1·00664	7·79412
Potassium sulphate	0·15624	0·22291
Sodium chloride	0·06329	0·20571
Ferrous bicarbonate	0·14022	0·08108
Magnesium bicarbonate	1·87476	0·88262
Calcium bicarbonate	9·84013	22·24300
Calcium phosphate	trace	trace
Silicic acid	0·59007	1·16846
Sulphuretted hydrogen	0·01490	0·01589
Total	13·69081	146·60834

VIRGINIA MINERAL SPRINGS.

AUGUSTA SPRINGS (STRIBLING), AUGUSTA CO., VA.

(*Chalybeate.*)

One pint contains,—	ALUM SPRINGS.			CHALYBEATE SPRINGS.		SULPHURETTED.
	No. 4. (D. K. TUTTLE, M.D.)	No. 5. (D. K. TUTTLE.)	No. 6. (D. K. TUTTLE.)	No. 1. (D. K. TUTTLE.)	No. 3. (D. K. TUTTLE.)	No. 2. (D. K. TUTTLE.)
	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.
Potassium sulphate	0·067	1·113	0·126	....	....	....
Sodium sulphate	0·083	0·293	0·224	....	....	....
Magnesium sulphate	0·066	0·043	0·822	....	....	....
Aluminum sulphate	2·086	2·244	4·801	....	....	....
Ferrous sulphate	1·192	1·643	1·615	....	....	....
Calcium sulphate	1·832	2·118	2·389	0·028	0·386	0·156
Sulphuric acid	0·631	1·227	0·817	....	....	....
Silicic acid	0·244	0·264	0·264	0·165	0·114	0·080
Organic matter	0·469	....	....	....	....	....
Potassium carbonate	....	....	....	0·044	0·095	0·093
Sodium carbonate	....	....	....	0·095	0·123	0·780
Magnesium carbonate	....	....	....	0·122	0·138	0·251
Ferrous carbonate	....	....	....	0·009	0·014	0·016
Calcium carbonate	....	....	....	....	0·104	1·204
Sodium chloride	....	....	....	....	....	0·080
Total	6·670	7·945	11·058	0·651	0·979	2·660
				Cubic inches.	Cubic inches.	Cubic inches.
Carbonic acid	....	....	....	3·	2·	1·30
Sulphuretted hydrogen	....	....	....	....	....	0·03

ALLEGHANY SPRING, MONTGOMERY CO., VA.

(*Calcareous.*)

One pint contains,— (F. A. GENTH.)	Grains.
Magnesium carbonate	0·037
Ferrous carbonate	0·016
Manganese carbonate	0·006
Calcium carbonate	0·376
Lithium carbonate	trace
Strontium carbonate	0·006
Barium carbonate	0·002
Sodium chloride	0·028
Potassium sulphate	0·385
Sodium sulphate	0·178
Magnesium sulphate	5·299
Calcium sulphate	12·007
Aluminium phosphate	0·002
Magnesium nitrate	0·335
Ammonium nitrate	0·058
Calcium fluoride	0·002
Aluminium silicate	0·021
Silicic acid	0·091
Organic matter	0·208
Total	19·057
Carbonic acid	1·20
Sulphuretted hydrogen	trace

BATH ALUM SPRING, BATH CO., VA.

(*Chalybeate.*)

One pint contains,— (A. A. HAYES, M.D.)	No. 1. Grains.	No. 2. Grains.
Sodium chloride	0·022	....
Potassium sulphate	....	0·032
Magnesium sulphate	0·352	0·160
Calcium sulphate	0·476	0·317
Ferrous oxide	1·814	2·722
Alumina	1·286	1·536
Ammonium crenate	0·232	0·222
Sodium silicate	0·253	0·394
Sulphuric acid	0·726	0·985
Total	5·161	6·368
	Cubic inches.	Cubic inches.
Carbonic acid	1·4	1·0

BEDFORD ALUM SPRINGS, BEDFORD CO., VA.

(*Chalybeate.*)

One pint contains,— (PROF. GILLIAM.)	Grains.
Potassium sulphate	1·270
Magnesium sulphate	1·583
Calcium sulphate	2·334
Aluminium sulphate	·905
Ferrous sulphate	2·932
Sulphuric acid	2·497
Total	11·521

BERKELEY SPRINGS, MORGAN CO., W. VA.

(*Calcareous.*)

One pint contains,— (A. A. HAYES, M.D.)	Grains.
Calcium carbonate	0·625
Sodium chloride	0·112
Calcium chloride	0·026
Magnesium sulphate	0·045
Calcium crenate	0·455
Ferrous crenate	0·010
Ferrous silicate	0·080
Loss	0·008
Total	1·361

BLUE RIDGE SPRINGS, BOTETOURT CO., VA.

(*Purgative.*)

One pint contains,— (F. A. GENTH.)	Grains.
Magnesium carbonate	0·223
Ferrous carbonate	0·037
Calcium carbonate	0·472
Sodium chloride	0·031
Potassium sulphate	0·050
Sodium sulphate	0·122
Magnesium sulphate	5·944
Calcium sulphate	12·527
Alumina	0·018
Silicic acid	0·157
Total	19·581

BUFFALO SPRINGS, MECKLENBURG CO., VA.

(*Sulphuretted.*)

One pint contains,—	Grains.
Sodium chloride	trace
Magnesium chloride	trace
Sodium sulphate	0·163
Magnesium sulphate	1·000
Ferrous sulphate	0·325
Calcium sulphate	0·437
Total	1·925
	Cubic inches.
Sulphuretted hydrogen	0·15

CAPON SPRINGS, HAMPSHIRE CO., W. VA.

(*Alkaline.*)

One imperial gallon contains,— (J. W. MALLET.)	No. 1. Main Spring. Grains.	No. 2. Beauty Spring. Grains.
Sodium carbonate	·591	·631
Lithium carbonate	distinct trace	faint trace
Calcium carbonate	8·325	8·355
Magnesium carbonate	1·441	1·269
Ferrous carbonate	·041	·052
Manganous carbonate	trace	trace
Cupric carbonate	....	trace
Sodium chloride	·056	·054
Potassium sulphate	·170	·163
Strontium sulphate	trace	trace
Calcium sulphate	·593	·408
Calcium phosphate	·002	·002
Calcium fluoride	trace	trace
Alumina	.018	·015
Silica	·707	·672
Nitrates	trace	trace
Organic matter	·204	·189
Total	12·138	11·810

DISSOLVED GASES.

60° F. and 30 inches pressure.

	No. 1. Cubic inches.	No. 2. Cubic inches.
Carbon dioxide	8·57	7·81
Oxygen	1·76	1·69
Nitrogen	3·68	3·71
	14·01	13·21

FREE GASES.

From No. 1 gas escapes in bubbles at frequent intervals to the extent of about 300 or 350 cubic inches per hour. This consists of,—

	Cubic inches.
Nitrogen	78·74
Oxygen	9·02
Carbon dioxide	4·38
Marsh-gas	7·87
	100·00

CHURCH HILL ALUM SPRINGS, VA.

(Chalybeate.)

One pint contains,— (J. C. BOOTH, M.D.)	Grains.
Sodium chloride	0·578
Potassium sulphate	0·305
Sodium sulphate	0·243
Magnesium sulphate	10·758
Calcium sulphate	11·104
Ammonium sulphate	0·080
Ferric persulphate	6·408
Ferric bisulphate	10·419
Ferrous sulphate	3·023
Aluminium persulphate	9·116
Silica	1·303
Phosphoric acid	trace
Total	53·337

GREENBRIER WHITE SULPHUR SPRINGS, GREENBRIER CO., W. VA.

(Sulphuretted.)

One pint contains,—	(PROF. A. A. HAYES.) Grains.	(PROF. W. B. ROGERS.) Grains.
Magnesium carbonate	....	0·146
Calcium carbonate	0·884	0·441
Sodium chloride	....	0·065
Magnesium chloride	0·125	0·020
Calcium chloride	....	0·003
Sodium sulphate	....	1·169
Magnesium sulphate	4·427	2·379
Calcium sulphate	9·794	9·148
Aluminium sulphate	....	0·003
Ferrous sulphate	....	0·019
Earthy phosphates	....	trace
Iodine, combined	....	undetermined
Organic matter	0·545	0·001
Silicates of potassum, sodium, magnesium, and a trace of ferric oxide	0·432	....
Total	16·207	13·394
	Cubic inches.	Cubic inches.
Carbonic acid	1·41	1·06
Sulphuretted hydrogen	0·03	0·37
Oxygen	0·06	0·05
Nitrogen	0·58	0·54

HOLSTON SPRINGS, SCOTT CO., VA.

(Calcareous.)

One pint contains,— (PROF. HAYDEN.)	Grains.
Calcium carbonate	·80
Sodium and ammonium chlorides	·19
Sodium sulphate	trace
Magnesium sulphate	1·59
Calcium sulphate	2·56
Aluminium sulphate	trace
Aluminium phosphate	trace
Total	5·14

HEALING SPRINGS, BATH CO., VA.

(Thermal.)

One pint contains,—	Old Spring. 85° F. (PROF. WM. E. A. AIKIN, M.D.) Grains.	New Spring. 88° F. (PROF. WM. E. A. AIKIN, M.D.) Grains.
Magnesium carbonate	0·156	0·246
Ferrous carbonate	0·009	0·034
Calcium carbonate	2·238	2·340
Potassium chloride	0·029	0·032
Sodium chloride	0·034	0·036
Potassium sulphate	0·276	0·316
Magnesium sulphate	0·906	0·924
Ferrous sulphate	0·022	0·013
Calcium sulphate	0·165	0·158
Ammonium sulphate	0·029	0·029
Iodine	trace	trace
Bromine	trace	trace
Silicic acid	0·237	0·228
Organic acid	0·107	0·109
Total	4·208	4·465
	Cubic inches.	Cubic inches.
Carbonic acid gas	0·58	0·60

JORDAN ALUM SPRINGS, ROCKBRIDGE CO., VA.

(Alkaline and Chalybeate.)

One pint contains,—	Alum Spring. (WM. E. AIKIN.) Grains.	Chalybeate Spring. (J. W. MALLET.) Grains.
Magnesium carbonate	....	0·092
Ferrous carbonate	....	0·088
Manganese carbonate	....	0·005
Sodium chloride	0·091	0·014
Potassium sulphate	0·164	0·016
Sodium sulphate	0·022	0·017
Magnesium sulphate	0·647	....
Aluminium sulphate	3·172	....
Ferrous sulphate	2·317	....
Calcium sulphate	0·555	0·464
Ferrous phosphate	0·031	....
Calcium phosphate (tribasic)	....	0·002
Sodium iodide	0·088	....
Sodium silicate	0·314	....
Ferrous crenate	0·085	....
Ammonium crenate	0·066	....
Alumina	....	0·007
Silica	....	0·090
Sulphuric acid	2·955	....
Organic matter	0·073	0·011
Total	10·580	0·806
	Cubic inches.	Cubic inches.
Carbonic acid	0·77	0·70
Oxygen	......	0·20
Nitrogen	......	1·07

HOT SPRINGS, BATH CO., VA.

(Thermal.)

One pint contains,—	Ladies' Boiler-Bath, 110° F. (COL. WM. GILHAM.) Grains.	Ladies' Sulphur-Bath, 102° F. (COL. WM. GILHAM.) Grains.	Gentlemen's Pleasure-Bath, 78° F. (COL. WM. GILHAM.) Grains.
Magnesium carbonate	0·335	0·350	0·252
Ferrous carbonate	0·014	0·008	0·010
Calcium carbonate	2·168	2·055	1·185
Potassium chloride	0·200	0·021	0·020
Sodium chloride	0·015	0·017	0·016
Potassium sulphate	0·168	0·228	0·071
Sodium sulphate	0·128	0·126	0·106
Magnesium sulphate	0·707	0·638	0·133
Calcium sulphate	0·217	0·263	0·378
Silica	0·218	0·171	0·086
Total	4·170	3·877	2·257

Jordan's White Sulphur Springs, Frederick Co., Va.

(*Sulphuretted.*)

One pint contains,— (T. Antisell.)	Grains.
Potassium carbonate	1·213
Magnesium carbonate	0·360
Ferrous carbonate	trace
Manganese carbonate	0·002
Sodium chloride	0·095
Potassium sulphate	0·262
Calcium sulphate	0·641
Alumina	0·001
Silicic acid	0·032
Total	2·606
	Cubic inches.
Sulphuretted hydrogen	0·25

Kimberling Springs, Bland Co., Va.

(*Sulphuretted.*)

One imperial gallon contains,— (Dr. Tuttle.)	Grains.
Calcium sulphate	2·3169
Magnesium carbonate	1·62
Calcium carbonate	·7238
Sodium chloride	·4229
Sodium carbonate	6·208
Potassium carbonate	·750
Silica	·6733
Organic matter	2·160
Iron	trace
Sulphuretted hydrogen	·1737
Total	15·0486

New London Alum Springs, Campbell Co., Va.

(*Chalybeate.*)

One gallon contains,— (Prof. Gilham.)	Grains.
Magnesium sulphate	12·664
Ferrous sulphate	23·456
Aluminium sulphate	7·240
Calcium sulphate	18·672
Potassium sulphate	10·160
Sulphuric acid, free	19·976
Total	92·168

Old Sweet Springs, Monroe Co., W. Va.

(*Carbonated.*)

One pint contains,— (Prof. W. B. Rogers.)	Grains.
Magnesium carbonate	0·103
Calcium carbonate	3·757
Sodium chloride	0·017
Magnesium chloride	0·039
Calcium chloride	0·018
Sodium sulphate	0·793
Magnesium sulphate	1·174
Calcium sulphate	1·646
Ferric oxide	0·018
Iodine	trace
Earthy phosphates	trace
Silica	0·021
Total	7·586
	Cubic inches.
Carbonic acid	11·00

Rawley Springs, Rockingham Co., Va.

(*Chalybeate.*)

One pint contains,— (Prof. J. W. Mallet.)	Grains.
Magnesium carbonate	0·085
Ferrous carbonate	0·203
Manganese carbonate	0·002
Calcium carbonate	0·055
Ammonium carbonate	trace
Lithium carbonate	trace
Sodium chloride	0·005
Potassium sulphate	0·014
Sodium sulphate	0·068
Calcium sulphate	0·013
Alumina	0·005
Silica	0·085
Organic matter	0·036
Loss	0·073
Total	0·644
	Cubic inches.
Carbonic acid	0·77

Orkney Springs, Shenandoah Co., Va.

(*Alkaline and Chalybeate.*)

One pint contains,—	Healing Spring. (J. W. Mallet.) Grains.	Powder Spring. (J. W. Mallet.) Grains.	Bear Wallow Spring. (J. W. Mallet.) Grains.
Sodium carbonate	0·002	0·406	....
Magnesium carbonate	0·141	0·369	....
Ferrous carbonate	0·058	0·027	....
Manganese carbonate	0·001	0·002	....
Calcium carbonate	1·033	0·477	....
Potassium chloride	0·004	0·003	0·008
Sodium chloride	0·015	0·044	0·011
Potassium sulphate	0·023	0·020	0·026
Magnesium sulphate	....	....	0·305
Aluminium sulphate	0·004	0·002	0·007
Ferrous sulphate	....	....	0·567
Manganese sulphate	....	....	....
Calcium sulphate	0·143	0·219	0·089
Lithium sulphate	....	....	0·008
Calcium phosphate (tribasic)	0·002	trace	0·001
Sodium sulphide	....	0·055	....
Sulphuric acid	....	....	0·044
Silica	0·104	0·173	0·192
Organic matter	....	trace	0·008
Total	1·530	1·797	1·266

Orkney Springs.—*Continued.*

	Cubic inches.	Cubic inches.	Cubic inches.
Carbonic acid	0·48	0·89	0·60
Sulphuretted hydrogen	......	0·61	......
Oxygen	0·17	......	0·05
Nitrogen	0·31	0·29	0·15

Rockbridge Alum Springs, Rockbridge Co., Va.

(*Chalybeate.*)

One pint contains,—	No. 1. (A. A. Hayes, M.D.) Grains.	No. 2. (A. A. Hayes, M.D.) Grains.	No. 3. (A. A. Hayes, M.D.) Grains.
Sodium chloride	0·053	0·126	0·055
Potassium sulphate	....	0·221	....
Magnesium sulphate	0·135	0·220	0·552
Calcium sulphate	0·180	0·408	0·413
Ferrous oxide	0·460	0·608	0·587
Alumina	1·846	2·238	3·011
Ammonium crenate	0·175	0·088	0·153
Sodium silicate	0·318	....	....
Sulphuric acid	2·347	1·903	0·689
Silicic acid	....	0·355	0·213
Organic matter	....	....	0·127
Total	5·514	6·167	5·800
	Cubic inches.	Cubic inches.	Cubic inches.
Carbonic acid	0·7	1·9	1·1

Red Sulphur Springs, Monroe Co., W. Va.

(*Sulphuretted.*)

One pint contains,— (A. A. Hayes, M.D.)	Grains.
Magnesium carbonate	0·602
Calcium carbonate	0·656
Sodium sulphate	0·518
Calcium sulphate	0·069
Sulphur compound (organic matter)	1·049
Silicious and earthy matter	0·102
Total	2·996
	Cubic inches.
Carbonic acid	1·00
Sulphuretted hydrogen	0·13

Rock Enon Springs (Capper Springs), Frederick Co., Va.

(*Chalybeate.*)

One gallon contains,— (Gale and Mew.)	Grains.
Calcium carbonate	5·13
Sodium carbonate	1·21
Ferrous carbonate	14·25
Manganese carbonate	1·05
Magnesium sulphate	12·89
Calcium sulphate	3·56
Magnesium chloride	1·12
Alumina	0·80
Silica	0·42
Total	40·43

By spectrum analysis lithia was also found in it.

Salt Sulphur Springs, Monroe Co., W. Va.

(*Sulphuretted.*)

One pint contains,—	Old Spring. (W. B. Rogers.) Grains.	Iodine Spring. (D. Stewart, M.D.) Grains.
Potassium carbonate	....	0·291
Sodium carbonate	....	1·350
Magnesium carbonate	0·414	0·875
Calcium carbonate	1·283	4·125
Sodium chloride	0·197	0·188
Magnesium chloride	0·033	0·035
Calcium chloride	0·007	0·070
Sodium sulphate	2·795	3·000
Magnesium sulphate	2·276	2·500
Calcium sulphate	10·613	8·500
Ferric oxide	0·012	0·133
Iodine	trace	0·079
Bromine	....	0·081
Silicic acid	....	0·220
Alumina	....	0·023
Earthy phosphates (soda and lithia)	trace	0·091
Organic matter (with sulphur)	1·155	....
Total	18·785	21·561
	Cubic inches.	Cubic inches.
Carbonic acid	1·66	4·32
Sulphuretted hydrogen	0·43	2·39

Sweet Chalybeate Springs, Alleghany Co., Va.

(*Chalybeate.*)

One pint contains,— (Prof. W. B. Rogers.)	Grains.
Calcium carbonate	0·337
Sodium chloride	0·011
Magnesium chloride	0·196
Calcium chloride	0·003
Sodium sulphate	0·404
Magnesium sulphate	0·897
Calcium sulphate	4·110
Ferric oxide	0·092
Total	6·050
	Cubic inches.
Carbonic acid gas	13·00

Variety Springs, Augusta Co., Va.

(*Alum.*)

One pint contains,— (Prof. Wm. Gilham.)	Grains.
Sodium chloride	0·037
Potassium sulphate	0·036
Magnesium sulphate	1·455
Aluminium sulphate	4·301
Ferrous sulphate	0·639
Calcium sulphate	1·666
Sulphuric acid, free	0·171
Silica	0·142
Total	8·447

YELLOW SULPHUR SPRINGS, MONTGOMERY CO., VA.

(*Sulphuretted.*)

One pint contains,— (PROF. W. M. GILHAM.)	Grains.
Magnesium carbonate	0·173
Ferrous carbonate	0·077
Calcium carbonate	1·080
Potassium chloride	0·012
Sodium chloride	0·009
Potassium sulphate	0·013
Sodium sulphate	0·093
Magnesium sulphate	2·637
Aluminium sulphate	0·397
Calcium sulphate	7·912
Magnesium phosphate	0·001
Calcium phosphate	0·002
Organic matter	0·466
Total	12·872

YELLOW SULPHUR SPRINGS.—*Continued.*

	Cubic inches.
Carbonic acid gas	1·25
Sulphuretted hydrogen	undetermined

WARM SPRINGS, BATH CO., VA.

(*Thermal.* 96° *to* 98° *F.*)

One gallon contains,— (A. A. HAYES, M.D.)	Grains.
Potassium sulphate	1·371
Ammonium sulphate	0·369
Calcium sulphate	14·531
Calcium carbonate	5·220
Ferrous crenate	2·498
Magnesia and aluminium silicates	1·724
Carbonic acid	6·919
Total	32·632

SOUTHERN AND SOUTHWESTERN STATES.

BLADON SPRINGS, CHOCTAW CO., ALA.

(*Alkaline.*)

One pint contains,—	Vichy Spring. (J. L. AND W. P. RIDDELL.) Grains.	Branch Spring. (J. L. AND W. P. RIDDELL.) Grains.	Old Spring. (PROF. R. T. BRUMBY.) Grains.	Sulphur Spring. (J. L. AND W. P. RIDDELL.) Grains.
Sodium carbonate	5·791	5·151	4·111	4·367
Magnesium carbonate	0·036	0·076	0·170	0·081
Ferrous carbonate	0·062	0·029	....	0·095
Calcium carbonate	0·109	0·267	0·344	0·302
Sodium chloride	....	....	0·962	....
Calcium sulphate	0·282	0·349	0·002	0·370
Ferrous sulphate	....	....	0·030	....
Manganese sulphate	trace	....	....	trace
Silica and alumina	....	....	0·263	....
Crenic acid	....	....	0·091	....
Hypocrenic acid	....	....	0·075	....
Organic matter	0·282	0·237	....	0·156
Loss	....	....	0·040	....
Total	6·562	6·112	6·088	5·371
	Cubic inches.	Cubic inches.	Cubic inches.	Cubic inches.
Carbonic acid gas	8·18	7·40	4·07	6·61
Sulphuretted hydrogen	trace	trace	undetermined	0·07
Chlorine	0·23	0·23	....	0·23

UPPER AND LOWER BLUE LICK SPRINGS, NICHOLAS CO., KY.

(*Sulphuretted.*)

One pint contains,—	Upper. (J. F. JUDGE AND A. FENNEL.) Grains.	Lower. (ROBERT PETER, M.D.) Grains.
Magnesium carbonate	0·018	0·017
Calcium carbonate	3·133	2·957
Potassium chloride	0·225	0·174
Sodium chloride	64·567	64·107
Magnesium chloride	4·716	4·049
Potassium sulphate	1·622	1·117
Calcium sulphate	5·517	4·249
Magnesium iodide	0·019	0·006
Magnesium bromide	0·476	0·030
Alumina (calcium phosphate and ferric oxide)	0·246	0·045
Silicic acid	0·125	0·138
Loss	1·860	2·216
Total	82·524	79·105
	Cubic inches.	Cubic inches.
Carbonic acid gas	6·02	12·35
Sulphuretted hydrogen	1·02	2·28

COOPER'S WELL, HINDS CO., MISS.

(*Chalybeate.*)

One pint contains,— (PROF. J. L. SMITH.)	Grains.
Sodium chloride	1·045
Magnesium chloride	0·435
Calcium chloride	0·540
Potassium sulphate	0·076
Sodium sulphate	1·463
Magnesium sulphate	2·910
Calcium sulphate	5·265
Aluminium sulphate	0·765
Ferric oxide	0·420
Calcium crenate	0·039
Silica	0·225
Total	13·183
	Cubic inches.
Carbonic acid	4·0
Oxygen	1·5
Nitrogen	4·5

CATOOSA SPRINGS, CATOOSA CO., GA.

(*Purgative.*)

One pint contains,—	All-Healing. (WM. J. LAND.) Grains.	Red Sweet. (WM. J. LAND.) Grains.	White Sulphur. (WM. J. LAND.) Grains.	Buffalo. (WM. J. LAND.) Grains.
Potassium carbonate	0·013	0·014	0·014	0·002
Sodium carbonate	0·031	0·036	0·032	0·003
Magnesium carbonate	0·878	0·993	1·050	1·087
Ferrous carbonate	0·016	0·018	0·035	0·035
Manganese carbonate	0·001	0·002	0·003	0·002
Calcium carbonate	0·440	0·497	0·481	0·482
Lithium carbonate	trace	trace	trace	trace
Strontium carbonate	0·005	0·006	0·005	0·005
Sodium chloride	0·016	0·018	0·017	0·014
Potassium sulphate	0·275	0·311	0·290	0·289
Sodium sulphate	0·187	0·212	0·209	0·209
Magnesium sulphate	3·317	3·747	4·001	4·127
Aluminium sulphate	0·063	0·083	0·309	0·298
Calcium sulphate	4·855	5·483	5·601	5·625
Strontium sulphate	0·025	0·029	0·026	0·036
Magnesium bromide	0·037	0·041	0·038	0·041
Calcium bromide	0·151	0·171	0·018	0·019
Calcium nitrate	0·052	0·059	0·040	0·004
Ammonium nitrate	0·015	0·017	0·012	0·114
Calcium fluoride	0·002	0·002	0·002	0·001
Crenic and apocrenic acids	0·003	0·003	0·001	0·001
Total	10·382	11·742	12·184	12·394
	Cubic inches.	Cubic inches.	Cubic inches.	Cubic inches.
Carbonic acid gas	1·17	1·16	1·19	1·22
Sulphuretted hydrogen	......	......	0·01	trace

CRAB ORCHARD SPRINGS, LINCOLN CO., KY.

(*Purgative.*)

One pint contains,—	Foley's Spring. (R. PETER, M.D.) Grains.	Sowder's Spring. (R. PETER, M.D.) Grains.	CRAB ORCHARD SALT. One hundred parts of dry salt contain,— (R. PETER, M.D.) Parts.
Magnesium carbonate	0·955	2·734	......
Ferrous carbonate	trace	trace	......
Calcium carbonate	6·648	3·689	......
Sodium chloride	2·216	7·290	4·77
Potassium sulphate	1·239	2·172	1·80
Sodium sulphate	7·384	2·900	4·20
Magnesium sulphate	25·660	21·789	63·19
Calcium sulphate	1·349	11·416	2·54
Bromine	......	trace	trace
Silica	0·408	0·153	......
Calcium, magnesium, iron carbonates, and silica	......	......	0·89
Loss and moisture	4·323	......	......
Water of crystallization and loss	......	......	22·61
Total	50·182	52·143	100·00
Carbonic acid gas	not estimated	not estimated	

BLOUNT SPRINGS, BLOUNT CO., ALA.

(*Sulphuretted.*)

One pint contains,—	Red Sulphur. (PROF. R. BRUMBY.) Grains.	Sweet Sulphur. (PROF. R. BRUMBY.) Grains.
Magnesium carbonate	0·55	0·45
Ferrous carbonate	0·24	0·14
Calcium carbonate	0·85	0·56
Sodium chloride	4·04	3·86
Magnesium chloride	0·75	......
Magnesium sulphate	0·20	0·30
Total	6·63	5·31
	Cubic inches.	Cubic inches.
Carbonic acid gas	0·75	0·75
Sulphuretted hydrogen	1·87	1·57

CHARLESTON ARTESIAN WELL, S.C.

(*Thermal. 87° F.*)

One pint contains,— (PROF. C. U. SHEPHARD, JR.)	Grains.
Sodium carbonate	7·353
Magnesium carbonate	0·001
Calcium carbonate	0·140
Sodium chloride	9·459
Calcium, iron, and aluminium phosphates	0·001
Silica	0·002
Organic matter	0·003
Total	16·959
	Cubic inches.
Carbonic acid gas	0·28

ESTILL SPRINGS, ESTILL CO., KY.

One pint contains,—	(*Sulphuretted.*) Red Sulphur. (ROBERT PETER, M.D.) Grains.	(*Chalybeate.*) (DR. PETER.) Grains.	(*Purgative.*) Irvine Spring. (ROBERT PETER, M.D.) Grains.
Sodium carbonate	0·168	....	....
Magnesium carbonate	0·605	0·335	0·321
Calcium carbonate	1·472	1·159	3·841
Sodium chloride	0·612	0·066	2·201
Potassium sulphate	0·670	0·080	0·313
Sodium sulphate	1·254	0·087	....
Magnesium sulphate	0·073	1·224	32·910
Ferrous carbonate	....	0·233	0·166
Calcium sulphate	....	2·084	3·987
Alumina and trace of phosphates	....	trace	....
Silica	0·044	0·233	0·503
Calcium chloride	....	....	0·211
Organic and volatile matters	0·292	1·028	....
Loss	....	....	10·736
Total	5·190	6·529	55·189
	Cubic inches.	Cubic inches.	
Carbonic acid gas	5·01	4·15	
Sulphuretted hydrogen	0·07	......	

HOT SPRINGS, GARLAND CO., ARKANSAS.

(*Thermal.* 93° *to* 150° *F.*)

One pint contains,— (PROF. E. H. LARKIN.)	Grains.
Magnesium carbonate	0·016
Calcium carbonate	0·496
Sodium chloride	0·001
Potassium sulphate	0·029
Sodium sulphate	0·047
Calcium sulphate	0·014
Ferric oxide	0·013
Iodine	trace
Bromine	trace
Calcium silicate	0·058
Silica	0·233
Alumina	0·056
Organic matter	0·088
Water	0·018
Total	1·069

HARRODSBURG SPRINGS, MERCER CO., KY.

(*Purgative.*)

One pint contains,—	Grenville Spring. (RAYMOND.) Grains.	Saloon Spring (RAYMOND.) Grains.
Magnesium carbonate	2·87	0·26
Ferrous carbonate	....	0·36
Calcium carbonate	0·60	2·99
Sodium chloride	trace	1·24
Magnesium sulphate	16·16	27·92
Calcium sulphate	11·06	10·24
Total	30·69	43·01

MONTVALE SPRINGS, BLOUNT CO., TENN.

(*Chalybeate.*)

One pint contains,—	(PROF. J. B. MITCHELL.) Grains.	(J. R. CHILTON, M.D.) Grains.
Ferrous carbonate	0·300	....
Calcium carbonate	1·657	....
Sodium chloride	0·245	....
Magnesium chloride	....	0·012
Calcium chloride	....	0·018
Sodium sulphate	0·564	1·102
Magnesium sulphate	1·500	2·134
Calcium sulphate	9·276	10·243
Ferric oxide	....	0·149
Alumina	0·062	....
Silica	....	trace
Organic matter	....	0·005
Total	13·604	13·663

OLYMPIAN SPRINGS, BATH CO., KY.

(*Sulphuretted.*)

One pint contains,— (DR. PETER.)	Grains.
Magnesium carbonate	0·904
Ferrous carbonate	trace
Calcium carbonate	1·742
Potassium chloride	1·334
Sodium chloride	20·752
Magnesium chloride	6·924
Calcium sulphate	trace
Ferrous bromide	trace
Alumina	trace
Silica	0·131
Water and loss	9·825
Total	41·612
Carbonic acid	not estimated
Sulphuretted hydrogen	not estimated

PAROQUET SPRINGS, BULLITT CO., KY.

(*Sulphuretted.*)

One pint contains,— (PROF. P. L. SMITH.)	Grains.
Sodium carbonate	0·047
Magnesium carbonate	0·188
Ferrous carbonate	0·022
Calcium carbonate	0·300
Potassium chloride	0·061
Sodium chloride	38·700
Magnesium chloride	6·004
Calcium chloride	8·464
Sodium sulphate	0·302
Aluminium sulphate	0·062
Calcium sulphate	0·285
Sodium iodide	0·019
Magnesium iodide	0·031
Sodium bromide	0·022
Magnesium bromide	0·039
Silica	0·488
Organic matter	0·267
Total	55·301
	Cubic inches.
Carbonic acid gas	0·75
Sulphuretted hydrogen	3·75

Ocean Springs, Jackson Co., Miss.

(*Chalybeate.*)

One pint contains,— (J. L. Smith.)	Grains.
Potassium chloride	trace
Sodium chloride	5·971
Magnesium chloride	0·621
Calcium chloride	0·485
Ferrous oxide	0·589
Iodine	trace
Alumina	trace
Organic matter	trace
Total	7·666
	Cubic inches.
Carbonic acid gas	1·22
Sulphuretted hydrogen	0·16

Warm Springs, Madison Co., N.C.

(*Thermal.*)

One pint contains,—	Bathing Springs. Temp., 102° F. (E. Adelmarth, M.D.) Grains.	Drinking Springs. Temp., 97° F. (E. Adelmarth, M.D.) Grains.
Potassium chloride	0·039	0·063
Sodium chloride	0·114	0·137
Magnesium chloride	0·027	0·046
Calcium chloride	1·263	1·118
Potassium sulphate	0·045	0·059
Sodium sulphate	1·128	1·113
Magnesium sulphate	0·168	1·016
Calcium sulphate	5·110	5·067
Soluble silicates	1·121	1·192
Total	9·015	9·811
	Cubic inches.	Cubic inches.
Carbonic acid gas	1·37	1·34
Sulphuretted hydrogen	0·22	0·31

St. Louis Artesian Well, St. Louis, Mo.

(*Saline.*)

One pint contains,— (Dr. Litton.)	Grains.
Magnesium carbonate	0·127
Ferrous carbonate	0·066
Calcium carbonate	1·329
Potassium chloride	1·126
Sodium chloride	43·826
Magnesium chloride	4·792
Calcium chloride	3·448
Calcium sulphate	5·709
Silica	0·017
Total	60·440
	Cubic inches.
Carbonic acid gas	0·82
Sulphuretted hydrogen	0·03

Warm Springs, Merriwether Co., Ga.

(*Thermal. 90° F.*)

One pint contains,— (Prof. A. Means.)	Grains.
Magnesium oxide	11·68
Calcium oxide	4·64
Ferrous oxide	2·14
Total	18·46
	Cubic inches.
Carbonic acid gas	1·11
Sulphuretted hydrogen	trace

WESTERN STATES (NOT INCLUDING CALIFORNIA AND OREGON).

Alpena Well, Alpena Co., Mich.

(*Sulphuretted.*)

One pint tains,— (Prof. S. P. Duffield.)	Grains.
Potassium carbonate	trace
Sodium carbonate	1·364
Magnesium carbonate	4·661
Ferrous carbonate	0·170
Calcium carbonate	4·787
Sodium chloride	8·532
Calcium sulphate	3·757
Alumina and silica	0·386
Total	23·657
	Cubic inches.
Carbonic acid gas	1·05
Sulphuretted hydrogen	4·42
Nitrogen	0·03

Greencastle Springs, Putnam Co., Ind.

(*Chalybeate.*)

One pint contains,—	North, or Daggy Spring. Grains.	Middle, or Dew-drop Spring. Grains.
Potassium carbonate	0·011	0·009
Sodium carbonate	0·012	0·008
Magnesium carbonate	0·588	0·667
Ferrous carbonate	0·051	0·298
Calcium carbonate	1·819	1·485
Sodium chloride	0·099	0·087
Sodium sulphate	0·017	0·012
Magnesium sulphate	0·131	0·129
Alumina	0·020	0·009
Silicic acid	0·011	0·001
Loss and undetermined	0·012	0·023
Total	2·771	2·733

Butterworth Springs, Grand Rapids, Mich.

(*Calcareous.*)

One pint contains,— (S. P. Duffield.)	Grains.
Sodium carbonate	0·434
Magnesium carbonate	0·432
Ferrous carbonate	0·088
Calcium carbonate	0·724
Potassium chloride	1·227
Sodium chloride	1·591
Magnesium chloride	5·232
Calcium chloride	0·763
Calcium sulphate	9·392
Silica	0·064
Alumina	0·051
Organic matter and loss	0·083
Total	20·081

Lansing Well, Ingham Co., Mich.

(*Saline.*)

One pint contains,— (Dr. Jennings.)	Grains.
Sodium carbonate	8·094
Magnesium carbonate	1·421
Ferrous carbonate	0·143
Calcium carbonate	7·782
Sodium chloride	33·349
Potassium sulphate	1·554
Sodium sulphate	3·131
Silica	0·413
Total	55·887
	Cubic inches.
Carbonic acid gas	24½·

EATON RAPIDS, EATON CO., MICH.

(*Calcareous.*)

One pint contains,—	Frost Well. (PROF. DUFFIELD.) Grains.	Shaw Well. (PROF. KEDZIE.) Grains.	Mosher Well. (PROF. KEDZIE.) Grains.	Stirling Well. (C. T. JACKSON, M.D.) Grains.	Bordine Well. (PROF. KEDZIE.) Grains.
Potassium carbonate	....	0·159	0·144	....	0·284
Sodium carbonate	....	1·446	0·672	0·542	0·472
Magnesium carbonate	0·949	0·480	0·565	....	0·622
Ferrous carbonate	0·248	0·154	0·125	0·292	0·203
Calcium carbonate	4·816	2·592	2·429	....	3·513
Sodium chloride	0·959	0·112	0·112	....	0·187
Sodium sulphate	....	....	....	1·311	....
Magnesium sulphate	....	....	....	0·978	....
Calcium sulphate	0·483	6·016	5·645	5·748	7·187
Ammonium nitrate	....	trace	trace	....	....
Silicic acid	....	0·175	0·317	....	....
Silica	1.639	....	....	....	0·250
Organic matter and loss	0·094	0·112	0·106	....	....
Total	9·188	11·246	10·115	8·871	12·718
	Cubic inches.	Cubic inches.	Cubic inches.	Cubic inches.	Cubic inches.
Carbonic acid gas	2·32	2·	1·92	2·	2·
Sulphuretted hydrogen	......	trace	trace	......	......

BETHESDA SPRINGS, WAUKESHA CO., WIS.

(*Alkaline and Calcareous.*)

One pint contains,— (C. F. CHANDLER.)	Grains.
Sodium carbonate	0·109
Magnesium carbonate	0·918
Ferrous carbonate	0·004
Calcium carbonate	1·478
Sodium chloride	0·145
Potassium sulphate	0·057
Sodium sulphate	0·068
Sodium phosphate	trace
Alumina	0·015
Silica	0·092
Organic matter	0·248
Total	3·134

FRENCH LICK SPRINGS, ORANGE CO., IND.

(*Sulphuretted.*)

One pint contains,—	Pluto's Well. (J. G. ROGERS, M.D.) Grains.	Proserpine. (J. G. ROGERS, M.D.) Grains.
Sodium carbonate	....	1.316
Magnesium carbonate	0·198	0·562
Aluminium and iron carbonates	trace	0·312
Calcium carbonate	0·868	2·536
Potassium chloride	....	0·626
Sodium chloride	17·567	11·365
Magnesium chloride	....	1·006
Calcium chloride	0·668	....
Sodium sulphate	2·796	4·590
Magnesium sulphate	2·264	3·666
Calcium sulphate	7·573	17·625
Silica	....	0·212
Total	31·934	43·816
	Cubic inches.	Cubic inches.
Carbonic acid gas	1·87	1·277
Sulphuretted hydrogen	3·18	2·125

HUBBARDSTON WELL, IONIA CO., MICH.

(*Calcareous.*)

One pint contains,— (PROF. P. H. DOUGLASS.)	Grains.
Magnesium carbonate	0·794
Calcium carbonate	2·067
Ferrous oxide	0·019
Silica	0·017
Total	2·897

FRUIT PORT WELL, OTTAWA CO., MICH.

(*Saline.*)

One pint contains,— (C. G. WHEELER.)	Grains.
Sodium carbonate	0·565
Magnesium carbonate	0·308
Ferrous carbonate	0·680
Manganese carbonate	0·010
Calcium carbonate	0·443
Potassium chloride	0·054
Sodium chloride	58·003
Magnesium chloride	5·851
Calcium chloride	13·888
Sodium sulphate	5·749
Magnesium bromide	0·095
Silica and silicates	1·325
Alumina	traces
Total	86·971

INDIAN SPRINGS, MARTIN CO., IND.

(*Sulphuretted and Saline.*)

One pint contains,— (E. T. COX.)	Grains.
Potassium carbonate	0·315
Sodium carbonate	0·452
Magnesium carbonate	2·368
Calcium carbonate	4·138
Sodium chloride	4·921
Magnesium chloride	0·007
Potassium sulphate	0·300
Sodium sulphate	1·478
Magnesium sulphate	3·799
Calcium sulphate	2·529
Aluminium sulphate	0·104
Ferric oxide	trace
Iodides and bromides	trace
Silicic acid	0·056
Total	20·467
	Cubic inches.
Carbonic acid	1·19
Sulphuretted hydrogen	0·42
Oxygen	0·49
Nitrogen	0·81

LAFAYETTE, TIPPECANOE CO., IND.

(Saline and Sulphuretted.)

One pint contains,— (C. M. WETHERELL, M.D.)	Grains.
Magnesium carbonate	3·590
Calcium carbonate	1·044
Sodium chloride	40·590
Magnesium chloride	3·707
Calcium chloride	0·465
Calcium sulphate	7·042
Magnesium iodide	trace
Aluminium and ferric oxide	0·062
Silica	0·058
Total	56·558
	Cubic inches.
Carbonic acid gas	1·52
Sulphuretted hydrogen	0·24
Nitrogen	0.61

MIDLAND WELL, MIDLAND CO., MICH.

(Purgative.)

One pint contains,— (S. P. DUFFIELD, M.D.)	Grains.
Sodium chloride	3·405
Magnesium chloride	0·228
Calcium chloride	0·647
Potassium sulphate	8·559
Sodium sulphate	2·298
Calcium sulphate	0·464
Aluminium phosphate	0·180
Silica	0·308
Organic matter	0·257
Loss	0·334
Total	16·680

LESLIE WELL, INGHAM CO., MICH.

(Calcareous.)

One pint contains,— (PROF. R. C. KEDZIE.)	Grains.
Potassium carbonate	0·359
Sodium carbonate	0·380
Magnesium carbonate	0·650
Ferrous carbonate	0·171
Calcium carbonate	2·214
Calcium sulphate	0·733
Silica	0·216
Organic matter	0·067
Total	4·790
	Cubic inches.
Carbonic acid	1·68

LODI ARTESIAN WELL, WABASH CO., IND.

(Sulphuretted.)

One pint contains,— (DR. PAHLE.)	Grains.
Magnesium carbonate	0·082
Calcium carbonate	0·252
Sodium chloride	62·808
Magnesium chloride	6·692
Calcium chloride	5·991
Potassium sulphate	0·100
Sodium sulphate	0·267
Magnesium sulphate	0·407
Calcium sulphate	6·944
Calcium phosphate	0·150
Magnesium iodide	trace
Magnesium bromide	0·110
Silicic acid	0·065
Sulphur (suspended)	0·625
Nitrogenous organic matter	0·100
Total	84·593
	Cubic inches.
Carbonic acid gas	undetermined
Sulphuretted hydrogen	0·99
Oxygen and nitrogen	undetermined

SALT LAKE HOT SPRINGS, UTAH.

(Thermal.)

One pint contains,— (C. T. JACKSON, M.D.)	Grains.
Magnesium Calcium } carbonates	0·447
Sodium chloride	2·443
Magnesium chloride	0·066
Calcium chloride	0·566
Sodium sulphate	0·692
Ferric oxide	0·021
Total	4·235

SCHUYLER SPRINGS, SCHUYLER CO., ILL.

(Chalybeate.)

One pint contains,— (DR. BLANEY.)	Grains.
Magnesium sulphate	0·373
Calcium sulphate	9·242
Ferrous sulphate	8·745
Silica	0·164
Alkaline sulphates	0·979
Total	19·503

PERRY SPRINGS, PIKE CO., ILL.

(Alkaline.)

One pint contains,—	No. 1. Middle Spring. (H. ENGELMANN, M.D.) Grains.	No. 2. Upper Spring. (H. ENGELMANN, M.D.) Grains.	No. 3. Lower Spring. (H. ENGELMANN, M.D.) Grains.
Potassium carbonate	0·199	0·181	0·157
Magnesium carbonate	1·260	1·097	0·777
Ferrous carbonate	0·051	0·040	0·025
Calcium carbonate	1·380	1·715	1·708
Sodium sulphate	0·055	0·137	0·173
Sodium and potassium silicates	0·330	0·285	0·431
Sodium silicate	0·015	0·048	0·072
Aluminium silicate	....	....	0·034
Total	3·290	3·503	3·377

Spring Lake Well, Ottawa Co., Mich.

(*Saline.*)

One pint contains,— (Prof. C. G. Wheeler.)	Grains.
Sodium carbonate	0·005
Magnesium carbonate	trace
Ferrous carbonate	0·092
Manganese carbonate	0·006
Calcium carbonate	0·012
Potassium chloride	0·536
Sodium chloride	50·691
Magnesium chloride	4·525
Calcium chloride	14·177
Sodium sulphate	5·837
Magnesium bromide	0·271
Alumina	traces
Ammonia	0·002
Lithia	traces
Silica	0·063
Organic matter	2·286
Total	78·503

St. Louis Spring, Gratiot Co., Mich.

(*Alkaline.*)

One pint contains,— (S. P. Duffield, M.D.)	Grains.
Sodium carbonate	7·684
Magnesium carbonate	1·080
Ferrous carbonate	0·091
Calcium carbonate	5·019
Calcium chloride	trace
Calcium sulphate	6·925
Calcium silicate	0·700
Silica	0·299
Organic matter and loss	0·208
Total	22·006
	Cubic inches.
Carbonic acid gas	1·36
Sulphuretted hydrogen	trace

Yellow Springs, Greene Co., Ohio.

(*Calcareous.*)

One pint contains,— (Wayne and Locke.)	Grains.
Calcium carbonate	2·446
Sodium chloride	0·019
Magnesium chloride	0·021
Calcium chloride	0·193
Calcium sulphate	0·169
Ferric oxide	0·049
Organic matter	....
Total	2·897

Green Springs, Sandusky Co., Ohio.

(*Purgative.*)

One pint contains,— (O. N. Stoddard.)	Grains.
Magnesium carbonate	2·798
Ferrous carbonate	2·462
Potassium chloride	0·310
Magnesium sulphate	4·517
Ferrous sulphate	0·816
Calcium sulphate	13·176
Potassium bromide	2·095
Silica	0·762
Alumina	0·122
Total	27·058
	Cubic inches.
Carbonic acid gas	12·06

West Baden Spring, Orange Co., Ind.

(*Sulphuretted.*)

One pint contains,— (E. T. Cox.)	Grains.
Potassium carbonate	0·078
Sodium carbonate	0·139
Magnesium carbonate	4·895
Calcium carbonate	5·172
Sodium chloride	9·748
Magnesium chloride	1·425
Calcium chloride	0·910
Potassium sulphate	0·171
Sodium sulphate	0·388
Magnesium sulphate	4·519
Calcium sulphate	1·398
Aluminium sulphate	0·569
Ferric oxide	0·011
Iodides and bromides	traces
Silicic acid	0·055
Total	29·478
	Cubic inches.
Carbonic acid gas	0·64
Sulphuretted hydrogen	0·61
Oxygen	0·21
Nitrogen	0·68

Sparta Artesian Well, Monroe Co., Wis.

(*Chalybeate.*)

One pint contains,— (J. M. Hirsch.)	Grains.
Sodium carbonate	0·015
Magnesium carbonate	0·249
Ferrous carbonate	1·083
Manganese carbonate	trace
Calcium carbonate	0·029
Ammonium carbonate	trace
Lithium carbonate	0·002
Strontium carbonate	0·001
Barium carbonate	trace
Sodium chloride	0·014
Calcium chloride	0·063
Potassium sulphate	0·066
Sodium sulphate	0·230
Calcium sulphate	0·018
Sodium phosphate	0·007
Aluminium phosphate	0·006
Sodium iodide	trace
Silica	0·029
Hydrogen sulphide	trace
Total	1·812

Idaho Hot Springs, Clear Creek Co., Col.

(*Thermal.* 85° *to* 115° *F.*)

One pint contains,— (J. G. Dohle.)	Grains.
Sodium carbonate	3·85
Magnesium carbonate	0·36
Ferrous carbonate	0·52
Calcium carbonate	1·19
Sodium chloride	0·52
Magnesium chloride	trace
Calcium chloride	trace
Sodium sulphate	3·67
Magnesium sulphate	2·34
Calcium sulphate	0·43
Sodium silicate	0·51
Total	13·39

Manitou Spring, El Paso Co., Colorado.

(*Alkaline.*)

Analysis of residual solids by T. M. Drown.	Percentage.
Sodium bicarbonate	24·01
Magnesium bicarbonate	8·89
Calcium bicarbonate	15·62
Potassium chloride	10·01
Sodium chloride	36·69
Sodium sulphate	4·78
Total	100·00

Owosso Spring, Shiawassee Co., Mich.

(*Chalybeate.*)

One pint contains,—	Grains.
Magnesium carbonate	1·413
Ferrous carbonate	1·443
Calcium carbonate	2·228
Sodium and potassium chlorides	0·262
Silica and alumina	0·077
Total	5·423

Versailles Springs, Brown Co., Ill.

(*Alkaline.*)

One pint contains,—	Magnesia Spring. (G. A. Marriner.) Grains.	Ourry Spring. (J. V. Blaney, M.D.) Grains.	Monitor Spring. (J. V. Blaney, M.D) Grains.
Sodium, Potassium } carbonates	0·165	trace	trace
Sodium carbonate	....	0·953	0·953
Magnesium carbonate	1·119	0·933	0·873
Ferrous carbonate	0·008	......	0·267
Calcium carbonate	1·825	1·514	2·017
Sodium chloride	trace	trace	trace
Calcium sulphate	trace	0·261	....
Potassa	....	....	....
Alumina and trace of iron	....	0·091	....
Silica	0·175	0.102	0·213
Organic matter	....	trace	trace
Total	3·292	3·854	4·323
	Cubic inches.		
Carbonic acid gas	3·0		

CALIFORNIA AND OREGON.

Adams Springs, Lake Co., Cal.

(*Alkaline.*)

One pint contains,— (Second Report Board of Health of California.)	Grains.
Sodium carbonate	7·129
Magnesium carbonate	12·378
Ferrous carbonate	0·064
Calcium carbonate	3·589
Sodium chloride	0·514
Potassium salts	traces
Nitric acid	traces
Silica	0·902
Organic matter	0·351
Total	24·927
	Cubic inches.
Carbonic acid gas	38·00

Calistoga Springs, Napa Co., Cal.

(*Sulphuretted.*)

One pint contains,— (F. W. Hatch, M.D.)	Grains.
Sodium carbonate	0·425
Sodium chloride	2·781
Calcium chloride	0·408
Sodium sulphate	0·202
Magnesium sulphate	0·058
Silica	0·812
Alumina	trace
Total	4·686
	Cubic inches.
Sulphuretted hydrogen	0·40

Des Chutes Hot Springs, Wasco Co., Oregon.

(*Thermal*, 143° and 145° F.)

One pint contains,— (L. M. Dornbach and Prof. E. N. Horsford)	Grains.
Sodium carbonate	4·312
Potassium chloride	0·250
Sodium chloride	2·552
Magnesium chloride	0·152
Sodium sulphate	1·183
Calcium sulphate	0·228
Sodium silicate	1·025
Iron	trace
Total	9·702
	Cubic inches.
Carbonic acid gas	2·82

Borax Spring, Lake Co., Cal.

(*Saline.*)

One gallon contains,— (G. E. Moore.)	Grains.
Potassium chloride	trace
Sodium chloride	84·62
Magnesium iodide	0·09
Magnesium bromide	trace
Sodium bicarbonate	76·96
Ammonium bicarbonate	107·76
Sodium biborate	103·29
Calcium sulphate	trace
Alumina	1·26
Carbonic acid gas	36·37
Silicic acid	8·23
Total	418·58

BEER SPRINGS, OREGON.

(*Purgative.*)

One pint contains,—	Grains.
Magnesium carbonate	1·61
Calcium carbonate	1·93
Sodium chloride	1·12
Magnesium chloride	0·56
Calcium chloride	0·67
Magnesium sulphate	6·05
Calcium sulphate	1·06
Vegetable extractive matter	0·42
Total	13·42

NAPA SODA SPRINGS, NAPA CO., CAL.

(*Alkaline and Chalybeate.*)

One pint contains,— (LANZWEERT.)	Grains.
Sodium carbonate	1·138
Magnesium carbonate	3·265
Ferrous carbonate	0·980
Calcium carbonate	1·360
Sodium chloride	0·650
Sodium sulphate	0·230
Silicic acid	0·085
Alumina	0·075
Loss	0·310
Total	8·093

CALIFORNIA SELTZER SPRINGS, MENDOCINO CO., CAL.

(*Alkaline.*)

One pint contains,— (F. A. BAUER.)	Grains.
Sodium carbonate	4·61
Magnesium carbonate	5·65
Calcium carbonate	8·80
Ferrous carbonate	trace
Sodium chloride	2·15
Silicic acid	trace
Total	21·21
Carbonic acid gas	abundant

PASO ROBLES HOT SPRINGS, CAL.

(*Thermal.*)

One pint contains,—	Main Spring. 112° F. (PROF. THOMAS PRICE.) Grains.	Mud Spring. 122° F. (PROF. THOMAS PRICE.) Grains.
Sodium carbonate	3·664	0·543
Magnesium carbonate	0·057	0·323
Sodium chloride	2·830	10·047
Potassium sulphate	0·092	trace
Sodium sulphate	0·818	4·281
Calcium sulphate	0·334	1·864
Ferrous oxide	0·037	....
Iodides and bromides	traces	....
Alumina	0·023	....
Silica	0·046	0·116
Organic matter	0·171	0·361
Total	8·072	17·535
	Cubic inches.	Cubic inches.
Carbonic acid gas	2·31	10·53
Sulphuretted hydrogen	saturated	saturated

CONGRESS SPRINGS, SANTA CLARA CO., CAL.

(*Alkaline.*)

One pint contains,—	Grains.
Sodium carbonate	15·418
Ferrous carbonate	1·753
Calcium carbonate	2·161
Sodium chloride	14·894
Sodium sulphate	1·517
Silica, alumina, and trace of magnesia	6·235
Total	41·978

VICHY SPRINGS, NEW ALMADEN, SANTA CLARA CO., CAL.

(*Alkaline.*)

One pint contains,—	Grains.
Sodium carbonate	17·440
Calcium carbonate	2·878
Sodium chloride	4·200
Magnesium sulphate	1·500
Calcium sulphate	5·250
Ferric oxide	0·600
Silica	trace
Total	31·868
	Cubic inches.
Carbonic acid gas	29·85

WILHOITS SODA SPRINGS, CLACKAMAS CO., OREGON.

(*Alkaline and Saline.*)

One pint contains,— (J. H. VEACH, M.D.)	Grains.
Sodium carbonate	10·946
Magnesium carbonate	10·665
Ferrous carbonate	0·750
Calcium carbonate	4·028
Sodium chloride	25·125
Sodium sulphate	0·425
Magnesium sulphate	0·810
Iodine	trace
Total	52·749
	Cubic inches.
Carbonic acid gas	42·

SUMMIT SODA SPRINGS, ALPINE CO., CAL.

(*Chalybeate.*)

One pint contains,—	Grains.
Sodium carbonate	1·187
Magnesium carbonate	0·525
Calcium carbonate	3·751
Sodium chloride	3·277
Ferric oxide	0·218
Potassa	trace
Silica	0·257
Alumina	0·218
Total	9·433
	Cubic inches.
Carbonic acid gas	23·29

ST. HELENA WHITE SULPHUR SPRINGS, NAPA CO., CAL.

(*Saline and Sulphuretted.*)

One pint contains,—	No. 2. (PROF. LE CONTE.) Grains.	No. 6. (PROF. LE CONTE.) Grains.	No. 7. (PROF. LE CONTE.) Grains.
Magnesium carbonate	0·077	0·070	0·545
Calcium carbonate	0·156	0·305	0·695
Sodium chloride	2·715	2·951	0·779
Magnesium chloride	0·108	0·277	0·081
Calcium chloride	0·145	0·107	0·097

ST. HELENA WHITE SULPHUR SPRINGS.—*Continued.*

	Grains.	Grains.	Grains.
Sodium sulphate	1·032	1·416	1·605
Calcium and sodium sulphides	0·331	0·231	0·202
Total	4·564	5·357	4·004
	Cubic inches.	Cubic inches.	Cubic inches.
Sulphuretted hydrogen	0·76	0·53	trace

CANADIAN MINERAL SPRINGS.

CALEDONIA SPRINGS, PRESCOTT CO., PROVINCE OF ONTARIO, DOMINION OF CANADA.

		(*Saline.*)		(*Sulphuretted.*)
One pint contains,—	Gas Spring, 44½° F. (T. S. HUNT.) Grains.	Saline Spring, 45° F. (T. S. HUNT.) Grains..	Intermittent Spring, 50° F. (T. S. HUNT.) Grains.	46° F. T. S. HUNT. Grains.
Sodium carbonate	·354	1·284	....	3·321
Magnesium carbonate	3·834	3·769	6·294	2·142
Ferrous carbonate	....	trace	trace	trace
Calcium carbonate	1·078	·856	·921	1·530
Manganese carbonate	....	trace	....	....
Potassium chloride	·225	·219	·222	·167
Sodium chloride	50·772	46·934	89·265	28·004
Magnesium chloride	....	....	7·533	....
Calcium chloride	....	....	2·091	....
Potassium sulphate	·038	·035	....	....
Sodium iodide	·003	·010	....	....
Magnesium iodide	....	....	·015	....
Sodium bromide	·109	·123	....	·073
Magnesium bromide	....	....	·173	....
Alumina	·032	trace	trace	·019
Silica	·225	·309	·164	·612
Sodium sulphate	....	....	....	·133
Total	56·670	53·539	106·673	36·001
	Cubic inches.	Cubic inches.		Cubic inches.
Carbonic acid gas	5·	4·		2·

CAXTON SPRINGS, THREE RIVERS, QUEBEC, CANADA.

(*Alkaline and Saline.*)

One pint contains,— (T. STERRY HUNT.)	Grains.
Magnesium carbonate	7·721
Ferrous carbonate	0·039
Calcium carbonate	1·574
Potassium chloride	0·583
Sodium chloride	85·828
Magnesium chloride	2·661
Calcium chloride	0·366
Iodine	traces
Magnesium bromide	0·249
Alumina	0·036
Silica	0·349
Total	99·406
	Cubic inches.
Carbonic acid gas	9·93

SANDWICH SPRINGS, ONTARIO, CANADA.

(*Sulphuretted and Saline.*)

One pint contains,— (PROF. S. P. DUFFIELD.)	Grains.
Potassium carbonate	trace
Sodium carbonate	6·070
Magnesium carbonate	1·618
Calcium carbonate	4·813
Sodium chloride	0·070
Magnesium chloride	19·220
Calcium chloride	0·007
Calcium sulphate	15·479
Silica	0·014
Total	47·291
	Cubic inches.
Carbonic acid gas	1·25
Sulphuretted hydrogen	4·72
Nitrogen	0·09

ST. CATHERINE'S WELLS, ONTARIO, CANADA.

(*Saline.*)

One pint contains,—	Stephenson House Well. (PROF. CROFT.) Grains.	Welland House Well. (PROF. CROFT.) Grains.
Ferrous carbonate	....	·380
Calcium carbonate	....	·060
Potassium chloride	2·587	2·060
Sodium chloride	217·234	275·868
Magnesium chloride	24·760	29·644
Calcium chloride	108·271	127.202
Ammonium chloride and silicic acid	0·056	....
Calcium sulphate	15·981	14·429
Sodium iodide	....	0·010
Magnesium iodide	0·030	....
Sodium bromide	....	trace
Magnesium bromide	0 045	....
Total	368·964	449 653

EUROPEAN MINERAL WATERS OF NOTE.

Under this heading will be given analyses of noted European mineral waters, either such as are known as articles of export or those where a health resort of reputation has been established. They will be grouped, not according to locality, but in classes, according to their chemical composition or reputed therapeutic value.

I.—Alkaline Waters.

APOLLINARIS WATER, NEUENAHR, RHENISH PRUSSIA.

Contents of 16 ozs.,— (BISCHOF.)	Grains.
Sodium carbonate	9·65
Magnesium carbonate	3·39
Calcium carbonate	·45
Sodium chloride	3·57
Sodium sulphate	2·30
Ferric oxide	0·15
Alumina	0·15
Silica	0·06
Total	19·59
	Cubic inches.
Carbonic acid gas	47·04

The water is exported.

VICTORIAQUELLE, NEUENAHR, RHENISH PRUSSIA.

One pint contains,—	Grains.
Sodium bicarbonate	10·80
Magnesium bicarbonate	3·74
Calcium bicarbonate	3·30
Sodium sulphate	0·73
Sodium chloride	0·91
Ferrous oxide and alumina	0·10
Silica	0·25
Total	19·83
	Grains.
Carbonic acid gas	12·86

EMS ON THE LAHN, GERMANY.

There are four springs here the waters of which are used,—Kesselbrunnen, Kränchen, Fürstenbrunnen, and Neucquelle. The analysis of the first is given.

KESSELBRUNNEN.

Temp. 115° F.

One pint contains,— (FRESENIUS)	Grains.
Sodium carbonate	10·5379
Magnesium carbonate	0·8510
Ferrous carbonate	0·0202
Manganese carbonate	0·0035
Calcium carbonate	1·2591
Strontium and barium carbonate	0·0030
Sodium chloride	7·7705
Potassium sulphate	0·3937
Sodium sulphate	0·0061
Aluminium phosphate	0·0096
Silica	0·3648
Total	21·2194
	Cubic inches.
Carbonic acid gas	6·788

FACHINGEN, NASSAU, GERMANY.

One pint contains,— (FRESENIUS.)	Grains.
Sodium carbonate	19·4763
Magnesium carbonate	1·3580
Ferrous carbonate	0·0801
Calcium carbonate	2·0110
Lithium carbonate	0·0004
Strontium carbonate	0·0007
Sodium chloride	4·5574
Calcium chloride	0·0034
Sodium sulphate	0·1372
Sodium phosphate	0·0506
Aluminium phosphate	0·0003
Calcium phosphate	0·0004
Lithium phosphate	0·0002
Silica phosphate	0·2610
Calcium fluoride	0·0027
Total	27·9397
	Cubic inches.
Carbonic acid gas	32·975
Nitrogen	0·025

The water of this spring is chiefly exported.

GEILNAU, HESSE, GERMANY.

One pint contains,— (FRESENIUS.)	Grains.
Sodium bicarbonate	8·142
Calcium bicarbonate	3·767
Magnesium bicarbonate	2·788
Barium bicarbonate	0·001
Ferrous bicarbonate	0·294
Manganese bicarbonate	0·035
Potassium sulphate	0·135
Sodium sulphate	0·066
Sodium phosphate	0·003
Sodium chloride	0·278
Total	16·699
	Grains.
Ammonium bicarbonate	0·010
Carbonic acid gas, free	21·400
Nitrogen	0·119
Total	21·529

Traces of lithium carbonate, sodium borate, alumina, sodium nitrate, calcium fluoride, strontium carbonate, organic matter, and hydrogen sulphide gas.

The water of this spring is used exclusively for export.

WEILBACH, HESSE, GERMANY.

One pint contains,— (FRESENIUS.)	Grains.
Sodium carbonate	7·3748
Sodium chloride	9·6677
Sodium sulphate	1·7173
Potassium sulphate	0·4233
Sodium bromide	0·0056
Sodium iodide	0·0010
Lithium carbonate	0·0452
Ferrous carbonate	0·0193
Manganese carbonate	0·0039
Calcium carbonate	0·7504
Magnesium carbonate	0·5563
Silica	0·0943
Total	20·6581
	Grains.
Ammonium carbonate	0·0871
Carbonic acid gas	5·9553
Sulphuretted hydrogen	0·0026
Total	6·0450

VICHY, FRANCE.

There are three springs here, the waters of which are used,—Grande Grille, Hôpital, and Celestins. The analysis of the first is given.

GRANDE GRILLE.

Temp. 105·8° F.

One pint contains,— (BOQUET.)	Grains.
Potassium carbonate	2·04
Sodium carbonate	26·00
Magnesium carbonate	1·38
Ferrous carbonate	0·02
Manganese carbonate	trace
Calcium carbonate	2·31
Strontium carbonate	0·01
Sodium chloride	4·10
Sodium sulphate	2·29
Sodium phosphate	0·78
Sodium borate	trace
Sodium arseniate	0·01
Silica	0·05
Total	38·99
	Cubic inches.
Carbonic acid gas	14·74

BILIN, BOHEMIA.

One pint contains,—	Josephsquelle. (BY REDTENBACHER.) Grains.
Sodium carbonate	23·106
Calcium carbonate	3·089
Magnesium carbonate	1·098
Lithium carbonate	0·110
Ferrous carbonate	0·080
Sodium sulphate	6·350
Potassium sulphate	0·985
Sodium chloride	2·935
Aluminium phosphate	0·065
Silica	0·244
Total	38·062
	Cubic inches.
Carbonic acid gas, free	15·092
Carbonic acid, combined as bicarbonate	17·247
Total	32·339

GIESSHÜBEL (NEAR CARLSBAD), BOHEMIA.

One pint contains,— (GÜTTEL.)	Grains.
Sodium carbonate	7·096
Calcium carbonate	1·459
Magnesium carbonate	0·340
Ferrous carbonate	0·0004
Potassium carbonate	0·656
Potassium sulphate	0·222
Potassium chloride	0·376
Silica	0·656
Alumina	0·017
Total	10·972
	Cubic inches.
Carbonic acid gas	38·208

OBERSALZBRUNN, SILESIA.

One pint contains,— (FISCHER.)	Oberbrunnen. Grains.	Mühlbrunnen. Grains.
Sodium carbonate	8·81	8·09
Sodium chloride	1·12	0·62
Sodium sulphate	3·93	2·61
Calcium carbonate	2·02	2·12
Magnesium carbonate	1·00	1·88
Ferrous carbonate	0·07	0·04
Silica	0·26	0·30
Total	18·60	15·66
	Cubic inches.	Cubic inches.
Carbonic acid gas	37·50	3·3

LUHATSCHOWITZ, MORAVIA.

One pint contains,— (FERSTL.)	Vincenzbrunnen. Grains.	Amandibrunnen. Grains.
Sodium carbonate	23·263	36·038
Sodium chloride	23·527	25·753
Sodium bromide	0·255	0·101
Sodium iodide	0·132	0·129
Lithium carbonate	0·009	0·014
Magnesium carbonate	0·422	0·568
Barium carbonate	0·070	0·064
Calcium carbonate	4·684	4·819
Strontium carbonate	0·093	0·115
Ferrous carbonate	0·111	0·135
Potassium chloride	1·795	1·595
Silica	0·395	0·107
Total	54·850	69·52
	Cubic inches.	Cubic inches.
Carbonic acid gas	50·	29·

II.—Saline Waters.

BOURBONNE, HAUTE-MARNE, FRANCE.

Temp. 149° F.

One pint contains,— (CHEVALLIER.)	Grains.
Calcium carbonate	2·264
Sodium chloride	46·110
Calcium chloride	5·683
Calcium sulphate	5·993
Potassium bromide	0·384
Total	60·434

HOMBURG, HESSE, GERMANY.

ELIZABETHBRUNEN.

One pint contains,— (LIEBIG.)	Grains.
Magnesium carbonate	2·01
Ferrous carbonate	0·46
Calcium carbonate	10·99
Sodium chloride	79·15
Magnesium chloride	7·79
Calcium chloride	7·77
Sodium sulphate	0·38
Silica	0·32
Total	108·87
	Cubic inches.
Carbonic acid gas	48·46

HOMBURG, HESSE.

One pint contains,—	Kaiserbrunnen. (HOFFMAN.) Grains.	Ludwigsbrunnen. (HOFFMAN.) Grains.	Stahlbrunnen. (LIEBIG.) Grains.
Sodium chloride	104·94	47·96	79·86
Potassium chloride	0·28	1·71	0·18
Magnesium chloride	8·52	3·06	5·23
Calcium chloride	17·50	7·28	10·67
Ferrous carbonate	0·53	0·42	0·94
Calcium sulphate	0·17	0·15	0·15
Calcium carbonate	0·68	5·74	7·53
Magnesium carbonate	....	0·10	....
Silica	0·09	0·20	0·31
Total	132·71	66·63	104·97
	Grains.	Grains.	Grains.
Carbonic acid gas	51·91	19·42	21·27
	Cubic inches.	Cubic inches.	Cubic inches.
Carbonic acid gas	109·16	43·59	46·91

KISSINGEN (RAKOCZI), BAVARIA.

One pint contains,— (LIEBIG.)	Grains.
Ferrous carbonate	0·24
Calcium carbonate	8·14
Potassium chloride	2·20
Sodium chloride	44·71
Magnesium chloride	2·33
Lithium chloride	0·15
Magnesium sulphate	4·50
Calcium sulphate	2·99
Calcium phosphate	0·04
Sodium iodide	trace
Sodium bromide	0·06
Sodium nitrate	0·07
Silica	0·09
Total	65·52
	Cubic inches.
Carbonic acid gas	41·77
Ammonia	0·007

SELTERS, NASSAU, GERMANY.

One pint contains,— (HASTNER.)	Grains.
Sodium carbonate	6·778
Magnesium carbonate	1·516
Ferrous carbonate	0·079
Manganese carbonate	0·002
Calcium carbonate	1·852
Potassium chloride	0·289
Sodium chloride	17·228
Sodium sulphate	0·261
Calcium sulphate	0·261
Sodium phosphate	0·0002
Aluminium phosphate	0·0004
Potassium bromide	0·0002
Calcium fluoride	0·0016
Silica	0·250
	28·5184
	Cubic inches.
Carbonic acid gas	30·
Oxygen	0·0046
Nitrogen	0·0285

Is exported only.

WIESBADEN (KOCHBRUNNEN), NASSAU, GERMANY.

Temp. 155·75° F.

One pint contains,— (FRESENIUS.)	Grains.
Magnesium carbonate	0·08
Ferrous carbonate	0·04
Manganese carbonate	0·004
Calcium carbonate	3·21
Potassium chloride	1·12
Sodium chloride	52·50
Magnesium chloride	1·57
Calcium chloride	3·62
Ammonium chloride	0·13
Lithium chloride	0·001
Calcium sulphate	0·69
Calcium phosphate	0·003
Magnesium bromide	0·03
Calcium arseniate	0·001
Aluminium silicate	0·004
Silica	0·46
Total	63·463
	Cubic inches.
Carbonic acid gas	16·7
Nitrogen	0·10

CHELTENHAM, ENGLAND.

One pint contains,— (PARKES AND BRANDE.)	Grains.
Sodium sulphate	15·00
Magnesium sulphate	11·00
Calcium sulphate	4·50
Sodium chloride	50·00
Total	80·50

KREUZNACH, RHENISH PRUSSIA.

One pint contains,—	Elisenquelle. (LÖWIG.) Grains.	Oranienquelle. (LIEBIG.) Grains.
Magnesium carbonate	0·106	0·130
Ferrous carbonate	....	0·356
Manganese carbonate	....	....
Calcium carbonate	1·693	0·255
Potassium chloride	0 624	0·460
Sodium chloride	72·883	108·705
Magnesium chloride	4·071	....
Calcium chloride	13·389	22 749
Lithium chloride	0·613	....
Calcium sulphate	....	....
Aluminium phosphate	0·025	0·095
Magnesium iodide	0·035	0·012

Kreuznach.—*Continued.*

	Grains.	Grains.
Magnesium bromide	0·278	1·780
Silica	0·129	0·999
Total	93·846	135·541
Carbonic acid gas	none	none

This is ranked rather as a medicinal brine.

Nauheim, Hesse-Cassel, Germany.

One pint contains,— (Bromeis.)	Kurbrunnen. Grains.
Ferrous carbonate	0·145
Manganese carbonate	0·021
Calcium carbonate	8·028
Potassium chloride	4·047
Sodium chloride	109·923
Magnesium chloride	2·155
Calcium chloride	8·215
Calcium sulphate	0·740
Magnesium bromide	0·295
Silica	0·115
Total	133·684
	Cubic inches.
Carbonic acid gas	31·2

This is ranked rather as a medicinal brine.

Hall, Austria.

One pint contains,— (Netwald.)	Hauptquelle. Grains.
Sodium chloride	112·04
Potassium chloride	0·049
Ammonium chloride	0·033
Calcium chloride	2·933
Magnesium chloride	2·622
Sodium iodide	0·061
Magnesium iodide	0·285
Magnesium bromide	0·518
Calcium phosphate	0·026
Calcium carbonate	0·480
Magnesium carbonate	0·242
Ferrous carbonate	0·088
Silica	0·073
Total	119·454
	Grains.
Carbonic acid gas	1·37

This is ranked rather as a medicinal brine.

III.—Sulphur Waters.

Aix-la-Chapelle, Rhenish Prussia.

There are four springs here, the waters of which are used,—Kaiserquelle, Corneliusquelle, Rosenquelle, and the Quirinusquelle. The analysis of the first is given.

Kaiserquelle.

Temp. 131° F.

One pint contains,— (Liebig.)	Grains.
Sodium carbonate	4·995
Magnesium carbonate	0·395
Ferrous carbonate	0·073
Calcium carbonate	1·217
Lithium carbonate	0·002
Strontium carbonate	0·002
Sodium chloride	20·271
Potassium sulphate	1·186
Sodium sulphate	1·271
Sodium sulphide	0·073
Sodium iodide	0·004
Sodium bromide	0·028
Silica	0·508
Organic matter	0·577
Total	31·502
	Per cent.
Carbonic acid gas	30·89
Sulphuretted hydrogen	0·31
Carburetted hydrogen	1·82
Nitrogen	66·98

Aix-le-Bains, Savoy, France.

One pint contains,— (Bonjean.)	Eaux de Soufre. 108°–110° F. Grains.
Magnesium carbonate	0·188
Ferrous carbonate	0·064
Calcium carbonate	1·084
Strontium carbonate	traces
Sodium chloride	0·057
Magnesium chloride	0·125
Sodium sulphate	0·701
Magnesium sulphate	0·257
Aluminium sulphate	0·400
Ferrous sulphate	traces
Calcium sulphate	0·117
Aluminium and calcium phosphates and calcium fluoride	0·017
Potassium iodide	traces
Silica	0·036
Loss	0·087
Total	3·133
	Cubic inches.
Carbonic acid gas	0·39
Sulphuretted hydrogen	0·82
Nitrogen	19·04

Baréges (Boucheries), Hautes-Pyrénées, France.

One pint contains,— (Latour.)	Grains.
Calcium carbonate	0·014
Sodium chloride	0·234
Magnesium chloride	0·292
Sodium sulphate	0·147
Ferrous sulphate	0·080
Sodium sulphide	0·116
Sodium iodide	0·007
Sodium silicate	0·146
Aluminium and calcium silicate	0·080
Calcium silicate	0·080
Bituminous, glairine, and loss	0·087
Total	1·203

Bagnères-de-Luchon (La Reine), Haute-Garonne, France.

Temp. 131° F.

One pint contains,— (Filhol.)	Grains.
Sodium carbonate	traces
Sodium chloride	0·492
Potassium sulphate	0·063
Sodium sulphate	0·162
Calcium sulphate	0·236
Sodium sulphide	0·401
Ferrous sulphide	0·020
Manganese sulphuret	0·024
Cupric sulphide	traces
Sodium hyposulphite	traces
Sodium iodide	traces
Sodium silicate	traces

Bagnères-de-Luchon.—*Continued.*

Magnesium silicate	0·060
Aluminium silicate	0·180
Calcium silicate	0·086
Silica	traces
Aluminium	traces
Phosphates	traces
Total	1·724
Sulphuretted hydrogen	traces

Meinberg (Schwefelquelle), Lippe-Detmold, Germany.

One pint contains,— (Brandes.)	Grains.
Magnesium carbonate	0·172
Ferrous carbonate	0·008
Calcium carbonate	2·149
Magnesium chloride	1·035
Potassium sulphate	0·005
Sodium sulphate	5·844
Magnesium sulphate	1·733
Calcium sulphate	8·335
Strontium sulphate	0·008
Sodium sulphide	0·067
Aluminium phosphate	0·010
Silica	0·120
Total	19·486
	Cubic inches.
Carbonic acid gas	2·31
Sulphuretted hydrogen	0·61
Nitrogen	0·40
Oxygen	0·02

Nenndorf, Hesse, Germany (Trinkquelle).

One pint contains,— (Bunsen.)	Grains.
Calcium carbonate	3·381
Magnesium chloride	1·851
Potassium sulphate	0·339
Sodium sulphate	4·549
Magnesium sulphate	2·318
Calcium sulphate	8·121
Calcium sulphide	0·555
Silica	0·162
Total	21·276
	Cubic inches.
Carbonic acid gas	5·25
Sulphuretted hydrogen	1·28
Carburetted hydrogen	0·05
Nitrogen	0·61

Harrowgate, England.

One pint contains,—	Old Sulphur Well. (A. W. Hofmann.) Grains	Montpellier Strong. (A. W. Hofmann.) Grains.
Sodium sulphide	1·548	1·441
Calcium sulphate	0·013	0·059
Calcium carbonate	1·237	2·418
Calcium fluoride	trace	trace
Calcium chloride	8·174	6·191
Magnesium chloride	5·569	5·467
Potassium chloride	5·470	0·575
Sodium chloride	86·018	80·309
Sodium bromide	trace	....
Sodium iodide	trace	....
Ammonia	trace	trace
Ferrous carbonate	trace	....
Manganese carbonate	trace	....

Harrowgate.—*Continued.*

	Grains.	Grains.
Silica	0 025	0·184
Organic matter	....	trace
Total	109·658	96·646
	Cubic inches.	Cubic inches.
Carbonic acid gas	2 200	1·401
Marsh-gas	0·584	0·053
Sulphuretted hydrogen	0·531	....
Oxygen	....	0·048
Nitrogen	0·291	0·482
Total	3·409	1·984

IV.—Chalybeate Waters.

Pyrmont, Waldeck, Germany (Trinkbrunnen).

One pint contains,— (Wiggers.)	Grains.
Magnesium carbonate	0·740
Ferrous carbonate	0·310
Manganese carbonate	0·024
Calcium carbonate	7·276
Ammonium carbonate	0·002
Sodium chloride	3·752
Magnesium chloride	0·508
Lithium chloride	0·019
Potassium sulphate	0·170
Magnesium sulphate	2·838
Calcium sulphate	6·609
Sodium nitrate	traces
Alumina	0·008
Silica	0 019
Organic matter	traces
Total	22·275
	Cubic inches.
Carbonic acid gas	47·10

Schwalbach (Stahlbrunnen), Nassau, Germany.

One pint contains,— (Fresenius.)	Grains.
Sodium carbonate	0·110
Magnesium carbonate	0·966
Ferrous carbonate	0·467
Manganese carbonate	0·103
Calcium carbonate	1·181
Sodium chloride	0·052
Potassium sulphate	0·029
Sodium sulphate	0·061
Sodium phosphate	traces
Sodium borate	traces
Silica	0·246
Organic matter	traces
Total	3·215
	Cubic inches.
Carbonic acid gas	50·27
Sulphuretted hydrogen	0·003

Spa (Pouhon), Liege, Belgium.

One pint contains,— (Monheim.)	Grains.
Sodium carbonate	0·700
Magnesium carbonate	0·241
Aluminium carbonate	0·024
Ferrous carbonate	·677
Calcium carbonate	0·580
Sodium chloride	0·157

SPA.—*Continued.*

	Grains.
Silica	0·217
Loss	0·012
Total	2·608
	Cubic inches.
Carbonic acid gas	71·6

ST. MORITZ (GRANDE SOURCE), GRISONS, SWITZERLAND.

One pint contains,— (PLANTA AND KEKULÉ.)	Grains.
Sodium carbonate	1·364
Magnesium carbonate	0·827
Ferrous carbonate	0·173
Manganese carbonate	0·030
Calcium carbonate	5·303
Sodium chloride	0·282
Potassium sulphate	0·119
Sodium sulphate	1·967
Phosphoric acid	0·003
Bromine, iodine, fluorine	traces
Alumina	0·002
Silica	0·278
Total	10·348
	Cubic inches.
Carbonic acid gas	39·29

TUNBRIDGE WELLS, ENGLAND.

One wine gallon contains,— (SCUDAMORE.)	Grains.
Sodium chloride	2·46
Calcium chloride	0·39
Magnesium chloride	0·29
Calcium sulphate	1·41
Calcium carbonate	0·27
Ferric oxide	2·22
Manganese, organic, and silica	0·44
Loss	0·13
Total	7·61

BRIGHTON, ENGLAND.

One pint contains,— (MARCET.)	Grains.
Ferrous sulphate	1·80
Calcium sulphate	4·09
Sodium chloride	1·53
Magnesium chloride	0·75
Silica	0·14
Loss	0·19
Total	8·50
	Cubic inches.
Carbonic acid gas	2·5

CHELTENHAM, ENGLAND.

One pint contains,— (BRANDE AND PARKES.)	Grains.
Sodium carbonate	0·5
Sodium sulphate	22·7
Magnesium sulphate	6·0
Calcium sulphate	2·5
Sodium chloride	41·3
Ferric oxide	0·8
Total	73·8
	Cubic inches.
Carbonic acid gas	2·5

V.—Purgative Waters.

CARLSBAD (SPRUDEL), BOHEMIA.

Temp. 162·5° F.

One pint contains,— (GÖTTL.)	Grains.
Sodium carbonate	9·062
Magnesium carbonate	0·399
Ferrous carbonate	0·031
Calcium carbonate	2·020
Sodium chloride	8·724
Potassium sulphate	0·370
Sodium sulphate	19·960
Aluminium phosphate	0·215
Silica	1·052
Total	41·833
	Cubic inches.
Carbonic acid gas	7·80
Nitrogen	0·03

FRIEDRICHSHALL, SAXE-MEININGEN, GERMANY.

One pint contains,— (BAUER.)	Grains.
Magnesium carbonate	3·53
Calcium carbonate	0·11
Sodium chloride	67·37
Magnesium chloride	31·08
Aluminium chloride	0·07
Ammonium chloride	0·06
Sulphate of potassa	0·02
Sodium sulphate	41·73
Magnesium sulphate	39·55
Calcium sulphate	11·24
Magnesium bromide	0·02
Silica	0·21
Total	194·99
	Cubic inches.
Carbonic acid gas	5·32

MARIENBAD (KREUZBRUNNEN), BOHEMIA.

One pint contains,— (KERSTEN.)	Grains.
Sodium carbonate	8·594
Magnesium carbonate	3·200
Ferrous carbonate	0·330
Manganese carbonate	0·039
Calcium carbonate	4·605
Lithium carbonate	0·049
Strontium carbonate	0·014
Sodium chloride	11·166
Potassium sulphate	0·449
Sodium sulphate	36·269
Aluminium phosphate	0·054
Calcium phosphate	0·018
Silica	0·679
Total	65·486
	Cubic inches.
Carbonic acid gas	15·7

PÜLLNA, BOHEMIA.

One pint contains,— (STRUVE.)	Grains.
Magnesium carbonate	6·406
Calcium carbonate	0·770
Magnesium chloride	19·666
Potassium sulphate	4·800
Sodium sulphate	123·800
Magnesium sulphate	93·086

PÜLLNA.—*Continued.*

	Grains.
Calcium sulphate	2·600
Calcium phosphate	0·003
Silica	0·176
Total	248·307

SEIDLITZ, BOHEMIA.

Sixteen ounces contain,— (STEINMANN.)	Grains.
Magnesium sulphate	79·55
Sodium sulphate	17·44
Calcium carbonate	5·29
Magnesium carbonate	·20
Strontium carbonate	·009
Calcium sulphate	4·14
Potassium sulphate	4·41
Magnesium chloride	1·06
Ferrous and manganese carbonates	·05
Silica	·05
Magnesium fluoride and bromide	trace
Total	112·199

VI.—Calcareous Waters.

CONTREXVILLE (PAVILLON), VOSGES, FRANCE.

One pint contains,— (HENRY.)	Grains.
Sodium carbonate	1·438
Magnesium carbonate	1·606
Ferrous carbonate	0·066
Calcium carbonate	4·927
Strontium carbonate	traces
Potassium and sodium chlorides	1·022
Potassium sulphate	traces
Magnesium chloride	0·292
Sodium sulphate	0·949
Magnesium sulphate	1·387
Calcium sulphate	8·395
Calcium phosphate	0·511
Organic matter and arsenic	
Silica	0·876
Total	21·469
	Cubic inches.
Oxygen gas	undetermined
Carbonic acid gas	0·29

BAGNÈRES-DE-BIGORRE (LA REINE), HAUTES-PYRÉNÉES, FRANCE.

Temp. 115·7° F.

One pint contains,— (GANDERAX AND ROSIERE.)	Grains.
Magnesium carbonate	0·321
Ferrous carbonate	0·584
Calcium carbonate	1·942
Sodium chloride	0·453
Magnesium chloride	0·949
Magnesium and sodium sulphates	2·891
Calcium sulphate	12·264
Loss	0·394
Silica	0·263
Residue and fatty matter	0·050
Total	20·111
	Cubic inches.
Carbonic acid gas	undetermined

LEUK (LORENZQUELLE), VALAIS, SWITZERLAND.

Temp. 123° F.

One pint contains,— (BRUNNER.)	Grains.
Magnesium carbonate	0·002
Ferrous carbonate	0·024
Calcium carbonate	0·357
Potassium chloride	0·020
Sodium chloride	0·055
Magnesium chloride	0·027
Sodium sulphate	0·509
Magnesium sulphate	1·991
Calcium sulphate	12·712
Strontium sulphate	0·031
Silica	0·102
Total	15·830
	Cubic inches.
Carbonic acid gas	0·26
Oxygen	0·19
Nitrogen	0·35

WILDUNGEN (STADTBRUNNEN), WALDECK, GERMANY.

One pint contains,—	Grains.
Sodium carbonate	0·492
Magnesium carbonate	2·403
Ferrous carbonate	0·139
Manganese carbonate	0·053
Calcium carbonate	3·778
Sodium chloride	0·071
Sodium sulphate	0·919
Magnesium sulphate	0·289
Alumina	0·008
Silica	0·279
Total	8·431
	Cubic inches.
Carbonic acid gas	42·70

VII.—Thermal Waters.

BADEN-BADEN, BADEN, GERMANY.

There are three springs here in use,—Hauptquelle, Meerquelle, and Fettquelle. The analysis of the first is given.

HAUPTQUELLE.

Temp. 155° F.

Sixteen ounces contain,— (BUNSEN.)	Grains.
Sodium chloride	16·520
Calcium bicarbonate	1·273
Magnesium bicarbonate	·042
Bicarbonate of iron	·037
Manganese bicarbonate	traces
Ammonium bicarbonate	·051
Calcium sulphate	1·556
Potassium sulphate	·017
Calcium phosphate	·021
Ferrous arseniate	traces
Magnesium chloride	·097
Potassium chloride	1·258
Sodium bromide	traces
Silica	·914
Alumina	·008
Nitrates	traces
Total	22·093
	Cubic inches.
Carbonic acid gas	·299

SCHLANGENBAD, NASSAU, GERMANY.

Temp. 82·4°–89·6° F.

One pint contains,— (FRESENIUS.)	Grains.
Sodium carbonate	0·079
Magnesium carbonate	0·047
Calcium carbonate	0·250
Potassium chloride	0·004
Sodium chloride	1·825
Potassium sulphate	0·091
Sodium phosphate	0·004
Silica	0·258
Total	2·558

WILDBAD, WÜRTEMBERG.

Temp. 94° F.

One pint contains,—	Grains.
Sodium chloride	1·82
Sodium carbonate	0·53
Sodium sulphate	0·40
Potassium sulphate	0·20
Calcium carbonate	0·34
Magnesium carbonate	0·70
Ferrous carbonate Manganese carbonate	0·20
Silica	0·39
Total	3·58

Gases.—Carbonic acid gas, oxygen, and nitrogen not determined.

GASTEIN, SALZBURG, AUSTRIA.

Temp. 87°–160° F.

One pint contains,— (WOLF.)	Grains.
Sodium carbonate	0·04
Magnesium carbonate	0·02
Ferrous carbonate	0·05
Manganese carbonate	0·02
Calcium carbonate	0·36
Sodium chloride	0·36
Potassium sulphate	0·01
Sodium sulphate	1·51
Aluminium phosphate	0·04
Calcium fluoride	traces
Strontia	traces
Silica	0·24
Organic matter	traces
Total	2·65
	In 100 parts.
Oxygen	30·89
Nitrogen	69·11

TÖPLITZ (HAUPTQUELLE), BOHEMIA.

Temp. 120° F.

One pint contains,— (WOLF.)	Grains.
Sodium carbonate	2·635
Magnesium carbonate	0·088
Ferrous carbonate	0·019
Manganese carbonate	0·021
Calcium carbonate	0·330
Strontium carbonate	0·027
Sodium chloride	0·433
Potassium sulphate	0·098
Sodium sulphate	0·290
Sodium phosphate	0·014
Aluminium phosphate	0·020
Silicon fluoride	0·351
Crenic acid	0·034
Silica	0·443
Total	4·803
	In 100 parts.
Carbonic acid gas	4·74
Oxygen	0·66
Nitrogen	94·59

PLOMBIÈRES (SOURCE DES DAMES), VOSGES, FRANCE.

One pint contains,— (SHERITIER.)	Grains.
Potassium chloride	0·275
Sodium chloride	0·275
Sodium sulphate	0·627
Sodium arseniate	0·005
Potassium silicate	0·008
Sodium silicate	0·626
Magnesium and calcium silicates	0·153
Alumina	0·076
Silica	0·089
Organic matter	0·153
Total	2·012

BATH, ENGLAND.

Temp. 115° F.

One imperial gallon contains,— (MERCK AND GALLOWAY.)	King's Well. Grains.
Calcium carbonate	8·820
Magnesium carbonate	0·329
Ferrous carbonate	1·064
Calcium sulphate	80·052
Potassium sulphate	4·641
Sodium sulphate	19·229
Sodium chloride	12·642
Magnesium chloride	14·581
Silica	2·982
Iodine and manganese oxide	traces
Total	144·34

NEUENAHR, RHENISH PRUSSIA.

(See Alkaline Waters, p. 1842.)

One pint contains,— (MOHR.)	Marienspudel. 101.75° F. Grains.
Sodium carbonate	5·60
Magnesium carbonate	2·68
Calcium carbonate	1·61
Sodium chloride	0·69
Sodium sulphate	0·76
Ferrous carbonate	0·06
Silica	0·19
Total	11·66
	Cubic inches.
Carbonic acid gas	22·52

ANALYSES OF BRINES AND OF SEA-WATER.

One U. S. gallon contains,— (VON BIBRA.)	Sea-Water. Grains.	Dead Sea. Grains.
Sodium chloride	1671·34	6702·73
Potassium chloride	....	682·63
Ammonium chloride	....	3·35
Calcium chloride	....	1376·75
Magnesium chloride	199·66	4457·23
Aluminium chloride	....	31·37
Ferric chloride	trace	1·50
Manganese chloride	....	3·35
Sodium bromide	31·16	156·53
Sodium iodide	trace	trace
Potassium sulphate	108·46	....
Magnesium sulphate	34·99	....
Calcium sulphate	39·90	38·07
Sodium phosphate	trace	....
Calcium carbonate	trace	trace
Silver	trace	....
Copper	trace	....
Lead	trace	....
Arsenic	trace	....
Silica	trace	trace
Organic matter	trace	34 59
Bitumen	....	trace
Total	2138·91	13488·10

BRINES OF MICHIGAN AND NEW YORK.

	MICHIGAN.		NEW YORK.	
	East Saginaw Company's Well. Grains.	Bangor Company's Well. Grains.	Syracuse. Grains.	Salina. Grains.
Sodium chloride	16·86	19·86	15·36	14·94
Magnesium chloride	0·96	1·26	0·14	0·13
Calcium chloride	2·27	2·96	0·08	0·08
Calcium sulphate	0·15	0·07	0·57	0·59
Total saline matter	20·24	24·15	16·15	15·74
Water	79·76	75·85	83·85	84·26
Total	100·00	100·00	100·00	100·00

TARENTUM SALT WELL, TARENTUM, PA.

Grains in one pound of 7680 grains.
(MR. PETERSON.)

Sodium chloride	253·519827
Potassium chloride	0·312945
Ammonium chloride	0·051571
Barium chloride	0·047055
Strontium chloride	0·736949
Calcium chloride	65·944942
Magnesium chloride	16·654496
Magnesium bromide	0·884175
Calcium iodide	0·618055
Barium carbonate	0·029084
Strontium carbonate	0·455685
Calcium carbonate	21·246190
Magnesium carbonate	10·582281
Ferrous carbonate	0·295349
Manganese carbonate	traces
Aluminium silicate	0·313881
Silicic acid	0·787515
Total solids	372·480000
Carbonic acid, loosely bound as bicarbonates	14·998187
Carbonic acid, really free	0·060572

EAST CLARION SALT SPRING, ELK CO., PA.

One gallon of 331 cubic inches contains,— (M. H. BOYE.)	Grains.
Potassium chloride	0·89971
Sodium chloride	336·80275
Lithium chloride	trace
Barium chloride	1·72573
Strontium chloride	0·06260
Calcium chloride	51·85625
Magnesium chloride	15·34206
Ammonium nitrate	0·19172
Magnesium nitrate	0·13623
Calcium phosphate	trace
Barium bicarbonate	0·12791
Strontium bicarbonate	0·00487
Calcium bicarbonate	9·79502
Magnesium bicarbonate	0·57155
Ferrous bicarbonate	0·72444
Silicic acid	0·69523
Total	418·94407

Readers who desire fuller information than is given in the above tables concerning European mineral waters, their composition, effects, and uses, should consult the work of Durand-Fardel et Le Bret, *Dictionnaire générale des Eaux minérales et d'Hydrologie médicale.*

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